Gondia Education Society's

DHOTE BANDHU SCIENCE COLLEGE, GONDIA

Dist: GONDIA (M.S.) 441614

Accredited 'A+' by NAAC, Bangalore | College with Potential for Excellence

UGC Community College & BVoc | Centre for Higher Learning and Research

Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University | Mentor Institution recognized by UGC & NAAC

Syllabus for all courses offered by the Institution across all programmes

(Prescribed by affiliating University)

Programme	Courses/Subjects	
Bachelor of Science	English	VIEW
Bachelor of Science	Marathi/Hindi	VIEW
Bachelor of Science	Mathematics	VIEW
Bachelor of Science	Chemistry	VIEW
Bachelor of Science	Physics	VIEW
Bachelor of Science	Botany	VIEW
Bachelor of Science	Electronics	VIEW
Bachelor of Science	Zoology	VIEW
Bachelor of Science	Microbiology	VIEW
Bachelor of Science	Computer Science	VIEW
Bachelor of Science	Biotechnology	VIEW
Bachelor of Science	Environmental Studies	VIEW
Bachelor of Computer Application	Bachelor of Computer Application	VIEW
Bachelor of Computer Application	Environmental Studies	VIEW
Bachelor of Vocation (Software Development)	Software Development	VIEW
Bachelor of Vocation (Food Processing and Engineering)	Food Processing and Engineering	VIEW
Master of Science (Chemistry)	Chemistry	VIEW
Master of Science (Physics)	Physics	VIEW
Master of Science (Botany)	Botany	VIEW
Master of Science (Computer Science)	Computer Science	VIEW
Master of Science (Microbilogy)	Microbiology	VIEW

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

Syllabus for Bachelor of Science /B.Sc (IT)/BCA Part-I

Compulsory English

(To be implemented from the session 2020-2021 and onwards)

Semester I

Theory - Full Marks : 60
Internal Assessment - Full Marks :15

Prescribed Textbook :

Empowering Minds by Board of Editors (Raghav Publishers & Distributors)

Unit I - Prose

1. My Struggle for an Education - Booker T. Washington
2. Florence Nightingale - Lytton Strachey

Unit II – Prose

3. The Birth of Khadi - Mahatma Gandhi
4. Go, Kiss the World! - Subroto Bagchi

Unit III – Poetry

1. Ulysses - Alfred Tennyson
2. Yussouf - James Russell Lowell
3. If - Rudyard Kipling

Unit IV – Comprehension & Grammar

1. Comprehension of Unseen Passage
2. Prepositions
3. Subject-verb agreement
4. Summarizing

Recommended books for Unit IV :

1. Macmillan Foundation English (Macmillan) by R.K.Dwivedi & A.Kumar
2. Oxford Practice Grammar by John Eastwood (Oxford University Press)
3. English for Practical Purposes (Macmillan) by Z.N. Patil, B.S.Valke, Ashok Thorat, Zeenat Merchant
4. Learners' English Grammar and Composition (S.Chand) by N.D.V.Prasada Rao

Distribution of Marks

	LAQ	SAQ	VSAQ	Total
Unit I (Prose)	06	08 (04+04)	02	16
Unit II (Prose)	06	08 (04+04)	02	16
Unit III (Poetry)	--	08 (04+04)	--	08
Unit IV (Grammar & Composition)	--	--	20	20

(Internal Assessment: Two assignments based on the Items given in the Prescribed Text Book)

Pattern of the Question paper

Q.1. (A) One out of Two LAQs to be answered in about 120 words from Unit I 06

(B) One out of Two LAQs to be answered in about 120 words from Unit II 06

Q. 2. (A) Two SAQs with internal choice to be answered in about 75 words each from Unit I. 04 + 04 = 08

(B) Two SAQs with internal choice to be answered in about 75 words each from Unit II. 04 + 04 = 08

Q.3. (A) Two SAQs with internal choice to be answered in about 75 words each from Unit III. 04 + 04 = 08

(B) 4 VSAQs out of 6 from Unit I & Unit II (3 questions each from both Units) (carrying 01 mark each) 4 x 1 = 04

Q.4. (A) Comprehension of Unseen Passage (4 Questions of 2 marks each) 4 x 2 = 08

(B) Prepositions (Four blanks to be filled in a given passage – 1 mark each) 4 x 1= 04

Q. 5. (A) Subject- Verb Agreement 4 x 1= 04

(B) Summarizing 1 x 4 = 04

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

Syllabus for Bachelor of Science/B.Sc (IT)/BCA Part-I

Compulsory English

(To be implemented from the session 2020-2021 and onwards)

SEMESTER II

Theory - Full Marks :60
Internal Assessment – Full Marks :15

Prescribed Textbook :

Empowering Minds by Board of Editors (Raghav Publishers & Distributors)

Unit I - Prose

1. Grassroots Innovation and Social Enterprise: Changing Lives
2. The Two Gentlemen of Verona

Unit II - Prose

3. The Verger
4. Synthesis of Science and Spirituality

Unit III - Poetry

1. Richard Cory
2. Allow Sanity A Little Space
3. Refugee Blues

Unit IV – Writing Skills

1. Paragraph Writing
2. Application and C.V. Writing
3. Phrasal Verbs

Recommended books for Unit IV :

1. Macmillan Foundation English (Macmillan) by R.K.Dwivedi & A.Kumar
2. Oxford Practice Grammar (Oxford India) by John Eastwood
3. Learners' English Grammar and Composition (S.Chand) by N.D.V.Prasada Rao
4. English for Practical Purposes (Macmillan) by Z.N. Patil, B.S.Valke, Ashok Thorat, Zeenat Merchant

Distribution of Marks

	LAQ	SAQ	VSAQ	Total
Unit I (Prose)	06	08 (04+04)	02	16
Unit II (Prose)	06	08 (04+04)	02	16
Unit III (Poetry)	--	08 (04+04)	--	08
Unit IV (Writing Skills)	--	--	20	20

(Internal Assessment: Two assignments based on the Items given in the Prescribed Text Book)

Pattern of the Question paper

Q.1. (A) One out of Two LAQs to be answered in about 120 words from Unit I 06

(B) One out of Two LAQs to be answered in about 120 words from Unit II 06

Q. 2. (A) Two SAQs with internal choice to be answered in about 75 words each from Unit I. 04+04 = 08

(B) Two SAQs with internal choice to be answered in about 75 words each from Unit II. 04+04 = 08

Q.3. (A) Two SAQs with internal choice to be answered in about 75 words each from Unit III. 04+04 = 08

(B) 4 VSAQs out of 6 from Unit I & Unit II (3 questions each from both Units) (carrying 01 mark each) 4 x 1 = 04

Q.4. (A) Write an application and prepare a C.V. for the given post 08

(B) Make sentences using the given phrasal verbs (Any 4 out of 6) 4 x 1 = 04

Q. 5. (A) Write 2 Short Paragraph of about 100 words each on any 2 of the given 3 topics/ statements 2 x 4 = 08

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

Syllabus for Bachelor of Science/ B.Sc (IT)/ BCA/ Part-I

Supplementary English

(To be implemented from the session 2020-2021 and onwards)

Semester - I

Theory Examination - Full Marks : 60
Internal Assessment – Full Marks : 15

Prescribed Text Book:
Pearls of Wisdom - Board of Editors (Raghav Publishers & Distributors)

Theory

Unit I : The following Short Stories from the prescribed Text:

1. The Postmaster - Rabindranath Tagore
2. After Twenty Years - O. Henry
3. A Happy Man - Anton Chekov

Unit II: The following Short Stories from the prescribed Text:

4. The Three Questions - Leo Tolstoy
5. The Story of an Hour - Kate Chopin
6. Mr. Know-All - W.S.Maugham

Unit III: Vocabulary Expansion

(Some Common Foreign Words Used in English; One Word for a Group of Words; Idioms and Phrases)

Unit IV : 1. Essay Writing

(Topics - Science and Technology; Environment Issues; Social Issues; Personal, Reflective Essay)

2. Email (Official)

Recommended Book for Units III & IV :

1. **Macmillan Foundation English** by R.K.Dwivedi & A.Kumar (Macmillan)
2. **English for Practical Purposes** (Macmillan) by Z.N. Patil, B.S.Valke, Ashok Thorat, Zeenat Merchant

Internal Assessment: 2 assignments to be given to the students on the basis of the items prescribed in Units I & II. These assignments should be submitted by the students for evaluation to the concerned Teacher

Semester - I

Pattern of the Question paper

Q.1. (A) One out of Two LAQs to be answered in about 120 words from Unit I 06

(B) One out of Two LAQs to be answered in about 120 words from Unit II 06

Q. 2. (A) Two SAQs with internal choice to be answered in about 75 words each from Unit I. 04 + 04 = 08

(B) Two SAQs with internal choice to be answered in about 75 words each from Unit II. 04 + 04 = 08

Q.3. (A) Four out of Six VSAQs on **Some Common Foreign Words Used in English** (carrying 01 mark each) 4 x 1 = 4

(B) Write an Essay on any ONE of the given topics 8

Q.4. (A) Write an Email on any ONE of the given topics 8

(B) Four words out of Six based on **One Word for a Group of Words** 4 x 1 = 4

Q. 5. (A) Four out of Six VSAQs (3 each from both the Units) from Unit I & II 4 x 1 = 4

(C) Four **Idioms and Phrases** out of Six to be used in sentences 4 x 1 = 4

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

Syllabus for Bachelor of Science/ B.Sc (IT)/ BCA/ Part-I

Supplementary English

(To be implemented from the session 2020-2021 and onwards)

Semester II

Theory Examination - Full Marks : 60
Internal Assessment – Full Marks : 15

Prescribed Text Book:
Pearls of Wisdom - Board of Editors (Raghav Publishers & Distributors)

Unit I : The following Short Stories from the prescribed Text:

1. The Open Window - Hector Hugh Munro
2. The Taxi Driver – K.S.Duggal
3. A Cup of Tea - Katherine Mansfield

Unit II : The following Short Stories from the prescribed Text:

4. The Devil - Guy de Maupassant
5. The Model Millionaire - Oscar Wilde
6. Men Who have Shaved Me - Stephen Leacock

Unit III : 1. Writing Advertisements (For sale of vehicle(s) / property, For Rent)
2. Letter Writing
(Letter of Complaint to an official; Letter to the editor of a newspaper highlighting an issue in your locality or town/city ; Application to the Principal of the College)

Unit IV : 1. Story writing based on the given outline.
2. Reporting an Event

Recommended Books for UNIT III & IV :

1. **Write Right** by Sarita Manuja (Macmillan)
2. **Macmillan Foundation English** by R.K.Dwivedi, A.Kumar (Macmillan)
3. **Learners' English Grammar And Composition** by N.D.V.Prasada Rao (S.Chand & Co. Ltd)

Internal Assessment: 2 assignments to be given to the students on the basis of the items prescribed in Units I & II. These assignments should be submitted by the students for evaluation to the concerned Teacher

Semester II

Pattern of the Question Paper

Q.1. (A) One out of Two LAQs to be answered in about 120 words from Unit I. 06

(B) One out of Two LAQs to be answered in about 120 words from Unit II. 06

Q. 2. (A) Two SAQs with internal choice to be answered in about 75 words each from Unit I. 04 + 04 = 08

(B) Two SAQs with internal choice to be answered in about 75 words each from Unit II. 04 + 04 = 08

Q.3. (A) Advertisement (One out of TWO) 6

(B) Write a Letter on any One of the Two topics 6

Q.4 (A) Write a story in about 100 words on the basis of the given outline. 8

(B) Four out of Six VSAQs (3 each from both the Units) from Unit I & II 4 x 1 = 4

Q. 5. Write a Report on an Event in about 100 words 8

राष्ट्रसंत तुकडोजी महाराज नागपूर विद्यापीठ, नागपूर

Syllabus for Bachelor of Science / B.Sc.(IT)/ BCA - Part - I

मराठी

(To be implemented from the session 2020-21 and onwards)

विज्ञान स्नातक भाग १, सत्र १व सत्र २

अनुक्रमणिका

सत्र पहिले

पाठ्यपुस्तक — साहित्यसेतू

गद्य विभाग

१ उमाइं नमस्कारे — म्हाइंभट
२ सार्वजनिक सत्यधर्म — महात्मा जोतीराव फुले
३ वाचन — गोपाळ गणेश आगरकर
४ भारतीय संविधानाची विज्ञाननिष्ठा — यशवंत मनोहर
५ ही श्रीची ईच्छा — श्रीनिवास ठाणेदार

पद्य विभाग

१ संतवाणी — ज्ञानेश्वर, नामदेव, चोखामेळा, तुकाराम
२ या भारतात बंधुभाव नित्य वसू दे — राष्ट्रसंत तुकडोजी महाराज
३ झपूर्झा — केशवसूत
४ माझ्या मना बन दगड — विंदा करंदीकर
५ पाऊस — ग्रेस

व्यावहारिक मराठी

१ प्रसारमाध्यमांसाठी लेखन — डॉ. संजय भक्ते
२ शुध्दलेखन

(डॉ. वसंत ठाकरे)

प्रथम सत्र (Semester -I)

	गुण.
विभाग एक गद्य (पहिल्या भागातील पाच पाठ)	२०
विभाग दोन पद्य (पहिल्या भागातील पाच कविता)	२०
विभाग तीन निबंध — खालील दोनपैकी एका विषयावर १) विज्ञानावर २) सामाजिक समस्या	१०
विभाग चार व्यावहारिक मराठी अ) प्रसारमाध्यमांसाठी लेखन ब) शुध्दलेखन	 ०५ ०५

सूचना :—

अभ्यासक्रमात नेमलेल्या **साहित्यसेतू** पुस्तकातील सर्व पाठ व सर्व कविता अभ्यासक्रमात समाविष्ट राहतील. प्रश्नपत्रिका ६० गुणांची राहिल. १५ गुण अंतर्गत मूल्यांकनावर (Internal Assessment) राहतील.

अंतर्गत मूल्यांकनासाठी अभ्यासक्रमातील कोणत्याही घटकांवरील लेखन विद्यार्थ्यांकडून गृहपाठरूपाने सादर करता येईल. अथवा विद्यार्थ्यांच्या सर्जनशील जाणीवा विकसित करण्यासाठी अभ्यासक्रमातील पाठ आणि कवितेवरील आपले स्वतंत्र विचार लिखित स्वरूपात मागण्यात येतील. याशिवाय आणखी नव्या संकल्पना अंतर्गत मूल्यांकनासाठी विद्यार्थ्यांकडून साकार करण्याचे स्वातंत्र्य विषय शिक्षकाला असेल.

डॉ. [illegible]

प्रश्नपत्रिकेचे स्वरूप व गुण विभागणी :—

वेळ : ३ तास गुण : ६०

प्रश्न १ला निबंध (खालील दोनपैकी एका विषयावर २०० शब्दांत)
१) विज्ञानावर
२) सामाजिक समस्या
(विभाग तीन) १०

प्रश्न २ रा दीर्घोत्तरी प्रश्न (१०० शब्दांत) २०
(सहा पैकी चार—पहिल्या भागातील पाच पाठातून)
(विभाग एक)

प्रश्न ३ रा दीर्घोत्तरी प्रश्न (१०० शब्दांत) २०
(सहा पैकी चार — पहिल्या भागातील पाच कवितांतून)
(विभाग दोन)

प्रश्न ४ था अ) प्रसारमाध्यमांसाठी लेखन ०५
ब) शुध्दलेखन ०५
(विभाग चार)

डॉ. यशवंत ठाकरे

राष्ट्रसंत तुकडोजी महाराज नागपूर विद्यापीठ, नागपूर

Syllabus for Bachelor of Science / B.Sc.(IT)/ BCA - Part – I

मराठी

(To be implemented from the session 2020-21 and onwards)

विज्ञान स्नातक भाग १, सत्र १व सत्र २

अनुक्रमणिका

सत्र दुसरे
पाठ्यपुस्तक — साहित्यसेतू

गद्य विभाग

१ अखेरचे कीर्तन — संत गाडगेबाबा
२ एक राष्ट्र एक जनता — डॉ. वि. भि. कोलते
३ अपंगशाहीचे पंतप्रधान — मधुकर केचे
४ भरती — वसंत वराडपांडे
५ वैज्ञानिक दृष्टिकोण म्हणजे काय? — डॉ. जयंत नारळीकर

पद्य विभाग

१ भंगु दे काठीण्य माझे — बा.सी.मर्ढेकर
२ उष:काल होता होता — सुरेश भट
३ खापराचे दिवे — विठ्ठल वाघ
४ आपल्याला नव्हती — अनुराधा पाटील
५ तू मदरबोर्ड माझ्या संगणकाचा — अरूण काळे

व्यावहारिक मराठी

१ अनुवादप्रक्रिया — डॉ. नंदकुमार मोरे
२ म्हणी व त्यांचा अर्थ

डॉ. सोमेश ठाकरे

द्वितीय सत्र (Semester -II)

	गुण
विभाग एक गद्य (दुसऱ्या भागातील पाच पाठ)	२०
विभाग दोन पद्य (दुसऱ्या भागातील पाच कविता)	२०
विभाग तीन निबंध — खालील दोन पैकी एका विषयावर १) पर्यावरणावर २) कल्पकतेवर	१०
विभाग चार व्यावहारिक मराठी अ) अनुवादप्रक्रिया ब) म्हणींचा अर्थ सांगून वाक्यात उपयोग करा	०५ ०५

सूचना :—

अभ्यासक्रमात नेमलेल्या **साहित्यसेतू** पुस्तकातील सर्व पाठ व सर्व कविता अभ्यासक्रमात समाविष्ट राहतील. प्रश्नपत्रिका ६० गुणांची राहिल. १५ गुण अंतर्गत मूल्यांकनावर (Internal Assessment) राहतील.

अंतर्गत मूल्यांकनासाठी अभ्यासक्रमातील कोणत्याही घटकांवरील लेखन विद्यार्थ्यांकडून गृहपाठरूपाने सादर करता येईल. अथवा विद्यार्थ्यांच्या सर्जनशील जाणीवा विकसित करण्यासाठी अभ्यासक्रमातील पाठ आणि कवितेवरील आपले स्वतंत्र विचार लिखित स्वरूपात मागण्यात येतील. याशिवाय आणखी नव्या संकल्पना अंतर्गत मूल्यांकनासाठी विद्यार्थ्यांकडून साकार करण्याचे स्वातंत्र्य विषय शिक्षकाला असेल.

(डॉ. कोमल ठाकरे)

प्रश्नपत्रिकेचे स्वरूप व गुण विभागणी :—

वेळ : ३ तास गुण : ६०

प्रश्न १ला निबंध (खालील दोन पैकी एका विषयावर २०० शब्दांत)
१) पर्यावरणावर
२) कल्पकतेवर
(विभाग तीन) १०

प्रश्न २ रा दीर्घोत्तरी प्रश्न (१०० शब्दांत) २०
(सहा पैकी चार — दुसऱ्या भागातील पाच पाठातून)
(विभाग एक)

प्रश्न ३ रा दीर्घोत्तरी प्रश्न (१०० शब्दांत) २०
(सहा पैकी चार — दुसऱ्या भागातील पाच कवितांतून)
(विभाग दोन)

प्रश्न ४ था अ) अनुवादप्रक्रिया ०५
ब) म्हणींचा अर्थ सांगून वाक्यात उपयोग करा ०५
(विभाग चार)

(डॉ. कोमल ठाकरे)

राष्ट्रसंत तुकड़ोजी महाराज नागपुर विश्वविद्यालय, नागपुर

Syllabus for Bachelor of Science / B.Sc. (IT)/BCA - Part - I

हिन्दी

(To be implemented from the session 2020-21 and onwards)

पाठ्यपुस्तक – ''मंथन''

अनुक्रमणिका

प्रथम सत्र (Semester - I)

इकाई १ : गद्य–विभाग

१. सिव सिर मालति माल – विद्यानिवास मिश्र
२. उसने कहा था – चंद्रधर शर्मा 'गुलेरी'
३. पुरस्कार – जयशंकर प्रसाद
४. दुर्मुख – महादेवी वर्मा
५. भोलाराम का जीव – हरिशंकर परसाई
६. लकी – ममता कालिया

इकाई २ : पद्य–विभाग

१. कबीर के दोहे – कबीरदास
२. भूषणवाणी – भूषण
३. मनुष्यता – मैथिलीशरण गुप्त
४. जनतंत्र का जन्म – रामधारीसिंह 'दिनकर'
५. वीरों का कैसा हो बसंत – सुभद्राकुमारी चौहान
६. जिंदगी की सीख – कलिका

इकाई ३ : व्यावहारिक हिन्दी

१. पारिभाषिक शब्दावली (विज्ञान एवं तकनीकी से संबंधित) – अंग्रेजी से हिन्दी/हिन्दी से अंग्रेजी
२. स्ववृत्त (Biodata) - परिभाषा, सामान्य परिचय, प्रारूप, विशेषताएँ, प्रकार ।
३. साक्षात्कार (Interview) - परिभाषा, सीमाएँ, उद्देश्य, सिद्धांत, प्रकार, महत्त्व ।
४. समाचार लेखन (News writing) - शीर्ष पंक्ति (Head line), समाचार लेखन प्रक्रिया, अच्छे समाचार की विशेषताएँ, भाषा–शैली, अच्छे संवाददाता की योग्यताएँ ।

} अध्ययन एवं अध्यापन के माध्यम से तैयार किया जाए।

इकाई ४ : अन्य पाठ्य सामग्री

१. विलोम शब्द
२. अनेक शब्दों के लिए एक शब्द
३. शब्दों का शुद्धिकरण
४. श्रुतिसम भिन्नार्थक शब्द

} अध्ययन एवं अध्यापन के माध्यम से तैयार किया जाए।

सूचना :

(i) पारिभाषिक शब्दावली (विज्ञान एवं तकनीकी से संबंधित) से अंग्रेजी से हिन्दी/हिन्दी से अंग्रेजी में केवल चार पारिभाषिक शब्द ही पूछे जायेंगे ।

(ii) विलोम शब्द से तीन शब्द, अनेक शब्दों के लिए एक शब्द से तीन शब्द, शब्दों का शुद्धिकरण से तीन शब्द तथा श्रुतिसम भिन्नार्थक शब्द से तीन शब्द ही पूछे जायेंगे ।

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हिन्दी

पाठ्यपुस्तक - ''मंथन''

प्रथम सत्र (Semester - I)

प्रश्न-पत्र का प्रारूप एवं अंक विभाजन

प्रश्न १ - (i) गद्य-विभाग पर आधारित पाठों में से विकल्प के साथ दीर्घोत्तरी प्रश्न। **अंक-६**
(दो प्रश्नों में से एक प्रश्न का उत्तर अपेक्षित है।)

(ii) पद्य-विभाग पर आधारित कविताओं में से विकल्प के साथ दीर्घोत्तरी प्रश्न। **अंक-६**
(दो प्रश्नों में से एक प्रश्न का उत्तर अपेक्षित है।)

प्रश्न २ - गद्य-विभाग से छः लघु प्रश्न पूछे जायेंगे, जिनमें से चार प्रश्नों के उत्तर अपेक्षित है। **अंक-१२**

प्रश्न ३ - पद्य-विभाग से छः लघु प्रश्न पूछे जायेंगे, जिनमें से चार प्रश्नों के उत्तर अपेक्षित है। **अंक-१२**

प्रश्न ४ - व्यावहारिक हिन्दी से चार लघु प्रश्न पूछे जायेंगे, जिनमें से प्रथम प्रश्न पारिभाषिक शब्दावली से, द्वितीय प्रश्न स्ववृत्त से, तृतीय प्रश्न साक्षात्कार से, चतुर्थ प्रश्न समाचार लेखन से पूछा जायेगा। इनमें से तीन प्रश्नों के उत्तर अपेक्षित है। **(३ x ४ अंक = १२ अंक)**

प्रश्न ५ - अन्य पाठ्य सामग्री से चार अनिवार्य प्रश्न पूछे जायेंगे, जिनमें से प्रथम प्रश्न विलोम शब्द से, द्वितीय प्रश्न अनेक शब्दों के लिए एक शब्द से, तृतीय प्रश्न शब्दों का शुद्धिकरण से, चतुर्थ प्रश्न श्रुतिसम भिन्नार्थक शब्द से पूछा जायेगा। सभी प्रश्नों के उत्तर अपेक्षित है। **(४ x ३ अंक = १२ अंक)**

सूचना :

(i) पारिभाषिक शब्दावली (विज्ञान एवं तकनीकी से संबंधित) से अंग्रेजी से हिन्दी/हिन्दी से अंग्रेजी में केवल चार पारिभाषिक शब्द ही पूछे जायेंगे ।

(ii) विलोम शब्द से तीन शब्द, अनेक शब्दों के लिए एक शब्द से तीन शब्द, शब्दों का शुद्धिकरण से तीन शब्द तथा श्रुतिसम भिन्नार्थक शब्द से तीन शब्द ही पूछे जायेंगे ।

कुल अंक विभाजन

इकाई १ - गद्य - विभाग	-	१८ अंक
इकाई २ - पद्य - विभाग	-	१८ अंक
इकाई ३ - व्यावहारिक हिन्दी	-	१२ अंक
इकाई ४ - अन्य पाठ्य सामग्री	-	१२ अंक
कुल अंक	-	**६० अंक**

(अंतर्गत मूल्यांकन १५ अंक का होगा, जिसमें गृहकार्य पर ५ अंक, उपस्थिति पर ५ अंक तथा मौखिकी पर ५ अंक होंगे।)

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Syllabus for Bachelor of Science / B.Sc. (IT)/BCA - Part - I

हिन्दी

(To be implemented from the session 2020-21 and onwards)

पाठ्यपुस्तक - ''मंथन''

अनुक्रमणिका

द्वितीय सत्र (Semester - II)

इकाई १ : गद्य-विभाग

१.	बड़े भाई साहब	- प्रेमचंद
२.	मरना : एक कला, एक चान्स	- कन्हैयालाल मिश्र 'प्रभाकर'
३.	रीढ़ की हड्डी	- जगदीशचंद्र माथुर
४.	दान	- भदन्त आनन्द कौसल्यायन
५.	अभाव	- विष्णु प्रभाकर
६.	हाथी के दाँत	- अनंत गोपाल शेवडे

इकाई २ : पद्य-विभाग

१.	रहीम के दोहे	- रहीम
२.	तुकड़ोजी महाराज के पद	- राष्ट्रसंत तुकड़ोजी महाराज
३.	पुष्प की अभिलाषा	- माखनलाल चतुर्वेदी
४.	कर्मवीर	- अयोध्यासिंह उपाध्याय 'हरिऔध'
५.	अकाल और उसके बाद	- नागार्जुन
६.	मन आजाद नहीं है	- गोपालदास सक्सेना 'नीरज'

इकाई ३ : व्यावहारिक हिन्दी

१. कल्पना विस्तार
२. प्रतिवेदन (Report Writing) - अर्थ एवं परिभाषा, विशेषताएँ, प्रतिवेदन तैयार करते समय ध्यान देने योग्य बातें।
३. विज्ञापन - अर्थ, परिभाषा, विज्ञापन रचना ।
४. अनुवाद - अर्थ, परिभाषा, प्रकार - (i) शब्दानुवाद (ii) भावानुवाद (iii) छायानुवाद (iv) आशुअनुवाद ।

} अध्ययन एवं अध्यापन के माध्यम से तैयार किया जाए।

इकाई ४ : अन्य पाठ्य सामग्री

१. देवनागरी लिपि - सामान्य परिचय, विशेषताएँ।
२. राजभाषा
३. संपर्क भाषा
४. राष्ट्रभाषा

} अध्ययन एवं अध्यापन के माध्यम से तैयार किया जाए।

राष्ट्रसंत तुकड़ोजी महाराज नागपुर विश्वविद्यालय, नागपुर

Bachelor of Science / B.Sc. (IT)/BCA - Part - I

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पाठ्यपुस्तक – ''मंथन''

द्वितीय सत्र (Semester - II)

प्रश्न-पत्र का प्रारूप एवं अंक विभाजन

प्रश्न १ – (i). गद्य-विभाग पर आधारित पाठों में से विकल्प के साथ दीर्घोत्तरी प्रश्न। **अंक-६**
(दो प्रश्नों में से एक प्रश्न का उत्तर अपेक्षित है।)

(ii) पद्य-विभाग पर आधारित कविताओं में से विकल्प के साथ दीर्घोत्तरी प्रश्न। **अंक-६**
(दो प्रश्नों में से एक प्रश्न का उत्तर अपेक्षित है।)

प्रश्न २ – गद्य-विभाग से छः लघु प्रश्न पूछे जायेंगे, जिनमें से चार प्रश्नों के उत्तर अपेक्षित है। **अंक-१२**

प्रश्न ३ – पद्य-विभाग से छः लघु प्रश्न पूछे जायेंगे, जिनमें से चार प्रश्नों के उत्तर अपेक्षित है। **अंक-१२**

प्रश्न ४ – व्यावहारिक हिन्दी से चार प्रश्न पूछे जायेंगे, जिनमें से प्रथम प्रश्न कल्पना विस्तार से, द्वितीय प्रश्न प्रतिवेदन से, तृतीय प्रश्न विज्ञापन से, चतुर्थ प्रश्न अनुवाद से पूछा जायेगा। तीन प्रश्नों के उत्तर अपेक्षित है। **(३ x ४ अंक = १२ अंक)**

प्रश्न ५ – अन्य पाठ्य सामग्री से चार अनिवार्य प्रश्न पूछे जायेंगे, जिनमें से प्रथम प्रश्न देवनागरी लिपि से, द्वितीय प्रश्न राजभाषा से, तृतीय प्रश्न संपर्क भाषा से, चतुर्थ प्रश्न राष्ट्रभाषा से पूछा जायेगा। सभी प्रश्नों के उत्तर अपेक्षित है। **(४ x ३ अंक = १२ अंक)**

कुल अंक विभाजन

इकाई १ – गद्य – विभाग	–	१८ अंक
इकाई २ – पद्य – विभाग	–	१८ अंक
इकाई ३ – व्यावहारिक हिन्दी	–	१२ अंक
इकाई ४ – अन्य पाठ्य सामग्री	–	१२ अंक
कुल अंक	–	**६० अंक**

(अंतर्गत मूल्यांकन १५ अंक का होगा, जिसमें गृहकार्य पर ५ अंक, उपस्थिति पर ५ अंक तथा मौखिकी पर ५ अंक होंगे।)

APPENDIX–III

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

Changes in SYLLABUSES for consideration of the Faculty and Academic Council,

Recommended by the Board of Sudies in Mathematics **Faculty of** Science and Technology.

1. Examination	2. Subject and Name of paper	3. Year to be implemented	4. Matter to be DELETED	5. Matter to be ADDED or SUBSTITUTED (Please initial after corrections in this column)	6. Special Instructions if any
B.Sc. Sem-IV	Maths-M-8	(Feb-2022)	M-8 Mechanics	M-8, Mathematical Methods	
B.Sc. Sem-V	Maths-M-11	(Feb-2022)	—	M-11 Mechanics	
B.Sc. Sem-VI	Maths-M-14	(Feb-2022)	M-13 Mathematical Modeling M-14 Differential Geometry	M-14, special Theory of Relativity.	

Notes :

(i) (A) The Board is requested to indicate very clearly as to what portions are to be added of deleted, with the year for their implementation. Nothing should be left to the discretion of the University staff. It may kindly be borned in mind that the University staff is not expected to presume anything in the matter of changes in the syllabii.

(B) An amendments whichever are to be proposed may please be made for the Examination of the next year.

(ii) According to the Statute 45 of the University the Board of Studies has the following powers :

(A) To prepare syllabus for subject(s) of instruction for which the Board is constituted.

(B) Combination of allied subjects permitted in various courses with which it is concerned.

However, if the Board feels it necessary to make certain suggestion regarding changes in the Ordinance of the Examination, care should be taken to see that such recommendations are made separately on a separate paper and not on the proforma prescribed for suggesting changes in the syllabii.

[signature] 4.1.2022

Chairman.

[initials] 4/1/2022

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

BOARD OF STUDIES IN MATHEMATICS

B. Sc. Three Years (SIX SEMESTER) DEGREE COURSE

B.Sc. Part I (Semester I & II)

Implemented from 2020-21

B. Sc. Part II (Semester III & IV)

Implemented from 2021-22

and

B. Sc. Final (Semester V & VI)

Implemented from 2022-23

(Chairman)

Syllabus: B. Sc. Mathematics

B. Sc. Part I (Semester I)
M-1: Elementary Mathematics

Unit I

Complex Numbers: De Moivre's Theorem and its application, Roots of complex number, Euler's formula, Polynomial equations, The n^{th} roots of unity, The elementary functions.

Unit II

Matrices: Rank of a matrix, Equivalent matrices, Row canonical form, Normal form, Elementary matrices and rank of a product, System of homogeneous and non-homogeneous equations, Characteristic equation and roots, Cayley-Hamilton Theorem.

Unit III

Theory of Equations: Theorems on roots of equation, Relation between the roots and the coefficients, Formation and solutions with surd and complex roots, Descartes' rule of signs, Calculation of f(x+h) by Horner's process, Transformation of equations, Reciprocal equations. Cardan's solution of Cubic equations, Ferrari's and Descartes' solution of Biquadratic equations.

Unit IV

Elementary Number Theory: Division Algorithm, Greatest Common Divisor, Euclidean Algorithm, The Diophantine equation $ax + by = c$, The Fundamental Theorem of Arithmetic (without proof), Basic Properties of Congruence, Linear Congruence and the Chinese Remainder Theorem.

Text Books:

1. Theory and problems of Complex variables: Murray R. Spiegel, Schaum's outline series, McGraw-Hill Book Company, New York (1981)
   Scope: Chapters 1, 2.
2. Theory and problems of Matrices: Frank Ayres, JR., Schaum's outline series, McGraw-Hill Book Company, New York. (1974)
   Scope: Chapters 5, 10, 19, 23.
3. Higher Algebra: Hall & Knight, S. Chand & Co. Ltd, New Delhi (1996)
   Scope: Chapter 3, 5 (Articles: 535 to 547, 549, 564 to 583)
4. Elementary Number Theory: David M. Burton (Seventh Edition), Tata McGraw-Hill Edition, New Delhi (2012)
   Scope: Chapters 2 (Articles: 2.2 to 2.5), Chapter 3 (Article: 3.1), Chapter 4 (Articles: 4.2, 4.4)

Reference Books:

1. R. S. Verma & K. S. Shukla: Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahbad.
2. A.I. Kostrikin, *Introduction to Algebra*, Springer Verlag, 1984.
3. S. H. Friedberg, A. L. Insel and L. E. Spence, *Linear Algebra*, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
4. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.
5. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi-2000.
6. Chandrika Prasad: Text Book on Algebra and Theory of Equations, Pothishala Private Ltd., Allahabad
7. Shanti Narayan: A Text Book of Matrices, S. Chand & Co. Ltd., New Delhi.
8. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, *Applications of Abstract Algebra with Maple*, CRC Press, Boca Raton, 2000.
9. Neville Robinns, *Beginning Number Theory,* 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2007.
10. George E Andrews, *Number Theory*, Hindustan Publishing Corporation, 1984.

B. Sc. Part I (Semester I)
M-2: Differential and Integral Calculus

Unit I

Leibnitz's theorem, Maclaurin's and Taylor's theorems, Indeterminate forms.

Unit II

Functions of two variables and its geometrical representation, Limit and continuity of functions of two variables, Partial derivatives, Homogeneous functions, Theorems on total differentials, Composite functions, Differentiation of composite functions (without proof), Equality of mixed partial derivatives, Asymptotes, Envelopes.

Unit III

Jacobians and its properties, Taylor's series of two variables, Maxima and Minima of function of two variables, Lagrange's method of multiplier.

Unit IV

Reduction formulae, Integration of algebraic rational functions, Integration of trigonometric functions, Integration of irrational functions.

Text Books:

1. Differential Calculus: Shanti Narayan and Dr P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2014).
   Scope: Chapter 5 (Article: 5.5), Chapter 6, 10, Chapter 11 (excluding 11.11), Chapter 15 (Articles: 15.1 to 15.4), Chapter 18 (Articles: 18.1 to 18.4, 18.7, 18.8)
2. Advanced Engineering Mathematics: H. K. Das, S. Chand & Co. Ltd, New Delhi (2009)
   Scope: Chapter 1 (Articles 1.15, 1.16, 1.19 to 1.21)
3. Integral Calculus: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005).
   Scope: Chapter 2 (Article 2.8), Chapter 3 (Articles 3.1, 3.4 to 3.6), Chapter 4 (Articles 4.1 to 4.6, 4.9, Chapter 5 (Articles 5.1, 5.4 to 5.7)

Reference Books:

1. H. Anton, I. Birens and S. Davis, *Calculus*, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, *Calculus*, Pearson Education, 2007.
3. N. Piskunov: Differential and Integral Calculus, Peace Publishers, Moscow.
4. Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahbad.
5. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahbad.
6. Ayres F. Jr.: Calculus, Schaum's Outline Series, McGraw- Hill, 1981
7. Edward J.: Differential Calculus for Beginners, MacMillan and Co. Ltd., 1963
8. Edward J.: Integral Calculus for Beginners, AITBS Publishers and Distributors, 1994
9.

B. Sc. Part I (Semester II)
M-3: Geometry, Differential & Difference Equations

Unit I

Equation of a sphere, General equation of a sphere, The sphere through four given points, Plane section of a sphere, Intersection of two spheres, A sphere with a given diameter, A sphere through a given circle, Intersection of a sphere and a line, Plane of contact, Condition for the orthogonality of two spheres, The right circular cone, The right circular cylinder.

Unit II

Families of curves, Orthogonal trajectories, Exact equations, Integrating factors, Linear and Bernoulli's equations, Reduction of order.

Unit III

Second Order Linear Differential Equations: Introduction, The general solution of the homogeneous equation, The use of a known solution to find another, The homogeneous equation with constant coefficients, The method of undetermined coefficients, The method of variation of parameters.

Unit IV

Difference Equations: Definition, Solution of simple difference equations, Homogeneous linear equations, General solutions of higher order homogeneous linear equations with variable coefficients, Non-homogeneous equation reducible to homogeneous equation, Method of evaluating $[1/f(E)]\Phi(x)$, First order Non-homogeneous linear equations, Higher order non-homogeneous linear equations with constant coefficients, First order linear equation with variable coefficients, Equation homogeneous in $u(x)$, Equations reducible to linear equations with constant coefficients.

Text Books:

1. Analytical Solid Geometry: Shanti Narayan and Dr P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2013)
   Scope: Chapter 6 (Articles: 6.1.1, 6.1.2, 6.2, 6.3.1, 6.3.2, 6.3.3, 6.4.1, 6.5, 6.6.1, 6.7.1), Chapter 7 (Articles: 7.6, 7.8)
2. Differential Equations with Applications and Historical Notes: G. F. Simmons, McGraw-Hill Inc, New Delhi (Second Edition) 1991.
   Scope: Chapter 1 (Article: 3), Chapter 2 (Articles: 8 to 11), Chapter 3 (Articles: 14 to 19)
3. Finite Differences and Numerical Analysis: H C Saxena, S. Chand & Co. Ltd. (1998).
   Scope: Chapter 8

Reference Books:

1. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London.
2. R.J.T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan India Ltd., 1994.
3. Gorakh Prasad and H. C. Gupta: Text Book on Coordinate Geometry. Pothishala Pvt. Ltd., Allahbad.
4. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
5. Ordinary and Partial Differential Equations (Theory and Applications) Nita H. Shah, PHI, 2010
6. E.A. Codington: An Introduction to Ordinary Differential Equations and their Applications, CBS Publisher and Distribution, New Delhi, 1985
7. H. T. H. Piaggio: Elementary Treatise on Differential Equations and Their Applications, CBS Publisher and Distribution, New Delhi, 1985
8. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and sons, 1999

B. Sc. Part I (Semester II)
M-4: Vector Analysis

Unit I

Vector differentiation, Differential Geometry, Gradient, Divergence and Curl.

Unit II

Double integration, Evaluation of double integrals, Change of order of integration, Application of double integrals, Area in polar coordinates, Triple integration, Gamma function, Transformation of Gamma function, Beta function, Evaluation of Beta function, Symmetric property of Beta function, Transformation of Beta function, Relation between Beta and Gamma functions.

Unit III

Ordinary integral of vectors, Line integral, Surface integral, Volume integral.

Unit IV

Green's Theorems in the plane and its application, Gauss Divergence Theorem, Stokes' Theorem.

Text Books:

1. Theory and Problems of Vector Analysis: Murray R Spiegel, Schaum's Outline Series, McGraw-Hill Book Company, New York. (1974)
   Scope: Chapters 3, 4, 5 and 6.
2. Advanced Engineering Mathematics: H. K. Das, S. Chand & Co. Ltd, New Delhi (2009)
   Scope: Chapter 2, (Articles: 2.1 to 2.5, 2.7), Chapter 21 (Articles: 21.1 to 21.7)

Reference Books:

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.
3. P.C. Matthew's, *Vector Calculus*, Springer Verlag London Limited, 1998
4. N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahbad.
5. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999

B. Sc. Part II (Semester III)

M-5: Partial Differential Equations & Calculus of Variations

Unit I

Simultaneous differential equations of first order and first degree in three variables, Methods of solution of $dx/P = dy/Q = dz/R$, Pfaffian differential forms and equations, Solution of Pfaffian differential equation in three variables, Partial differential equations of first order, Origins of first order partial differential equations.

Unit II

Linear equations of first order, Integral surface passing through a given curve, Compatible system of first order equations, Charpit's method, Jacobi's method.

Unit III

Partial differential equation (PDEq) of second order, Linear PDEq with constant coefficients and their solutions.

Unit IV

Calculus of Variations: Functionals, Classes of functions, Extremum of a functional, Variation of functional, The necessary condition for an extremum of a functional, Special cases of integrability of Euler's equation, Functional dependent on higher order derivative, Functional dependent on two functions of one independent variable, Euler-Ostrogradsky equation, Invariance of Euler's equation.

Text Book:

1. Elements of Partial Differential Equations: IAN N. Sneddon, McGraw- Hill Book Company, 1957
   Scope: Chapter 1 (Articles: 2, 3, 5, 6), Chapter 2 (Articles: 1, 2, 4, 5, 9, 10, 13)
2. Mathematics for Degree Students (B.Sc. Second year): Dr P.K. Mittal, S. Chand & Co. Ltd, New Delhi, 2011 (First edition)
   Scope: Chapters 10 and 11, Chapter 13 (Articles: 13.2 to 13.11, 13.13)

Reference Books:

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. Ordinary and Partial Differential Equations (Theory and Applications) Nita H. Shah, PHI, 2010,
3. Erwin Kreyzig: Advanced Engineering Mathematics, John Willey and Son's, Inc. New York,1999.
4. A.R. Forsyth: A Treatise on Differential Equations, McGraw-Hill Book Company,1972.
5. B. Courant and D. Hilbert: Methods of Mathematical Physics (Vol I and II), Willey-interscience,1953.
6. I.M. Gelfand and S.V. Fomin: Calculus of Variables, Prentice Hill, Englewood Cliffs (New Jersey),1963.
7. A.M. Arthurs: Complementary Variational Principles, Clarendon Press, Oxford,1970.
8. V. Komkav: Variational Principles of Continuum Mechanics with Engineering Applications, (Volume I), Reidel Pup. Dordrecht, Holland,1985.
9. J.I. Oden and J.N Reddy: Variational Methods in Theoretical Mechanics, Springer-Veriag, 1976.

B. Sc. Part II (Semester III)
M-6: Modern Algebra

Unit I

Group Theory: Definition of a Group, Some examples of Group, Some preliminary lemma, Sub-group, A counting principle.

Unit II

Normal sub-group and Quotient Group, Homomorphism, Permutation groups.

Unit III

Ring Theory: Definition and examples of rings, Some special classes of rings, Homomorphisms, Ideals and Quotient rings, More ideals and Quotient rings.

Unit IV

The field of Quotients of an integral domain, Euclidean rings, A particular Euclidean ring, Polynomial rings.

Text Book:

1. Topics in Algebra: I. N. Hartstein, Wiley Eastern Ltd. (Second edition) 1992
   Scope: Chapter 2 (Articles: 2.1 to 2.7, 2.10), Chapter 3 (Articles: 3.1 to 3.9)

Reference Books:

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.
4. P.B. Bhattachaya, S.K. Jain and S.R. Nagpaul: First Course in Linear Algebra, Willey Eastern, New Delhi,1983.
5. P.B. Bhattachaya, S.K. Jain and S.R. Nagpaul: Basic Abstract Algebra, (2nd Edition) Cambridge University Press India Edition.
6. H.S. Hall and S.R. Knight: Higher Algebra, S. Chand & Co. Ltd., New Delhi, 2008.

B. Sc. Part II (Semester IV)
M-7: Real Analysis

Unit I

Bounded sets, Completeness, Archimedean property of R, Absolute value of Real Number, Neighborhoods, Open Sets, Interior point of a set, Limit point of a set, Bolzano-Weierstrass theorem, Close sets, Closure sets.

Unit II

Sequences: Definition and examples, Bounded sequences, Convergent sequences, Monotone sequences, Subsequences, Cauchy sequences, Divergent sequences, Limit superior and limit inferior of sequences.

Unit III

Infinite series: Convergent series, Cauchy criterion of convergence of a series, Positive term series, Geometric series test, Comparison test, Limit comparison test, Ratio comparison test, p-Test, Cauchy's root test, D'Alembert ratio test, Integral test, Alternating series, Leibnitz's test, Absolute and conditional convergence.

Unit IV

Riemann Integration: Riemann integral, Criterion for Integrability, Properties of integrable functions, Certain classes of integrable function, The Fundamental theorem of calculus. Mean value theorem.

Text Book:

1. An Introduction to Real Analysis: P K Jain and S K Kaushik, S. Chand & Co. Ltd. New Delhi, (2000)

Scope: Chapters 1, 2, 3, Chapter 4 {Articles: 1, 2 (2.1 to 2.10), 3, 4, 5}, Chapter 8 (Articles: 1, 2, 3, 5, 6, 7)

Reference Books:

1. T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis,* John Wiley and Sons (Asia) P. Ltd., 2000.
3. E. Fischer, *Intermediate Real Analysis*, Springer Verlag, 1983.
4. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series*- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
5. Principles of Mathematical Analysis (Third Edition) by Walter Rudin, McGraw-Hill International Edition,1976.
6. I. M. Apastol: Mathematical Analysis, Narosa Publishing house, New Delhi, 1985
7. R. R. Goldberg: Real Analysis, Oxford & IBH Publishing Co., New Delhi, 1970
8. S. Lang: Undergraduate Analysis, Springer-Verlag, New York, 1983
9. D. Somasundaram and B. Chaudhary: A First Course in Mathematical Analysis, S. Chand Co. New Delhi, 2000

B. Sc. Part II (Semester IV)
M-8: Mathematical Methods

Unit I – Power Series Solution

Introduction, A review of Power series, Series solution of first order equations, Second order linear equations, Ordinary point, Singular point, Regular singular point, Irregular singular point, Legendre's and Bessel's equations.

Unit II – Special Functions

Legendre's and Bessel's functions with their properties, Generating functions, Recurrence relations, Orthogonality of functions.

Unit III – Laplace Transforms

Laplace transform of some elementary functions, Properties of Laplace transforms, Inverse Laplace transforms, Laplace transforms of derivatives and integrals, Laplace transform of t.f(t), Laplace transform of f(t)/t, Convolution theorem, Solution of Ordinary differential equations with constant coefficients, Solution of simultaneous ordinary differential equations.

Unit IV – Fourier Series

The Fourier coefficients, The problem of convergence, Even & Odd functions, Half range cosine and sine series, Extension to arbitrary intervals.

Text Books:

1. Differential Equations with Applications and Historical Notes (Second Edition): G. F. Simmons, McGraw-Hill International Editions,1991.
   Scope: Chapter 5 (Articles: 26 to 30), Chapter 6 (Articles: 33 to 36)

2. Advanced Engineering Mathematics: H. K. Das, S. Chand and Co. Ltd, New Delhi (2009).
   Scope: Chapter 8 (Articles: 8.6 to 8.21), Chapter 13 (Articles: 13.1 to 13.12, 13.18)

Reference Books:

1. Laplace Transforms: Murray R. Spiegel, Schaum's Outline Series, McGraw-Hill
2. Laplace and Fourier Transforms: Goyal & Gupta, Pragati Prakashan, Meerut
3. Applied Mathematics (Vol II): P.N. Wartikar & J.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune

B. Sc. Final (Semester V)
M-9: Complex Analysis

Unit I

Definition of Functions of complex variable, Limit, Continuity, Differentiability, Analytic function, Necessary and sufficient conditions for f(z) to be analytic, C-R equations in polar form. Orthogonal curves, Harmonic function, Method to find the conjugate function, Milne-Thomson method.

Unit II

Transformation, Conformal transformation, Transformations - Linear, Magnification, Rotation, Inversion, Reflection and their combinations, Bilinear transformation. Schwarz-Christoffel transformation.

Unit III

Complex integration, Cauchy integral theorem, Cauchy integral formula, Morera Theorem, Cauchy's inequality, Liouville Theorem.

Unit IV

Convergence of a series of complex terms, Taylor's theorem, Laurent's theorem, Singular point, Residue, Residue theorem, Evaluation of real definite integral by contour integration, Evaluation of improper indefinite integral.

Text Books:

1. Advanced Engineering Mathematics: H. K. Das, S. Chand and Co. Ltd, New Delhi (2009).
   Scope: Chapter 7 (Articles: 7.1 to 7.47)

Reference Books:

1. Functions of a Complex Variable by Goyal & Gupta, Pragati Prakashan, 2010.
2. R. V. Churchil and J. W. Brown: Complex Variables and Applications (5th Edition), McGraw Hill, New York, 1990
3. Shanti Narayan: Theory of Complex Variables, S. Chand & Co. Ltd., New Delhi.
4. Mark J. Ablowitz and A. S. Fokas: Complex Variables (Introduction and Applications), Cambridge University Press, South Asian Edition, 1998

B. Sc. Final (Semester ~~IV~~ V)

M-10: Metric Space, Boolean Algebra & Graph Theory (Optional)

Unit I

Countable set, Uncountable set, Metric spaces, Interior point, Open set, Limit point, Closed set, Closure of a set, Dense set.

Unit II

Complete metric space, Compact Set, Connected set.

Unit III

Partial order relation, Partial ordered set, Lattices as Partially ordered set, Some properties of Lattices, Lattices as algebraic systems, Sub-lattices, Direct product and homomorphism, Some special lattices.

Boolean algebra, Sub-algebra, Direct product and homomorphism, Boolean functions, Boolean forms and free Boolean algebra, Values of Boolean expressions and Boolean functions.

Unit IV

Graph Theory: Basic concepts, Path, Reachability and connectedness, Matrix representation of graphs, Trees, Storage representation and manipulation of graphs.

Text Books:

1. Introduction to Topology and Modern Analysis: G. F. Simmons, McGraw-Hill International Edition (1963).
   Scope: Chapter 1 (Articles: 6 & 7), Chapter 2 (Articles: 9 to 12), Chapter 4 (Article: 21), Chapter 6
2. Discrete Mathematical Structures with Applications to Computer Science: J. P. Tremblay, R. Manohar, Tata McGraw-Hill Pub Company, New Delhi (1997)
   Scope: Chapter 2 (Articles: 2-3.8, 2-3.9), Chapter 4 (Articles: 4-1, 4-1.1 to 4-1.5, 4-2, 4-2.1, 4-2.2, 4-3, 4-3.1, 4-3.2), Chapter 5 (Articles: 5-1, 5-2)

Reference Books:

1. P. K. Jain and K. Ahmad: Metric Spaces, Narosa Publishing House, New Delhi, 1968.
2. B A. Davey and H. A. Priestley, *Introduction to Lattices and Order*, Cambridge University Press, Cambridge, 1990.
3. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
4. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory*, 2nd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2003.
5. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004

B. Sc. Final (Semester V)
M-11: Mechanics (Optional)

Unit I

Forces acting at a point, Parallel forces, Moments, Couples, Coplanar forces, Reduction theorems and examples, Equilibrium under three forces, General conditions of equilibrium, Centre of gravity.

Unit II

Work and Energy, Virtual work, Flexible strings, Common catenary.

Unit III

Motion in a plane: Velocity and acceleration, Radial and transverse components of velocity and acceleration, Angular velocity and acceleration, Relation between angular and linear velocities, Tangential and normal components of velocity and acceleration, Newton's Laws of motion, Projectile.

Unit IV

Basics concept of Lagrange's Dynamics, Constraints, Generalized Coordinates, Principle of Virtual work, D' Alembert principle, Lagrange's Equations, Reduction of two body central force problem to the equivalent one body problem, Central force and motion in a plane, Differential equation of an orbit, Inverse square law of force, Virial theorem.

Text Book:

1. Text Book of Statics: R S Varma, Pothishala Private Ltd. Allahabad (1996)
   Scope: Chapters 2, 3, Chapter 4 (Articles: 4.1, 4.2, 4.4), Chapter 6 (Articles: 6.1 to 6.5), Chapter 7, Chapter 9 (Articles: 9.2, 9.3, 9.5, 9.7, 9.8) Chapter 10 (Articles: 10.1, 10.2, 10.21, 10.22, 10.3, 10.4)
2. A Text Book of Dynamics: M Ray, S. Chand & Co. (2000)
   Scope: Chapter 1 (Articles: 1.3 to 1.6, 1.8, 1.9), Chapter 3 (Articles: 3.1, 3.2)
3. Classical Mechanics: J C Upadhyaya, Himalaya Publishing House, New Delhi, 2006.
   Scope: Chapter 2 (Articles: 2.2 to 2.9), Chapter 4: (Articles: 4.1, 4.2, 4.4, 4.5, 4.9)

Reference Books:

1. A.S. Ramsay, *Statics*, CBS Publishers and Distributors (Indian Reprint), 1998.
2. A.P. Roberts, *Statics and Dynamics with Background in Mathematics*, Cambridge University Press, 2003.
3. Classical Mechanics (Second Edition) by Herbert Goldstein , Narosa Publishing House , New Delhi , 1998.
4. S.L. Loney: Statics, Macmillan and Company, London.
5. S.L. Loney: An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Cambridge University Press, 1956.

B. Sc. Final (Semester VI)
M-12: Linear Algebra

Unit I

Vector Spaces: Definition and examples of vector spaces, Sub-spaces, Span of a set, More about sub-spaces, Linear dependence, Linear independence, Dimensions and Basis.

Unit II

Linear Transformations: Definition and examples, Range and kernel of linear map, Rank-Nullity, Inverse of a linear transformation, Consequences of Rank-Nullity Theorem.

Unit III

The space L(U, V), Composition of linear maps, Operator equations, Applications to the theory of ordinary linear differential equations, Matrix associated to linear map, Linear map associated with matrix.

Unit IV

Linear Operations in Matrices, Matrix multiplication, Rank and Nullity of a matrix, Inner product spaces, Normed linear space, Orthogonal and orthonormal vectors, Gram-Schmidt orthogonalisation process, Orthogonal and Unitary matrices, Application to reduction of quadrics.

Text Books:

1. An Introduction to Linear Algebra: V Krishnamurthy, V P Mainra and J L Arora, Affiliated East West Press Pvt. Ltd (1976).
   Scope: Chapters 3, 4, Chapter 5 (Articles: 5.1 to 5.5), Chapter 7 (Articles: 7.2 to 7.4)

Reference Books:

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra*, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, *Introduction to Linear Algebra*, 2nd Ed., Springer, 2005.
4. Gilbert Strang, *Linear Algebra and its Applications*, Thomson, 2007.
5. S. Kumaresan: Linear Algebra (A Geometrical Approach), Prentice Hall of India, 2000
6. S. K. Jain, A. Gunawardena and P. B. Bhattacharya: Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag) 2001.
7. K. Hoffman and R. Kunze: Linear Algebra (2nd Edition), Prentice-Hall, Englewood Cliffs (New Jersey), 1971.
8. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt., New Delhi, 2000
9. Shanti Narayan: A Text Book of Modern Abstract Algebra, S. Chand & Co.Ltd., New Delhi.

B. Sc. Final (Semester ~~VI~~)

M-13 ~~M-10~~: Numerical Methods (Optional)

Unit I

Solution of Algebraic and Transcendental Equations: The Bisection Method, The method of False position, The iteration method, Newton-Raphson method, Ramanujan's method, The Secant method, Muller's method, Solution to systems of non-linear equations.

Unit II

Interpolation: Finite differences, Differences of a polynomial, Newton's formulae for interpolation, Central difference interpolation formulae, Interpolation with unevenly spaced points, Divide differences and their properties, Inverse interpolation.

Unit III

Numerical Differentiation and Integration: Numerical differentiation, Maximum and minimum values of a tabulated function, Numerical integration, Euler-Maclaurin formula.

Unit IV

Numerical Solution of Ordinary Differential Equation: Solution by Taylor's series, Picard's method of successive approximation, Euler's method, Runge-Kutta method, Predictor-Corrector method, The cubic spline method, Simultaneous and higher order equations.

Text Books:

1. Introductory Methods of Numerical Analysis: S. S. Sastry, Prentice Hall of India (4th Edition) (2008).
   Scope: Chapter 2 (Articles: 2.2 to 2.8, 2.12), Chapter 3 (Articles: 3.3, 3.5 to 3.7, 3.9 to 3.11), Chapter 5 (Articles: 5.2 to 5.5), Chapter 7 (Articles: 7.2 to 7.8)

Reference Books:

1. B. Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 5th Ed., New age International Publisher, India, 2007.

B. Sc. Final (Semester VI)
M-14: Special Theory of Relativity (Optional)

Unit I

Review of Newtonian Mechanics: Inertial frames, Speed of light and Galilean relativity, Relative character of space and time, Postulates of Special theory of relativity, Lorentz transformation equations and its geometrical interpretation, Group properties of Lorentz transformations.

Unit II

Relativistic Kinematics: Composition of parallel velocities, Relativistic addition law for velocities. Transformation equation for components of velocities and acceleration of a particle , Transformation of Lorentz contraction factor, length contraction and time dilation.

Unit III

Geometrical representation of Space-Time: Four dimensional Minkowskian space-time of relativity, Space like and time like intervals, Proper time, Light cone or null cone World line of a particle, Four vector and tensors in Minkowskian space-time.

Unit IV

Relativistic Mechanics and Electromagnetism: Variation of mass with velocity. Equivalence of mass and energy i.e., $E = m c^2$, Transformation equations for mass, momentum and energy. Relativistic force and transformation equations for its components. Relativistic Lagrangian and Hamiltonian.

Maxwell's equation in vacuum, Propagation of electric and magnetic field strengths, Four potential, Transformation equations for electromagnetic four potential vector. Transformation equations for electric and magnetic field strengths.

Text Books:

C. Molar. The Theory of Relativity, Oxford Clarendon Press, 1952

Reference Books:

1. J.K. Gupta, K.P. Gupta, Theory of Relativity, Krishna Prakashan Media (P) Ltd.
2. T. M. Karade, K.S. Adhav, M.S. Bendre, Lectures on Special Relativity, Sonu Nilu
3. P.G. Bergman, Introduction to The Theory of Relativity, Prentice Hall of India Pvt. Ltd., 1969
3. J.L. Anderson, Principles of Relativity Physics, Academic Press, 1967
4. V.A. Ugarov, Special Theory of Relativity, Mir Publishers, 1979
5. R. Resnick, Introduction to Special Relativity Wiley Eastern, Pvt.Ltd.1972

R.T.M NAGPUR UNIVERSITY NAGPUR

SEMISTER PATTERN PROPOSED SYLLABUS

SUBJECT CHEMISTRY

B.Sc. –I, Semester - I

CH – 101: Paper- I (Inorganic Chemistry)

Unit-I **(7.5 Hrs)**

(A) Atomic Structure :Idea of de-Broglie matter Waves, Heisenberg's uncertainty principle.Schrodinger wave equation, significance of Ψ and Ψ^2, Quantum numbers, shapes of s, p, and dorbitals, Aufbau principle, Pauli's exclusion principle and Hund's rule of maximum

multiplicity.Electronic Configuration of elements and ions (Z = 1 to 30)

(B) Periodic Properties: Atomic and ionic radii, ionization energy, electron affinity and electronegativity- Definition, trends in periodic table. Factors affecting ionization potential. Pauling's and Mulliken's scale of electronegativity. Effective nuclear charge and Slater's rule with some numericals.

Unit-II **(7.5 Hrs)**

(A) Ionic bond :Introduction to Ionic bonding with respect to formation (Kossel Theory), Lattice energy and Born- Habercycle with numericals. Solvation energy and solubility of ionic solids, polarizing power andpolarisability of ions, Fajans rule.

(B)Covalent Bond: Valence Bond Theory, Formation of Hydrogen molecule with Potential energy diagram Limitations of VBT, directional characteristics of covalent bond, overlap criterion and bond strength. Bond energy, bond length, Bond order and Bond angle. Various types of hybridization involving s, p, d orbitals and shape of inorganic molecules.

Unit – III **(7.5 Hrs)**

(A) s- block elements- Electronic configuration, Comparative study with respect to atomic andionic radii, Ionization potential, reducing properties. Application of s-block elements(Na, Kand,Ca) in biosystem.Diagonal Relationships (Li-Mg).Hydrogenbonding .Classification and effect of Hydrogen bonding on viscosity, solubility, Melting point and Boiling point.

(B) Chemistry of Noble Gases: Chemical properties of the noble gases, Preparation, chemical

properties, structures, bonding and applications of Xenon fluorides (XeF_2, XeF_4, XeF_6). Structureand bonding in $XeOF_2$ and $XeOF_4$

Unit- IV **(7.5 Hrs)**

(A) p-block elements – Introduction to p-block elements with respect to following compounds: Hydrides: Comparative study with respect to structure of NH_3, PH_3, AsH_3 and SbH_3.

Oxides: Structure of P_2O_3 ,P_2O_5

Oxyacids of Phosphorous: Structure of H_3PO_3 and H_3PO_4

Peroxyacids of sulphur: Preparation and structure of Caro's and Marshall's acids.

Hydrides of boron: Structure and bonding of diborane, structure of borazine.

(B) Food Adulteration and Detection: Definition, Conditionsof adulteration, Types of adulteration (intentional, unintentional, natural) . Chemical contamination, Simple tests for the detection of food adulteration in tea leaves and coffee, spices(turmeric andchili powder)and,milk..

WEF Academic Section: 2020-21

Proposed Syllabus, RTM Nagpur University, Nagpur

Semester Pattern

Subject: Chemistry

B.Sc. Sem. I CH-102 Paper -II (Physical Chemistry)

Unit - I: Thermodynamics **7.5 Hrs**

(A) Definitions of some common thermodynamic terms: system, surrounding, types of systems: open, closed, isolated, homogeneous and heterogeneous systems, extensive and intensive properties, thermodynamic processes: isothermal, adiabatic, isochoric, isobaric, cyclic, reversible and irreversible processes, concept of heat and work, Zeroth law of thermodynamics, First law of thermodynamics, internal energy, enthalpy, heat capacity, relationship between C_p and C_v. Joule-Thomson effect, Joule-Thomson experiment, Joule-Thomson coefficient and inversion temperature.

(B) Thermochemistry: Standard states, enthalpy of formation, enthalpies of compounds, enthalpy of combustion, enthalpy of solution, enthalpy of dilution, enthalpy of neutralisation, enthalpy of ionisation. Hess's law of constant heat summation and its applications, heat of reaction, relationship between heat of reaction at constant volume and at constant pressure, average bond energy, bond dissociation energy and its calculations from thermochemical data.
Numerical problems.

Unit-II: Gaseous State **7.5 Hrs**

(A) Postulates of kinetic theory of gases, derivation of kinetic gas equation, deductions of various gas laws from kinetic gas equation: Boyle’s law, Charle’s law, Avogadro’s law, Graham’s law, Dalton’s law, Ideal gas equation. Qualitative discussion of Maxwell-Boltzmann distribution of molecular velocities, effect of temperature on molecular velocities, different types of molecular velocities with their expressions and interrelationships: average, root mean square and most probable velocities, collision diameter, collision number and mean free path.

(B) Ideal and real gases, deviation of real gases from ideal behaviour, explanation of the terms: compressibility factor and Boyle temperature, causes of deviation from ideal behaviour, Vander-Waal's equation of state, explanation of behaviour of real gases by Vander-Waal's equation, Andrew's experiment on critical phenomenon: isotherms of CO_2 , continuity of state, isotherms of Vander

Waal's equation, relationship between critical constants and Vander Waal's constants, reduced equation of state and law of corresponding states.

Numerical problems.

Unit-III: Liquid State **7.5 Hrs**

(A) Intermolecular forces: dipole-dipole attraction, ion-dipole attraction, dipole- induced dipole attraction and induced dipole-induced dipole attractions, models of liquid state, structural differences between solids, liquids and gases, liquid crystals, types of liquid crystals: nematic, smectic and cholesteric liquid crystals, difference between liquid crystal, solid and liquid, thermography, liquid crystal display and seven segment cells.

(B) Properties of liquid: surface tension, measurement of surface tension by capillary rise method and drop number method, parachor and its applications, viscosity, coefficient of viscosity, effect of temperature on viscosity. Relative viscosity, specific viscosity, reduced viscosity and intrinsic viscosity, determination of viscosity by Ostwald's viscometer, refractive index, determination of refractive index by Abbe's refractometer, specific refraction, molar refraction.

Numerical problems.

Unit-IV: Surface Chemistry, Catalysis and Colloidal State **7.5 Hrs**

(A) Adsorption: Physical and chemical adsorption, difference between physisorption and chemisorption, Freundlich adsorption isotherm, Langmuir adsorption isotherm, applications of adsorption.

Catalysis, characteristics of catalyst, homogeneous and heterogeneous catalysis, promotors and inhibitors, autocatalysis, enzyme catalysis, applications of catalysts.

(B) Colloidal states: Introduction, types of colloidal systems, classification of colloids, true solutions, colloidal solutions and suspensions. General properties of colloidal systems, properties of hydrophobic colloidal systems (a) electrical properties: charge on colloidal particles, coagulation of colloidal sols: Hardy and Schulzer rule, Gold number (b) electrokinetic properties: electrophoresis and electro-osmosis. Surfactants, types of emulsions, emulsifiers, gels, preparation of gels, importance and application of colloids. Numerical problems.

CH-103: Laboratory Course

Practical- I (Inorganic Chemistry):

Semi micro Qualitative Analysis Qualitative analysis of inorganic salt mixture containing two acidic radicals of different group and two basic radicals of same groups. (At least six mixtures to be analysed)

1. To detect presence of iron, coal tar and catechu (as adulterants) in Tea powder.
2. To detect presence of brick powder and Rhodamine B (as adulterants)in chili powder.
3. To detect yellow lead salt and chalk powder (as adulterants) in Turmeric powder
4. To detect urea and sugar (as adulterants) in milk.

Practical-II (Physical Chemistry)

1 .Determination of heat of solution of potassium nitrate calorimetrically.
2. Determination of heat of ionisation of acetic acid calorimetrically.
3. Determination of integral heat of solution of salt at two different concentrations and hence determine integral heat of dilution.
4. Determination of viscosity coefficient of unknown liquid by Ostwald's viscometer.
5. Determination of surface tension of given liquid by drop number method (Stalagmometer method)
6. To compare cleansing power of two samples of detergent.
7. To determine refractometrically specific and molar refractions of given liquids.
8. To study the adsorption of oxalic acid on activated charcoal and verify Freundlich adsorption isotherm.

Reference Books (Therory):

1. Barrow G. M; Physical Chemistry, Tata Mc Grow Hills(2007).
2. Castellan G. W; Physical Chemistry, Narosa (2004).
3. Puri B. R; Sharma L. R; Pathania M. S; Principles of Physical Chemistry, Vishal Publishing Company (2018).
4. Gurdeep Raj; Advanced Physical Chemistry, Goel Publishing House (2009).
5. Bajpai D.N; Advanced Physical Chemistry, S. Chand Publishing (2001).
6. Atkins P.W; Paula J.De; Physical Chemistry, 8th Edn. Oxford University Press (2006).
7. Negi A.S., Anand S. C; A Textbook of Physical Chemistry, New Age International Publishers (2007).

Reference Books (Practical)

1. Das R. C., Behra B., Experimental Physical Chemistry, Tata McGraw Hill.
2. Yadav J. B., Advanced Practical Physical Chemistry, Goel Publishing House.
3. Alexander Findlay, Levitt B. P., Findlay's Practical Physical Chemistry, Longman, London.

WEF from the session 2020-21

RTM NAGPUR UNIVERSITY NAGPUR
SEMISTER PATTERN SYLLABUS
SUBJECT CHEMISTRY
B.Sc. –I, Semester - II
CH–201: Paper- I (Organic Chemistry)

Unit - I (**7.5 Hrs**)

(A) Structure and Bonding: Hybridization in case of Methane, Ethane, Ethylene and Acetylene.Bond lengths, bond angles and bond energies. Elementary ideas of Inductive effect, Electromeric effect, Resonance effect, Hyperconjugation (definition and examples). Hydrogen bonding in organic compounds (with reference to alcohol and carboxylic acid) and its consequences.

(B) Mechanism of Organic Reactions: Homolytic and heterolytic bond fission with examples. Electrophiles and nucleophiles: Definition and example both neutral and charged. Types of organic reactions: Addition, substitution, elimination and rearrangement(Definition and examples). Reactive intermediates: Carbocations, carbanions, free radicals and carbenes (Defination, formation, geometry, stability).

Unit - II **(7.5Hrs)**

(A) Stereochemistry of Organic Compounds: Concept of isomerism. Types of isomerism with examples. Optical isomerism: Elements of symmetry, molecular chirality, enantiomers, stereogenic centre (lactic acid as example). Optical activity, chiral and achiral molecules with two stereogenic centres (Tartaric acidas example), diastereo-isomers, meso-compound. Resolution of enantiomers: Biological and chemical methods. Inversion, retention, racemisation and asymmetric synthesis. Relative and absolute configuration.Sequence rules - D & L and R & S system of nomenclature.

(B) Geometrical isomerism:E and Z system of nomenclature, geometric isomerism in maleic acid, fumaric acid and 2-butene. **Conformational isomerism:** Conformational analysis of ethane and n-butane. Newman's projection and sawhorse formulae. Difference between Configuration and Conformation.

Unit - III **(7.5 Hrs)**

(A) Alkanes: IUPAC nomenclature ofalkanes (branched and unbranched). Alkyl group(definition and examples), methods of formation (Ethane and Propane): Wurtz reaction, Kolbe's reaction and decarboxylation of carboxylic acid. Physical properties andChemical reactions of alkanes (Ethane and Propane): Halogenation, nitration, sulphonation,isomerization, cyclization,aromatization,and pyrolysis, cracking and oxidation.L. P. G., Octane number. Mechanism of free radical chlorination of methane.

Cycloalkanes: NomenclatureIntroduction, Baeyer's strain theory and its limitations. Ring strain in small rings cyclopropane and cyclobutane. Theory of stainless rings.Conformational analysis of cyclohexane, axial and equatorial bonds.

(B) Alkenes: IUPAC nomenclature of alkenes, methods of formation (ethylene and propylene): Dehydrogenation of alkanes, dehydrohalogenation of alkyl halides, dehydration of alcohols and dehalogenation of dihalides. Chemical reactions of alkenes (ethylene and propylene):Hydroboration, oxidation $KMnO_4$, HIO_4, Epoxidation, Ozonolysis, Hydroxylation, Polymerization.Substitution in allylic position of alkenes.Markownikoff's rule and Peroxide effect. Ionic Mechanism of addition of Br_2 to ethene and HBr to propene, Free radical mechanism of addition of HBr to propene.

Unit - IV **(7.5 Hrs)**

(A) Dienes: Nomenclature and classification of dienes. Methods of formation of 1,3-butadiene. Chemical reactions of butadiene: 1,2- and 1,4–additions. Diels-Alder reaction.

Alkynes: Nomenclature, structure and bonding in Alkynes.Methods of formation of acetylene from: Calcium carbide and dehydrohalogenation of dihalides. Chemical reaction: Hydroboration,oxidation, metal ammonia reduction and polymerization. Oxyacetylene flame and Acidity of alkynes.

(B) Aromatic Compounds and Aromaticity: Nomenclature of Benzene derivatives.Introduction,Structure of benzene - Molecular formula, Kekule structure, Resonance structure, MO picture, Huckel rule and aromaticity.Aromatic ions (cyclopentadienyl anion and cycloheptatrienyl cation). Aromatic electrophillic substitution mechanism with energy profile diagram (e.g. nitration and sulphonation).

Fuel Chemistry: LPG, CNG, LNG, and Bio-Gas (definition, calorific value, composition, properties and uses). Octane number.Lubricants:Definition, classification (solid, semisolid, liquidwith example), properties (viscosity index, cloud point, pour point,acid value,saponification value) and applications of lubricants.

WEF from the session 2020-21

RTM NAGPUR UNIVERSITY NAGPUR
SEMISTER PATTERN SYLLABUS

Subject: Chemistry

B.Sc. Sem. II

CH-202 Paper- II (Physical Chemistry)

Unit-I: Thermodynamics 7.5 Hrs

(A) Second law of thermodynamics, need for second law of thermodynamics, statements of second law of thermodynamics, Carnot's cycle and its efficiency, Carnot theorem, thermodynamic scale of temperature, concept of entropy, entropy change in reversible and irreversible processes, entropy change of the universe, entropy changefor an ideal gas with change in P, V and T, entropy change during physical changes,
Free energy functions: work function (A) and Gibb's free energy function (G), variation of work function with T and V, variation of Gibb's free energy with T and P, A and G as criteria for spontaneity and equilibrium of a process, Gibb's-Helmholtz equation and its applications.

(B) Partial molar properties, chemical potential, Gibb's-Duhem equation, Clapeyron equation, Clapeyron-Clausius equation, chemical equilibrium: law of mass action, law of chemical equilibrium, relation between k_p and k_c, Van't- Hoff reaction isotherm, relation between standard free energy change and equilibrium constant, effect of temperature on equilibrium constant, integrated form of Van't Hoff equation.
Numerical problems.

Unit-II: Phase Equilibria and Solutions of Liquids in Liquids 7.5 Hrs

(A) Phase rule, definitions and explanation of the terms: phase, components and degree of freedom, derivation of Gibb's phase rule, application of Phase rule to one component systems (i) water system and (ii) sulphur system, need of reduced phase rule equation, application of Phase rule to two component system: lead-silver system, Pattinson process for de-silverization of lead, Potassium iodide-water system.

(B) Solutions of liquids in liquids, Raoult's law, positive deviation from Raoult's law, negative deviation from Raoult's law, Henry's law, partially miscible liquids: lower and upper consolute temperature (examples of phenol-water, trimethylamine-water system, nicotine-water systems), effect of impurity on consolute temperature, Nernst distribution law, conditions for the validity of the distribution law, Applications of Nernst distribution law: association, dissociation and in the process of extraction,
Numerical problems.

Unit-III: Chemical Kinetics and Theories of Reaction Rates 7.5 Hrs

(A) Rate of reaction, factors affecting the rate of reaction (concentration, temperature, pressure, solvent light and catalyst), order and molecularity of reaction, reactions of zero order, expression of the rate constant for the zero order reaction, derivation of integrated rate equation for first and second order reactions (both for equal and unequal concentration of reactants), characteristics of first and second order reactions, pseudo-unimolecular reactions, methods for determination of order of reactions: integration, differential, graphical, half life period, isolation methods.

(B) Theories of reaction rate: concept of energy of activation, Arrhenius equation, effect of temperature on rate of reaction, collision theory of bimolecular reactions (hard sphere model), transition state theory (equilibrium hypothesis), expression of rate constant based on equilibrium constant and thermodynamic aspects, Lindemann theory of unimolecular reactions.
Numerical problems.

Unit-IV: Nuclear Chemistry and Pollution and its Control 7.5 Hrs

(A) Nuclear chemistry: Radioactivity, stability of nucleus, rate of radioactive decay, mass defect and binding energy, average binding energy, explanation of nuclear stability on the basis of graph between binding energy per nucleon and atomic mass number, Nuclear reactions: fission and fusion, nuclear models: shell model and liquid drop model, comparison between shell model and liquid drop model, Bohr-Wheeler theory, radioisotopes, applications of radioisotopes in medicine, agriculture, industry and Carbon dating.

(B) Pollution and it's control: Introduction, pollution, causes of pollution, segments of environment: lithosphere, hydrosphere, biosphere and atmosphere, composition of atmosphere, atmospheric structure, air pollution, air pollutants like SO_2, SO_3, H_2S, NO, NO_2, CO, CO_2, and O_3, Acid rain, Greenhouse effect/Global warming, Particulates: dust, smoke, fly ash and smog: London smog and photochemical smog, Air pollution control, methods used to control gaseous pollutants: combustion, absorption and adsorption.
Numerical problems.

CH-203: Laboratory Course

Practical - I (Organic Chemistry):

(A) Qualitative Analysis: Element detection(N, Cl, Br, F & S), Identification of functional groups (-COOH, Phenolic –OH, -CHO, Aromatic -NH_2, -$CONH_2$). Determination of M.P & B.P.

(B) Preparation:

(i) Hydrolysis: Preparation of Benzoic acid from Benzamide
(ii) Oxidation: Preparation of Benzoic acid from Benzaldehyde
(iii) Bromination of Phenol.

Practical-II(Physical Chemistry)

1. To determine solubility of benzoic acid at different temperatures and hence determination of heat of solution of benzoic acid.
2. To determine heat of solution of solid calcium chloride and calculate lattice energy of calcium chloride from its enthalpy change data using Born-Haber cycle.
3. To construct phase diagram of three- component system (acetic acid-chloroform-water)
4. To determine critical solution temperature of two partially miscible liquids (phenol-water system).
5. To study the distribution coefficient of iodine between water and carbon- tetra chloride/kerosene.
6. To determine molecular state of benzoic acid in benzene by distribution method.
7. To determine rate constant of hydrolysis of methyl acetate in the presence of acid.
8. To determine the velocity constant of hydrolysis of ethyl acetate by NaOH (Saponification of an ester).

Reference Books (Theory)

1. Barrow G. M; Physical Chemistry, Tata Mc Grow Hills (2007).
2. Castellan G. W; Physical Chemistry, Narosa (2004).
3. Puri B. R; Sharma L. R; Pathania M. S; Principles of Physical Chemistry, Vishal Publishing Company (2018).
4. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House (2009).
5. Bajpai D.N; Advanced Physical Chemistry, S. Chand and Compony Ltd. (2001).
6. Atkins P.W, and Paula J. De ; Physical Chemistry, 8th Edn. Oxford University Press (2006).
7. Negi A. S., Anand S. C., A Textbook of Physical Chemistry, New Age International Publishers (2007).
8. Dey A. K., Environmental Chemistry, New Age International Publishers (2019).
9. Dara S.S., A Text Book of Engineering Chemistry, S. Chand and Company Ltd.(2002).

Reference Books (Practical)

1. Das R. C., Behra B., Experimental Physical Chemistry, Tata McGraw Hill.
2. Yadav J. B., Advanced Practical Physical Chemistry, Goel Publishing House.
3. Alexander Findlay, Levitt B. P., Findlay's Practical Physical Chemistry, Longman, London.

RTM NAGPUR UNIVERSITY NAGPUR

PROPOSED SEMISTER PATTERN (CBS) SYLLABUS

(Implemention from session 2021-22)

B.Sc. –II, Semester - III

CH – 301: Paper- I (Inorganic Chemistry)

Unit- I: **(7.5 Hrs)**

(A) Valence Shell Electron Pair Repulsion (VSEPR) Theory: Structure with respect to H_2O, NH_3, NH_4^+, ClF_3, SF_4, ICl_4^-.

Preparation properties and structure of Interhalogen compounds.

Polyhalides (Structure of I_3^-, I_5^-, ICl_4^-)

(B) MO theory: LCAO approximation, wave equation for molecular orbitals. Differencebetween bonding and anti bonding MO in terms of energy and electron density distributioncurves, order of energy levels in MO. Molecular Orbital diagrams for homonuclear diatomicmolecules of elements (with Z = 1 to 9). Concepts of nonbonding MO in HF molecule.Coulson'sMO diagram of CO and NO diatomic molecule.

Unit- II: **(7.5 Hrs.)**

A) Chemistry of elements of first transition series:

Characteristic properties of the elementsof first transition series with reference to their:Electronic configuration, Atomic and ionic radii, Ionization potential, Variable oxidation states,Magnetic properties, Colour, Complex formation tendency and catalytic activity.

(B) Chemistry of elements of second and third transition series:

Electronic configuration of 4d and 5d transition series.Comparative treatment with their 3danalogous (Group Cr-Mo-W, Co-Rh-Ir,) in respect of oxidation states and magnetic behaviour.

Unit – III: **(7.5 Hrs)**

A) Chemistry of Lanthanides:

Position in periodic table, electronic configuration, Oxidation states, Atomic and ionic radii,Lanthanide contraction and its consequences, Complex forming tendency.

Occurrence andSeparation of lanthanides (ion exchange and solvent extraction).

B) Chemistry of Actinides:

Position in periodic table, electronic configuration, Oxidation states, Atomic and ionic radii.Actinide contraction.

Unit IV: **(7.5 Hrs)**

A) Errors in Chemical Analysis:

i) Random and Systematic errors, Explanation of terms: Accuracy and Precision, Uncertainty,Absolute and Relative errors, Mean, Median, Average and Standard deviations, Significantfigures, numerical problems.

ii) Statistical Test of Data: Q-test, 2.5d and 4d Rules for rejection of data. Numerical problems.

B) Soil Chemistry: Types of soil, Components of soil, Introduction to soil analysis. Analysis of moisture, pH, salinity, nutrients (N, P, K) and micronutrients.

B.Sc. –II, Semester - III
CH-302: Paper- II (Organic Chemistry)

Unit–I **(7.5 Hrs)**

(A) Orientation: Activating (– OH, – NH_2) & deactivating (–Cl, –NO_2, –COOH) substituent's, their orientation and directive influence on further electrophilic substitution, o/p ratio. Methods of formation and chemical reactions of alkyl benzene (Toluene) and biphenyl.

(B) Alkyl and Aryl halides: Nomenclature, classification, methods of formation, chemical reactions. Mechanism of nucleophilic substitution reactions of alkyl halides SN^1 and SN^2 with energy profile diagrams. Chlorobenzene and benzyl chloride: Method of formations and chemical reactions

Polyhalogen compounds: Chloroform and carbon tetrachloride: formation and chemical reactions.

Unit–II **(7.5 Hrs)**

(A) Alcohols: Classification and nomenclature.

Dihydric alcohols: Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage ($Pb(Oac)_4$ and HIO_4) and Pinacol – pinacolone rearrangement with mechanism.

Trihydric alcohols : Nomenclature and methods of formation of Glycerol from (i) Propene and (ii) Hydrolysis of oils and fats, chemical reactions of glycerol - with oxalic acid at two different temperatures, HI, HNO_3, dehydration.

(B)Phenols: Nomenclature, structure and bonding. Preparation of phenols from cumene, Chlorobenzene (Dows and Raschig process) and diazonium salts. Acidic character, Resonance stabilization of phenoxide ion, Reactions of phenols, Electrophilic aromatic substitution, acetylation and carboxylation, Claisen rearrangement, Gatterman synthesis, Reaction Mechanism of (i) Fries Rearrangement, (ii) Reimer-Tiemann reaction.

Unit–III **(7.5 Hrs)**

(A) Aldehydes and Ketones: Nomenclature, structure of the carbonyl group, synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides and ketones from nitriles. oxidation of aldehydes by $KMnO_4$, Tollen's reagent and Fehlings solution. Reduction by $LiAlH_4$ and $NaBH_4$.

(B) Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knoevenagel condensation. Wittig reaction, Mannich reaction, Baeyer-Villiger oxidation of Ketones, Cannizaro reaction, (with mechanism), MPV, Clemmensen and Wolf-Kishner reaction.

Unit–IV **(7.5 Hrs)**

(A) Carboxylic Acids: Nomenclature, structure and bonding.Acidity of carboxylic acids, effect of substituent's on acid strengths, preparation of carboxylic acids from Grignard Reagent and cyanides. Chemical reactions of carboxylic acids, Hell-Volhard-Zelinsky reactions, Mechanism of decarboxylation with soda lime.

Dicarboxylic acids: Methods of formation of succinic acid from ethylene dibromide and Phthalic acid from *o*-xylene. Effect of heat and dehydrating agents (Succinic acid, Phthalic acid).

Carboxylic acid derivatives: Structure, preparation and chemical reactions of acid chlorides, esters, amides and acid anhydrides.

(B) Agrochemicals: Introduction and examples of insecticides, herbicides, fungicide, rodenticides. Advantages and disadvantages of agrochemicals. Synthesis and applications of DDT, BHC, Aldrin, Endosulphan, Atrazine
Bio pesticides: Neem oil and Karanj oil.

CH- 303: Laboratory Course

Practical-I (Inorganic Chemistry):

A) Volumetric Analysis (All Experiments to be performed). Preparation of standard solution by weighing is compulsory

1) Estimation of Fe (II) by dichromate using internal indicator.
2) Determination of acetic acid in commercial vinegar using NaOH
3) Determination of alkali content in antacid tablet using HCl

B) **Short experiments on soil analysis.**

1. Determination of percentage of moisture in a given soil sample.
2. Determination of pH of a given soil sample.
3. Determination of Electrical conductivity of a given soil sample.
4. Determination of free lime ($CaCO_3$) in a given soil sample.

Practical- II (Organic Chemistry):

Complete analysis of simple organic compound involving following steps:-

(i) Preliminary examination (ii) Detection of elements (iii) Detection of functional group (iv) Determination of M.P. / B.P. (v) Preparation of derivative and its M.P./B.P. (vi) Performance of specific test if any.

RTM NAGPUR UNIVERSITY NAGPUR

PROPOSED SEMISTER PATTERN (CBS) SYLLABUS

(Implementation from session 2021-22)

B.Sc. –II, Semester – IV

CH – 401: Paper- I (Inorganic Chemistry)

Unit-I: **(7.5 Hrs)**

Coordination compounds: Distinction among simple salts, double salts and coordination compounds. Werner's Coordination theory and its experimental verification. Sidgwick's electronic interpretation, EAN rule with examples, Nomenclature of Coordination compounds. Chelates: Classification and their applications, Valence Bond Theory of transition metal complexes.

Unit- II: **(7.5 Hrs)**

A)Isomerism in coordination compounds: Structural isomerism and Stereoisomerism in coordination compounds with respect to C.N. 4 & 6

B)Oxidation and reduction: Concept of oxidation and reduction. Methods of balancing redox reactions by Ion-Electron methodand oxidation number method, (numericals.) EMF series and its applications. Use of redox potential data: Analysis of Redox cycle, redox stability in water, Latimer diagram of Chlorine and Oxygen, Construction and explanation of Frost diagram. Frost diagram of Nitrogen and Oxygen. Pourbaix diagram of Iron.

Unit- III: **(7.5 Hrs)**

A) Colorimetry and Spectrophotometry: Principles of photometry: Beer-Lamberts Law, derivation and deviation (Numericals). Types of colorimeter and spectrophotometer with simple schematic diagrams. Application of colorimeter and spectrophotometer in quantitative analysis with reference to estimation of Cu(II) as Cu-ammonia complex.

B) Separation Techniques: a) Chromatography: Classification, Principle, Technique and Application of Paper and Column Chromatography. b) Ion- Exchange: Types of ion exchange resins, Equilibria and ion exchange capacity, Application in separation of binary mixtures. c) Solvent Extraction: Principle and Classification, Factors influencing extraction and application in chemistry.

Unit- IV: **(7.5 Hrs)**

(A)Inorganic Polymers: Silicones: Introduction, Nomenclature, preparation, properties and uses, Phosphonitrilic halide polymers: Introduction, Preparation, properties and uses. Structure and bonding in $(NPCl_2)_3$

(B)Water Analysis: Water and its quality parameters, Physical and chemical quality parameters of drinking water. Analysis of water quality parameters (pH, conductance, TDS, Turbidity,. Temporary and permanent Hardness, BOD, COD, DO, alkalinity, Chloride, Fluorides, Sulphate)

B.Sc.Semester-IV

CH-402,CHEMISTRY-II(PhysicalChemistry)

UNIT-I:SOLIDSTATE

(7.5 Hrs)

(A) Solidandtheirclassification,differencebetweencrystallineandamorphoussolids,crystallography: some terms used in crystallography, Laws of crystallography: Law ofconstancyofinterfacialangles,Lawofrationalityofindices,Lawofsymmetry,Elementsof symmetry of a crystal, space lattice and unit cell, Bravais lattices, crystal systems,identification of crystal planes, Weiss indices and Miller indices, interplanar distances incubic systems.

(B) X-ray diffraction by crystal, derivation of Bragg's equation, experimental methods ofdeterminationofcrystalstructure:Powder method,Laue's method, determinationofcrystal structure of NaCl, KCl and CsCl, types of crystals, characteristics of various typesof crystals, characteristic structures of ionic crystals, zinc blende structure and Rutilestructure,numericalproblems.

UNIT-II:ELECTROCHEMISTRY

(7.5Hrs)

(A) Electrical transport: Electrolytic and metallic conductance, difference between metallicandElectrolyticconductors,electricalresistanceandconductance,specific,equivalentandmolar conductance, measurement of Electrolytic conductance, variation of conductance,specific,equivalentandmolarconductancewith concentration.

Kohlrausch's law, Arrhenius theory of Electrolytic dissociation, limitations of Arrheniustheory,Ostwald'sdilutionlaw,validityandimportanceofOstwald'sdilutionlaw,Debye-Huckel theory (elementary treatment), relaxation effect, electrophoretic effect, Debye-Huckel-Onsagarequation.

(B) Transportnumber,determinationoftransportnumber:Hittorf'smethod,Movingboundarymethod,relationbetweenionicconductanceandtransportnumber,applicationsofKohlrausch's law, applications of conductance measurement: determination of equivalentconductance at infinite dilution, (λ_∞) for weak electrolytes, determination of degree ofdissociation, determination of solubility and solubility product of sparingly soluble salts,conductometrictitrations:acid-baseandprecipitationtitrations,numericalproblems.

UNIT-III:MOLECULARSPECTROSCOPY

(7.5Hrs)

(A) Rotational spectra: Introduction, electromagnetic radiation, regions of electromagneticspectrum, types of molecular spectra, rotational spectra of diatomic molecules, energylevels of rigid rotors, selection rules, expression for wave numbers of spectral lines interms of rotational constant and rotational Quantum number, intensity of spectral lines,types of molecules showing rotational spectra, Applications of rotational spectra fordeterminationofmomentofinertia and bondlength, introductionto non-rigidrotor.

(B) Vibrational spectra: Vibrational energy levels of simple harmonic oscillator, selectionrules,typesofmoleculesshowingvibrationalspectra,vibrationalenergylevelsofanharmonic oscillator, selection rules, Idea of overtones, Vibrational-Rotational spectra,P,QandRbranchesofvibrational-rotationalspectra,structuralinformationfromInfraredspectra,momentofinertiaandbondlength,force constant,normalmodesofvibrationsinpolyatomicmolecules,numericalproblems.

UNIT-IV:QUANTUMCHEMISTRY(7.5Hrs)

(A) Failure of classical mechanics, explanation of black body radiation, photoelectric effect,heat capacity of solids, de-Broglie's hypothesis (derivation and experimental proof),Heisenberguncertaintyprinciple(explanationandexperimentalproof),Schrodingerwaveequation,Eigenvaluesand Eigenfunctions,normalisedandorthogonal wavefunctions,operators,algebraofoperators,Laplacianoperator,Hermitianoperator,postulates of quantum mechanics, derivation of Schrodinger wave equation on the basisof postulatesofquantummechanics.

(B) Dielectric and Magnetic properties of molecules: polarization of molecules in an electricfield, Clausius-Mosotti equation, effect of temperature on polarization, dipole momentandchemicalConstitution(applicationsofdipolemoment),Magneticpermeability,diamagnetic,paramagneticandferromagneticsubstances,magneticsusceptibility,measurementofmagneticsusceptibility(Gouy'smethod),applicationsofmagneticsusceptibility, numericalproblems.

Reference Books:

1. WestAR,Solidstatechemistryand It'sapplications,Wiley (1984)
2. Castellan GW,Physicalchemistry,Narosa(2004).
3. BanwellCNandMccash,FundamentalsofMolecularspectroscopy,McGraw-Hill(1994)
4. PrasadRK, QuantumChemistry,Wiley-EasternLtd,NewDelhi(1992)
5. KapoorKL,PhysicalChemistry,Vols.I,II,IIIandIV,McMillan(India)Ltd.NewDelhi (1984)

CH-403,Laboratory Course.

Practical-I (Inorganic Chemistry):

A) Preparation of following complexes and Comments on its VBT structure, magnetic Properties and colours: a) $[Cu\ NH_3)_4(H_2O)_2]SO_4$ b) $[Ni(NH_3)_6]SO_4$

c) Trans $[Co\ (NH_3)_4Cl_2]Cl$ d) $K_3[Fe(C_2O_4)_3].H_2O$

B) Chromatographic separation of binary mixtures (at least Two) containing Cu(II), Co(II) and Ni(II) ions by paper chromatography and determination of Rf values.

C) Determination of Zn by complexometric titration with EDTA

D) Determination of total Hardness of water (permanent and Temporary) by EDTA

E) Determination of following parameters of drinking water

a) pH b) Conductance c) Turbidity d) alkalinity and d) TDS

Practical-II,(PhysicalChemistry)

1. Toconstructvariouscrystallattices.
2. Todeterminethestrengthofgivenacid(HClorCH$_3$COOH)conductometricallybyusingstandardalkali(NaOH)solution.
3. To determine the strength of strong acid and weak acidin a mixtureConductometrically by usingstandard alkali(NaOH)solution.
4. Todeterminesolubilityandsolubilityproductofasparinglysolublesaltconductometrically.
5. Todetermineionizationconstantofweakacidconductometrically.
6. To determine electron polarization and electron polarizabilityof aliquidrefractometrically.
7. Todeterminethemolarvolumeofethanolandit'spartialmolalvolumeatroomtemperaturein dilute solution.
8. Todeterminetheequilibriumconstantofthereaction,$KI+I_2=KI_3$bythedistributionmethod.

PHYSICS

(B. Sc. Part- I)

Semester I

(Paper-101, 102, 103)

Semester II

(Paper-201, 202, 203)

(2013-2014)

B. Sc. First Year (Semester I)

Course - PHYSICS – Paper - I (101)

(Properties of Matter and Mechanics)

Marks- 50 **Time- 30 hours**

Unit I:

Elasticity- Introduction, Hooke's law, Elastic constants (Y, K, η) and relation between them, Poisson's ratio, Elastic limit, Work done in stretching a wire, Bending of beam, Bending moment, External and internal bending moment, Cantilever supported at one end and at both end, Torsional pendulum, and Maxwell needle.

Unit II:

Viscosity- Streamline and turbulent flow, Coefficient of viscosity, Equation of continuity, Euler's equation, Bernoulli's theorem and its applications (Lift of an Airplane, Atomizer) , Poiseuilli's formula, Reynolds number, Terminal velocity, Stokes law by the method of dimension, Variation of viscosity with temperature.

Unit III:

Surface tension- Introduction, Angle of contact and wetting, Surface energy, Surface tension by Jaeger's, Quincke's and Capillary rise methods.

Mechanics- Newton's law of motion, motion in a plane, components of velocity and acceleration in different coordinate system, Centripetal acceleration, Coriolis force and its applications.

Unit IV:

Mechanics- System of particles, Center of mass, Equation of motion, Conservation of linear and angular momentum, Conservation of energy, Single stage and multistage rockets, Elastic and inelastic collisions, Moments of inertia and their products, Moment of inertia of cylinder and sphere, Principal moments and axes.

References & Text books-

1. Applied Fluid Mechanics, by- Mott Robert, Pearson Benjamin Cummir, VI Edition, Pearson Education/Prentice Hall International, New Delhi
2. Properties of Matter, by- D. S. Mathur, Shamlal Chritable Trust New Delhi
3. Properties of matter, by- Brijlal
4. Physics for Degree Students B.Sc.-Part-I, by- C. L. Arora, Dr. P. S. Hemne, S Chand & Company.
5. General Properties of matter, by- J. C. Upadhyay, Ram Prasad & Sons
6. Mechanics, by- D. S. Mathur, S Chand.
7. Mechanics, by-B. M. Roy, Das Ganu Publications.

8. Mechanics & Electrodynamics, by- Brijlal & Subramaniam.
9. A text book of properties of Matter, by- N. S. Khare& S. Kumar.
10. Mechanics & Properties of Matter, by-J. C. Upadhyaya.

B. Sc. First Year (Semester I)

Course - PHYSICS - Paper-II (102)

(Electrostatics, Time varying fields & Electric Currents)

Marks- 50 **Time- 30 hours**

Unit I:

Electrostatics- Coulombs law in vacuum in vector form, Force between two charges, Electric field intensity, Electric potential, Electric field intensity due to a point charge, Electric dipole, Electric dipole moment, Electric field intensity due to an electric dipole, Electric field as a negative gradient of potential, Conservative nature of the electric field.

Unit II:

Dielectric- Introduction, definition of polar and non polar molecules, Polarization of charges in a dielectric, Clausius - Mossitti equation, Three electric vectors D, E and P and relation between them, Concept of capacitance, Parallel plate capacitor without and with dielectric, application of Gauss's law to parallel plate capacitor.

Unit III:

Time varying fields-Electromagnetic induction, Faradays laws in differential and integral form, Lenz's law, self and mutual induction, Transformer, Construction, working and its parameters, Energy losses.**Electric Currents**- Current density, Equation of continuity, Kirchhoff's law, Rise and decay of current in LR and CR circuits, Decay of charge in LCR circuits.

Unit IV:

Electric Currents- Application of complex number in solving an a. c. circuit, j- operator method, A.C. applied to pure resistive, pure inductive and pure capacitive circuit, application of j- operator in LR, CR and LCR circuit, Resonance, Sharpness of resonance, Series resonance circuit (Calculate I, Z, Φ and f_r),Q factor, Power in an a. c. circuit, Power factor.

References and Text books -

1. Electricity and Magnetism, by- Brijlal , Subramanyam.
2. Fundamental of Magnetism and Electricity, by- D. N. Vasudiva.
3. Electricity and Magnetism with Electronics, by- K. K. Tiwari.
4. Electricity and Magnetism, by K.K. Tiwari.
5. Elements of Electronics, by- M. K. Bagde, S. P. Singh, K Singh S - Chand.
6. Solid State Physics and Electronics, by- R. K. Puri, and V. K. Babbar.
7. Solid state Electronic Devices II Edition, by-B. G. Strretman.
8. Introduction to Electrodynamics, by- D. J. Griffiths.

9. Electromagnetic fields, by- T. V. S. Arun Murthy.
10. Electronics Fundamental and Applications II nd Edition, by-J. D. Ryder.

B. Sc. First Year (Semester I)
Course - Physics Practical (103)

1. A student will have to perform at least **ten** experiments per semester and **two** experiments (from different fields) at the time of university practical examination in 6 hours.
2. The distribution of practical/laboratory work of 30 marks is-

Two experiments (9 Marks each)	- 18 Marks
Record book	- 06 Marks
Viva Voce	- 06 Marks
Total	30 Marks

List of the experiments-

1. Range and least count of Instruments, measurements using various instruments and error analysis (vernier caliper, screw gauge, traveling microscope, spectrometer etc.)
2. Young's modulus by cantilever.
3. Young's modulus by bending of beam.
4. Young's modulus by vibrational method.
5. Modulus of rigidity by Torsional pendulum.
6. Modulus of rigidity by Maxwell's needle.
7. Determination of η by statical method.
8. To determine Coefficient of Viscosity of water by Poiseulle's method.
9. Surface tension of a liquid by Quincke's method.
10. Surface tension of a liquid by Jagers method.
11. Surface tension of a liquid by Capillary rise method.
12. To determine the moment of inertia of a body using torsion pendulum.
13. To determine the moment of inertia of a fly-wheel.
14. Measurement of Inductance by phasor diagram method.
15. Measurement of Capacitance by phasor diagram method.
16. To study charging and discharging of a condenser through a resistor R.
17. To study growth/decay of current in LR circuit.
18. Study of growth of current in CR Circuit using microammeter.
19. Frequency of A.C. Mains by sonometer.
20. Study of frequency response of series LCR circuit and determination of Q- factor.
21. Study of Transformer (parameters determination).
22. Verification of Kirchhoff's law, using electrical network.
23. To calculate low resistance by potentiometer.

24. Calibration of an ammeter by potentiometer.
25. Determination of dielectric constant of a solid.

B. Sc. First Year (Semester II)

Course – PHYSICS - Paper-I (201)

(Oscillations, Kinetic theory of gases and Thermodynamics)

Marks- 50 **Time- 30 hours**

Unit I:

Free oscillations- Introduction to linear and angular S.H.M., Differential equation of S.H.M. and its solution, Composition of two perpendicular linear S.H.M.s for 1:1 and 1:2 (analytical method), Lissajous's figure.

Damped oscillations- Differential equation of damped harmonic oscillator and its solution, Energy equation of damped oscillations, Power dissipation and quality factor.

Unit II:

Forced oscillations- Forced oscillation with one degree of freedom, Differential equation of forced oscillation and its solution, Resonance (Amplitude), Sharpness of resonance, Power dissipation, Quality factor and bandwidth.

Kinetic theory of gases -Assumptions, Boyle's law, Equipartition of energy, Molecular collision, Mean free path and collision cross section, Estimate of molecular diameter and mean free path.

Unit III:

Transport phenomenon in gases- Transport of mass, momentum, energy and their relationship, dependence on temperature and pressure, Van der wall's gas (Real gas, Equation of state), Critical constants. **Thermodynamic** -Thermodynamic variables, Thermal equilibrium and temperature, Zeroth law of thermodynamics, Thermodynamic processes (Reversible and Irreversible), Indicator diagram, First law of thermodynamics, Carnot's cycle and it's efficiency, Carnot's theorem.

Unit IV:

Thermodynamic-Entropy, Second law of thermodynamic, Thermodynamic scales of temperature, Third law of thermodynamics, Maxwell general relationship[$\delta(T,S)/\delta(x, y) = \delta(P,V)/\delta(x, y)$] and it's applications, Joules coefficient, Porous plug experiment, Liquefaction of gases- Boyle's temperature and inversion temperature, Liquefaction of Helium, Air conditioning (Concept only).

References and Text books -

1. Waves and Oscillations, by-Stephenson.
2. A Text Book of Oscillations, waves and Acoustic, by- Dr. M. Ghosh, Dr. D. Bhattacharya.
3. Oscillation, waves and sound, by- Sharma and Saxena.
4. Waves and oscillation, by- N. Subrahmanuam and Brijlal.
5. The Physics of waves and oscillation, by- N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd.
6. Heat, Thermodynamics and Statistical Physics, by- Pragati Prakashan , Singhal, Agrawal.
7. Heat and Thermodynamics, by- Brijlal, Subramanyam.
8. A Text Book of Heat, by- J. B. Rajam.

9. Heat, thermodynamics and statistical physics, by- Brijlal, Subramayam and Hemne.
10. Heat and thermodynamics, by- C. L. Arora.
11. Treatise on heat, by- Shah, Srivastava.

B. Sc. First Year (Semester II)

Course-PHYSICS - Paper-II (202)

(Gravitation, Astrophysics, Magnetism and Magneto statics)

Marks- 50 **Time- 30 hours**

Unit I:

Gravitation- Kepler's laws of Planetary motion (statement only), Newton's law of gravitation, Relation between G and g, Gravitational field, Gravitational potential, Gauss's theorem, Gravitational potential and intensity due to uniform solid sphere at a point inside and outside the sphere, Gravitational self energy of a galaxy.

Unit II:

Astrophysics- The constituents of universe (Solar system, Stars, Galaxies), Introductory study of solar systems, To measure size of a planet ($d=D.\alpha$), To measure distance of a planet by parallax method ($D=b/\theta$), Mass of the sun and the planets($M=4\pi^2r^3/GT^2$), Structure of sun, Solar interior, surface temperature of sun ($T=[R/r]^{1/2}.[S/\sigma]^{1/4}$), Solar luminosity, Stellar spectra, The Milky way (shape, size, clusters), Cosmological theories of the universe (Concept only).

Unit III:

Magnetism- Introduction, Magnetic materials, Langevin's theory of diamagnetism, its application as superconductor, Critical magnetic field and Meissner effect, Langevin's theory of para magnetism, Ferromagnetism, Ferromagnetic domain, Curie temperature, Ferrimagnetisms, Ferrites and its applications, Antiferromagnetism, Neel temperature.

Unit IV:

Magneto statics- Concept of magnetic field, Lorentz force equation, Magnetic dipole moment, angular momentum and gyro magnetic ratio, Biot- Saverts law, It's applications (B due to steady current in a long straight wire, B along the axis of circular coil), Ampere's law, It's applications(B for a solenoid, A Toroid), Magnetization current, Magnetic vectors, Gauss law of magnetization.

References and Text books -

1. Modern's abc of physics, Vol. II, by- Satish K. Gupta. (For Astro Physics, Unit 13).
2. The Great Universe, by- G. K. Sasidharan, S Chand publications.
3. University physics, by- H. D. Young, R. A. Freedman.
4. Astronomy structure of the universe, by- A. E. Roy, D. Clarke, Adam Hilger Pub.
5. Electricity and Magnetism, by- D. C. Tayal
6. Electricity and Magnetism, by- Rakshit, Chottopadhay

7. Electricity and Magnetism, by- S. S. Atwood.
8. Electricity and Magnetism, by- K. K. Tiwari.
9. University physics, by-I. J. C. Upadhayay, Himalaya publications.
10. Foundation of Electrodynamics, by- Theory, Rietz and Millford.

B. Sc. First Year (Semester II)

Course - Physics Practical (203)

1. A student will have to perform at least **ten** experiments per semester and **two** experiments (from different fields) at the time of university practical examination in 6 hours.
2. The distribution of practical/laboratory work of 30 marks is-

Two experiments (9 Marks each) -	18 Marks
Record book	- 06 Marks
Viva Voce	- 06 Marks

Total	30 Marks

List of the experiments-

1. Acceleration due to gravity by compound pendulum.
2. To study damping of a bar pendulum.
3. To study oscillations of a rubber band and to draw potential energy curve for it.
4. To study the oscillation in a bifilar suspension arrangement.
5. To determine acceleration due to gravity by Kater's reversible pendulum.
6. Study of Lissajous's figure
7. To determine the pressure coefficient of air by constant volume air thermometer.
8. To verify the Stefan's law of radiation by using an incandescent lamp.
9. Thermal conductivity of a metal rod using Forbes method.
10. Thermal conductivity of a bad conductor by Lee's disc method.
11. To determine the critical temperature and critical pressure of a gas.
12. To determine the coefficient of thermal conductivity of glass in the form of a tube.
13. To determine specific heat of a given liquid by method of cooling.
14. To find Υ ratio of specific heat of gas by Clamert and Desormi's method.
15. Mechanical equivalent of heat by Calender- Barne's constant flow method.
16. To determine the mechanical equivalent of heat (J) with the help of Joule's calorimeter.
17. To determine temperature coefficient of resistance of platinum using platinum resistance thermometer
18. Study of heating efficiency of electrical kettle with varying voltages.
19. To study the variation of total thermal radiation with temperature using the torch bulb filament.
20. To determine height of a building, altitude of sun and angular diameter of sun with the help of a sextant.
21. To determine the horizontal component of Earth's magnetic field and magnetic moment of the magnet.
22. To study the variation of magnetic field along the axis of a current carrying circular coil.

23. Study of magnetic field by vibration magnetometer.
24. To determine the dipole moment of a given liquid.
25. To determine magnetic susceptibility of $FeCl_3$.

PHYSICS

(B. Sc. Part- II)

Semester III

(Paper-301, 302, 303)

Semester IV

(Paper-401, 402, 403)

(2014-2015)

B. Sc. Second Year (Semester III)

Course-PHYSICS - Paper-I (301)

(Sound waves, Applied acoustic, Ultrasonic and Power supply)

Marks- 50 **Time- 30 hours**

Unit I:

Waves in media- Speed of transverse wave on a string, Group velocity and phase velocity and their relation and measurement, Standing waves, Harmonics, Quality of sound, Human ear and its response (Diagrammatic introduction only), Limit of human audibility, Intensity and loudness, bel and decibel, the musical scale, Temperaments and musical instruments.

Unit II:

Applied acoustic- Transducers and their characteristics (Crystal microphone, Moving coil loud speaker), Recording and reproduction of sound (Magnetic tape, Cine film, Compact disc), Acoustic of building, Reverberation and reverberation period, Sabine's formula, Factors affecting the acoustics of building, Requirements for good acoustics.

Unit III:

Ultrasonic- Introduction, Properties and production of ultrasonic waves, piezoelectric effect, piezoelectric generator, Magnetostriction effect and oscillators, Frequency of ultrasonic waves, Application of ultrasonic waves (measurement of depth of sea, SONAR system and Medical science).

Unit IV:

Power supply-Introduction, rectification using half wave and full wave rectifiers (Find $I_{d.c.}$, $V_{d.c.}$, I_{rms}, η and ripple factor), Working of Full wave bridge rectifier, Filters, Difference between regulated and unregulated power supply, line and load regulation, voltage stabilization, Zener diode as voltage regulator, IC voltage regulation.

References and Text books -

1. A Text Book of sound, by- Khanna , Bedi
2. A Text Book of sound, by- L. P. Sharma, Saxena (S. Chand)
3. Properties of Matter and Acoustics, by- R. Murugeshan, Kiruthign Sivaprakash.
4. Fundamental of Acoustics 4th Edition, by- Kinsler , John Wiley and Sons.
5. Basic Acoustics, by- D. E. Hall, Oxford University Press.
6. A Text Book of Oscillations, Waves and Acoustics, by- Dr. M. Ghosh, Dr. D. Bhattacharya (S. Chand)

7. Oscillation, Waves and Sound, by- Sharma and Saxena.
8. Science and Technology of Ultrasonics, by- Baldevraj, Narosa.
9. Elements of Electronics, by- M. K. Bagde, S. P. Singh, K Singh S- Chand.
10. Solid State Physics and Electronics, by- R. K. Puri, and V. K. Babbar.
11. Solid State Electronic Devices II Edition, by- B. G. Strretman

B. Sc. Second Year (Semester III)

Course-PHYSICS - Paper-II (302)

(Physical optics and Electromagnetic waves)

Marks- 50 **Time- 30 hours**

Unit I:

Interference of light- Introduction, Interference in equal thickness thin film, Phase change on reflection, refraction and transmitted system. Newton's ring and its application to determine the wavelength and refractive index, Michelson Interferometer and its application to wavelength determination and wavelength difference, Fabry- Parrot Interferometer and its application.

Unit II:

Diffraction of light- Introduction, Fresnel's diffraction- Half period zones, Zone plates, Diffraction due to straight edge and due to narrow slit.

Fraunhoffer diffraction- Fraunhoffer diffraction at a single slit, at circular aperture, Plane diffraction grating and its application, Resolving power of grating, Rayleigh's criterion for resolution.

Unit III:

Polarization- Introduction, Brewster's law, Polarization by scattering (concept only), Blue color of the sky(only idea), Uniaxial and biaxial crystal , positive and negative crystal, ordinary and extraordinary rays, Nicol prism, its application as an analyzer and polarizer, Double refraction in uniaxial crystal, phase retardation plate (Half and Quarter wave), Double prism.

Unit IV:

EM Waves- Introduction to EM spectrum related to wavelength, origin and characteristics of EM waves, Physical significance of Maxwell's equations, EM wave equations (in conducting medium and in free space), It's transverse nature, Plane polarized EM wave ($E_0/H_0= \sqrt{\mu}/_{\varepsilon}$), Characteristics impedance of dielectric, Poynting vector, Poynting theorem.

References and Text books -

1. Physics for Degree students for B. Sc. Second year, by- C. L. Arora, Dr. P. S. Hemne.
2. Optics and Spectroscopy, by- R. Murugeshan , Kiruthign Sivaprakash.
3. Optics, by- Brijlal and Subramayam.
4. Optics, by- Ajay Agatak.
5. A text book of optics, by- Dr. Subrahmanyam, Brijlal and M. N. Avadhanulu.
6. Optics, by- J. K. Sharma, K. K. Sarkar.
7. Fundamentals of optics, by-Jenkins and white.

8. Optics, by- D. P. Khandelwal.
9. Electromagnetic field and waves, by- Paul Lorrain and Dale R. Corson.
10. Foundation of Electromagnetic theory, by- John R. Retitz, Fredrick, J. Milford.
11. Electromagnetic, by- B. B. Laud.
12. Electrodynamics, by- Jordon

B. Sc. Second Year (Semester III)

Course - Physics Practical (303)

1. A student will have to perform at least **ten** experiments per semester and **two** experiments (from different fields) at the time of university practical examination in 6 hours.
2. The distribution of practical/laboratory work of 30 marks is-

Two experiments (9 Marks each)	- 18 Marks
Record book	- 06 Marks
Viva Voce	- 06 Marks

Total	30 Marks

List of the experiments-

1. Study the speed of waves on stretched string.
2. Determination of velocity of sound using volume resonator.
3. To determine frequency of A. C. Mains with a Sonometer using single/two magnetic wire.
4. To determine unknown frequency and to verify the law of inverse variation of frequency and volume of air by Helmholtz resonator.
5. To determine the velocity of sound wave in air (gas) with Kundt's tube.
6. To determine the radius of curvature of the lower surface of a plano-convex lens by using Newton's ring apparatus.
7. Study of wavelength of light using Newton's ring.
8. To study the variation of the fine width with color of light.
9. To study the characteristics of micro phone.
10. Study of loudspeaker (woofer, squawker, tweeter) as a transducer.
11. Study of Piezoelectric effect.
12. To Study the current regulation and ripple factor of half wave / full wave rectifier using semiconductor diodes with L and Π type filter.
13. To study the characteristics of zener diode.
14. To study the zener diode voltage regulating characteristics.
15. To study the regulation characteristics of zener regulated and IC 741 regulated power supply.
16. To determine the velocity of ultrasonic waves in a given liquid.
17. To produce interference pattern using Lloyd's mirror and to determine the wavelength of sodium light.
18. To determine the dispersive power of a prism.
19. Study of polarization of light by reflection (Brewster's law).
20. To find R.I. of glass by using Brewster's law.

21. To determine the resolving power of a grating.
22. To study diffraction at straight edge and to determine the wavelength of monochromatic light.
23. To determine the resolving power of a telescope.
24. Study of wavelength of light using plane diffraction grating.
25. To determine the wavelength of prominent lines of mercury by plane transmission grating.

B. Sc. Second Year (Semester IV)

Course-PHYSICS - Paper-I (401)

(Solid state physics, X-ray and Laser)

Marks- 50 **Time- 30 hours**

Unit I:

Solid state physics- Introduction, Crystal structure, periodicity, lattices and basis, fundamental translation vector, unit cell and primitive cell, Miller indices, allowed rotations, lattice types, lattice planes, Bravais lattices, packing fraction, coordination number, Inter-planer distances, Crystal structures-Na Cl, diamond, CsCl, ZnS etc.

Unit II:

X-ray-Introduction, discrete and continuous X-ray spectra, Main feature of continuous X-ray spectra, Characteristics X-ray spectra, Duane-Hunt law, X- ray emission spectra, Moseley law its importance and applications, Auger effect, X-ray absorption spectra, applications of X-rays in various fields.

Unit III:

Solid state physics- Reciprocal lattice, Wigner Seitz cell, Geometrical relation between direct and reciprocal lattice, Laue's theory of X-ray diffraction, Bragg's law and Bragg's diffraction conditions in direct and reciprocal lattice, Laue's pattern, Bragg's spectrometer and its applications (wavelength determination and simple cubic structure determination).

Unit IV:

Laser- Introduction to Laser (purity of spectral line, spatial and temporal coherence), Einstein's relation, absorption, spontaneous and stimulated emission, Population inversion, Optical pumping, characteristics of laser beam, three level and four level laser system, Ruby laser, He-Ne laser, Semiconductor laser, Application of lasers.

References and Text books –

1. Solid State Physics, by- S. U. Pillai.
2. Cryptography Applied to SSP, by- O. N. Shrivastave
3. Solid State Physics, by- Gupta Kumar.
4. Introduction to Solid State Physics, by- C. Kettel.
5. Modern Physics, by- R. Mugadesham
6. Modern Physics, by- J. B. Rajam

7. Modern Physics, by- Kumar , Krishane, Nandeem
8. A Text Book of Modern Physics, by- K. C. Lal, S. T. Ahmad.
9. Modern Physics, by- Aurther Biser.
10. Lasers and Non linear optics. By- B. B. Laud
11. LASERS- Theory and Applications, by- Thyagarajan and A. K. Ghatak
12. Optics and LASER, by- V. K. Sewane
13. Introduction to Lasers, by- Dr. Avadhanulu, Dr. P. S. Hemne.

B. Sc. Second Year (Semester IV)

Course - PHYSICS - Paper-II (402)

(Solid state electronics, and Molecular physics)

Marks- 50 **Time- 30 hours**

Unit I:

Solid state electronics- Light emitting diode, Solar Cell, Photovoltaic cell, **Bipolar transistor**- Construction and working, transistor characteristics in CE and CB Mode, Graphical analysis of CE configuration. Hybrid parameters, Equivalent circuit at low frequency in CE mode, Thermal Runaway, Stabilization, Heat sink, Stability factor, Bias stabilizing circuits.

Unit II:

Field Effect Transistor- Construction, and working principal of JFET, Difference between BJT and JFET, Characteristics of JFET, Parameters , JFET as an amplifier (input and output impedance, voltage gain), Advantage of JFET over BJT. **MOSFET**- Types of MOSFET, Construction and working of MOSFET, Characteristics of MOSFET, Special features of MOSFET.

Unit III:

Molecular physics- Quantization of vibrational and rotational energies, types of molecules based on moment of inertia, rigid diatomic molecules, Intensity distribution in rotational levels, Diatomic molecules as harmonic and anharmonic oscillator, Rotational-vibrational spectra, Born Oppenheimer approximation.

Unit IV:

Raman spectroscopy- Raman effect, Classical and quantum explanation, Experimental set up, Raman spectra and molecular structure, Applications of Raman effect, Electronic spectra, Dissociation energy, Frank-Condon principle, Elementary ideas of NMR and ESR and their applications in spectroscopy.

References and Text books -

1. Elements of Electronics, by- M. K. Bagde, S. P. Singh, K Singh S- Chand.
2. Solid State Electronic Devices II Edition, by- B. G. Strretman
3. Electronics Fundamentals and Applications II Edition, by- J. D. Ryder
4. Principals of Electronics, by- V. K. Mehta, Rohit Mehta.

5. Basic Electronics (Solid State) by- B. C. Theraja.
6. Atomic and Molecular Physics, by- ULP publications, Prof. C. Mande.
7. Elements of Spectroscopy, by- Pragati prakashan, Gupts kumar Sharma.
8. Optics and Spectroscopy, by- R. Murugeshan and Kiruthiga Sivaprakash, S Chand publication.
9. Advanced Molecular Physics, by- Shriram and Sharma.

B. Sc. Second Year (Semester IV)

Course - Physics Practical (403)

1. A student will have to perform at least **ten** experiments per semester and **two** experiments (from different fields) at the time of university practical examination in 6 hours.
2. The distribution of practical/laboratory work of 30 marks is-

Two experiments (9 Marks each)	- 18 Marks
Record book	- 06 Marks
Viva Voce	- 06 Marks

Total	30 Marks

List of the experiments-

1. To determine wavelength of LASER beam using plane diffraction grating or cylindrical obstacle.
2. To study the divergence of a LASER beam.
3. To study LASER as a monochromatic coherent source.
4. Study of total internal reflection using LASER.
5. Measurement of the focal length of a given convex lens using LASER.
6. Goniometric study of crystal faces using models.
7. To construct SC, BCC, FCC and to find packing fraction, coordination number.
8. To determine lattice parameter 'a' of a unit cell of a cubic crystal using X-ray diffraction film.
9. To determine the energy gap of a semiconductor using four probe method.
10. To determine energy gap of a semiconductor using PN junction diode in reverse bias mode.
11. To determine the dielectric constant of a solid and its polarisability by resonance method.
12. Study of IR Spectra of HCl molecule.
13. Identification of unknown element from line emission spectra.
14. To determine the Rydberg constant for Hydrogen.
15. Study of characteristics of LED.
16. To study the characteristics of photo diode and use as light sensor (LDR).
17. Study of Solar cell as a Photo voltaic cell.
18. Study of characteristics of transistor in common base mode.
19. Study of characteristics of transistor in common emitter mode.
20. To study the variation of gain with frequency of single stage common emitter amplifier.

21. To study the frequency response of a single stage transformer coupled transistor amplifier.
22. To study variation of gain of CE amplifier with load at fixed frequency.
23. Study of characteristics of field effect transistor.
24. Study of FET as an amplifier.
25. To determine the Hybrid parameters of a transistor.

PHYSICS

(B. Sc. Part- III)

Semester V

(Paper-501, 502, 503)

Semester VI

(Paper-601, 602, 603)

(2015-2016)

B. Sc. Final Year (Semester V)

Course-PHYSICS - Paper-I (501)

(Atomic physics, free electron theory and Statistical physics)

Marks- 50 **Time- 30 hours**

Unit I:

Atomic physics- Introduction (Revision of Bohr's model, Somerfield and Chadwick), Vector atom model, Stern-Gerlach experiment, Spinning of electron, Space quantization, Selection rules, Quantum numbers, L-S and J-J Coupling, Pauli's exclusion principal, Hunds rule, Zeeman effect, Normal Zeeman effect, Anomalous Zeeman effect, Stark effect.

Unit II:

Free electron theory- Drude Lorentz model, Mean free path, Electrical and thermal conductivity, Wiedemann Franz law (Derivation), Density of states, Fermi energy, Fermi temperature. **Band theory of solids**- Bloch theorem (statement only), Kroning Penny model, Concept of hole, Hall effect, Energy bands in solid, distinction between metal, semiconductor and insulator.

Unit III:

Statistical physics- μ- space, Gamma space, probability distribution, thermodynamic probability, Principle of a priori probability, Boltzmann's entropy relation, accessible and inaccessible estates, macro and micro states, Maxwell- Boltzmann distribution law, its application to molecular speed, distinction between mean, r. m. s. and most probable speed values.

Unit IV:

Statistical physics- Bose-Einstein statistics, its application to black body radiation, Planck's radiation law, Estimation of temperature of sun, Bose- Einstein condensation.Fermi-Dirac distribution and its application to free electrons in a metal, concept of negative temperature, Fermi level and Fermi temperature, comparison between M-B, B-E and F-D statistics.

References and Text books –

1. Atomic and Molecular Physics, by- ULP publications, Prof. C. Mande.
2. Introduction of Atomic Physics, by- White
3. Atomic and Nuclear Physics, by- T. A. Littlefield, N. Thorley
4. Atomic and Nuclear Physics, by- S. N. Ghoshal.
5. Atomic Physics (Modern Physics), by- S. N. Ghoshal.
6. Atomic Physics, by- J. B. Rajam.

7. Solid state physics, by-R. K. Puri, V. K. Babbar, S Chand.
8. Atomic and Nuclear Physics, by- N. Subramanyam, Brijlal.
9. Statistical Mechanics, by- Kamal Singh
10. Quantum Mechanics ,Statistical Mechanics and Solid state physics, by- Chattopadhyay and P. C. Rakshit
11. Heat, Thermodynamics and Statistical Physics, by- Pragati Prakashan , Singhal, Agrawal.
12. Fundamental of Statistical Mechanics, by- B. B. Laud, New Age International publications.

B. Sc. Final Year (Semester V)

Course-PHYSICS - Paper-II (502)

(Quantum mechanics, Nanomaterials and Nanotechnology)

Marks- 50 **Time- 30 hours**

Unit I:

Quantum mechanics- Failure of classical physics to explain black body spectra, Planck's radiation law, Compton Effect, Wave particle duality, de Broglie's hypothesis, Concept of wave and group velocity, Experimental demonstration of matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle and Thought experiment.

Unit II:

Quantum mechanics- Schrodinger's equation (Time dependent and time independent equations), Physical significance of wave function Ψ, Operators, Expectation values of a dynamical quantities, Ehrenfest's theorem, Eigen value and Eigen functions, Particle in a box, Application to free particle in a one and three dimension.

Unit III:

Nanomaterials-Introduction to Nanoscience and Nanotechnology, Difference between nanomaterials and bulk materials, Reduction of dimensions 3D, 2D, 1D, 0D materials, various morphologies of nanomaterials, Bottom up and top down approaches, size dependent physical properties, Nano cluster.

Unit IV:

Nanotechnology- Different methods of synthesis of nanomaterials (Wet chemical, Sol-gel, and HCR Technique), Determination of size of nanoparticles by particle analyzer(BET) and Debye- Scherer's formula, Characterization technique of SEM and TEM , application of nanomaterials in various fields (General).

References and Text books -

1. Quantum Mechanics, Statistical Mechanics and SSP, by- D. Chattopadhay, P. C. Rakshit.
2. Fundamentals of Quantum Mechanics, by- P. R. Waghmare
3. Quantum Mechanics, by- John L. Powel, Bernd Crasemann.
4. Quantum Mechanics, by- Mathews and Venketesan.
5. Quantum Mechanics, by- A. K. Ghatak, S. lokanathan.

6. Quantum Mechanics, by- S. P. Singh, M. K. Bagde and Kamal Singh.
7. Quantum Mechanics, by- Chatwal, Anand, Himalaya publications.
8. Advanced Quantum Mechanics, by- Satya Prakash, Pragati Publications.
9. Introduction to Nano Technology, by- C. P. Poole, Jr. F. J. Owens.
10. Nano Technology, by- T. J. Daming.
11. Nano Structure and Nano Materials, by- M. Balkrishanarao, K. Krishana Reddy.
12. Nano Technology, by- Rakesh Rathi.

B. Sc. Final Year (Semester V)

Course - Physics Practical (503)

1. A student will have to perform at least **ten** experiments per semester and **two** experiments (from different fields) at the time of university practical examination in 6 hours.
2. The distribution of practical/laboratory work of 30 marks is-

Two experiments (9 Marks each)	- 18 Marks
Record book	- 06 Marks
Viva Voce	- 06 Marks

Total	30 Marks

List of the experiments-

1. To study the absorption spectra of iodine vapour and to determine its dissociation energy and force constant.
2. To estimate the temperature of sodium flame by studying the reversal of the spectral lines (D-line).
3. To determine the electric charge of an electron by Millikan's oil drop method.
4. To determine the value of e/m of an electron by Busch's helical beam method.
5. To determine the value of e/m of an electron by Thomson method.
6. To determine electronic charge and work function of the cathode material using photocell.
7. To determine the plank's constant 'h' by vacuum type photocell using DPMS.
8. To determine Planck's constant by photo cell.
9. To determine Planck's constant by solar cell.
10. To determine Hall coefficient and mobility of charge carriers in a semiconductor.
11. To verify the laws of probability distribution throwing one coin, two coins and ten coins.
12. Study of statistical distribution from the given data and to find most probable, average value and RMS value.
13. Study of random decay of nuclear disintegration and determination of decay constant using one colored face dices.
14. To show that deviation of probability of an event from theoretical value decreases with increase in number of events.
15. Determination of average grain size of a particle from X-Ray diffraction spectra using Debye-Scherrer Formula.
16. Study of particle size of nano particles by SEM /TEM method.
17. Determination of size of nano particles by particle analyzer (BET).
18. To determine the transmission coefficient of a transmitting plate using photometer.
19. To determine the electro-chemical equivalent of hydrogen using Hoffman's tube.

20. To measure A. C. / D. C. voltage using a C. R. O. and to calculate it's deflection sensitivity.
21. To determine the unknown frequency /to compare the frequency of two unknown signals using C. R. O.
22. To study and trace different wave forms of oscillator using C. R. O.
23. Measurement of thermo emf.
24. To determine the concentration of sugar solution by half shade polarimeter.
25. Measurement of global and diffuse radiation using pyranometer.

B. Sc. Final Year (Semester VI)

Course-PHYSICS - Paper-I (601)

(Relativity, Nuclear physics and Bio Physics)

Marks- 50 **Time- 30 hours**

Unit I:

Relativity- Frame of reference, Inertial and non inertial frames, Galilean transformation equations, Galilean invariance, Michelson-Morley experiment, Postulates of the special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, , Variation of mass with velocity, Mass energy equivalence.

Unit II:

Nuclear physics- G. M. counter, Wilson cloud chamber, Cyclotron, Linear accelerator, Nuclear reaction, Discovery of neutron, Packing fraction, Mass defect and binding energy, Nuclear fission, Liquid drop model, Chain reaction, Nuclear reactors, Nuclear fusion, Cosmic ray, Elementary particles, Shell model of the nucleus.

Unit III:

Nuclear physics- Alpha decay, Range of α particle, Geiger Nuttal law, Magnetic spectrometer for energy of α particle, Tunneling, Gamow's theory of α decay, β- decay, Measurement of energy of β particle and end point energy, Neutrino theory of β- decay, γ- decay, Energy of γ photon.

Unit IV:

Bio physics-History of bio physics, Bio Potential- compound action Potentials of the human body, Electrocardiogram for heart (ECG), Electroencephalogram for brain (EEG), Electroretinogram for eye retina (ERG), Electromyogram for muscle (EMG) and Sonography (Working mechanism).

Bioinstruments- Basic principle, construction and working of colorimeters, Spectrophotometer, PH-Meter and centrifuge measurement.

Reference and Text books -

01. Nuclear Physics, by- S. N. Ghoshal.
02. Atomic and Nuclear physics, by- N. Subramanyam, Brijlal.
03. Introduction to Nuclear physics, by-H. A. Enge.
04. Atomic and Nuclear physics, by- T. A. Littlefield, N. Thorley.
05. Introduction to special theory of Relativity, by- Shrivastava

06. Elements of special theory of Relativity, by- S. P. Singh and M. K. Bagde.
07. Introduction to theory of Relativity, by- P. G. Bergmann
08. Introduction to Bio Physics, by- P. Narayanan, New Age Publications.
09. Medical Instrumentation, by- Khandpur TMH.
10. Text Book of Bio Physics, by- R. N. Roy
11. Laboratory manuals of Bio Physics Instruments, by- P. B. Vidyasagar.
12. Bio physics, by- Vatsala Piramal, Dominant Publications and Distributions, New Delhi.

B. Sc. Final Year (Semester VI)

Course-PHYSICS - Paper-II (602)

(Electronics, Fiber optics, Communication and Digital electronics)

Marks- 50 **Time- 30 hours**

Unit I:

Amplifiers- Classification of amplifiers, multistage amplifiers, **Operational amplifier**- parameters, Basic idea of IC-741, Application of Op. Amp. as inverting, Non inverting, Adder, Subtractor, Integrator and Differentiator, **Oscillators**- Concept of feedback, Physical consideration of tuned circuits, Phase shift oscillator, Hartley oscillator, Colpitts oscillator.

Unit II:

Fiber optics- Importance of optical fiber, Propagation of light waves in optical fiber, Basic structure, Stepped index monomode fiber, Graded index fiber, Acceptance angle and acceptance cone, Numerical aperture, Fiber losses and their units (basic concept), Electrical and optical band width, bandwidth length product, Dispersion in optical fiber.

Unit III:

Communication- Introduction, amplitude modulation - Frequency spectrum, Modulation factor, over modulation, Percentage modulation, Expression for Power and Currents in AM wave, disadvantages, **Frequency modulation** - Frequency deviation, Carrier swing, Modulation index, Deviation ratio, Expression for FM wave, Frequency spectrum, significant side band terms, FM band width, Merits and demerits.

UNIT IV:

Number Systems- Unitary systems, Binary, decimal, octal, hexadecimal and their interconversions, Binary coded decimal (BCD), Addition and subtraction of binary numbers, 1S, 2S and 10S compliment, basic logic gates, NOR, NAND, Ex-OR, Ex-NOR and their truth table, Half adder, Full adder, Half subtractor and full subtractor, Boolean equations, De Morgan's theorem and its verification.

References and Text books -

1. Op. Amps and Linear Intergated circuits 2nd Edition, by- Ramakant Gaikwad, PHI Publications.
2. Digital and Analog Technique 1st Edition, by- Navneet, Gokhale, Kale, Kitab Mahal Nagpur.
3. Basic Electronics (Solid State), by- B. C. Therja.
4. Optoelectronics and fiber optics communication, by- C. K. Sarkar, D.C. Sarkar.

5. Laser and Optical fiber communication, by- P.Sarah.
6. An introduction to fiber optics, by-R. Allen Shotwell.
7. Optical fiber communication, by-John M. Senior.
8. Communication Electronics, by- A. Kumar
9. Digital Electronics, by- V. K. Jain
10. Digital Principle and Application, by- Malvino and Leach
11. Digital Electronics and It's Application, by- R. P. Jain
12. Digital computer Electronics, II nd Edition, by- Malvino, TMH Edition.

B. Sc. Final Year (Semester VI)

Course - Physics Practical (603)

1. A student will have to perform at least **ten** experiments per semester and **two** experiments (from different fields) at the time of university practical examination in 6 hours.
2. The distribution of practical/laboratory work of 30 marks is-

Two experiments (9 Marks each)	- 18 Marks
Record book	- 06 Marks
Viva Voce	- 06 Marks

Total	30 Marks

List of the experiments-

1. To draw the histogram of theoretical Gaussian curve.
2. Recording and analysis of ECG Signals.
3. Verification of Beer's- Lambert's law.
4. To determine pH value of Amino acids.
5. Measurement of BP and recording of Kortov sound.
6. Measurement of body temperature using GSR and thermister probe.
7. Measurement of skin resistance using GSR.
8. To draw the plateau curve of a given Geiger Mueller counter
9. Study of Op. Amp. as an Inverting and Non Inverting amplifier.
10. Study of Op. Amp. as an Adder and Subtractor.
11. Study of Op. Amp. as an Integrator and differentiator.
12. To construct and study the working of a phase shift oscillator.
13. Study of Hartley Oscillators.
14. Study of Colpitts Oscillators.
15. Study of Amplitude modulation.
16. Study of diode as an AM detector.
17. Study of diode as clipper, clamper and voltage doublers.
18. Study of Frequency modulation using IC.

19. Study of F M detector using IC.
20. Study of basic gates (AND, OR, NOT)
21. Study of logic gates (using IC) and verification of De Morgan's theorem.
22. To study the characteristics of NAND/NOR gate and its use as a universal gate.
23. Verification of laws of Boolean algebra using NAND gate.
24. Study of Ex- OR gate as a half adder and full adder.
25. Study of Ex- OR gate as a half subtractor and full subtractor.

Books for Experimental Physics –

1. B. Sc. practical physics, by- Harnam Singh, DR. P.S. Hemne , S Chand Publications
2. Practical Physics, Volume-I, II by- Gupta and Kumar.
3. Advanced practical physics, Volume I, II by- DR. S. P. Singh.
4. Advanced Viva- Voce in physics, Volume I, II by- Gupta and Narain.
5. Laboratory Physics, Part A and B, by- Berkeley Physics Laboratory.
6. Laboratory Physics (Laser Exp.), by- Berkeley Physics Laboratory.
7. University Practical Physics with Viva Voce, by-C. K. Bhattacharya (C. B. S. Publications, Delhi).
8. A Textbook of Practical Physics, by- Brijlal and Subramanyam.
9. Introduction to Experimentation, by- B. J. Brinkwork (The English University Press Ltd.).
10. Advanced Practical Physics, Vol. I and II, by- M. S. Chauhan, S. P. Sinha.
11. Experimental Physics, by-C. Daish (Hodder and Sons, 1970).
12. Practical Physics for B. Sc., by- A. Dhanalaxmi , A Williams .
13. Experiments in Electronics, by-Paunik S. Jabbar.
14. Digital Electronics Practice, by- Jain, Anand Integrated Circuits, (Tata Mc Graw Hill).
15. A Laboratory Manual of Physics for Undergraduate Classes, by- D. P. Khandelwal (Vani Publishing House, New Delhi).
16. Experiments in Modern Physics, by-Olon.
17. B. Sc. Practical Physics, by-K. Hanumantha Rao, D. P. Siva Ramrah, V. Krishna Murthy.
18. Advanced Practical Physics, by S. S. Sharma (Business Promotion Bureau, Delhi).
19. B. Sc. Practical Physics by- Harnam Singh (S Chand).
20. Advanced Practical Physics, by- S. P. Singh (Pragati Prakashan).
21. Experiments in Electronics, by-S. V. Subramanyam (Macmillan India Ltd.).
22. Experimental Crystal Physics, by-W. A. Wooster, A. Breton.
23. Introduction to Biomedical Electronics, by-Joseph Bovy (Mc Graw Hill).

24. Handbook of Biomedical Instrumentation, by-R. S. Khandpur.
25. Acoustic Measurement, by-L. Beranek.
26. Fundamentals of Acoustics, by-Kinsler, Frey.
27. Solar Cells, by-M. A. Green.
28. Electronic Communication, by- Roddy Coolen.

RTM, NAGPUR UNIVERSITY, NAGPUR.

SEMESTER PATTERNSYLLABUS

FOR B Sc. BOTANY

B.Sc. SEMESTER- I

PAPER-I Viruses, Prokaryotes& Algae

PAPER-II Fungi, Lichen, Plant-Pathology&Bryophyta

B.Sc. SEMESTER-II

PAPER-I Pteridophyta& Gymnosperms

PAPER-II Palaeobotany& Morphology of Angiosperms

B.Sc. SEMESTER-III

PAPER-I Angiosperm Taxonomy

PAPER-II Cell Biology, Plant Breeding& Evolution

B.Sc. SEMESTER-IV

PAPER-I Angiosperm Anatomy& Embryology

PAPER-II Genetics & Molecular Biology

B.Sc. SEMESTER-V

PAPER-I Biochemistry & Plant Physiology-I

PAPER-II Plant Ecology I

B.Sc. SEMESTER-VI

PAPER-I Plant Physiology- II& Biotechnology

PAPER-II Plant Ecology- II, Techniques & Utilization of Plants.

SEMESTER – I

PAPER – I

VIRUSES, PROKARYOTES AND ALGAE

Unit I

Introduction to Botany.

Virus: General characteristics and nature of Viruses,.

Ultra structure of TMV, Structure and Multiplication of T_4 - Bacteriophage. Economic importance.

Mycoplasma : - structure, Properties, Reproduction.

Comparison between Archaebacteria and Eubacteria.

Unit II

Bacteria:-Cell structure, Flagella. Reproduction: (Binary fission, Conjugation). Economic importance.

Cyanobacteria: -General account, Economic Importance, Ultra cell structure, Reproduction. eg.*Nostoc.*

Unit III

Algae – General characteristics, Classification (Fritsch 1954),

Life history of: - *Oedogonium, Chara.*

Unit IV

Algae **- Life history** of *Vaucheria, Ectocarpus, and* Economic importance of Algae.

Note:- Developmental stages not expected

List of Practicals :

Study of Bacterial forms from permanent micropreparation

Gram staining of Bacteria, ultrasturcture of Bacteriophage from TEM photographs

Study of Cyanobacteria: *Nostoc*.

Study of Algal genera: *Oedogonium, Chara, Vaucheria, Ectocarpus.*

SEMESTER – I

PAPER – II

FUNGI, LICHEN, PLANT PATHOLOGY, BRYOPHYTA

Unit I

Fungi:- General charachteristics, Classification(Alexopoulos 1996), Economic importance

Life history of: - *Albugo, Mucor.*

Unit II

Fungi- Life history of :- *Puccinia, Cercospora*

Lichens :- Types, Reproduction and Economic importance

Unit III

Plant pathology:– Host, pathogen, symptoms, Causes and Control of following diseases:-Leaf curl of Papaya, Citrus canker and Red rot of Sugarcane

Bryophyta:–Classification (Proskauer 1957), General characters (Hepaticopsida, Anthocerotopsida and Bryopsida), Economic importance, and alteration of generation

Unit IV

Life history of:- *Riccia, Anthoceros, Funaria*

Note: developmental stages not expected

List of Practicals :

Study of Fungal genera:- *Albugo, Mucor, Puccinia, Cercospora*

Study of Lichen: - Thallus structure, Types

Plant pathology: – Leaf curl of Papaya, Red rot of Sugarcane, Citrus canker

Study of Bryophytes :- *Riccia, Anthoceros, Funaria*

Botanical Excursions (One short/Long excursion is compulsory).

Semester - I Botany Practical examination
Question Paper

Time: 5 hrs **Marks: 30**

Q. 1) Gram Stain the given Bacterial strain / Stain the **Cyanobacterial** material [A], & Identify **04**

Q. 2) Identify & give characters of the given **Algal** material [B]and make a temporary Mount **04**

Q. 3) Identify & give characters of the given **Fungal** material[C] and make a temporary Mount **04**

Q. 4) Identify & give characters of the given **Bryophytic** material [D] and make a temporary Mount **04**

Q. 5) **Spotting** : **06**

E-Virus/Bacteria/Cyanobacteria	F- Algae	G- Fungi
H-Bryophyte	I- Plant pathology	J- Lichen

Q. 9) Viva-voce **03**

Q. 10) Practical Record & Excursion Report **05**

SEMESTER – II

PAPER – I

(PTERIDOPHYTA & GYMNOSPERMS)

Unit I

Pteridophyta :- Classification system (Smith 1952), General characters (Psilopsida, Lycopsida, Sphenopsida and Pteropsida), Economic importance, alternation of generation

Life history of:- *Rhynia, Selaginella*

Unit II

Life history of:- *Equisetum,*

Apogamy, Apospory, Stelar system in pteridophytes, Concept of heterospory and seed habit.

UNIT III

Gymnosperms:- Classification (Stewart 1982), General characters, Economic importance, alternation of generation.

Life cycle of the following:- *Cycas.*

UNIT IV

Life cycle of the:- *Pinus*.

Cycadeoidea (morphology, anatomy of Stem and flower)

NOTE: Developmental stages not expected.

List of Practicals

Study of Pteridophytes : *Rhynia, Selaginella, Equisetum.*

Study of Gymnosperm: *Cycas*, *Pinus*, *Cycadeoidea.*

SEMESTER – II

PAPER – II

PALAEOBOTANY & MORPHOLOGY OF ANGIOSPERMS

Unit I

Palaeobotany: Geological time scale

Fossilization: Replacement theory, Infilteration theory

Types of fossils: Impression, Compression, Petrifaction

Fossil plants: Gymnosperms: *Glossopteris* (Leaf, Scutum),

Unit II-

Root Morphology - Tap root & adventitious roots, Modifications for storage, Respiration & reproduction.

Stem Morphology:- shape, surface, texture, nature, Branching (Monopodial, Sympodial), modifications (Runner, Rhizome, Tuber, Bulb, cladode).

Leaf Morphology:--Typical Leaf, Types (Simple, Compound), Phyllotaxy, Venation, and modifications of leaf (Tendril, Phyllode)

Unit III-

Inflorescence: Simple (Racemose and Cymose type).

Flower: Details of typical flower, Epigyny, Perigyny & Hypogyny, Androphore, Gynophore & Gynandrophore.

Calyx & Corolla: - Cohesion, Forms of corolla and Aestivation.

Unit IV

Flower: **Androecium: -** Parts, Cohesion & Adhesion, Fixation, dehiscence. **Gynoecium:** - Parts, Cohesion, Adhesion, Placentation.

Fruit: Classification of fruits, simple and aggregate fruits, Composite fruit.

List of Practicals

i. **Fossils** : Types, *Glossopteris*, *Cycadeoidea*

ii. Study of **Root**: Types, Modifications.

iii. Study of **Stem**: shape, surface, texture, nature Branching, Modifications (Ex. *Hibiscus, Ocimum,* any grass).

iv. Study of **Leaf**: Stipules, base, kind, shape, surface, margin, Apex, texture, Phyllotaxy, Venation & Modifications.

v. **Inflorescence:** Types.

vi. **Flower**: Parts, Thalamus, Calyx, Corolla, Androecium, Gynoecium.

vii. **Fruits:** Types.

Botanical Excursion: (Two short or one long out of the state is compulsory).

Semester II practical examination

Question Paper

Time : 5 hrs **Marks : 30**

Q. 1) Identify & give characters of the given **Pteridophytic** material **[A]**and make temporary Mount. **04**

Q. 2) Identify & give characters of the given **Gymnospermic [B]** material and make temporary mount **04**

Q. 3) Describe the given **leaf** material **[C]** **04**

Q.4) Describe (Calyx, Corolla, Androecium & Gynoecium) of given **Flower [D]**. **04**

Q. 5) **Spotting** : **06**

E. Pteridophyte	F. Fossil
G. Gymnosperm	H. Vegetative morphology
I. Inflorescence/flower	K. Fruit.

Q. 9) Viva-voce **03**

Q. 10) Practical Record & Excursion Report **05**

SEMESTER – III

PAPER – I

ANGIOSPERM TAXONOMY

Unit I

Origin of Angiosperms (Benettitalean theory). Phylogeny of Angiosperm: Homology, monophyly, polyphyly, Clads.

Fossil Angiosperms: Flower (Sahanianthus).

Angiosperm Taxonomy: Floras, Herbarium, keys (Indented and Bracketed), Holotype, Lectotype, Neotype.

Botanical Nomenclature: Principles (rank and ending of taxa, principle of priority),

Unit II

Classification of angiosperms: Natural, Artificial, Phylogenetic system of classification.

Systems of classification: Bentham & Hooker and Engler &Prantl (along with merits and demerits),

Modern trends in Taxonomy : Cytotaxonomy (Karyotype), Phytochemistry (Proteins, flavonoids, Betalains) , Taximetrics to taxonomy.

Unit III

Study of Families (Dicot): Malvaceae, Brassicaceae, Fabaceae (Papilionoideae, Caesalpinioideae, Mimosoideae)

Unit IV

Study of Families (Dicot): Asteraceae, Asclepiadaceae, Euphorbiaceae

Study of Families (Monocot): Poaceae

List of Practicals

Study of Families covered in the theory portion.

Study of fossil Angiosperms micropreparation and specimens: *Sahanianthus*, *Enigmocarpon*

Botanical Excursions (Two short or One long out of the state is compulsory).

SEMESTER – III

PAPER – II

CELL BIOLOGY, PLANT BREEDING & GENETICS

Unit I

Structure of typical plant cell, Ultrasturcture and functions of: Cell wall, Cell Membrane (Fluid mosaic model), Nucleus, Endoplasmic reticulum (RER and SER)

Unit II

Ultrastructure & Functions of: Golgi Complex, Vacuoles, Ribosomes (70S and 80S), Mitochondria, Chloroplasts,

Unit III

Chromosome organization: Morphology (chromatid, chromomere, centromere, telomere, secondary constriction, satellite, karyotype), Molecular organization (Nucleosome model)

Sex Chromosome : Structure of sex chromosome in plants (XY type in *Melandrium*)

Cell division in plants: Mitosis, Meiosis and their significance.

Unit IV

Plant Breeding- Definition and objective, Pure line selection, Hybridization (emasculation, bagging, crossing, labelling), Colonal selection, Heterosis (Definition and scope)

Biostatistics- Mean, Mode, Median, Standard deviation, Standard error, Student's t- test

Evolution- Origin of life (Millers theory),

List of Practicals

Study of Cell organelles with the help of photographs/ Slides

Study of mitosis in plant material

Study of meiosis in plant material

To calculate Mean, Mode, Median, standard error from the given data (At least 10 problems to be solved)

To calculate the student's t-value from the given data (At least 10 problems to be solved)

Semester III practical examination

Question Paper

Time : 5 hrs **Marks : 30**

Q. 1) Describe in technical language the given Angiospermic material [A]**.** Classify &Identify the Family giving reasons **06**

Q. 2) Write floral formula and Draw Floral Diagram of the given flower [B] **03**

Q. 3) Prepare semi-permanent squash / smear of given material [C] & Identify the stage of cell division **05**

Q. 4) To solve the given problem of biostatistics **04**

Q. 5) Spotting : **04**

D. Fossil angiosperm H. Cell organell (photocopy)

E. Cytology I. Taxonomy

Q. 6) Viva-voce **03**

Q. 7) Practical Record & Excursion Report **05**

SEMESTER – IV

PAPER – I

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Unit I

Basic body plan & Modular type of Growth.

Meristems :Classification of meristems based on origin and position.

Permanent tissue and their functions:Simple tissue (parenchyma, collenchyma, sclerenchyma), Complex tissue(xylem and phloem).

Unit II

Apical meristem of Root and Shoot: Apical cell theory, tunica-corpus theory, Types of root apex according to Newman.

Primary structure of root in dicot (Sunflower) and monocot (Maize)

Primary structure of stem in dicot (Sunflower) and monocot (Maize)

Types of vascular bundles- dicots and monocots

Cambium (structure, types, function)

Unit III

Periderm, growth ring, sap wood, heart wood

Secondary growth (Sunflower stem) and anomalous secondary growth in *Bignonia* and *Dracena* stem.

Anatomy of leaf: Dicot (Nerium), monocot (Maize).

Senescence and abscission of leaves.

Unit IV

Pollination: Types and adaptation, significance

Structure of anther, Microsporogenesis, male gametophyte

Types of ovules, structure of anatropous ovule

Megasporogenesis and female gametophyte (polygonum type)

Double fertilization and triple fusion, endosperms and its types, Structure of dicot (Onagad) and monocot embryo.

List of practicals

Study of simple tissue, complex tissue and secreatory tissue from permanent slides

Study of types of vascular bundles

Study of internal structure of dicot and monocot root using hand section and prepare temporary mounts -Sunflower, Maize

Study of internal structure of dicot and monocot stem using hand section and prepare temporary mounts -Sunflower, Maize

Study the growth ring in woods-Teak wood

Study of internal structure of secondary growth and anomalous secondary growth using hand section and prepare permanent micropreparations - *Bignonia* stem and *Dracena* stem.

Study of internal structure of leaves- *Nerium*, Maize

Study of types of ovules, anther structure, pollen grains, adaptations for pollination

To calculate the percent pollen germination in the given specimen

Botanical Excursions (One short tour is compulsory).

SEMESTER- IV

Paper-II

Genetics & Molecular Biology

Unit- I

Mendelism: - Laws of inheritance (Law of segregation and independent assortment)

Interaction of genes: Allelic- Incomplete dominance (1:2:1 ratio in *Mirabilis jalapa*); Non-allelic- Complementry (9:7 ratio) and Dominant epistasis (12:3:1 ratio)

Linkage: Definition, Theory of linkage (Coupling and Repulsion theory), types (complete and incomplete), significance

Unit- II

Crossing over: Definition, theories (Breakage and reunion), significance

Variation in chromosome number: Polyploidy (auto- and allo-), aneuploidy (nullisomics, monosomics, trisomics and tetrasomics), significance

Structural changes in chromosome: deficiency, duplication, significance of inversion and translocation.

Unit- III

Structure of DNA (Watson and Crick model)

Semi conservative method of DNA replication in eukaryotes

Concept of gene; Benzor's concept, cistron, mutons and recons, jumping gene.

Mutation: Spontaneous and induced, physical and chemical mutagens, application of induced mutations in crop improvement

DNA damage and repair: Photoreactivation, excision repair

Unit- IV

Satellite and repetitive DNA

Genetic code: Definition and characteristics

t-RNA (Clover leaf model)

Gene expression in prokaryotes: Transcription and translation

Regulation of gene expression (Lac operon model).

List of practicals

To prove the Mendel's law of segregation with the help of coloured beads.

To prove the Mendel's law of independent assortment with the help of coloured beads.

From the given data workout the type of gene interaction in the given cross (Atleast 10 problems of each type mentioned in theory syllabus).

Semester IV Practical examination

Question Paper

Time : 5 hrs **Marks : 30**

Q. 1) Prepare temporary mount of the given material [A](Root/Leaf)& Identify giving diagnostic character **03**

Q. 2) Prepare double stained permanent mounts of the given material [Stem] [B] & Identify giving diagnostic character **06**

Q. 3) Calculate percent germination in the given pollen grains [C] **02**

Q. 4) To prove Mendel's Law of Inheritance through coloured beads [D] **04**

Q. 5) To work out the type of gene interaction in the given cross from the given data. **03**

Q. 6) Spotting: **04**

E- Tissue F- Root anatomy

G-Stem anatomy H-Embryology

Q. 7) Viva-voce **03**

Q. 8) Practical record and excursion report **05**

SEMESTER – V

PAPER – I

BIOCHEMISTRY & PLANT PHYSIOLOGY-I

Unit I

Carbohydrates: Definition, properties and role; Classification: Aldoses and ketoses; monosaccharides, disaccharides and polysaccharides; Structure of Glucose and starch

Lipids: Definition, properties and role; fatty acids, oils and waxes, beta oxidation.

Aminoacids- Chemistry of amino acids present in proteins (Classification), peptide bond

Basics of Enzymology: Nomencleture, Characteristics and properties of Enzymes, factors affecting enzyme activity, Holoenzyme, Apoenzyme, Co-enzymes& Co-factors, Regulation of Enzyme Activity (Enzyme-Substrate Complex Theory), Mechanism of Action (Lock & Key Model, Induced Fit Model)

Unit II

Plant-water relations: Properties of water, diffusion, diffusion pressure deficit and its significance; Osmosis: Concept, types, osmotic potential and its significance; Imbibition: concept and significance

Water conduction through xylem: Root pressure theory, cohesion-adhesion theory; transpiration; stomatal opening mechanism with reference to K^+-malate hypothesis

Phloem transport: Munch hypothesis

Unit III

Mineral nutrition: Role and deficiency symptoms of macro- and micro- nutrients (N, P, Fe, Mn, B , Ca); Solute transport: passive (Donnan's equilibrium), active (carrier concept)

Lipid metabolism:

Respiration: Types (aerobic and anaerobic respiration), respiratory substrates and Respiration quotient, glycolysis, Kreb's cycle, oxidative phosphorylation (ETS); fermentation (alcohol and lactic acid), photorespiration. Glyoxylate cycle .

Unit IV

Photosynthesis: concept, definition, significance, photosynthetic pigments and their role, action spectra, Emerson's enhancement effect, red drop mechanism; photolysis of water (Hill's reaction), cyclic and non-cyclic photophosphorylation, Light independent reactions: C3, C4 and CAM pathways and their significance; factors affecting photosynthesis

Nitrogen metabolism: Mechanism of biological nitrogen fixation, importance of nitrate reductase

List of practicals

To study the effect of various chemicals on permeability of membranes.

To study the ascent of sap in suitable plant material.

To separate chlorophyll pigment by paper chromatography.

To determine the RQ of given plant material.

To perform microchemical tests for determination of reducing and non-reducing sugars, starch, cellulose, oils and proteins.

To study the effect of light intensity and quality, CO_2 concentration and temperature on rate of photosynthesis by suitable method.

To determine osmotic potential of the cell sap by plasmolytic method.

To study the activity of enzyme amylase, catalase and peroxidase.

Miner Physiology experiments

SEMESTER – V

PAPER – II

PLANT ECOLOGY - I

Unit I

Ecology: definition, branches and significance of ecology

Climatic Factors: Atmospheric (Gaseous composition), Light & Temperature (effect on vegetation).

Edaphic Factor :Pedogenesis, Soil profile, Soil properties (physical and chemical)

Unit II

Physiographic factor- Biotic Factor: Interactions between plants and animals and human, Interaction between plants growing in a community, Interactions between plants and soil microorganisms. Biogeochemical Cycles: Nitrogen, phosphorous

Unit III

Ecosystem: Biotic and Abiotic components, Food chain, Food web, Ecological pyramids

Autecology (definition, importance), ecad, ecotype- characteristics and importance

Synecology (or community ecology)- Study of community: analytical (quantitative- frequency, density, abundance; qualitative- Life forms, Raunkier's Biological spectrum) and synthetic characters (presence, fidelity, dominance)

Unit IV

Principles of Phytogeography, Distribution (wides, endemics, discontinuous species), Theories (Landbridge and continental drift), Climatic regions of India, Phytogeographic regions of India (Chatterjee 1962; Name, distribution area, typical vegetation)

List of practicals:

To determine frequenct, density, abundance of the community by quadrate method.

To determine the homogeneity of vegetation by Raunkiers frequency diagram.

To determine the water holding capacity of the given soil samples.

To determine the water rising capacity of the given soil samples.

To determine the soil moisture of the given samples.

Botanical Excursions (One short tour is compulsory).

Semester V Practical examination

Question Paper

Time : 5 hrs **Marks : 30**

Q. 1) To perform given Physiology Experiment [A] & report the findings **06**

Q. 2) To perform the given Biochemical Experiment [B] & report the findings **04**

Q. 3) To perform the given Ecological Experiment [C] & report the findings **05**

Q. 4) To perform the given microchemical test [D] & report the findings **03**

Q. 5) Spotting : **04**

- E - Plant Physiology
- F -Plant Physiology
- G - Ecology (Component of aquatic ecosystems)
- H - Ecology(Component of terrestrial ecosystems)

Q. 6) Viva Voice **03**

Q. 7) Practical Record & Excursion Report **05**

SEMESTER – VI

PAPER – I

PLANT PHYSIOLOGY-II & BIOTECHNOLOGY

Unit I

Growth: Concept, growth curve, phases of growth

Phytochromes: Pr and Pfr forms, their role

Circadian rhythms and biological clock

Plant growth regulators: Role of auxin, cytokinins, gibberilins, ABA and ethylene

Plant movements: Tropic and nastic movements

Unit II

Photoperiodism: physiology of flowering, photoperiodism and vernalization, role of florigen

Senescence and abscission

Seed dormancy: Causes and role, methods to break seed dormancy

Plant defence: Definition: Hypersensitive response and Systemic acquired resistance; Role of secondary metabolites (Terpenes and phenolic compounds)

Unit III

Plant tissue culture: definitions of- totipotency, explant, asceptic culture, in vitro, micropropagation; methods of sterilization (autoclaving, dry heat, chemicals), culture media (MS media) hormone requirement & applications of tissue culture.

Callus and organ culture (shoot tip, anther) and its application, cybrid production and its application.

Unit IV

Genetic engineering: Tools- Enzymes (Restriction enzymes, ligases, DNA polymerases), Plasmid as cloning vectors.

DNA library: cDNA and genomic library.

Agarobacteriumtumefaciens mediated gene transfer, structure of Ti -plasmids

Advantages and disadvantages of transgenic plants, example Bt cotton and golden rice.

List of Practicals

To determine seed viability by a convenient method

Principle and working of: oven, autoclave, laminar air flow hood

To study the structure of following vectors on the basis of photographs and diagrams: plasmid vector, Binary vector

To study the effect of various plant growth regulators on the growth and development of plants.

To study steps of genetic engineering from photograph example Bt cotton and golden rice.

SEMESTER – VI

PAPER – II

PLANT ECOLOGY, TECHNIQUES & UTILIZATION OF PLANTS

Unit I

Plant succession: Definition, Causes of succession, Hydrosere, Xerosere

Plant adaptations: Morphological, Anatomical & Physiological responses of Hydrophytes, Xerophytes, Halophytes (with one example)

Unit II

Environmental Pollution: Agricultural, noise and thermal pollution, Control of environmental pollution, Environmental management

Natural resources- types (renewable and non-renewable), factors for depletion; conservation of forest and water resources

Unit III

Principle, types and application of: microscopy (Light, fluorescent,SEM, TEM), centrifugation, electrophoresis (SDS-PAGE and Agarose), spectroscopy (UV-Vis), chromatography (Paper chromatography, Thin layer chromatography)

Unit IV

Utilization of **Plants**: Morphology, Utilization and Important chemical constituents of :-

Food: Wheat; Oil: Ground nut; Fibre: Cotton; Spices: Clove; Beverages: Coffee; Medicinal: Neem; and Rubber.

Ethnobotany: Introduction, definition, branches &importance of ethnobotany

List ofPracticals

To study the morphological and anatomical characteristics of anyone hydrophyte and xerophyte.

To study the morphological characteristics of cladode, phylloclade, phyllode and pneumatophores.

Principle and working of: spectrophotometer, microscope etc.

To determine the DO of water samples

different sources.

To study the dust holding capacity of leaves.

To estimate transparency, pH and temperature of different water bodies

To estimate salinity (chlorides) of different water samples.

To determine the percent leaf-area injury of different leaf samples collected around polluted sites.

Utilization of **Plants**: Morphology, Utilization and Important chemical constituents of plants mentioned in theory. To study the plants of ethnobotanical importance.

Microchemical Tests: Lipid, Proteins, starch, Lignin, Carbohydrates, Cellulose.

Electrophoretic /chromate graphic separation of amino acids carbohydres

Botanical Excursions (One short tour is compulsory).

Semester VI Practical examination

Question Paper

Time : 5 hrs **Marks : 30**

Q. 1) To determine seed viability [A] & report the findings **05**

Q. 2) To study the given Ecological material [B] & report the findings. **05**

Q. 3) Electrophoretic/chromatographic separation of amino acid and carbohydrates [D]. **04**

Q. 4) Morphology, anatomy and utilization of the given plant material [E]. **04**

Q. 5) **Spotting:** **04**

E -Ecology (morphology)

F - Biotechnology Instruments

G - Utilization of plant

H -Utilization of plant

Q. 7) Viva Voice **03**

Q. 8) Practical Record & Excursion Report **05**

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Vashishtha, B. R. [1992] :Bryophyta (S. Chand & Co. New Delhi)

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Shukla RS and Chandel (2005) A Text Book of Plant Ecology. S Chand and Co. Ltd., New Delhi.

B. Sc. Semester V Suggested Laboratory Exercises

MAJOR PLANT PHYSIOLOGY EXPERIMENTS (ANY NINE):

1. To study the permeability of plasma membrane using different concerntrations of organic solvents.
2. To study the effect of temperature on permeability of membranes.
3. To determine the osmotic potential of vacuolar sap by plasmolytic method.
4. To determine the water potential of any tuber.
5. To compare the rate of transpiration from two sufaces of leaf- a) bell jar method b) Cobalt chloride method.
6. To determine the path of water (Ascent of sap).
7. To separater chloroplast pigments a) by solvent method and preparation of their absorption spectra b) paper chromatography.
8. To separate amino acids from plant materials an paper chromatography and their identification by comparison with standards.
9. To measure rate of photosynthesis by Wilmott's bubbler under variable conditions of light, temperature and CO_2.
10. To compare rates of respiration f various plant parts.
11. To demonstrate bioassay of auxin, cytokinin, GA, ABA and ethylene using appropriate plant materials.

MINOR MAJOR PLANT PHYSIOLOGY EXPERIMENTS (ANY SEVEN):

1. To demonstrate the phenomenon of dispersion.
2. To demonstrate the phenomenon of adsorption.
3. To demonstrate the phenomenon of imbibitions.
4. To demonstrate the root pressure.
5. To demonstrate that the amount of water absorbed and the amount of water transpired is approximately equal.
6. To demonstrate that the light is necessary for photosynthesiss (Ganong's light screen).
7. To demonstrate that the light, chlorophyll and CO_2 are necessary for photosynthesis (using Moll's half-leaf experiment).
8. To demonstrate fermentation by Kuhne's tube.
9. To demonstrate aerobic respiration.
10. To demonstrate the evolution of CO_2 in respiration.
11. To demonstrate that the part of energy is released in the form of heat during respiration.
12. To demonstrate the measurement of growth of germination pea seeds.
13. To demonstrate the phomenon of gravitropism (geotropism), phototropism and hydrotropism.
14. To demonstrate seed vaiability test by T.T.C. (Triphenyl-tetrazolium chloride).

15. To demonstrate the phenomenon of nastic movement in *Mimosa pudica / Biophytum sensituvum* plants.

Suggested Laboratory Exercises

ECOLOGY EXPERIMENTS (Any nine):

1. To determine the minimum number of quadrates required for reliable estimate of biomass in grasslands.
2. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkiaer's Standard Frequency Diagram.
3. To estimate importance value index for grassland species on the basis of relative frequency relative density and relative biomass in protected and razed grassland.
4. To measure the vegetation cover of grassland through point-frame method.
5. To measure the above-ground plant biomass in a grassland.
6. To determine the Kemp's constant for dicot and monocot leaves and to estimate leaf-area-index of a grassland community.
7. To determine diversity indices (Richness, Simpson, Shannon-Wiener) un grazed and protected grasslands.
8. To estimate bulk density and porosity of grassland and woodland soil.
9. To determine moisture content and water holding capacity of grassland and woodland soil.
10. To study the vegetation structure through profile diagram.
11. To estimate transparency, pH and temperature of different water bodies.
12. To measure dissolved oxygen content in polluted and unpolluted water samples.
13. To estimate salimity of different water samples.
14. To determine the percent leaf-area-injury to different leaf samples collected around polluted sites.
15. To estimate dust-holding capacity of the leaves of different plant species.
16. To study the ecological characters (morphological and anatomical) of the following plants-
    a. **Hydrophytes**: *Hydrilla, Vallisneria, Nymphaea, Potamogeton, Eichhornia* and *Trapa*. (Any Four).
    b. **Xerophyte**: i. For morphological features: *Acacia auriculiformis, Parkinsonia, Muehlenbeckia, Ruscus, Asparagus, Kalanchoe, Euphorbia nerifolia, Opuntia*; ii. For morphological and anatomical features: *Nerium, Casuarina*.
    c. **Halophytes**: for morphological features: *Rizophora*.
    d. **Epiphytes**: for morphological and anatomical features: Orchid (*Vanda*).
    e. **Parasite**: For morphological and anatomical features: *Cuscuta*.

    Note: - 1. Experiment no. 16 is compulsory, 2. Frequent tours to the different ecological sites to study vegetation are compulsory. 3. One long excursion is

essential, 4. Excursion and study tour reports dully signed by the H.O.D. to be submitted at the time of examination.

Suggested Laboratory Exercises

BIOCHEMISTRY EXPERIMENTS (Any nine):

1. To study the ENZYME activity of **Catalase** and **Peroxidase** in suitable plant material as influenced by pH and temperature.
2. To study the ENZYME activity of **Amylase** from germination Barley/ Wheat grains.
3. Colorimeteric/Spectrophotometric estimation of sugar and starchy (Carbohydrates in suitable plant materials.
4. To prepare the standard curve of protein and determine the protein content in plant samples.
5. Estimation of Anthocyanin pigments from different plant material (At least two) and preparation of absorption spectra.

Semester VI Practical

Biotechnology:

1. To get acquainted with the laboratory equipments, apparatus and instruments in biotechnology laboratory.
2. To demonstrate the technique of micropropagation by using different explants e.g. axillary buds and shoot meristem.
3. To demonstrate the technique of anther culture.
4. To demonstrate the root and shoot formation from the apical and basal portion of the stem segments in liquid medium containing different hormones.
5. To isolate protoplast from different tissues using commercially available enzymes.
6. Immobilization of embryos from suitable plant seeds using sodium alginate.

Utilization of plants:

1. **Food plants:** Study of morphology, structure and simple micro-chemical tests of the food storing tissues in rice, wheat, maize, potato and pulses (soybean, pea) and sugarcane.
2. **Fibres:** Study of cotton flower, section of cotton ovules developing seeds to trace the origin and development of cellulosic ‘fibers’ (seed epidermal hair, microscopic study of cotton and test for cellulose). Section and staining of jute stem to show the location and development of fibres, microscopic structure and test for lingo-celllose.
3. **Vegetable oils:** Study of hand sections of groundnut, mustard and coconut and staining of oil droplets by Sudan-III and Sudan black.
4. **Field visits:** Study sources of firewood (ten plants), timber-yielding trees (ten plants), and bamboos, preparation of list mentioning special features.

5. **Spices:** samples of black paper, cloves, cinnamon (had sections and opend fruit of cardamom and describe them briefly) survey of spices found and use locally for practical assignment.
6. **Medicinal plants:** preparation of an illustrated inventory of ten medicinal plants used in indigenous system of medicine and allopathy- write their botanical and vernacular names, part/s used and diseases disorders for which they are prescribed.
7. **Beverages:** study section of boiled coffee beans and tea leaves to study the characteristic structural features.
8. **Rubber:** Collect illustrative materials of *Havea Brasilensis*, study morphology of the plant and tapping practices, history of rubber, list the many uses of rubbers.

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B.Sc. ELECTRONICS ***Semester 1 Paper 1***

Electronic Components, Network Theorems

Unit 1

Definition, types, identification and uses of electronic components: Resistors, Capacitors, Inductors, Switches, Transformers and Relays

Block diagram of C. R. O.

Unit 2

Ideal Voltage and Current sources (Internal impedance of battery and its effect on its performance), Kirchoff's current and voltage laws, Voltage and current divider circuits, Superposition, Thevenin, Norton, Maximum power transfer theorems (Statement and simple numerical)

(DC circuits only)

Unit 3

Introduction to semiconductors: Concept of energy band diagram (Conductor, Semiconductor, Insulator) , Intrinsic and extrinsic semiconductor (P type, N type), diffusion junction, depletion layer, Barrier potential, PN Junction diode, forward and reverse bias characteristics of diode, Avalanche and Zener effect; Zener diode, L.E.D.

Unit 4

The bipolar junction transistor, construction of B. J. T. , modes of B.J.T. (CE, CC, CB), transistor equation; α, β and their relationship, junction biasing, Input, output and transfer characteristics of BJT in CE mode, Transistor Biasing (Voltage divider and emitter biasing only), DC load line, Q point, transistor as switch

B.Sc. I ELECTRONICS PRACTICAL *Semester 1 Section A*

1. Study of laws of series resistor and application as voltage divider.
2. Study of laws of parallel resistor and application as current divider.
3. Study of laws of series capacitor and application as voltage divider.
4. Study of laws of parallel capacitor and application as current divider.
5. Verification of Terman's equation for inductance. Reactance characteristics of inductor
6. Study of transformer.
7. Study of battery as practical (i) voltage source (ii) current source.
8. Study of maximum power transfer.
9. Study of Forward Bias characteristics of diode. (PN & LED)
10. Study of Reverse Bias characteristics of ZENER diode.
11. Study of Characteristics of BJT. (Input, Output, Transfer)
12. Study of voltage divider biasing of transistor.
13. Verification of Norton's Theorem.
14. Verification of Thevenins Theorem.

B.Sc. ELECTRONICS *Semester 1 Paper 1*

Reference Books

1	Basic Electronics solid state physics	B.L.Theraja S.Chand and company
2	Electronic Devices and circuits	Allen Mottershed Prentice hall of India pvt.ltd.
3	An Introduction to Electronics	R.G.Kale,U.K.Puranik,V.N.Pendse,A .A.Sakale Kitab mahal
4	Basic Electronics	Grob Tata McGraw Hill
5	Electronic Devices	T.L.Floyd Pearson Education Asia
6	Electronic Principles	Malvino Tata McGraw Hill
7	Electronic components and materials	Madhuri Joshi Schroff pub. And distributors
8	Electronic components and materials	S.M.Dhir TMH
9	Network analysis	Van valkenburg PHI

B.Sc. ELECTRONICS ***Semester 1 Paper 2***

Fundamentals of Digital Electronics

Unit 1

Number Systems and Codes: Decimal, Binary, Octal, Hexadecimal, representation of integer, fraction, mixed numbers and their mutual conversion, Complement of numbers-1's, 2's, complements, addition and subtraction using 1's and 2's complement method sign and magnitude of numbers. Codes- BCD, 8421, Excess 3, Parity and gray code

Unit 2

Logic gates- OR, AND, NOT, NAND, NOR, XOR and XNOR gates and their truth table, Boolean Laws, double inversion, De Morgans and Duality theorems, use of NAND and NOR as universal building blocks

Unit 3

Karnaugh Maps: pair, quads, octets , minterm, max term in K Map, K-map for 2,3,4 variables, concept of SOP and POS, simplification of SOP and POS logic expressions using K-map, Design of binary to gray code converter, gray to binary code converter using K-map

Unit 4

Combinational Logic Circuits- Half Adder, full adder, half subtracter and full subtracter, Concept of Encoder , Concept of Decoder: BCD to gray converter, BCD to seven segment converter, parity generator checker, 4-bit Full Adder/ subtracter, Concept of multiplexer, 4:1 mux using gate , Concept of demultiplexer, 1:4 demux using gate

B.Sc. I ELECTRONICS PRACTICAL *Semester 1 Section B*

1. Study of basic logic gates.
2. Study of NAND as universal gate.
3. Study of NOR as universal gate.
4. Verification of Demorgan's Theorem.
5. Simplification of logic expressions using Boolean algebra.
6. Study of binary to gray code converter using K map.
7. Study of gray to binary code converter using K map.
8. Study of Multiplexer using gates.
9. Study of De Multiplexer using gates.
10. Study of Multiplexer using IC.
11. Study of De- Multiplexer using IC
12. Study of BCD to 7 segment decoder.
13. Construction and study of half adder and full adder.
14. Construction and study of half subtractor and full subtractor.
15. Verification of Boolean laws & Verification of duality theorem.

B.Sc. ELECTRONICS ***Semester 1 Paper 2***

Reference Books

1	Digital principles and applications	A.P.Malvino,D.P.Leach McGraw Hill Book Co.
2	Principles of digital Electronics	M.B.Matsagar,V.S.Kale Vision publication
3	Modern digital Electronics	R.P.Jain Tata McGraw Hill publishing co.ltd
4	Digital fundamentals	Floyd,Jain Pearson
5	2000 solved problems in digital Electronics	S.P.Bali Tata McGraw Hill publishing co.ltd.
6	Electronic circuits and systems Analog and digital	Y.N.Bapat Tata McGraw Hill publishing co.ltd.
7	Digital electronics and logic design	B.S.Nair Prentice hall
8	digital computer electronics	Malvino,Brown Tata McGraw Hill
9	Fundamentals of Digital Electronics	C.V.Dhuley and V.M. Ghodki

B.Sc. ELECTRONICS ***Semester 2 Paper 1***

Semiconductor Devices

Unit 1

Construction, working, characteristics and applications of JFET, MOSFET (depletion and enhancement type), parameters of JFET and their relationship parameters of MOSFET and their relationship

Unit 2

Construction, working, characteristics and applications of Silicon Controlled Rectifier, DIAC, TRIAC and UJT, UJT as relaxation oscillator

Unit 3

Amplifier parameters, notations, concept and definition of h-parameters, open circuit and short circuit tests, Introduction to input impedance, output impedance, current, voltage and power gains using h parameters, classification of amplifiers (Descriptive ideas only)

Unit 4

Introduction to power transistor, difference between Voltage and power amplifiers, transformer coupled class A power amplifier and its efficiency, class B Push-pull amplifier, derivation for efficiency, complementary symmetry power amplifier with two power supplies

B.Sc. I ELECTRONICS PRACTICAL *Semester 2 Section A*

1. Study of JFET characteristics.
2. Study of MOSFET characteristics.
3. Study of SCR characteristics.
4. Study of DIAC characteristics.
5. Study of UJT characteristics.
6. Study of UJT as relaxation oscillator.
7. Study of Transistor as a switch.
8. Study of transistor as voltage amplifier using CRO.
9. Study of class A power amplifier.
10. Study of TRIAC characteristics.
11. Study of Band width in single stage amplifier.
12. Study of complementary symmetry power amplifier.

B.Sc. ELECTRONICS *Semester 2 Paper 1*

Reference Books

1	Principles of Electronics	V.K.Mehta,Rohit Mehta
2	Functional circuits in Electronics	S.G.Pimpale,Sushama Pimpale Mcmillan India ltd.
3	Electronics,Fundamental and applications	Ryder PHI
4	Elements of electronics	M.K.Bagde,S.P.Singh,Kamal singh S.Chand and co.
5	Op-Amp and linear circuits	Gaikwad PHI
6	Electronic Instrumentation	Khedkar
7	Monograph on electronic design principles	Goel, Khaitan Khanna publisher
8	Basic electronics and linear cicuits	Bhargava,KUlshreshtha,Gupta Technical education series
9	EDC I, EDC II	A.P. Godse, U.P.Bakshi Technical Publishers pune

B.Sc. ELECTRONICS ***Semester 2 Paper 2***

Advanced Digital Electronics

Unit 1

Logic Families: Characteristics of digital ICs, construction and working of TTL NAND and NOR gates, construction and working of CMOS NAND and NOR gates, Tristate logic, comparison of TTL and CMOS logic families with respect to propagation delay, power consumption, noise immunity, noise margin, fan in and fan out.

Unit 2

Sequential Logic Circuits- Concepts of Edge and Level Triggering, Propagation Delay, set up time, hold time, R-S Flip Flop, Clocked R-S Flip Flop, Limitations of R-S FF, D FF, JK FF, preset and clear , Limitations of JK FF: Race around Condition, JKMS FF

Unit 3

Counters: Asynchronous, up/down, Decade, Synchronous, Modified counter, Ring Counter, Johnson counter (Truth tables and timing diagrams) (4 bit)

Unit 4

Registers: Buffer , left shift, right shift, SISO, SIPO, PISO, PIPO Registers , introduction to memories, classification, Memory expansion (word size and word capacity)

B.Sc. I ELECTRONICS PRACTICAL *Semester 2 Section B*

1. Switching characteristics of NOR.
2. Switching characteristics of NAND.
3. Study of RS Flip Flop using NAND/NOR gate.
4. Study of clocked RS Flip Flop using NAND/NOR gate.
5. Study of D Flip Flop using NAND/NOR gate.
6. Study of JK MS FF.
7. Construction and study of decade counter.
8. Study of mod-counter.
9. Study of ring counter.
10. Study of Johnson counter.
11. Study of SISO register.
12. Study of SIPO register.
13. Study of PISO register.
14. Study of PIPO register.
15. Construction and study of synchronous counter.

B.Sc. ELECTRONICS *Semester 2 Paper 2*

Reference Books

1	Digital principles and applications	A.P.Malvino,D.P.Leach McGraw Hill Book Co.
2	Principles of digital Electronics	M.B.Matsagar,V.S.Kale Vision publication
3	Modern digital Electronics	R.P.Jain Tata McGraw Hill publishing co.ltd
4	Digital fundamentals	Floyd,Jain Pearson
5	2000 solved problems in digital Electronics	S.P.Bali Tata McGraw Hill publishing co.ltd.
6	Electronic circuits and systems Analog and digital	Y.N.Bapat Tata McGraw Hill publishing co.ltd.
7	Digital electronics and logic design	B.S.Nair Prentice hall
8	digital computer electronics	Malvino,Brown Tata McGraw Hill
9	Fundamentals of Digital Electronics	C.V.Dhuley and V.M. Ghodki

B.Sc. ELECTRONICS ***Semester 3 Paper 1***

OP AMP And Power Supply

Unit 1

Introduction to DC amplifier, difference amplifier, Need of two power supplies, working of difference amplifier, differential mode gain, common mode gain, C.M.R.R., IC OP-AMP (block diagram), parameters of OP AMP and characteristics of an ideal OP AMP.

Unit 2

OP AMP as an inverting amplifier, concept of virtual ground, non-inverting amplifier, unity gain amplifier, adder, subtractor, integrator, differentiator, comparator, zero crossing detector, Schmitt trigger

Unit 3

Half wave rectifier, full wave rectifier, bridge rectifier; concept of filter (capacitive). Unregulated, regulated PS, power supply parameters – ripple factor, efficiency, line regulation, load regulation, Zener regulator, Regulated power supply design using series pass transistor, short circuit protection

Unit 4

General features of IC regulators, design of fixed and variable power supply, 78xx,79xx , LM 317, design of dual power supply, LM 317 as variable regulator, Limitations of linear regulator, Switching regulator- (SMPS), Concept of Low Drop Out regulator (LDO)

B.Sc. II ELECTRONICS PRACTICAL *Semester 3 Section A*

1. Study of Op-amp as inverting and sign changer amplifier.
2. Study of Op-amp as Non-inverting and unity gain amplifier.
3. Op-amp as adder and averaging amplifier.
4. Op-amp as difference amplifier. (Subtractor)
5. Op-amp as integrator.
6. Op-amp as Differentiator
7. Op-amp as comparator and zero crossing detector.
8. Op-amp as Schmitt trigger.
9. Study of Half wave rectifier.
10. Study of Full wave rectifier.
11. Study of Full wave Bridge rectifier.
12. Study of Zener regulator.
13. Regulated P.S. using series pass transistor.
14. Study of LM-317 (variable regulator)
15. Study of 78XX
16. Study of 79XX
17. Study of difference using transistors.

B.Sc. ELECTRONICS ***Semester 3 Paper 1***

Reference Books

1	Principles of Electronics	V.K.Mehta,Rohit Mehta
2	Functional circuits in Electronics	S.G.Pimpale,Sushama Pimpale Mcmillan India ltd.
3	Electronics,Fundamental and applications	Ryder PHI
4	Elements of electronics	M.K.Bagde,S.P.Singh,Kamal singh S.Chand and co.
5	Op-Amp and linear circuits	Gaikwad PHI
6	Electronic Instrumentation	Khedkar
7	Monograph on electronic design principles	Goel, Khaitan Khanna publisher
8	Basic electronics and linear cicuits	Bhargava,KUlshreshtha,Gupta Technical education series
9	EDC I, EDC II	A.P. Godse, U.P.Bakshi Technical Publishers pune

B.Sc. ELECTRONICS ***Semester 3 Paper 2***

Electronic Circuit Design

Unit 1

Concept development: defining inputs, process and output, generating ideas, screening ideas, developing and testing ideas, Simulation, Prototyping or Trial Production, Design Review, techno-commercial feasibility, product development, Erogonomic & asthetic design, quality assurance and compliance.

Unit 2

Introduction to circuit maker, basics, accessing tools& features, saving schematic options, file management, drawing a schematic, creating simple RC circuit, setting up the analysis, running the simulation, mix signal simulation example.

Unit 3

Digital logic simulation, setting of parameters, analysis of simple circuits, Analog / mixed signal simulation setting of parameters, analysis of simple circuits.

Unit 4

Introduction to Virtual Instrumentation,

Virtual Instrumentation System: Interface Bus, Input devices, Output devices, Software, Advantages of Virtual Instrumentation, Applications of Virtual Instrumentation, Virtual Instruments beyond the Personal Computer:

B.Sc. II ELECTRONICS PRACTICAL *Semester 3 Section B*

1. Study transient & AC analysis of RC circuit
2. Study transient & AC analysis of different OP-Amp as comparator
3. Study transient & AC analysis of different OP-Amp as inverting amplifier
4. Study transient & AC analysis of different OP-Amp as IA
5. Study CE amplifier parameters
6. Study CB amplifier parameters
7. Study CD FET amplifier parameters
8. Study of MOSFET Characteristics
9. Study of Low Pass Filter
10. Study of VI for Function Generator
11. Study of VI for Display(CRO)
12. Study of Average / Running average VI

B.Sc. ELECTRONICS ***Semester 3 Paper 2***

Reference Books

1	Measurements of high frequency acoustic characteristics	Vilas Ghodki, Satish Sharma and S Rajagopalan
2	Circuit maker mannual	

B.Sc. ELECTRONICS ***Semester 4 Paper 1***

Analogue And Digital Techniques

Unit 1

Feedback: type, positive and negative feedback, Barkhausen criterion, Oscillators, types (AF and RF), basic oscillator action, L-C oscillator :Colpitts oscillator, RC oscillator using OP Amp ,phase shift oscillator, Wein bridge oscillator, oscillator stability, crystal oscillator, NOT gate based crystal oscillator.

Unit 2

Study of OP AMP as: astable multivibrator (asymmetric and symmetric), monostable multivibrator (simple circuit) , concept and working of sample and hold circuit, concept of Instrumentation Amplifier (three OP Amp circuit) and working

Unit 3

D/A converter, parameter: range, resolution, linearity and speed, weighted type D/A, limitations of weighted type D/A, R-2R D/A using Op Amp, limitations, types of D/A output (voltage , current, differential), dual bias D/A

Unit 4

Need for A/D conversion, parameters: range, resolution and speed, single slope A/D converters, dual slope A/D converter, Counter type, successive approximation type, Flash type, sampling theorem, Reference voltage and ADC stability

B.Sc. ELECTRONICS PRACTICAL II *Semester 4 Section A*

1. Study of OP-amp based Wein bridge oscillator.
2. Study of OP-amp based Phase shift oscillator.
3. Study of Colpitt's oscillator.
4. Study of Op-amp as astable multi vibrator.
5. Study of Op-amp as Mono stable multi vibrator.
6. Study of Instrumentation amplifier.
7. Study of successive approximation ADC.
8. Study of Flash type ADC.
9. Study of Single slope ADC.
10. Study of Dual slope ADC.
11. Study of Binary weighted DAC.
12. Study of ladder type DAC
13. Study of NOT gate based crystal oscillator.
14. Study of Sample and hold circuit.

B.Sc. ELECTRONICS ***Semester 4 Paper 1***

Reference Books

1	Digital and analogue Techniques	G.N.Navaneeth,V.M.Gokhale,R.G.Kale Kitab mahal
2	Digital principles and applications	A.P.Malvino,D.P.Leach McGraw Hill Book Co.
3	Op-Amp and linear circuits	Gaikwad PHI
4	Principles of digital Electronics	M.B.Matsagar,V.S.Kale Vision publication
5	Modern digital Electronics	R.P.Jain Tata McGraw Hill publishing co.ltd.
6	Digital fundamentals	Floyd,Jain Pearson
7	2000 solved problems in digital Electronics	S.P.Bali Tata McGraw Hill publishing co.ltd.
8	Electronic circuits and systems Analog and digital	Y.N.Bapat Tata McGraw Hill publishing co.ltd.
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10	Digital computer electronics	Malvino,Brown Tata McGraw Hill
11	Fundamentals of Digital Electronics	C.V.Dhuley and V.M. Ghodki

B.Sc. ELECTRONICS ***Semester 4 Paper 2***

Electronic Instrumentation

Unit 1

Block diagram for electronic system, Defining the system, characteristics, Analog, digital, real, virtual, dedicated, versatile, stand alone, PC based instruments.

Concept of calibration, standards for calibration

Unit 2

Sensors, actuators, transducers, active & passive transducers, characteristics,

Passive : Thermister (NTC & PTC), LM35, L.D.R. photo-transistor

Active : Piezo-electric transducer

Digital: pressure sensor (MPXV4006DP)

Unit 3

Block diagram of :

temperature measurement using thermister,

temperature measurement using LM35, advantage over thermister

lux meter using LDR,

colorimeter using LDR

insect repellent using piezo buzzer

Unit 4

Man-Instrument system, components, introduction to physiological system, generation of bio potential, Block diagram and working of EEG, ECG & EMG, electrical shock hazards, precautions, safety codes biomedical

B.Sc. II ELECTRONICS PRACTICAL *Semester 4 Section B*

1. Study transfer characteristics of NTC type thermister
2. Study resolution in characteristics of NTC type thermister
3. Study transfer characteristics of LM 35
4. Study transfer characteristics of Water heater (around 300W)
5. Study of ON/ OFF type thermo-state using LM 35
6. Study transfer characteristics of LDR
7. Study transfer characteristics of Piezo-electric transducer
8. Comparative study of accuracy in 3 ½ digit, 4 ½ digit 5 ½ digit Multimeters
9. Directivity study of carbon Mic.
10. “Look up table” based o/p using microcontroller

B.Sc. ELECTRONICS ***Semester 4 Paper 2***

Reference Books

1	Applied electronics and Instrumentation	C.M.Dhir	Tata McGraw Hill
2	Digital Instrumentation	Bouwens	Tata McGraw Hill
3	Electronic Instrumentation	Khedkar	
4	Modern . electronic Instrumentation and measurement techniques	Cooper	Prentice hall

B.Sc. ELECTRONICS ***Semester 5 Paper 1***

Electronics Communication

Unit 1

Introduction to Electronics communication, block diagram of communication system, Types of communication: analog, digital; simplex, duplex; baseband, modulated, concept of modulation, need for modulation, types of modulation (AM, FM, PM)

Unit 2

Propagation modes of signals: ground waves, sky waves, Ionosphere and satellite; antenna fundamentals, basic principles and types.

Unit 3

Digital communication: Introduction, synchronous, asynchronous transmission, Shannon theorem, ASK, FSK, and PSK modulation.

Unit 4

Fiber optic communication system, Advantages of FOC, concept of Fax, concept of cellular telephone, block diagram of cellular telephone, advantages

B.Sc. ELECTRONICS PRACTICAL III *Semester 5 Section A*

1. Study of Half duplex communication system using PC/µC (2 wire interface)
2. Study of Full duplex communication system using PC/µC (3 wire interface)
3. ASK using op-Amp
4. FSK using op-Amp
5. Study of AM detector
6. Study of narrow band amplifier using op-amp/ Transistor
7. Study of intensity characteristics of LASER diode
8. X-bee interface using PC/ µC / field strength study
9. IR Link study
10. Wire impedance measurement

B.Sc. ELECTRONICS *Semester 5 Paper 1*

Reference Books

1	Electronic communication system	John kennedy	Tata McGraw Hill
2	Communication electronics principles and application	Frenzel	Tata McGraw Hill
3			
4			

B.Sc. ELECTRONICS ***Semester 5 Paper 2***

Fundamentals of Microprocessor

Unit 1

Block diagram of Intel 8085, ALU, Timing and control unit, General purpose registers, Accumulator, PC, SP, IR, ID, Interrupt, Address and Data bus multiplexing, Flags. Instruction Cycle: T-states, Fetch operation, Execute operation, Machine cycle

Unit 2

Addressing mode, instruction Set- Data transfer group, arithmetic group, logic group, simple programs

Unit 3

Instruction set: branch control group, I/O and machine control group, simple programs, stack and subroutines

Unit 4

Need for interfacing, modes of data transfer, synchronous and asynchronous, interrupt driven, DMA, PPI 8255- Block diagram, modes, control word format

B.Sc. ELECTRONICS PRACTICAL III *Semester 5 Section B*

1. Program based on Data transfer instructions.
2. Program based on Arithmatic instructions.
3. Program based on Logical instructions.
4. Program based on Branch instructions.
5. Program based on Control instructions.
6. Study of PPI 8255.

B.Sc. ELECTRONICS ***Semester 5 Paper 2***

Reference Books

1	Fundamentals of Microprocessor and Microcomputers	B.Ram Dhanpat Rai publications
2	Microprocessor Architecture, programming and applications with 8085/8080 A	Ramesh S. Gaonkar Wiley eastern ltd.
3	Introduction to microprocessor	A.P. Mathur Tata McGraw Hill
4	Microprocessor and interfacing	D.V.Hall Tata McGraw Hill
5	Introduction to Microprocessors	Vilas Ghodki and Satish Sharma

B.Sc. ELECTRONICS ***Semester 6 Paper 1***

Programming in "C"

Unit 1

Constant, Variables and Operators: Character set, C tokens, constant, Keyword, identifiers, variables, data types, declaration of variables, Arithmetic, relational logical, assignment, increment, conditional, bitwise, operators, Arithmetic expression, evaluation of expression, precedence of operators, input/output functions

Unit 2

Control Structures & Arrays: if- statements, if-else statement, switch statement, go-to statement, while statement, do-while statement, for statement, one dimensional array

Unit 3

User Defined Functions, Types of functions, return values and their types, scope and lifetime of variables in function; basic concept of structure and unions, difference between structure and union

Unit 4

Pointers: Basic concept, expression, variables Defining and opening file, closing a file, I/O operations on file, command line arguments, port interfacing.

B.Sc. III ELECTRONICS PRACTICAL *Semester 6 Section A*

1. Programs based on use of Variables, Operators, Input Output function
2. Programs based on Control Structure using if, if-else, switch, goto, while & do while
3. Programs based on use of one dimensional Array , Operations on array
4. Programs based on function writing, Use of structure and Union
5. Programs based on pointer operation, file operation
6. Programs based on communication with external data source like Printer & serial port

B.Sc. ELECTRONICS ***Semester 6 Paper 1***

Reference Books

1	Let us C	Y.Kanetkar
2	Gate to C programming	Kishor S B, Vilas Ghodki and Madhavi
3	C in depth	Shrivastava BPB publication
4	Programming in ANSI C-E	Balgurusamy Tata McGraw Hill
5	Programming with C	Byron Gottfried Schaums outline series Tata McGraw Hill
6		

B.Sc. ELECTRONICS ***Semester 6 Paper 2***

Microcontroller 8051

Unit 1

Architecture and features, Internal and External memory, Flags, SFR Map, SFR Function, Accumulator, Register B, Port registers (P0, P1, P2 and P3), Power Management (PCON)

Unit 2

Instruction set: Data transfer, logical, arithmetic, interrupt handler, Addressing Modes

Unit 3

Subroutine and Stack, Need for Subroutine LCALL and RETURN Instructions, ACALL Instructions, Nesting of subroutine, Stack Operation and Stack Instruction, Branching (Jump Instruction), simple programs

Unit 4

Interfacing with Keyboard, display - LCD (16 x 2), ADC and DAC, LED Matrix and Serial communication with personal computer

B.Sc. ELECTRONICS PRACTICAL III

Semester 6 Section B

1. LED Blink
2. Relay interface
3. Stepper Motor Interface
4. 16x2 Interface
5. Study of bit operation on port(A,B,C,D)
6. LED Blink using timer
7. Frequency Generator using timer
8. External frequency counting timer
9. Interrupt driven operation
10. Single blink on key I/P
11. Opto- triac interface
12. Key to clk/CC
13. Serial interface with PC
14. ADC 0808 interface
15. DAC 0808 interface
16. IIC interface using R.T.C.

B.Sc. ELECTRONICS ***Semester 6 Paper 2***

Reference Books

1	8051 microcontroller	V.Udayshankara, Mallikarjuna swamy	Tata McGraw Hill
2	Microcontroller theory and applications	A.V.Deshmukh	Tata McGraw Hill
3	Microcontroller	Rajkamal	Pearsons
4	Microcontroller	Mazidi and Mazidi	

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SYLLABUS FOR B.Sc. ZOOLOGY (SEMESTER PATTERN)

(With effect from the academic year 2013-2014)

The semester pattern syllabus for B.Sc. Three Year Degree Course in the Subject - Zoology comprises of six semesters. Each semester is based on six theory periods and six practical periods per week. The examination of each semester shall comprise of two theory papers each of three hours duration and carries 50 marks each and a practical of 4 hours duration carries 30 marks. Internal assessment for each semester based on two theory papers of 10 marks each and shall be conducted by university approved teachers. Internal assessment marks should be submitted to the university one month prior to the final examination. Candidates are expected to pass separately in theory, internal assessment and practical examination.

The Structure of Syllabus for B.Sc. Zoology (Semester Pattern) along with distribution of marks is also displayed in the following Table

Semester	Semesterwise Theory Papers and Practicals	Marks			Total Marks
		Theory	Internal Assessment*	Practical	
Semester - I	**Theory** **Paper – I** : Life and Diversity of Animals-Nonchordates (Protozoa to Annelida)	50	10		150
	Paper -II : Environment Biology	50	10		
	Practical - I (Based on Paper I & II)			30	
Semester- II	**Theory** **Paper - III** : Life and Diversity of Animals- Nonchordates (Arthropoda to Hemichordata)	50	10		150
	Paper - IV : Cell Biology	50	10		
	Practical - II (Based on Paper III & IV)			30	
Semester- III	**Theory** **Paper - V** : Life and Diversity of Animals-Chordates (Protochordata to Amphibia)	50	10		150
	Paper - VI : Genetics	50	10		
	Practical - III (Based on Paper V & VI)			30	
Semester - IV	**Theory** **Paper - VII** : Life and Diversity of Animals-Chordates (Reptilia, Aves and Mammals)	50	10		150

Contd. on Pg. 2

	Paper - VIII : Molecular Biology and Immunology	50	10		
	Practical - IV (Based on Paper VII & VIII)			30	
Semester - V	**Theory** **Paper - IX** :General Mammalian Physiology I	50	10		150
	Paper - X : Applied Zoology I (Aquaculture and Economic Entomology)	50	10		
	Practical - V (Based on Paper IX & X)			30	
Semester - VI	**Theory** **Paper - XI** : General Mammalian Physiology II	50	10		150
	Paper - XII : Applied Zoology II (Biotechniques, Microtechnique, Biotechnology, Bioinformatics and Biostatistics)	50	10		
	Practical - VI (Based on Paper XI & XII)			30	
		Grand total			900

*****Internal assessment –

- (For Semester I to IV) Based on students attendance and the performance during Unit test exam. and field work
- (For Semester V & VI) Based on students attendance and the performance during Unit test exam., field work and seminar

Semester - I

Paper – I : Life and Diversity of Animals - Nonchordates (Protozoa to Annelida)

Unit – I **(9 Periods)**

1.1 **Protozoa** : General characters and classification up to classes

1.2 ***Paramoecium*** : Structure and reproduction

1.3 ***Plasmodium*** : Structure and life cycle

1.4 **Parasitic Protozoans of Man :** *Entamoeba, Trypanosoma, Giardia and Leishmania* - Mode of infection and its control

Unit – II **(9 Periods)**

2.1 **Porifera** : General characters and classification up to classes

2.2 ***Sycon*** : Structure, reproduction and development, Canal system in sponges

2.3 **Coelenterata** : General characters and classification up to classes

2.4 ***Obelia*** : Structure and life cycle, corals and coral reef formation

Unit – III **(9 Periods)**

3.1 **Helminthes** : General characters and classification up to classes

3.2 ***Ascaris*** : External morphology, reproductive system and life cycle

3.3 ***Taenia solium*** : Structure and life cycle

3.4 **Elementary idea of parasitic adaptations in helminthes**

Unit – IV **(9 Periods)**

4.1 **Annelida** : General characters and classification up to classes

4.2 **Leech** : Morphology, digestive and urinogenital system

4.3 Trochophore larva and its significance

4.4 Vermiculture and its importance

Semester – I

Paper – II : Environmental Biology

Unit – I **(9 Periods)**

1.1 Atmosphere: Major zones and its importance, composition of air

1.2 Hydrosphere: Global distribution of water, Physico-chemical characteristics of water

1.3 Lithosphere: Types of rocks, formation of soil

1.4 Renewable and non- renewable energy sources

Unit – II **(9 Periods)**

2.1 Ecosystem - Definition and types

2.2 Detailed study of pond ecosystem

2.3 Food chain, food web and ecological pyramids

2.4 Energy flow in an ecosystem, Single channel, Y – shape and Universal model

Unit – III **(9 Periods)**

3.1 Biodiversity and its conservation

3.2 Causes of reduction of biodiversity

3.3 Wildlife conservation acts (1972 and 1984), Introductory study of national parks and sanctuaries – Tadoba, Kanha, Bharatpur and Nagzira

3.4 Hot spots of biodiversity in India

Unit – IV **(9 Periods)**

4.1 Sources, effect and control measures of air pollution, Acid rain, green house effect, ozone depletion and global warming

4.2 Sources, effect and control measures of water pollution

4.3 Sources effect and control measures of noise pollution

4.4 Toxic effect of heavy metals (lead, cadmium and mercury) – Bioaccumulation and biomagnification

Semester – I

PRACTICAL – I (Based on Paper – I and II)

Section A : Life and Diversity of Animals – Nonchordates (Protozoa to Annelida)

& Section B : Environmental Biology

Section A : Life and Diversity of Animals – Nonchordates (Protozoa to Annelida)

1. Study of museum specimens (Classification of animals up to orders)

I. Protozoa (Slides) : *Paramoecium ,Euglena,* Amoeba*, Plasmodium vivax*
II. Porifera: *Sycon, Leucosolenia, Hyalonema, Euplectella, Spongilla*
III. Coelenterata : *Obelia, Aurelia, Tubipora, Fungia, Adamsia*
IV. Platyhelminthes : *Planaria, Fasciola, Taenia*
V. Aschelminthes : *Ascaris, Drancunculus, Ancylostoma, Wuchereria*
VI. Annelida : *Aphrodite, Nereis, Chaetopteurs, Tubifix, Hirudinaria*

2. Study of permanent slides

Enatmoeba, Giardia, Sponge gemmules, Sponge spicules,V.S. *Sycon*, T.S. *Sycon, Obelia* medusa, Miracidium, Redia and Cercaria larvae of *Fasciola*,T.S. male and female *Ascaris,* Scolex of *Taenia,* Mature and gravid proglottids of *Taenia solium,* T.S. of Leech through crop pockets, Trochophore larva

3. Dissection

Digestive, nervous and reproductive system of Earthworm

4. Mounting

Spicules and gemmules of Sponge, *Obelia* colony, *Nereis* parapodia, Jaws of Leech, Nephridia of Leech.

Section B: Environmental Biology

1. Estimation of dissolved oxygen of water
2. Estimation of free CO_2 of water
3. Estimation of pH of water sample
4. Estimation of total hardness of water
5. Study of pond ecosystem - Producers, consumers and decomposers
6. Quantitative analysis of plankton

Visit to a National park and Sanctuary

Distribution of Marks – Total Marks 30

i.	Identification and Comment on Spots (4 Museum specimens + 1 Env. bio. spot + 3 slides)	08
ii.	Dissection -	08
iii.	Environmental biology experiment	04
iv.	Permanent stained preparation	03
v.	Submission of certified practical record	03
vi.	Submission of Slides & tour diary	02
vii.	Viva voce	02

Semester – II

Paper – III : Life and Diversity of Animals – Nonchordates

(Arthropoda to Hemichordata)

Unit – I **(9 Periods)**

1.1. **Arthropoda** : General characters and classification up to classes

1.2. **Cockroach** : Mouth parts, digestive system and reproductive system

1.3. **Insects as Vectors** : Mosquito, Housefly, Sandfly, Tse-Tse fly

1.4. **Study of crustacean larvae** : Nauplius, Zoea and Megalopa; Social behavior in honey bees

Unit – II **(9 Periods)**

2.1 **Mollusca** : General characters and classification up to classes

2.2 ***Pila*** : Morphology, digestive, respiratory and reproductive system

2.3 **Pearl formation in Mollusca**

2.4 **Molluscan larvae :** Glochidium and Veliger

Unit – III **(9 Periods)**

3.1 **Echinodermata** : General characters and classification up to classes

3.2 ***Asterias*** : External features and digestive system

3.3 Water vascular system and locomotion in Starfish

3.4 **Echinoderm larvae** : Bipinnaria and Auricularia

Unit – IV **(9 Periods)**

4.1 **Hemichordata** : General characters and phylogeny

4.2 ***Balanoglossus*** : External features and digestive system

4.3 Reproduction in *Balanoglossus* , Tornaria larva

4.4 Affinities of *Balanoglossus*

Semester – II

Paper – IV: Cell Biology

Unit – I **(9 Periods)**

1.1 Ultrastructure of prokaryotic and eukaryotic cell

1.2 Plasma membrane: Structure- Fluid Mosaic Model and functions

1.3 Endoplasmic reticulum: Types, ultrastructure and functions

1.4 Golgi complex: Ultrastructure and functions

Unit – II **(9 Periods)**

2.1 Ultrastructure of mitochondria

2.2 Oxidative phosphorylation – Glycolysis and Kreb's cycle

2.3 Electron Transport Chain and terminal oxidation

2.4 Lysosome: Structure, polymorphism and functions

Unit – III **(9 Periods)**

3.1 Nucleus: Ultrastructure of nuclear membrane

3.2 Structure and functions of nucleolus

3.3 Chromosome: Structure and types, structure of nucleosome

3.4 Giant chromosomes: Lamp-brush and polytene chromosome

Unit - IV **(9 Periods)**

4.1 Ribosome: Structure, types, Lake's model and functions

4.2 Somatic cell division: Cell cycle and Mitosis

4.3 Meiosis (different phases and significance), synaptonemal complex

4.4 Cellular ageing and cell death, Elementary idea of cancer and its causative agents

Semester – II

PRACTICAL – II (Based on Paper – III and IV)

Section A : Life and Diversity of Animals – Nonchordates (Arthropoda to Hemichordata) & Section B: Cell Biology

Section – A : Life and Diversity of Animals – Nonchordates (Arthropoda to Hemichordata)

1. **Study of museum specimens** (Classification of animals up to orders)
   - I. Arthropoda : *Peripatus, Cyclops, Daphnia, Lepas, Sacculina, Limulus,* Crab, *Scolopendra, Julus,* Dragonfly, Grasshopper, Moth
   - II. Mollusca : *Chiton, Dentalium, Aplysia, Pila, Mytilus, Loligo, Sepia, Octopus*
   - III. Echinodermata : *Asterias, Ophiothrix, Holothuria, Antedon, Echinus*
   - IV. Hemichordata : *Balanoglossus, Saccoglossus*
2. **Study of permanent slides**-

   Nauplius, Zoea and Megalopa larva of Arthopoda, Veliger and Glochidium larva of Mollusca, T.S. of arm of star fish, Bipinnaria and Auricularia larva, T.S. *Balanoglossus* through collar and proboscis, Tornaria larva
3. **Dissection -**
   - I. Digestive system of Cockroach
   - II. Reproductive system of Cockroach
   - III. Nervous system of *Pila*
4. **Mounting-**

   Crustacean larvae and plankton**;** Mouth parts, trachea and salivary gland of Cockroach; Gill lamella, osphradium and radulla of *Pila*

Section B: Cell Biology

1. Study of pictures of ultra structure of prokaryotic cell & eukaryotic cell
2. Study of osmosis in human RBCs (hypotonic, hypertonic and isotonic medium)
3. Demonstration of mitotic cell division in onion root tips by squash method
4. Demonstration of meiosis in *Tradescantia* bud/ Grasshopper testis by squash method
5. Demonstration of salivary gland chromosome in Chironomous larva
6. Demonstration of mitochondria in buccal epithelium/ lip mucosa by Janus Green-B method
7. Use of ocular micrometer and measurement of micro objects
8. Demonstration of Barr body in blood smear

Distribution of Marks – Total Marks 30

i.	Identification and Comment on Spots (5 Museum specimens + 3 slides)	08
ii.	Dissection -	08
iii.	Cell biology experiment	04
iv.	Permanent stained preparation	03
v.	Submission of certified practical record	03
vi.	Submission of Slides	02
vii.	Viva voce	02

List of Recommended Books : (For Semester – I & II)

Life and Diversity of Animals – Non Chordates

1. Barnes **– Invertebrate Zoology (Halt-Saunders international)** Philadelphia, USA
2. Barradaile L.A. & Potts F.A. – **The Invertebrate**
3. Nigam **– Biology of Nonchordates**
4. Kotpal, Agrawal & Khetrapal **– Modern Text Book of Zoology - Invertebrates,** Rastogi Publication, Meerut
5. Puranik P.G. & Thakur R.S. **– Invertebrate Zoology**
6. Majupuria T.C. **– Invertebrate Zoology**
7. Dhami & Dhami **– Invertebrate Zoology**
8. Parker & Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers & Distributors, New Delhi
9. Dr. S.S. Lal **Practical Zoology Invertebrates 9th edition,** Rastogi Publication Meerut
10. EJW Barrington– **Invertebrate Structure and Function** ELBS III Edition

11. R.L. Kotpal **– Phylum Protozoa to Echinodermata (series),** Rastogi and Publication, Meerut
12. Parker J. and Haswell W. – **Text Book of Zoology**, ELBS Edition
13. Vidyarthi – **Text Book of Zoology**, Agrasia Publishers, Agra
14. Jordan E.L. and Verma P.S. – **Chordate Zoology**, S. Chand and Co., New Delhi
15. Ayer E. – **Manual of Zoology**
16. M.D. Bhatia – **The Indian Zoological Memories – Leech**
17. Beni Prasad – **The Indian Zoological Memories – Pila**
18. P. K. Gupta – **Vermicomposting for Sustainable Agriculture**, Agrobios India Ltd
19. A manual of Practical Zoology Invertebrates – P. S. Verma

Environmental Biology

1. Ashthana D.K. **– Environmental Problem & Solution**
2. Agrawal K.C. **– Environmental Biology**
3. Agrawal K.C. - **Biodiversity**
4. Mukharjee **– Environmental Biology**
5. S. Arora **– Fundamentals of Environmental Biology**
6. Sharma **– Ecology & Environmental Biology**
7. Verma P.S. & Agrawal V.K. **– Environmental Biology, S. Chand.**
8. Trivedi & Rao **– Air Pollution**
9. Chapman & Reiss – **Ecology-Principles and Applications**, Cambridge
10. Chatterjee B – **Environmental Laws-Implementation and Problems**
11. Sharma P.D. – **Environmental Biology**, Rastogi Publication, Meerut
12. Trivedi R.K. – **Hand Book of Environmental Laws, Rules, Guidelines, Compliances and Standards, Enviromedia**
13. Odum E.P. and Barret – **Fundamentals of Ecology**, Thomson
14. Smith R.L. – **Ecology and Field Biology**, Harper Collins
15. D.N. Saxena **– Environmental Biology**, Studium Press (India)
16. Davis – **Behavioral Ecology**
17. Kumar and Asija – **Biodiversity – Principle of Conservation**
18. Rao and Rao – **Air Pollution**
19. S. Satyanarayan, S. B. Zade, S.R. Sitre and P.U. Meshram – **A Text Book of Environmental Studies**, Allied publisher (India)
20. Smitz – **Introduction to Water Pollution**
21. N.S. Subrahmnyam A V.S.S. Sambamurthy **– Ecology**

Cell Biology

1. C.B. Powar, **Cell Biology** – Himalaya Publication, New Delhi
2. Dr. S.P. Singh, Dr. B.S. Tomar – **Cell Biology** 9th revised edition, Rastogi Publication, Meerut
3. Gupta P.K. – **Cell and Molecular Biology**, Rastogi Publication, Meerut

4. Veer Bala Rastogi – **Introduction to Cell Biology**, Rastogi Publication, Meerut
5. Gerald Karp – **Cell and Molecular Biology-Concepts and Experiments**, John Wiley, 2007
6. De-Robertis – **Cell Biology**
7. Verma and Agrawal **– Concepts of Cell Biology**
8. Dowben **– Cell Biology**
9. Witt **– Biology of Cell**
10. Ambrose and Eastyr – **Cell Biology**

Semester – III

Paper – V : Life and Diversity of Animals - Chordates

(Protochordata to Amphibia)

Unit – I **(9 Periods)**

1.1 **Protochordata** : General characters and classification up to order

1.2 ***Herdmania*** : Structure, digestive system, ascidian tadpole and retrogressive metamorphosis

1.3 ***Amphioxus*** : Structure, digestive system, circulatory system, sense organs and protonephridia

1.4 **Agnatha** : General characters of Cyclostomata (*Petromyzon* and *Myxine*)

Unit – II **(9 Periods)**

2.1 **Pisces** : Salient features of Chondrichthyes and Osteichthyes, Origin of paired fins in fishes

2.2 Migration and Accessory respiratory organs in fishes

2.3 **Amphibia** : General characters and classification up to order

2.4 Parental care and Neotony in Amphibia

Unit – III **(9 Periods)**

3.1 Gametogenesis and type of eggs

3.2 Fertilization of egg

3.3 Post fertilization development of fish

3.4 Types of scales of fishes, Development of placoid scales

Unit – IV **(9 Periods)**

4.1 Frog Embryology - Cleavage , blastulation and gastrulation

4.2 Fate map, Morphogenetic movements in gastrula of frog

4.3 Development of respiratory organs in frog

4.4 Development of Aortic arches of frog

Semester – III

Paper – VI : Genetics

Unit – I **(9 Periods)**

1.1 Mendelian Principles- Dominant recessive relationships, Mendelian laws

1.2 Interaction of genes- Epistasis - dominant and recessive, codominance, incomplete dominance

1.3 Quantitative genetics – Polygenic traits, inbreeding and outbreeding, hybrid vigor

1.4 Extracellular genome – Presence and functions of mitochondrial DNA, plasmids

Unit – II **(9 Periods)**

2.1 Cytoplasmic inheritance- *Kappa* particles in *Paramecium*, CO_2 sensitivity in *Drosophila*, milk factor in mice

2.2 Linkage and crossing over – Basic concepts of linkage, types and theories

2.3 Concepts of genes – Cistron , muton and recon

2.4 Genetic disorders in human beings – Haemoglobin disorders – Thalassemia and Sickle cell anemia. Metabolic disorder: Phenylketonurea

Unit – III **(9 Periods)**

3.1 Sex determination – ZZ, XY, XO, ZW pattern, Sex determination in *Drosiphila* – Genic balance theory, Environmental sex determination in *Bonellia*

3.2 Chromosomal aberrations: addition, deletion, duplication and inversion

3.3 Gene mutations- Spontaneous and induced mutations, mutagenic agents

3.4 Disorders related to chromosomal number- Turner syndrome, Klinefelter syndrome and Down syndrome

Unit – IV **(9 Periods)**

4.1 Lethal genes – Concepts and consequences

4.2 Population genetics: Basic concepts in population genetics, Hardy Weinberg equilibrium and its significance

4.3 Genetic counseling – Introduction , purpose, hereditary diseases and disorders

4.4 Applied genetics - DNA fingerprinting , amniocentesis, sperm banks, karyotyping

Semester – III

PRACTICAL – III (Based on Paper – V and VI)

Section A : Life and Diversity of Animals – Chordates (Protochordata to Amphibia)
& Section B : Genetics

Section A : Life and Diversity of Animals – Chordates (Protochordata to Amphibia)

1. **Identification, classification , distinguishing characters and adaptive features of**
   - I. **Urochordata** : *Herdmania, Salpa, Doliolum*
   - II. **Cephalochordata** : *Amphioxus*
   - III. **Cyclostomata** : *Petromyzon, Myxine*
   - IV. **Pisces** *: Pristis, Torpedo, Notopterus, Exocoetus, Clarius, Ophiocephalus, Catla, Rohu, Mrigal*
   - V. **Amphibia** : *Ichthyophis ,Bufo, Salamander*
2. **Dissection of the locally available culturable fish-**
   - i. Digestive system
   - ii. Reproductive system
   - iii. Brain

3. **Developmental Biology** –
   Study of permanent slides of Frog embryology: T.S. Blastula, T.S. Gastrula, T.S. Neurula, T.S. tadpole passing through internal and external gill stage

4. **Study of permanent slides-**
   Amphioxus through Pharynx, Intestine, Gonad and Caudal region; V.S. skin, T.S. Testis, T.S. Ovary of Frog; T.S. Stomach, T.S. Intestine, T.S. Liver of fish

5. **Permanent stained preparation:**
   Fish scales – Placoid, cycloid, ctenoid; Hyaline cartilage and striated muscle

Section B : Genetics –

1. Study of monohybrid and dihybrid ratio
2. Study of normal human karyotype (Normal male and female)
3. Study of characters and karyotypes of Syndrome like Down, Klinefelter & Turner
4. Study of the genetic traits (Hardy Weinberg law) in human being (Tongue rolling, ear lobe, PTC taster/ non taster)

Distribution of Marks – **Total Marks 30**

i.	Dissection	06
ii.	Identification and comment on spots (4 Museum specimens, 4 slides – 2 from frog embryology and 2 from histology)	08
iii.	Genetics experiment	03
iv.	Genetics study – Karyotypes , syndromes, genetic traits in man	03
v.	Permanent stained preparation	03
vi.	Submission of certified practical record	03
vii.	Submission of slides	02
viii.	Viva voce	02

Semester – IV
Paper - VII : Life and Diversity of Animals – Chordates (Reptilia, Aves and Mammals)

Unit – I **(9 Periods)**

1.1 **Reptilia**- Classification based on temporal vacuities

1.2 Poison apparatus, biting mechanism , snake venom and its importance

1.3 **Aves** – Comparison of Ratitae and Caranitae, Flight adaptations and migration

1.4 **Mammals** – General characters of Prototheria, Metatheria and Eutheria

Unit –II **(9 Periods)**

2.1 Modern theories of evolution : Darwinism and Neo-Darwinism

2.2 Adaptations – Cursorial, Aquatic, Terrestrial, Fossorial and Volant

2.3 Introduction to genetic basis of evolution – Species Deme, Variation

2.4 Races in Man (Caucasoid, Negroid, Mongoloid and Australoid)

Unit –III **(9 Periods)**

3.1 Comparative account of aortic arches and heart in Reptiles, Birds and Mammals

3.2 Structure of hen's egg

3.3 Development of chick up to premitive streak stage

3.4 Development of extra embryonic membranes in chick and functions

Unit –IV **(9 Periods)**

4.1 Blastocyst and implantation in Mammals; Types of placenta on the basis of morphological and histological structure; functions of placenta

4.2 Stem cells : Sources, types and their use in human welfare

4.3 Biological clock : Diurnal and rhythmic behavior in birds and mammals

4.4 Role of pheromones in reproductive behavior

Semester – IV

Paper - VIII : Molecular Biology and Immunology

Unit - I **(9 Periods)**

1.1 DNA: Structure of DNA, forms of DNA, properties of DNA, DNA as a genetic material

1.2 RNA: Structure of RNA, types of RNA, RNA as a genetic material

1.3 Prokaryotic and eukaryotic gene structure

1.4 **Recombination in Bacteria**: Bacterial transformation – Griffith's experiment, Conjugation in bacteria, transduction

Unit - II **(9 Periods)**

2.1 **DNA replication**: Semiconservative model, Meselson Stahl experiments. Process of replication – origin of replication, concept of replication, directionality of replication

2.2 **Genetic code**: Characteristics of genetic code, Wobble hypothesis

2.3 **Protein synthesis**: Transcription mechanism – Initiation , elongation and termination of transcription. Translation – activation of amino acids, transfer of activated amino acids to tRNA, Initiation, elongation and termination of polypeptide chain; inhibitors of protein synthesis

2.4 **Gene regulation models** - Lac operon and tryptophan operon

Unit - III **(9 Periods)**

3.1 **Concepts of immunity –** Innate and acquired immunity, organs of the immune system

3.2 **Antigen -** Structure, diversity, functions and types of antigen

3.3 **Antibody**- Structure, types and functions

3.4 **Antigen-antibody interaction** – Precipitation and agglutination

Unit - IV **(9 Periods)**

4.1 **Types of immune response**: B cell response (antibody mediated), T cell response (cell mediated)

4.2 **Complement system:** Basic concepts of complement cascades, classical, alternative and MBL pathways, implications of complement system in immune defense

4.3 **Cytokines**- General account on cytokines, Cytokine related diseases

4.4 **Autoimmunity and immunodeficiencies**- Autoimmune diseases and their treatment, AIDS and other immunodeficiencies

Semester – IV

PRACTICAL – IV (Based on Paper – VII and VIII)

Section A : Life and Diversity of Animals – Chordates

(Reptilia, Aves and Mammals) & Section B: (Molecular Biology and Immunology)

Section A : Life and Diversity of Animals – Chordates (Reptilia, Aves, Mammals, Embryology)

1. **Identification, classification , distinguishing characters and adaptive features of –**
   - i. **Reptilia** : *Chameleon, Varanus, Pharynosoma, Draco, Tortoise*, Cobra, Krait, Russel's viper, Sea snake
   - ii. **Birds** : Owl, Woodpecker, Kingfisher, Kite, Duck, Parrot
   - iii. **Mammals** : Squirrel, Mongoose, Bat, Loris, Rabbit
2. **Study of skeleton of Rabbit and Fowl**
3. **Developmental Biology** –

Study of permanent slides of chick embryology W.M.: 18 hrs, 24 hrs, 30 hrs, 36 hrs, 72hrs

4. **Study of permanent slides-** V.S. skin of Bird, Filoplume of bird, V.S. Skin of Mammal

Section B: Molecular Biology and Immunology

Molecular Biology :

1. Staining of DNA and RNA in blood smear of fish/human by methyl green pyronin technique
2. Introduction to basic laboratory instruments and equipments- Autoclave, Centrifuge, pH meter, Micropipettes, Digital balance, Homogenizer, Electrophoresis apparatus; Molar and normal solutions calculations
3. Isolation of DNA (Genomic DNA from any available source) by phenol extraction method

Immunology :

1. Determination of blood groups (ABO and Rh) in humans
2. Antigen – Antibody interaction by double diffusion method (Ouchterlony)
3. Study of histological slides of organs of immune system – Thymus, Lymph nodes and Spleen

Distribution of Marks – **Total Marks 30**

i.	Identification and comment on spots- (3 Museum specimens, 5 slides – 2 from chick embryology; from histology and 1 from immunology, 2 bones)	10
ii.	Molecular biology experiment	08
iii.	Immunology experiment	07
iv.	Submission of certified practical record	03
v.	Viva voce	02

List of Recommended Books: (For Semester - III and IV)

Life and Diversity of Animals -Chordates

1. T. B. of Zoology vol II – Parker & Haswell
2. T. B. of Vertebrate Zoology -S. N. Prasad
3. Chordate Zoology –E. L. Jorden and P. S. Verma
4. Vertebrate Zoology – Vishwanath
5. Zoology of Chordates – Nigam H. C.
6. Phylum: Chordata – Newman H.H.
7. Biology of Vertebrates –Walter & Sayles
8. The Vertebrate Body – Romer A. S.
9. Comparative Anatomy of the Vertebrates – Kingslay J. D.
10. The Biology of Amphibia – Noble G. K.
11. Snakes of India – Gharpura K. G.
12. Life of Mammals – Young J.Z.
13. Vertebrates – Kotpal R. L.
14. Introduction to Chordates – Majupuria T.C.
15. Vertebrate Zoology – Dhami & Dhami
16. T. B. Vertebrate Zoology – Agrawal
17. Protochordates – Chatterjee & Pandey
18. Protochordates – Bhatia
19. T. B. of Chordates – Bhamrah and Juneja
20. Chordate Anatomy – Arora M.P.
21. The Chordates – Alexander.
22. T. B. of Animal Embryology – Puranik
23. T. B. of Chordate Embryology – Dalella & Verma
24. T. B. of Embryology – Sandhu
25. T. B. of Embryology – Armugam

26. Early Embryology of Chick – Pattern
27. Chordate Embryology – Verma & Agrawal
28. Chordate Embryology – Tomar
29. The Frog – Rugh
30. An Introduction to Embryology – Balinsky
31. Comparative Vertebrate Embryology – Mcwen
32. Developmental Biology – S. C. Goel
33. Introduction to Embryology – Berry
34. Organic Evolution – N. Armugam
35. Evolution – M. P. Arora
36. Animal Behavior – Smith and Hill
37. Animal Behavior – Arora
38. Animal Behavior – Gundevia and Singh
39. Practical Zoology Vertebrates – Dr. S. S. Lal, Rastogi Publication, Meerut
40. A manual of Practical Zoology Vertebrates – P. S. Verma

Genetics

1. Genetics & Genetic Engineering – Joshi
2. Genetic Engineering & its applications – Joshi
3. Genetics – Gardener
4. Genetics – Winchester
5. Genetics – Gupta
6. Principles of Genetics – Sinnot Dunn, Dobzansy
7. Genetics –Ahluwalia
8. Genetics – Sarin
9. Elementary Genetics – Singleton
10. General Genetics – SRb, Owen & Edger
11. Genetics –Alenberg
12. Foundation of Genetics – Pai
13. Genetics - Stickberger
14. T. B. of Genetics- Veerbala Rastogi
15. Gene VI by Benjamin Lewis, Oxford press
16. Gene VIII by Benjamin Lewis, Oxford press
17. Genetics Vol. I and II by Pawar C. B., Himalaya publication

Molecular Biology

1. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication
2. Molecular Biology by Turner P. C. and Mc Lennan , Viva Books Pvt. Ltd
3. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd
4. Molecular Biology by Freifelder D., narosa publication House

5. Molecular Biology of Gene by Watson J. D. et. al., Benjamin publication
6. Molecular Cell Biology by Darnell J. Scientific American Books USA
7. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc
8. Essentials of Molecular Biology by Freifelder D., narosa publication House
9. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P. Baltimore D. and Darnell J., W. H. Freeman and Co.
10. The Cell: Molecular Approch by Cooper G. M.
11. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication
12. Molecular cell Biology by Bamrach
13. Cell and Molecular Biology by P.K. Gupta

Immunology

1. Immunology – R. C. Kuby et al.
2. Immunology - Tizzard
3. Immunology -. Roitt, Brostoff and D. Male
4. Immunology - Abbas

Semester – V

Paper - IX : General Mammalian Physiology –I

Unit – I : Enzymes (9 Periods)

1.1 Enzymes **–** Distribution and chemical nature of enzymes

1.2 General properties of enzymes

1.3 Classification of enzymes

1.4 Factors affecting enzyme activity

Unit-II : Nutrition and Digestion (9 Periods)

2.1 Structure and functions of digestive glands - (Salivary, Gastric, Intestinal, Liver and Pancreas)

2.2 Gastrointestinal hormones

2.3 Digestion and absorption of proteins, carbohydrates and lipids.

2.4 Vitamins- Fat soluble and water soluble vitamins; Sources, deficiency and diseases

Unit-III :Respiration (9 Periods)

3.1 Respiratory pigments - Types , distribution and properties

3.2 Mechanism of Respiration

3.3 Transport of O_2 and CO_2

3.4 Respiratory disorders and effects of smoking

Unit-IV : Circulation **(9 Periods)**

4.1 Composition and functions of blood

4.2 Blood clotting – Intrinsic and extrinsic factors, blood groups and *Rh* factor

4.3 Cardiac cycle

4.4 E.C.G. and Blood pressure

Semester – V

Paper –X : Applied Zoology-I

(Aquaculture and Economic Entomology)

Unit –I : Aquaculture **(9 Periods)**

1.1 Site selection and construction ,Pre stocking and post stocking manangement of nursery, rearing and stocking ponds

1.2 Breeding of fishes by bund and Chinese hatcheries. Induced breeding by hypophysetion. New generation drugs in induced breeding

1.3 Brief study of freshwater aquaculture system – Polyculture, cage culture, sewage fed fish culture, integrated fish farming

1.4 Fish products and byproducts, Fish preservation

Unit-II **(9 Periods)**

2.1 Prawn culture and Pearl culture

2.2 Fabrication and setting up of aquarium and its maintenance

2.3 Breeding of aquarium fishes – Live bearers and egg layers

2.4 Diseases caused by fungi, bacteria, protozoa and helminthes

Unit-III : Economic Entomology (Methods of pest control) **(9 Periods)**

3.1 Chemical control : Insecticides - Pyrethroids, carbomate and HCN – mode of action, merits and demerits

3.2 Biological control – Biological agents – predators and parasites; merits and demerits

3.3 Crop pest: Life cycle, damage and control of

I. Cotton spotted boll worm -*Earias vitella*

II. Stored grain pest- Rice Weevil, *Sitophilus oryzae*

3.4 Animal pest: Life cycle, damage and control of –

I. House fly – *Musca nebulo*

II. Stable fly – *Stomoxys calcitrans*

Unit-IV : Economic Entomology (Industrial entomology) **(9 Periods)**

4.1 Sericulture- Types of Silkworm. Life cycle and rearing of mulberry silkworm, *Bombyx mori*

4.2 Life cycle and rearing of non mulberry silkworm (Tasar), *Antheraea mylitta* ; Brief idea of coccon processing for silk fabric - coccon boiling, reeling, rereeling, winding, doubling, twisting and weaving

4.3 Apiculture – Types of honey bees. Life cycle, culture, movable frame hive, bee product and its economic importance

4.4 Lac culture – Lac insect, *Laccifer lacca* - Life cycle, Lac processing, Lac products and Economic Importance

Semester – V

PRACTICAL – V (Based on Paper IX and X)

Section A: General Mammalian Physiology - I and Section B : Applied Zoology –I (Aquaculture and Economic Entomology)

Section A: General Mammalian Physiology – I

1. Detection of action of salivary amylase on starch
2. Detection of carbohydrates, proteins and Lipids
3. Detection of Vitamin A and Vitamin C
4. Measurement of lung capacity
5. Preparation Haemin crystal
6. Total count of WBC and RBC
7. **Study of histological slides of Mammal** – T.S. salivary gland, T.S. stomach, T.S. intestine, T.S. pancreas, T.S. liver and T.S. lung

Section B : Applied Zoology –I (Aquaculture and Economic Entomology)

Aquaculture:

1. **Collection and identification of fishes**
   a. Freshwater edible fishes – catla, rohu, mrigal, grass carp, silver carp, *Cyprinous carpio* , *Ophiocephalous, Clariaus, Heteropneustes, Wallago, Mystus,*
   b. Aquarium fishes – Gold fish, Molly, Sword tail, Kissing *Gourami*
2. **Dissection**: a. Digestive, reproductive and brain with pituitary of culturable fishes
   b. Gonosomatic index
3. **Fabrication and setting up of aquarium**
4. **Mounting**: Scales of fishes, zooplankton

Economic Entomology:

1. **Study of Insect Pest**
    a. Agriculture pest – Grasshopper , Red Cotton bug, Gram pod borer, Cotton pink bollworm, Cotton spotted bollworm
    b. Medical pest – House fly, Mosquito , *Pediculus humanus*
    c. Veterinary pest – Stable fly , Dog tick, Bird lice
    d. Stored grain pest – Stored grain weevil, Flour moth
    e. Useful Insects – Honeybee, Silk moth, Lac insect, Dragon fly, Lady bird beetle
2. **Mounting** : Mouth parts, Legs, wings of any insects and sting of Honeybee
3. **Visit** to – Fish farm, Apiculture, Sericulture, Agricultural educational centre, Sea shore and Lake

Distribution of Marks		**Total Marks 30**
i.	Physiology experiment	05
ii.	Identification and comment on spots (2 from Mammalian histology,3 from Aquaculture and 3 from Economic Entomology)	08
iii.	Dissection of fish / Gonosomatic index	05
iv.	Permanent stained preparation	02
v.	Submission ,collection and study tour report	02
vi.	Submission of certified practical record	03
vii.	Viva voce	05

Semester – VI

Paper -XI : General Mammalian Physiology - II

Unit –I : Nerve and Muscle Physiology (9 Periods)

1.1 Types of neurons, E.M. structure of neuron

1.2 Conduction of nerve impulse

1.3 Ultrastructure of striated muscle, Sliding filament theory of muscle contraction

1.4 Properties of muscles (Twitch, Tetanus, Tonus, Summation, All or None Principle, Muscle fatigue)

Unit-II : Excretion **(9 Periods)**

2.1 Structure of uriniferous tubule

2.2 Mechanism of urine formation

2.3 Counter – current mechanism

2.4 Normal and abnormal constituents of urine; Elementary idea of dialysis

Unit-III : Endocrinology **(9 Periods)**

3.1 Structure and functions of pituitary gland

3.2 Structure and functions of thyroid and parathyroid gland

3.3 Structure and functions of adrenal gland

3.4 Structure and functions of pineal gland

Unit-IV : Reproduction **(9 Periods)**

4.1 Oestrous and menstrual cycle

4.2 Male and female sex hormones

4.3 Causes of infertility in male and female

4.4 Contraceptives – Mechanical and hormonal ; *In-vitro* fertilization

Semester - VI

Paper - XII : Applied Zoology –II

(Biotechniques, Microtechnique, Biotechnology, Bioinformatics and Biostatistics)

Unit –I : Biotechniques **(9 Periods)**

1.1 **Concepts of sterilization**: Filtration, autoclaving, dry heat sterilization, wet sterilization and radiation

1.2 **Separation of biomolecules**: Centrifugation (Sedimentation, density gradient); Chromatography (Elementary idea of thin layer, gel filtration and ion exchange - Principles and applications)

1.3 **Electrophoresis**: Agarose gel electrophoresis, SDS-PAGE

1.4 Principles of colorimeter and spectrophotometers

Unit-II : Microtechnique **(9 Periods)**

2.1 Fixation, dehydration, clearing, embedding & section cutting

2.2 Difficulties encountered during section cutting (causes and remedies)

2.3 Double staining with Haematoxylin and Eosin

2.4 Histochemical staining techniques for carbohydrates (Periodic acid schiff), proteins (Mercury-bromophenol blue) and lipids (Sudan black-B)

Unit-III : Biotechnology (9 Periods)

3.1 Basic concepts in recombinant DNA technology, Gene isolation method- Shotgun cloning

3.2 Isolation of gene- DNA manipulation enzymes: Nucleases, ligases, polymerases

3.3 Basic concepts of cloning vectors and splicing : Insertion of DNA and ligation using blunt ends, cohesive ends, Cloning vectors

3.4 Application of biotechnology: Insulin and vaccine production

Unit-IV : Bioinformatics and Biostatistics (9 Periods)

4.1 Bioinformatics: Definition, Basic concepts in bioinformatics, importance and role of bioinformatics in life sciences

4.2 Bioinformatics databases- introduction, types of databases

4.3 Nucleotide sequence databases, Elementary idea of protein databases

4.4 Biostatistics – Tabulation of data, presentation of data, sampling errors, mean, mode, median, probability, standard error and standard deviation

Semester – VI

PRACTICAL – VI (Based on Paper XI and XII)

(Section A: General Mammalian Physiology – II and Section B: Applied Zoology – II , Biotechniques, Microtechnique, Biotechnology, Bioinformatics and Biostatistics)

Section A : General Mammalian Physiology – II

1. Detection of urea, albumin, sugar and creatin in urine
2. Sperm count in a given semen sample
3. **Dissection:** Endocrine glands of Culturable fishes
4. **Study of histological slides of Mammal** – T.S. kidney, pituitary, thyroid, adrenal, testis, ovary; uterus, placenta, medulated and non medulated nerve fibre, smooth and striated muscle

Section B : Applied Zoology – II (Biotechniques, Microtechnique, Biotechnology, Bioinformatics and Biostatistics)

1. Separation of amino acids by paper chromatography
2. Separation of proteins by electrophoresis technique
3. Block preparation and section cutting
4. Double staining method (H-E)
5. Demonstration of carbohydrates, proteins and lipids by histochemical methods
6. Determination of mean, mode, median from a given biostatistical data and/or graphical representation of the data using computers

7. Use of internet for survey of literature using protein and nucleotide databases(NCBI)
8. Use of softwares like Microsoft offices
9. **Visit to Biotechnology centre to study working principles of different instruments**

Distribution of Marks		**Total Marks 30**
I.	Physiology experiment	05
II.	Identification and comments on spots (Mammalian histology 3 spots)	03
III.	Microtechnique - Section cutting, spreading and H-E staining of given slide	03
IV.	Dissection of fish	05
V.	Analysis of given biostatistical data	02
VI.	Retrieval of specific literature from given information	02
VII.	Submission of slides and study tour report	02
VIII.	Submission of certified practical record	03
IX.	Viva voce	05

List of Recommended Books: (For Semester V and VI)

Physiology

1. Human Physiology – Chatterjee A. G. vol. I & II
2. Medical Physiology – Gyton
3. T. B. of Animal Physiology – Berry
4. Introduction to Animal Physiology and Related Biotechnology – H. R. Singh
5. Animal Physilogy – Arora M.P.
6. General and Comparative Physiology – Hoar W. S.
7. T. B. of Animal Physiology – Hurkat and Mathur
8. Animal Physiology – Nahbhushan and kodarkar
9. T. B. of Animal Physiology & General Biology – Thakur & Puranik
10. General Endrocrinology – Turner Bagnaro
11. Reproduction and Human welfare – Greep and koblinsky
12. Animal Physiology – Shashtri & Goel
13. Animal Physiology – Verma & Tyagi
14. Human Physiology - Vander and sheman
15. Applied Physiology – Keels, Neils and Joels
16. Animal Physiology – Rastogi S. C.
17. Animal Physiology – Veerbala Rastogi

18. Comparative Vertebrate Endocrinology – Beutley

Aquaculture

1. Wealth of India, Raw Material, Vol. IV – ICAR
2. Fishes of India vol I & II- Day
3. Fish & Fisheries of India – Jhingran
4. Hatchery Manual for Common Indian & Chinese carps – Jhivgan & Pallin
5. Fish Pathology – Roberts
6. Introduction of Fishes – Khanna
7. Fishery Science & Indian Fishes – Khanna
8. Fishery Science & Indian Fisheries – Shrivastava
9. A Manual of F. W. Aquaculture – Santhanam
10. An Aid to Identification of Commercial Fishes of India & Pakistan- Mishra
11. Standard Methods for Examination of Water & Waste Water - APHA
12. Hand Book of Breeding of Major Carps by Pituitary Hormones – S. L. Chonder
13. Principles of Aquaculture – Zade S. B., Khune C. J., Sitre S.R. and Tijare R.V.

Entomology

1. T. B. of Applied Entomology – K. P. Shrivastava
2. T. B. of Agricultural Entomology - II S Pruthi
3. Modern Entomology – D. B. Tembhare (2nd Edition)
4. A Hand Book of Practical Sericulture – Ullar S. R. & Narsimhanna M.N.
5. Destructive and Useful Insects – Metcalf C.L. & Flint W.P.
6. General Text Book of Entomology – Richards O. W. & Davis R. G.
7. Agricultural Pests of India & South East Asia – Atawal A.S.
8. Hand Book of Economic Entomology for South Asia – Ayyar & Ram Krishna.
9. Medical Entomology – Hati A. K.
10. Bee-Keeping in India – Singh S

Biotechnique and Microtechnique

1. Animal Tissue Technique – Humason
2. Histological Technique – Devaenport
3. Microtechnique – Jiwaji & Patki
4. Microtechnique – Wankhede
5. Biophysical Chemistry – Upadhyay, Upadhyay and Nath
6. Techniques in Life Sciences – D. B. Tembhare

Biotechnology

1. Elements of Biotechnology – Gupta
2. T. B. of Biotechnology – Dubey
3. Modern Concept of Biotechnology – Kumar H. D
4. Advances in Biotechnology – Jogdand

5. T. B. of Biotechnology – Chatwal
6. Molecular Biotechnology – Primrose

Bioinformatics and Biostatistics

1. Mount W. 2004. Bioinformatics and Sequence Genome Analysis 2nd Editon CBS Pub. New Delhi.
2. Bergman, N. H. Comparative Genomics. Humana Press Inc. Part of Springer Science+Business Media, 2007.
3. Baxevanis, A. D. Ouellate, B. F. F. 2009. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. John-Wiley and Sons Publications, New York.
4. Campbell A. M. and Heyer, L. J. 2007. Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings.
5. Des Higgins and Willie Taylor 2000. Bioinformatics: Sequence, Structure and Databanks. Oxford University Press.
6. Rashidi H. H. and Buehler 2002. Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London.
7. Gibas Cynthia and Jambeck P. 2001. Developing Bioinformatics Computer Skills: Shroff Publishersand Distributors Pvt. Ltd. (O'Reilly), Mumbai.

B.Sc. I

Semester-I

Paper-I

History And Microbial Morphology

Unit-I:History and scope of Microbiology.

i)Discovery of microbeii)Theory of biogenesis and a biogenesis.

iii)Contributions of Louis Pasteur, Robert Koch, Lister Winogradsky and Beijerink, John Tyndal iv)Branches of Microbiology: a] systemic microbiology including bacteriology, mycology, phycology, virology, b] biotechnology, c] geomicrobiology, d] exobiology,e]medical microbiology, f]environmental microbiology

Unit-II:Prokaryotic Cell structure I

i)A Typical Bacterial cell structure, ii)Structure of cell wall(-gram +ve, gram-ve)

iii) Cell membrane: Fluid mosaic model, mesosomes iv)Ribosomes, Nucleoid, plasmids, Storage granule

Unit- III

i)Capsules, slime layer, Pili, Flagella(including types and structure).

ii)Endospore structure, formation and germination iii) Exospores, Myxospores, Eukaryotic spores, iv) significance of dormancy

Unit IV—Bacterial Taxonomy

i)Significance of classification, ii)Intuitive classification, Whittaker five kingdom system, iii)Bergys manual ninth edition, numerical classification, iv) Approaches in modern classification: GC:AT Ratio, DNA Hybridization, 16SrRNA Cataloguining and phylogeny

Paper-II-Microbial Diversity.

Unit-I:Prokaryotic microbes

i)General characters of a)Proteobacteria, b)Mycoplasma, c)Rickettsia and chlamydia

ii)Cyanobacteria: Study of anabena and applications of cyanobacteria

iii)Actinomycetes: Streptomysis and their applications

iv)Archaebacteria: Methanogenic bacteria and their importance

Unit-II:Eukaryotic microbes

i)Fungi and yeast:General characters,Asexual and sexual mode of reproduction,slide culture techniques.

ii)Algae:-General characters and industrially important algal cells

iii)Protozoans: General characters and life cycle of trypanosome

iv)Differences between prokaryotes and eukaryotes

Unit-III:Acellular microbes:Viruses.

i)Discovery of viruses, General structure, symmetry and classification

ii)Cultivation,chick embryo,tissue culture

iii) Detection of viral growth iv)T4-Bacteriophages,lytic cycle, Lysogeny and Lambdaviruses.

Unit-IV:Microbial interaction.

i)Positive and negative interaction:Commensalism, synergism, syntropism, mutualism, parasitism, predation, antagonism, competetion

ii)Protist-Protist Interaction:Bdellovibrio

iii)Protist-Plant interaction: Root nodule bacteria

iv)Protist-Animal interaction: Rumen bacteria, insect midgut bacteria, luminescent bacteria

Semester-II

Paper-I-Microbial Physiology

Unit-I:Microbial Nutrition.

i)Nutritional types of bacteria.ii)Basic nutritional requirements.

iii)Types of culture media, growth, selective, enriched, enrichment, synthetic non synthetic.

iv)Axenic cultures. Diauxic cultures.

Unit-II:Microbial growth and cell cycle.

i)Bacterial cell cycle ii)Principle of growth curve and mathematical expression.

iii)Continuous culture: Turbidostat and chemostat.

iv) Factors influencing microbial growth.

Unit-III:Microbial control.

i)Concept of microbial death ii)General terms: microbiostatic, cidal disinfectant, sanitizer.

iii)Ideal antimicrobial agents.

iv)Physical methods;a)Heat and moist sterilization.b)Dry sterilization, c)Low temperature.

d)Filtration, e)radiation, f)osmotic pressure.

Unit-IV: Chemical agents

i) Phenolics, Alcohols, Halogens, Heavy metals, Quaternary ammonium compounds, Bignamides-Chlorohexidines, Surface active agents, Aldehydes

b)Gaseous sterilization

c)Chemotherapeutic agents

i)Mechanism of cell injury.

ii)Factors influencing antibiotic activity

d)Phenol coefficient

Semester-II

Paper-II-Microbial Techniques

Unit-I:Microscopy-I Principle and application

i)Bright field microscopy, ii) Dark field microscopy, iii)Electron Microscopy(TEM, SEM),

iv)Confocal microscopy.

Unit-II: Microscopy- II-Principle and applications

i)Atomic Force Microscopy ii)Phase contrast microscopy.iii)Fluorescent microscopy.

Unit-III- Staining techniques

i) Stains and dyes, chromophore, auxochrome, chromogens, types of stains.

ii) Staining techniques :simple, differential, gram staining, acid fast staining.

iii) Staining of specific structure: flagella, spores, capsule (negative)

iv) Theory of staining

Unit-IV:Nutritional and growth techniques.

i)Isolation of pure culture:various techniques.

ii)Determination of C N P etc. by auxeno graphic and replica plate technique

iii)Synchronous culture techniques.iv)Measurement of growth.

Practicals SemI

1.General concept of basic equipments and apparatus

2.Preparation of media and stains

3.Isolation of microbes from air, water, soil

4. Performance of simple Grams, acidfast and spores staining

5. Isolation of pure culture

6. Performance of slide culture technique and fungal staining

7. Performance of antibiosis

8. Performance of motility

Practicals Sem II

1. Enumeration of microbes by SPC method
2. Performance of oligo dyanamic action
3. Determination of phenol coefficient
4. Study the effect of salt on growth
5. To perform membrane filtration
6. To demonstrate the effect of radiation
7. To cultivate anaerobic bacteria
8. Demonstration of Micrometry

B.Sc. II Semester III
Paper I
Chemistry of Organic Constituents And Enzymology

Unit I—Carbohydrates And Lipids
Classification of carbohydrates ,Structure of glucose, fructose, maltose, lactose, sucrose, raffinose, starch, hyaluronic acid, glycogen, cellulose, osazone formation
Classification of lipids, structure of triglyceride, compound lipids, derived lipids

Unit II---Amino acids and proteins
Classification of amino acids, titration curve, acidic, basic and neutral amino acids, peptide bond theory, organizational levels of proteins, concept of oligomeric protein

UnitIII--- Enzymology
Definitions and nature of enzymes, classification, nomenclature, primary concept of enzyme kinetics, MM equation, modifications of MM equations, activation energy, transition state, ES complex, enzyme activity, katal,specific activity, turn over number
Enzyme inhibition and their types, enzyme regulation, their types, allosteric sites, allosteric modulaters, functional diversity such as holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group, isoenzymes, membrane bound enzymes, multienzyme complex, zymogens

Unit IV---Nucleic acid and Vitamins
Structure of purines, pyrimidines, nucleosides, nucleotides, DNA, RNA, and various forms of DNA
Types of vitamins, Classification on the basis of solubility, functions of vitamins, Hyper and hypovitaminosis

B.Sc. II Semester III

Paper II

Industrial Microbiology

Unit I---Fundamentals of industrial microbiology

Definition and scope of industrial microbiology, general concept, primary screening,secondary screening, strain development, sterilization of fermentors, production of media and air

Unit II---Fermentor design

Types of fermentation processes, design of typical fermentor, parts of fermentor, factors effecting fermentor design, control of agitation,aeration, pH anddissolved oxygen, types of fermentors

Unit III ---scale up and DSP

Inoculum development, scale up of fermentor process, raw media for media preparation, Harvesting and product recovery

Unit IV ---Industrial Production

Production, biochemistry, recovery and uses of: SCP, Bakers yeast, ethanol, penicillin, semisynthetic penicillin, citric acid, Vit B12 and beer and wine

B.Sc. II Semester IV

Paper I

Metabolism

Unit I---Carbohydrate

General strategy of metabolism, EMP pathway and its regulation, TCA cycle and its regulation, Outline of ED pathway, Pentose Phosphate pathway, PK pathway

Unit II---Lipid and Nucleic Acid

Betaoxidation, Omegaoxidation, Replication of DNA, modes of replication, general features, enzymes involved, rolling circle and knife and fork model, Prokaryotic transcription including general features, enzymes involved and reverse transcription

Unit III---Amino acids and Proteins

Amino acid breakdown, deamination,(alanine, tyrosine, metionone) urea cycle, metabolic breakdown of individual amino acids, glucogenic and ketogenic amino acids
Genetic code and Prokaryotic translation

Unit IV---Energy Generation

High energy molecules, substrate level phosphorylation, Cyclic and noncyclic photophosphorylation, Oxidative phosphorylation and ATP generation

B.Sc. II Semester IV

Paper II

Applied Microbiology

Unit I ---Water microbiology

Significance of bacteriological analysis of water, collection and handling of water samples, indicators of excretal pollution, bacteriological analysis of water for coliforms and faecal streptococci (MTFT, MFT), water treatment using SSF and RSF,methods of chlorination, differences between fecal and non fecal organisms

Unit II---Waste water treatment

Sewage types, composition, physical, chemical and biological characteristics, BOD, COD, ThOD, trickling filter,activated sludge, RBC, sludg digester, oxidation pond, septic tank, imhoff tank

Unit III--- Air and Soil microbiology

Microbial analysis of air , settling plate and Anderson technique, bacteria and fungi as biopesticides, biofertilizers, PSB, mycorrhiza, microbial leaching of copper and uranium

Unit IV --- Food microbiology

Food spoilage organisms, canning process, pasteurization, low temperature preservation, chemical preservation

Food borne diseases and food intoxication

Practicals
Semester III

1. Identification of carbohydrates and lipids
2. Detection of enzymes: amylase, catalase, gelatinase, lipase
3. Estimation of proteins
4. Estimation of DNA
5. Estimation of RNA
6. Production and estimation of alcohol
7. Isolation of amylase producer from soil

8. Leavening capacity of yeast
9. Immobilization of yeast and demonstration of invertase activity

Practicals Sem IV

1Isolation of organisms from water and sewage

2Determination of MPN

3IMViC Test

4Determination of DO, alcalinity

5MBRT, Phosphatase test

6,BOD and COD

7 Detection of arsenic by bioassay

8 determination of Chlorine demand

B.Sc. Final Semester V

Paper-I

Medical microbiology

Unit-I

Epidemiology and host –parasite relationship.

a) Definitions:

i)Signs,symptoms and syndrome of disease,stages of infectious diseases-incubation period,prodromal phase,Invasive phase,decline phase and the period of convalescene,primary infection,secondary infection,acute infection,chronic infection local and systemic infection.

ii)Bacteremia,septicaemia,pyamia,toxemia,Viremia.

iii)Epidemic,Endemic,Pandemic,Zoonotic,Exotic.

b)Dynamics of disease transmission:

i)Causative or etiological agents[list]

ii)sources of reservoir of infection.

.Exogenous Human (case and carrier) Non-living reservoir.

Endogenous infections.

iii)Portal of exit

iv)Mode of transmission-Contact, Vehicle,Vector,Air-borne,transplacental and laboratory/hospital infections.

v)Portal of entry.

vi)Susceptibility of host.

c)control of communicable diseases: Control of sources, blocking the channels of transmission,protecting the susceptible host.

Unit-II

a)Microbial mechanism of Pathogenicity: pathogenicity and virulence,exaltation and attenuation,MID,MLD,ID 50,LD50.

i)Invasiveness:-adherence,capsule,enzymes.

ii)Toxigenicity:-Exotoxins and Endotoxins.

b)Normal flora of healthy human host:

Definition,origin significance,Germ free and Gnotobiotic life.

Characteristics of normal flora..

c)Infectious microbiology: Microbial diseases of skin, eye,digestive, respiratory,cardiovascular,lymphatic,urinary,reproductive and nervous systems.

(outline of structure of each system and lists of infectious diseases affecting the particular system).

Unit-III

Study of pathogenic organisms: Morphology, cultural characteristics, biochemical characteristics, serology, lab diagnosis

1.Bacteria:

.Salmonella typhi and paratyphi A & B.

.Mycobacterium tuberculosis.

.Spirochetes-treponemma pallidum

2.Viruses:

.HIV

.Hepatitis A & B

3.Protozoa:

.Plasmodium

Unit-IV

Disease control:

Basic principle of drug designing.

Development of modern drug delivery system.

Basic mechanism of action of drugs.

Bacterial cell wall synthesis inhibitor; Penicillin

Bacterial protein synthesis inhibitor: chloramphenicol

Bacterial DNA synthesis inhibitor: Nalidixic acid, Floxacin antibiotics.

Antimetabolites:Trimethoprime,sulfamethoxazole.

Non automated and automated in vitro drug susceptibility testing-kirby-Bauer disc diffusion method and e-strip method.

Reasons for development of resistance

Semester V

Paper-II

Molecular biology and bioinstrumentation

Unit-I

Gene mutation and regulation.

a)Concept of gene,muton,recon,cistron,monocistronic and polycistronic gene,gene within gene,spit gene.

b)Gene regulation:lac operon(detail)

c)mutation:Definition,random vs directed mutation,type of mutation,base pair substitution,frame shift,point,nonsense,missense,and silent mutation.

d)Genetic suppression:Intergenic and Intragenic.

e)Molecular basis of mutation:Mechanism of spontaneous and induced mutation.

Unit-II

Genetic recombination:

a)Definition,Basic concept of recombination

b)General types of recombination.

c)Transformation.

d)Conjugation

e)Transductions

f)Transposable genetic elements(Prokaryotic)

Unit-III

Bioinstrumentation-I(Principles and applications)

a)Spectroscopy:Laws of absorption,limitations of beer law,UV-Visible spectroscopy and its applications.

b)Centrifugation:Type of centrifuge,analytical and ultra centrifugation,density gradient centrifugation.

c)Electrophoresis:Principle,types of electrophoresis,agarose gel electrophoresis and SDS-PAGE.

Unit-IV

Bioinstrumentation-II(Principles and applications)

a)Chromatography:Thin layer chromatography, ion exchange, gel filtration, HPLC

b)Isotope tracer technique: Method and applications.

Detection and measurement of stable isotope: Mass spectrometry.

Detection and measurement of radioactive isotope: GM counter, scintillation counter.

B.Sc. Final Semester VI

Paper-I

Immunology

Unit-I: Defensive mechanism of host:

a)Nonspecific defences of the host:

i)species,race and Individual resistance.

ii)age,sex,hormonal and nutritional influences.

iii)Mechanism of non-specific defences:

I.First line of defence:Skin,mucus membrane,Mechanical chemical and microbial defences.

II.Second line of defence:Phagocytosis,inflammation,fever,interferon,complement system.

b)Acquired immunity: Active and Passive immunity.

c)Organs involved in immune function:

1.Primary lymphoid organs:Bursa,bone marrow,thymus.

2.Secondary lymphoid organs:Lymph nodes, Spleen,MALT,GALT,CALT.

Unit-II:

a)Diagram of Haematopoiesis.

b)Cells of immune system: general characters of

1)B and T cells,

2)Monocytes and macrophages,

3)Neutrophils,Eosinophils and basophiles.

4)Mast cells

5)Dendritic cells

6)Natural Killer cells.

c)B-cell biology:(Humoral immunity)

1.Primary and secondary immune response

2.Clonal selection and clonal deletion(immune tolerance)

3.T-cell dependent antibody response. outline

4.T-cell independent antibody response.outline

d)T-cell biology:(Cell mediated immunity)

1.Types of T-cells and Cluster of differentiation(CD)

2.T-cell receptor(TCR)

3.Cytotoxic T-cell response

4.MHC molecules and antigen presentation.(diagrammatic)

5.Cytokines-Definition,types(colony stimulating factor,Interleukins,Tumor necrosis factor alpha).

Unit-III:

a)Antigens:

I)Definition,Complete antigen,hapten,epitope,valence.

II)Factors determining antigenicity

III)Antigenic mosaic of bacteria

IV)Antigens in relation to human being:Species specific,isoantigen,autoantigen(RA),Organ specific antigens,Heterophile antigens.

b)Antibody:

I.Definition,General structure.

II. Classes of Immunoglobulins and their functions.

c)Ag-Ab reactions(Diagnostic immunology)

I. General features of antigen-antibody reactions.

II. Antibody titre,rising antibody titre,paired sera

III. Precipitation: Precipitation in liquids, Immunodiffusion, Immunoelectrophoresis.

IV. Agglutination: Slide agglutination,tube agglutination,haemagglutination,Haemagglutination inhibition test,coomb's test,passive agglutination.

UNIT IV

a) Tagged antibody test: ELISA direct and indirect
b) Immunofluroscence

c)Hypersensitivity reactions:Definition,Gel & Coomb's classification.

1.Type I (Anaphylaxis) Hypersensitivity:Mechanism of anaphylaxis,systemic and localized anaphylaxix,prevention of anaphylaxis.

2.Type II (Cytotoxic) Hypersensitivity:

.Blood transfusion reaction(Rh compatibility)

.Heamolytic diseases of the new borne

3.Type III (Immune complex)hypersensitive:

.Arthus reaction

.Serum sickness.

4.Type IV(delayed)Hypersensitivity: Mantaux test, allergic contact dermatitis.

Semester VI

Paper II

Biotechnology

Unit I:

Tools & techniques of genetic engineering:

a)Preparation of pure samples of DNA,range of enzymes used in DNA manipulation,analysis of DNA fragment size,Joining of DNA molecule,vectors and their types.

b)Introducing rDNA into host cell,transformation of cells,identification of transformed cells,selection of clones,direct and indirect method.

c)Expression of cloned genes,construction of gene library,cells for cloning,expression of prokaryotic genes.

d)PCR and its application,DNA fingerprinting.

Unit-II:Application of genetic engineering:

a)Health Biotechnology:

i)Production of hormones:insulin

ii)Production of interferon.

iii)Production of vaccines:Conventional vaccines:BCG,salk,Diphtheria toxoid,ATS,DNA vaccines,Edible vaccines.

iv)Hybridoma technology,monoclonal antibody formation

Unit-III

b)Agricultural biotechnology:

i)Protoplast fusion

ii)Biopesticides.

iii)Biofertilizers

c)Industrial biotechnology

i)Bio sensor and Nano biotechnology applications

ii)Biochips and concept of microarray.

d)Ethics and hazards of biotechnology.

Unit-IV Food

1) Genetically modified food. definition and one example

2)Oriental Fermented food:soya sauce,miso,sufu

3)Transgenic plants.BT Cotton

4)Transgenic animals and clones: Knockout mice, Dollyship, Milching animals

Practicals

Semester v

1) Isolation of bacterial DNA
2) Isolation of plasmid DNA
3) Demonstration of restriction digestion
4) Estimation of creatinine by spectrophotometric method
5) Perform gelfiltration
6) Perform paper chromatography
7) Perform TLC
8) Identification of bacteria: E coli, S aureus, Salmonella, Proteus

Practicals

Semester VI

1) Perform VDRL test
2) Perform Widal test
3) Perform immunodffusion
4) Perform Western blot
5) Perform PCR
6) Development of sphaeroplast
7) Production of biofertilizer
8) Production of soyasauce

REFERENCES

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2. David R. Boone and Richard W. Castenholz, Bergey's manual of systematic bacteriology, second edition, Vol One, Springer,2005.
3. Don J. Brenner, Noel R. Krieg and James T. Staley, Bergey's manual of systematic bacteriology, Second edition, Vol two A, B and C, Springer, 2005.
4. Dr. H. A. Modi, Elementary Microbiology, Fundamentals of Microbiology, Vol. I, Akta Prakashan Nadiad, 1995.
5. Eugene W. Nester, Denise G. Anderson, C. Evans Roberrts, Jr., Nancy N. Pearsall, Martha T. Nester, Microbiology A Human Perspective, Third edition, McGraw-Hill Interrnational edition, 2001.
6. George A. Wistreich, Max D. Lechtman, Microbiology, Fifth edition, Macmillan Publishing Company, 1988.
7. Gerard J. Tortora, Berdell R. Funke & Christine L. Case, Microbiology an introduction, Ninth edition, Pearson Education Inc., 2011.
8. Jacquelyn G. Black, Microbiology Principles and Explorations, Sixth edition, Wiley International edition, 2005.
9. John G. Holt, Noel R. Krieg, Peter H. A. Sneath, James T. Staley and Stanley T. Williums, Bergey's manual of determinative bacteriology, Ninth Edition, Lippincolt Williams and Wilkins, 2000.
10. John L. Ingraham, Catherine A. Ingraham, Introduction to Microbiology, Second edition, Brooks/Cole, 2000.
11. Kathleen Park Talaro, Foundation in Microbiology, Sixth edition, McGraw-Hill Interrnational edition, 2008.
12. Michael T. Madigan, John M. Martinko, Brock Biology of Microorganisms, Eleventh edition, International edition, Pearson Prentice Hall, 2006.
13. O. P. Sharma, Algae, Tata McGraw Hill Education Private Limited, 2011.
14. Powar & Daginawala, General Microbiology, Vol. II, Himalaya Publishing House, 1982.
15. Prescott, Harley, Klein's, Willey, Sherwood, Woolverton, Microbiology, Seventh edition, McGraw-Hill International edition, 2008.
16. Roger Y. Stanier, John L. Ingraham, Mark L, Wheelis & Page R. Painter, General Microbiology, Fifth edition, 1987.
17. The Bacteria, Dr.J.B.Chawla, Dr.M.L.Jisnani; M/s Rajni Prakashan, First edition, 2013
18. Microbial Diversity, Dr.J.B.Chawla, Dr.M.L.Jisnani; M/s Rajni Prakashan, First edition, 2013
19. Industrial Microbiology, Dr. G.L. Bhoosreddy, Dr. B.J. Wadher, Dr. A.V. Gomashe and Dr.Mrs. K.V. Dubey, Himalaya Publishing House.

Semester-wise Syllabus for B.Sc. Computer Science Subject

Structure

B.Sc. Part I Semester I
Paper-I :- Programming in C
Paper-II :- Fundamentals of Information Technology

B.Sc. Part I Semester II
Paper-I :- Object Oriented Programming using 'C ++'
Paper-II :- System Analysis and Design

B.Sc. Part II Semester III
Paper I :- Data Structures
Paper II :- Operating Systems

B.Sc. Part II Semester IV
Paper I :- Java Programming
Paper II :- Linux Operating System

B.Sc. Final Semester V
Paper I :- Visual Basic Programming
Paper II :- Database Management System
.
B.Sc. Final Semester VI
Paper I :- Compiler Construction
Paper II :- SQL AND PL/SQL

Practicals

Note :- 1) A student has to perform ALL exercises.
II) Not more than two students should be allowed on one machine.

B.Sc. Part I Semester I **:** Programming in C
B.Sc. Part I Semester II **:** Object Oriented Programming using 'C ++'
B.Sc. Part II Semester III **:** Data Structure (using C++)
B.Sc. Part II Semester IV **:** Java Programming
B.Sc. Final Semester V **:** Visual Basic Programming
B.Sc. Final Semester VI **:** SQL AND PL/SQL (Oracle)

Valuation Pattern :-

In University practical examination a student has to perform any one exercise from the list prescribed in the syllabus and it is to be executed on machine.

The valuation scheme of practical examination will be as under.

Record	- 6
Viva	- 6
Writing	- 09
Execution	- 09
TOTAL	**- 30**

B.Sc. Part I Semester I (From 2013-2014)

Paper I

PROGRAMMING IN 'C'

UNIT- I :

Programming Structure : Sequence, Selection, Iteration and Modular. **Problem Solving techniques**: Development Tools**:** Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) **Developing Algorithm and Drawing flowcharts**

UNIT- II :

C Character set, Tokens, Identifier, Keywords, Variables**,** Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions. : Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do..while, Nested loops, Jump statement: break, continue, goto. (Special emphasis on problem solving)

UNIT- III :

Arrays: Need, Types: Single and Two Dimensional Array.

Strings: Strings Manipulation, Arrays of Strings, Evaluation order

Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT- IV :

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.

Union: Unions, Differences between Structure and Union

Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers.

File handling : Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access , Command Line arguments.

Text Books

1. **The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.**
2. **Programming in C by E. Balagurusamy** TMH Publications**.**

Reference Books

1. C Programming - Kernighen Ritche
2. Programming with C – Y. Kanetkar.
3. C Programming – Holzner, PHI Publication.
4. Programming in C – Ravichandran.

B.Sc. Part I Semester I

Paper II

FUNDAMENTALS OF INFORMATION TECHNOLOGY

UNIT - I :

Basic Components of Digital Computers: Block Diagram**. CPU:** Functions of Each Unit: Primary Memory, ALU and CU, Instruction format. **Bus**: Data, Control and Address Bus **Number Systems:** Binary, Octal, Decimal, HexaDecimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC**.**

Language Evolution : Generation of Languages : Machine, Assembly, High Level Languages. Characteristics of Good Language **Translators :** Compiler, Interpreter and Assembler. Source and Object Program.

UNIT - II :

Memory: Static & dynamic, RAM, ROM, PROM, EPROM, EEPROM, flash and Cache.
Storage Devices: Hard Disk, Zip Disk and Optical Disk. Pen Drive, Blue Ray

UNIT - III :

Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input , MICR, OCR, OMR, Barcode Reader and Flatbed Scanner.
Output Devices: VDU, Printers: Dot Matrix, Laser and Inkjet.
Plotters: Drum, Flat-Bed and Inkjet.

UNIT - IV :

Network: Network terminology, Topologies : Linear, Circular, Tree and Mesh. Types of Networks: LAN, WAN, MAN. Repeaters, Bridge, Routers, Brouters and Gateway. Modem for Communication between pc's, wi-fi network, Introduction of Bluetooth and Infrared devices. Network protocols. Architecture **:** Peer-to-Peer, Client/Server.

Text Books:

1. Information technology concepts by Dr. Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology By Alexis And Mathews Leon
[Leon Press, Chennai & Vikas Publishing House Pvt Ltd, New Delhi]

B.Sc. Part I Semester I
Practical List
Programming in 'C'

1) Program to Compute Fibonacci series
2) Program to find if a given number is prime or not.
3) Program to accept number and display it in words
4) Program to find sum of digits of any entered no.
5) Program to reverse the digit.
6) Program to find frequency of occurrence of a given number from array of N elements.
7) Program to reverse the array.
8) Program to Insert an element in One dimensional Array at a given position.
9) Program to Delete an element form One dimensional Array.
10) Program to Arrange string data (name of students) in alphabetical order using bubble sort.
11) Program to search the element in an array of N elements using
    a) Linear search method
    b) Binary search
12) Program to a) Multiply two Two dimensional Array's (3 X 3 matrix)
    b) Find largest element in Two dimensional Array (3 X 3 matrix).
13) Program a) To Check if given String is Palindrome or not
    b) To calculate number of blanks, vowels and words from entered phrase.
14) Program to a) compute Cosine series : cos x = 1- x^2/2! + x^4/4!-x^6/6!+---------.
    b) Compute Sine series : sin x = x- x^3/3!+ x^5/5! –x^7/7! + ---------
15) Program to find Factorial of a number using recursive function.
16) Program using function to find sum of two numbers
    a) With no argument & no return values
    (b) With argument & no return values
    (c) With argument & return values
17) Program to demonstrate passing structure to functions. Fields are empno, name, Basic
    a) Call by Value
    b) Call by reference
18) Program to
    a) swap values of two variables by passing pointers.
    b) Read two integers and determine bigger of the two with the help of function big() returning an integer pointer.
19) Create a sequential file and perform following operation fields are Roll, Name, M1, M2, M3
    a)Add records
    b)Process & Display output.

B.Sc. Part I Semester II

Paper I

OBJECT ORIENTED PROGRAMMING USING 'C++'

UNIT - I :

Object Oriented Methodology:

Elements of Object Oriented programming, Objects, Classes, OOPs features.

Classes & Objects: Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access Specifiers: Private, Protected and Public Members.

UNIT - II :

CONSTRUCTORS & DESTRUCTORS: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors.

OPERATOR OVERLOADING: Definition, Overloadable Operators, Unary Operator Overloading, Unary & Binary overloading, Rules for Operators Overloading.

UNIT - III :

DYNAMIC OBJECTS: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer**.**

INHERITANCE: Defining, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

UNIT - IV :

VIRTUAL FUNCTIONS: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions.

EXCEPTION HANDLING: Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Text Books

1. **Mastering C++ by K R Venugopal Tata McGraw-Hill , New Delhi.**

Reference Books**:**

1. The C++ Programming Language –Bjarne Stroustrup
2. Programming with C++ - Ravichandran
3. Programming with C++ - Robert Lafore
4. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

B.Sc. Part I Semester II
Paper II

SYSTEM ANALYSIS AND DESIGN

UNIT - I :

Introduction : System, Subsystems, Components of Computerized Information System, Systems Analysts, SDLC, Prototyping.

Feasibility Study and Analysis: Identifying Problems, Organizing Feasibility Analysis: Economic, Financial, Organizational and Technological. Feasibility Decision, Choice of a solution.

Data Collection: Interviews, Brain Storming, Questionnaires, Document Search, Observation.

UNIT - II :

Structured tools and techniques of Data analysis : Structured English, Process Charts, SOP, Decision Tables and Decision Trees, Data Flow Diagram, Data Dictionary.
(Special emphasis on problem solving)

System Design : Input design: Input Validation, Human factor Consideration, Messages, System Tolerance. Output design: Categories of output, Design Principles, Control of Output. Forms: Principles of Form Design, Ways to ensure Quality Forms.

Codes: Types, Physical Representation of Codes, Principle of Code Design.

UNIT - III :

Implementation: Training, Operational Training and Related Activities, Planning to Implement Change, Change Strategies.

Testing: Preparation for Testing, Test Execution: Levels of Testing, Component, Function, Subsystem, System, Test Evaluation, Acceptance.

Conversion: Cold Turkey, Parallel, Pilot, Modular and Sequential Methods. Conversion Period Length. **System Evaluation.**

UNIT - IV :

Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, **Scheduling:** Work Breakdown Structure, Activity Networks and CPM, Gantt Charts, PERT Charts, Project Monitoring and Control. Risk Management, Software Configuration Management: Necessity, Configuring Management Activities

Software Reliability and Quality Management: Software Reliability, Software Quality, ISO 9000. Software Maintenance: Characteristics of Software Maintenance, Maintenance Process Models, Estimation of Maintenance Cost.

Software Reuse: What can be reused, Why no reuse so far, Basic Issues.

Text Books:

1) Information Systems Analysis, Design and Implementation By K. M. Hussain Donna Hussain [Tata McGraw-Hill Publishing Company Ltd, New Delhi]
2) Fundamentals of Software Engineering by Rajib Mall [PHI Publication]
3) Workbook on Systems Analysis & Design by V. Garg [PHI Publication]

Reference Books**:**

1. System Analysis and Design- Don Yeates, shiebls, Helmy (M).
2. System Analysis & Design - Edward –TMH
3. System Analysis and Design – Satzinger, Robert Jackson and Stephen Burd, Thomson Learning
4. Introduction to Systems Analysis Design, Igor Hawryszkiewycz, PHI

B.Sc. Part I Semester II
Practical List
OBJECT ORIENTED PROGRAMMING USING 'C++'

1) Demonstrate the usage of Constructor and Destructor.
i) Define a class **data** with data member **acct_no, balance** containing constructor **data** to initialize data member and a member function **display** for output.

2) Program to demonstrate usage of a constructor and Destructor function. Declare a class with public data member count. The class containing one constructor and destructor to maintain updated information about active objects i.e. i) No of objects created. ii) No of objects Destroyed.

3) Program to accept the distance between city **1st & 2nd**, city **2nd & 3rd**. calculate the distance between city **1st & 3rd**. Define a class **road** with private data member **km, m, d1, d2, d3** containing member function getdata to accept values of **d1, d2** and **calculate** for calculating distance.

4) Demonstrate the use of operators overloading (string manipulation: + for concatenation and relational operators for alphabetical comparison).

5) In a bank N depositor deposit the amount, write a program to find total amount deposited in the bank. Declare a class deposit with private data member **Rupee** and **Paisa** containing member function **getdata, putdata.**
- **i) Use array of objects**
- **ii) Use Operator '+' overloading.**

6) Declare class event and accept time of first event and second event and find the difference between 1st and 2nd event. Containing public member function **getdata** and **display** with private data member **hour**, **minute, second and total.**
- **i) Use Operator '-' overloading.**

7) Program to demonstrate **Single Inheritance**. Declare a class **B** and derive publically class **D** from **B**.
i) The class **B** contains private data member **a**, public data member **b** with member function **get_ab, get_a, show_a.**
ii) The derived class **D** contains data member **c** with member function **mul** and **display.**

8) Program to demonstrate **Multiple Inheritances. Declare class M** and **N** and derive publically class **P** from **M** and **N.**
i) Declare a class **M** with protected data member **m** and public member function **get_m.**
ii) Declare a class **N** with protected data member **n** containing member function **get_n.**
iii) Declare class **P** containing member function **display.**

9) Program to demonstrate Multilevel Inheritance. Declare a class **student** and derive publically a class **test** and derive publically class **result** from class **test.**
i) The class student contains protected data member **roll_number** with public member functions **get_number** and **put_number.**
ii) The class **test** containing protected data member **sub1, sub2** with public member function **get_marks** and **put_marks.**
iii) The class **result** contains data member **total** and public member function **display.**

10) Program to demonstrate Hierarchical Inheritance. Declare a class **Side** and derive publically class **Square** from base class **side** and also derive publically class **cube** from base class **side.**
i) Class **Side** contains protected data member **L** with a member function **set_values.**
ii) Class **Square** contains member function **sq.**
iii) Class **Cube** contains member function **cub.**

11) Program to demonstrate usage of normal virtual function and pure virtual Function with abstract class.

12) Program to determine whether the input is +ve or –ve through exception.

13) Program to raise exception if an attempt is made to perform divide-by-zero.

B.Sc. Part II Semester III (From 2014-2015)

Paper I

DATA STRUCTURES

UNIT - I :

LINKED LIST : Linked List, Representation of Single, Double, Header, Circular Single and Double Linked list, All possible operations on Single and Double linked List using Dynamic representation, Polynomial Representation and its Manipulation.

UNIT - II :

STACKS : Stacks terminology, Representation of Stacks in Memory, Operation on Stacks, Polish Notations, Translation of infix to postfix & prefix expression, Infix to Postfix Conversion, Evaluation of Postfix Expression, Recursion, Problems on Recursion, Quick Sort and Tower of Hanoi Problem.

UNIT - III :

QUEUE : Representation of Queues in Memory, Circular Queue. Dequeue and Priority Queue. Operations of above Structure using Array and Linked Representation.

SORTING AND SEARCHING: Selection Sort, Insertion Sort, Merge Sort, Efficiency of Sorting Methods, Big-O Notations.

Hash Tables, Hashing Technique, Collision Resolution Technique.

UNIT - IV :

TREES : Basic Terminologies, Representation of Binary Trees in Memory, Traversing of Binary tree, Binary Search Tree, Operation on Binary Search Tree, Heap Tree, Operation on Heap Tree, Heap Sort Method

GRAPHS : Basic Terminologies, Definition and Representation of Graphs in Memory: Linked List and Matrix Representation. Traversing graphs : BSF, DFS Method.

Text Books:

1.Classical Data Structures : D. Samanta. PHI, New Delhi.
2. DATA STRUCTURE : LIPSCTUZ SCHUM OUTLINE SERIES

Reference Books:

1. Data structure Using C++ : Y. Kanetkar
2. Data Structures Using C++: Tennenbaum
3. Data structures by Tremblay Sorenson
4. Data structures by Bhagat singh Naps

B.Sc. Part II Semester III

Paper II

OPERATING SYSTEMS

UNIT - I :

Structure of Operating System, Operating System functions, Characteristics of Modern OS. **Process Management**: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels

CPU Scheduling: Schedulers, Scheduling Methodology, CPU Scheduling Algorithm: FCFS, SJF, RR, Priority Scheduling.

UNIT – II :

Performance comparison : Deterministic Modeling , Queuing analysis, Simulators.

Deadlock and Starvation: Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

UNIT - III :

Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, Segmentation with paging. Protection.

UNIT - IV :

I/O Management: I/O hardware, I/O Buffering, Disk I/O, Raid, Disk Cache. **File Management:** File Management system, File Accessing Methods, File Directories, File Allocation Methods, File Space Management, Disk Space Management, Record blocking. **Protection Mechanisms**: Cryptography, Digital Signature, User Authentication.

Text Books:

1: **Operating Systems by P. Balakrishna Prasad [Scitech Publication]**

Reference Books:

1. Operating System Concept : Silbershaz (Addision Education)
2. Operating Systems - H.M. Deitel - Addision Wesley.
3. Operating Systems- John J. Donoven.
4. Operating System : A.S.Godbole (TMH)
5. Modern Operating Systems : Tenenenbaum (Pearson Education)
6. Operating System : Peterson.

B.Sc. Part II Semester III
Practical List

Data Structure (Programming using C++)

1) Program to insert a node at the beginning, at the end and in the middle of the given linked list.
2) Program to delete a node at the beginning, at the end and in the middle of the given linked list.
3) Program to create a linked list of customer names and their telephone numbers. (Using Menu Driven and include features of adding a new Customer and deleting an existing Customer.)
4) Program to reverse a linked list.
5) Program to search a value in the given linked list.
6) Program to insert a node at the beginning, at the end or in the middle of a given doubly linked list.
7) Program to delete a node from the beginning, at the end or in the middle of a given doubly linked list.
8) Program to create, insert and delete a node in Circular linked list.
9) Program to push and pop an element into / from a stack implemented using linked list.
10) Program to push and pop an element into / from a stack implemented using Array.
11) Program to evaluate postfix expression.
12) Program to sort an array using quick sort.
13) Program to solve Towers of Hanoi problems using recursion.
14) Program to perform insertion and deletion operation in linear queues.
15) Program to perform insertion and deletion operation on circular queues.
16) Program to sort an array using Insertion sort.
17**)** Program to sort an array using Selection sort.
18) Program to insert an element in a binary search tree.
19) Program to traverse inorder of a binary tree.
20) Program to traverse preorder of a binary tree.
21) Program to traverse postorder of a binary tree.

B.Sc. Part II Semester IV

Paper I

JAVA PROGRMMING

UNIT - I :

Introduction to Java: -History of Java, features of Java, getting started with Java. **Java programs**:-Introduction of Application & Applets. **Variables**: -Variable naming, variable initialization, assign values, Rules of variables, Scope of variable. **Operators**: -Arithmetic, Assignment, Unary, Comparison, Shift, Bit- Wise, Logical, Conditional, New, Special, Relational. Data types:-Integers, Char, String, Float etc. Typecasting: **Tokens**: -Java tokens Order of precedence of operators Streams: - Input and output.

UNIT - II :

Creating a class & subclass: -Declaring a class, Naming class, Rules to assign Class & Subclass, Creating a new object, Class of an object. **Data members**: -Declaring data member, Naming variables, using class members. **Methods**: -Using data members, Invoke a method, passing arguments to a method, calling method. **Access Specifier & Modifiers**: -Public, Private, Protected, Static & Final. **Overloading**: -Method overloading, Constructor overloading. **Java class library**: - Different types of classes. **Decision making & loops**:-If-then-else, Switch,? : operator, While-loop, do-while loop, for. **Array**: -Creating an array, one-dimensional array, two-dimensional array. **String**: -String array, string methods. **Inheritance**: -Single & multiple inheritances **Interfaces**: -Defining interfaces, extending interfaces, implementing interfaces.

UNIT - III :

Packages: -Java API packages, creating packages, accessing packages, adding a class to packages. **Import statement**: - Introduction & implementation of import statement. **Applets**:-Introduction to Applets & Application, how applets application are different creating An applet. Applets life cycle, designing a web page, creating an executable applet, running the applet, applet tags, passing a parameter to applet, HTML tag, Converting applet to application. **Threads**:-Overview of threads, single & multiple threads, lift cycle of threads, stopping & blocking threads, working with threads, priority to thread, synchronization. **Exceptions & Errors**:-Introduction, types of error, exception, syntax of exception, handling techniques, exception for Debugging.

UNIT - IV :

Event: -Event driven programming**,** handling an (AWT) events**. Graphic class:-** Introduction, the graphic classes, drawing & filling of lines, rectangle, circle & ellipse, arcs, polygons, text & fonts, creating a font class, font objects, text, coloring object. **Streams:-**Introduction, Abstract stream classes, file input & output. **AWI Applications**: -Creating a GUI using AWT toolkit, using component class, frames. **Components & Control: -**Textfield, textarea class, label, button, choice, list, checkbox, class, and combo. **Menus: -**Creating a popup menus. **Image**: - Type of image, Properties of an image, Displaying an image. **Layouts**: -Using Window Listener interface, Different types of Layout, Layout manager, Flow manager, Grid manager. **Container**: -Different types of container (Frame, Dialog, Panel)

Text Books:

1. Programming with Java a primer II edition:-E Balaguruswamy(Tata McGraw-Hill)
2. Java Programming (For absolute beginners) Russell PHI

Reference Books:

1. Black Book on Java
2.Java-Complete References

B.Sc. Part II Semester IV
Paper II

LINUX OPERATING SYSTEM

UNIT - I :
Logging In and Logging Out, Anatomy of Linux OS, Directory Structure, /usr Directory, File Types: User datafiles, System data files, Executable files. Naming files and directories, Spawning Processes. **Shell:** Creating User Account, Shell Program, bash shell, Changing shell prompt. **Commands:** Basic Syntax for a command, Exploring the Home Directory, ls, mkdir, rmdir, stat, cat, rm, mv, cp

UNIT - II :
Editor: Vi editor. **Hooking up Hardware Devices:** Formatting a Floppy Disk**,** Gathering important system information. Backing Up and restoring the File **System:** Simple Backup, gzip, gunzip, tar. **Printing files:** Print Spool directory, Sending files to Printer.

UNIT - III :
Sharing Files with other Users: Maintaining User Accounts, Changing Password, Creating Group Accounts, Granting Access to files, Changing File Ownership, Protecting Files, Making a File Read-Only. Working with Processes**:** Types of processes, ps Command, Creating process, killing process, free command and top utility.

UNIT - IV :
Managing Disk Space: df, du commands, Creating Additional Free Disk Space, Locating Unused Files, Setting System Clock. Communication Utilities: who, who am i, finger, mesg, write, wall, talk, Creating a message of the day. X Window System, Graphical User Interfaces: KDE and GNOME Desktop Environment.

Text Books:
1. **SAMS Teach Yourself Linux by Craig and Coletta Witherspoon [Techmedia]**

Reference Books:
1. LINUX complete reference by Richard Peterson

B.Sc. Part II Semester IV
Practical List

JAVA PROGRMMING

1) a) Write a program that declares a class, object and also it access the data member of it's class.
   b)Write an applet that accepts a value from the user and display it.
2) a) Write a program that accept marks of 5 subject, calculate total, percentage and display the grade according to their percentage.
   b) Write a program that will print the multiplication table from 1 to 10.
3) a) Write an program to accept a set of values from the user into an array, display the values as well as their average.
   b) Accept string into a text field, sort the characters in the string and display the sorted string in another text field.
4) a) Write a program to demonstrate the overloading & constructor.
. b)Write an applet that accepts two numbers from the user and display all the numbers between them.
5) a) Write a program to demonstrate the single inheritance.
   b) Write an applet to accept ten numbers into array, sort the array and display the sorted array. Accept the ten numbers into the ten different text fields.
   c) Write a program to create a multiple selection list and also display the list of items selected by the user.
6) a) Write an applet to demonstrate the user menu Bar.
   b) Write a sample program that will convert the applet to application.
   c) Write a program to demonstrate the Interfaces.
7) a)Write a program for exception handling that accept two no as textfields, the values are added & their sum is displayed. The code traps the error when user could enter text instead of an numbers.
   b)Write a program that would accept it input for the user & store it in a file called Test. java.
8) a) Write a program to implement graphic class draw (line, rectangle, fill rectangle, Circle, oval).
   b) Write an applet that display a choice menu of three buttons (Add, Modify, Delete) selecting a choice from the menu should display the appropriate button Use the show () method of the layout Manager.
9) a)Write a java program to read & display the information from the file ABC. dat.
   b) Write a program to implement the concept of loading & displaying images.
   c) Write a program to demonstrate the Animation in Java.

B.Sc. Final Semester V (From 2015-2016)

Paper I

VISUAL BASIC PROGRAMMING

UNIT - I :

Working with Visual Basic Window Components: Menu Bar, Tool Bar, Project Explorer Window, Form Layout Window, properties Window, Toolbox, Code Editor Window **Working with Forms:** Properties, Events, Methods Working with Basic Controls:Label, CommandButton, TextBox, OptionButton, Frame, CheckBox, ListBox, ComboBox, Image, Scroll, Picture, Timer, DriveListBox, DirListBox, FileListBox and Shape Controls. **Basic Programming Fundamentals:** Variables, Data types, Constant, Conversion Function. Scope of Variable: Public, Private Static. Operators: Logical, Arithmetic, Concatenation, Comparison. Decision Structure: If.. Then, If..Then..Else, Select Case.. End Case. Loop Structure: Do..While, While.. Wend, For.. Next, With..EndWith. DoEvents()

UNIT - II :

Arrays: Dynamic Array, Preserve and Control arrays. **Procedure:** General procedure, General Methods for Passing Arguments to a Procedure, **Functions:** User-Interaction, String, Math, Date, Conversion Functions.
Modules: Form, Standard.

UNIT - III :

Menus: Creating, Adding Menu Items, Creating Shortcut, Adding Separators Bars, Submenus, Code for Menus. Creating Popup Menu: System, Custom. **Database Handling:** Database Concepts, Creating and Accessing Database, Using Data Control.
Using DAO: Creating Search Programs, Numeric Search and Complex Search Programs.

UNIT - IV :

Using ADO Data Control, Data Link, ODBC Data Source name, Using Connection String, Creating Navigating buttons. Working with Advanced Data Controls **:** DataList Control, DataCombo Control, DataGrid Control and Msflexgrid Control. **Handling Errors** : Run Time, Trapping and Handling Error, ERR Object. Data Environment and Data Reports.

Text Books:

1) VISUAL BASIC – to Advance by Soma Dasgupta [BPB Publication]

Reference Books:

1. Evangelos Petroutsos, Mastering Visual Basic 6.0 BPB Publication.
2. VISUAL BASIC 6 COMPLETE REFRENCE (TMH PUB)
3. Visual Basic 6 Deitel & Deitel (Pearson Education)
4. Mastering VB 6.0 Black Book -Peter - Norton-Techmedia.

B.Sc. Final Semester V

Paper II

DATA BASE MANAGEMENT SYSTEM

UNIT - I :

DBMS : Definition: Databases, DBMS, Problems with traditional file processing system, Objectives of the database systems, Three level architectures of DBMS, Component of DBMS, Database Administrator, Database Users, Data model, Different types of data models, Concepts of Hierarchical, Network Models.

UNIT - II :

E-R Models : Basic Concepts, Entity, Attributes, Relation Ship, Mapping, Keys, Weak and Strong Entity Set, Problems on E-R Diagrams, Extended E-R Features: Specialization, Generalization, Aggregation, Problems on Reduction of an E-R Schema to Tables, Tabular representation of Strong, Weak entity Sets and Relationship Sets.

UNIT - III :

Relational Model: Structure, Relational Algebra, Fundamental Operations, Set – Intersection, Natural Join, Division and Assignment Operation. Extended Relational Algebra Operations, Aggregate Functions.

UNIT – IV :

Functional Dependency: Functional Dependency, Fully Functional Dependency, Partial Dependency, Transitive Dependency, Multi Valued Dependency.

Normalization, Normal Forms (1NF, 2NF, 3NF, BCNF, 4NF, 5NF). Problems on Normal forms.

Text Books:

1) Data Base System Concepts By A SilbersChatz By Henry Korth And S.Sudarshan [Mcgraw-Hill ltd. New Delhi] 3rd Edition.
2) Introduction to Data Base Management by NAVEEN PRAKASH [Tata McGrawHill ltd.]

Reference Books:

1. Bipin C. Desai, An Introduction to Database Systems, Galgotia Publications.
2. Raghu Ramakrishnan & Johannes Gerhrke, "Data Base Management Systems", Mc Graw Hill International Edition, 2000
3. Muzumdar, Introduction to Database Management Systems. TMH

B.Sc. Final Semester V
Practical List

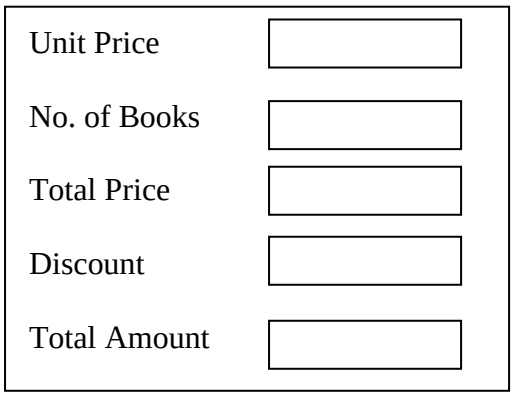
VISUAL BASIC PROGRAMMING

1. a) Make an application in Visual Basic, which display a picture when
   i) Command button with caption " click here" is clicked.
   ii) After delay time 100ms (by using Timer control)
   b) Design an Application to find
   iii) sin x = x- x^3/3!+ x^5/5! –x^7/7! + ---------
   iv) cos x = 1- x^2/2! + x^4/4!-x^6/6!+---------.
   v) Find a even/odd no.
   vi) Find Factorial of no.
   vii) Find if number is a Prime Or not prime

2. a) A book stall gives discount on the books as per following conditions,

No. of books purchased	Discount
<=5	Nil
>5 and <=10	10%
>10 and <=15	12%
>15	20%

Create a form as follows to calculate the discount.



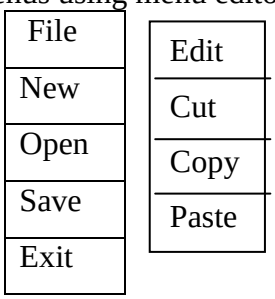
b) Design a form for speed control program using scrollbars.

3. a) Design an application, which display a text and given choice to change text to bold, italic, underline (any one or in combination) using check box controls.
   b) Write a VB code to give five choices of colors. Design an application to choose any one color using option button and change the forecolor of TextBox Caption.

4.a)Write a program in VB to build application to display sorted list of group A & group B student in two list boxes. Make provision to shift name (s) on either side using List Box control.
   b)Write a program in VB to build application which display list of states. Make provision to display capital of the state and cities when a particular state is selected using combo box.

5. a)Write a VB Program to create an array of N elements. Find the frequency of element and display the positions in an array.
   b) Create an application, which counts no. of characters and no. of words entered in TextBox.

6) Create Menus using menu editor as follows.

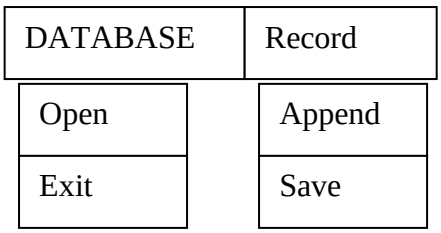


And Write appropriate code on click event of New & Exit Menu Options.

7) Create a database pay.mdb using Visual Database Manager with fields code number (n), Name of Employee (T), Designation (T), Address (T), Joining date (d), Basic pay (n), Status (T) [permanent / temporary], Department (T) [purchase, sales, account]. Achieve connectivity using Data control. Develop an application in V.B. to display the data of employees using MSFlexgrid control as shown below with company's logo.

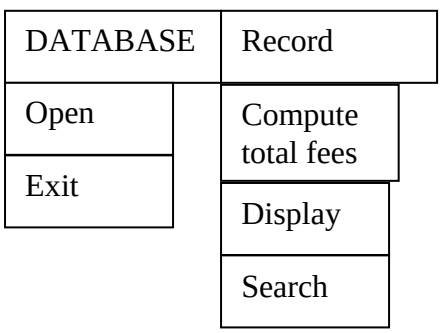
EMPLOYEE INFORMATON						< logo>	
I.D.	NAME	ADDRESS	DESIGNATION	DEPT.	Date of Joining	Status	BASIC

8) Design a Menu as shown below.



Create table pay.mdb using Visual Data Manager and connect it to vb application using Data Control. Display/view records using DbGridControl.
Create an application in V.B. to open database of employee pay.mdb by using menu option "OPEN" .Use APPEND and SAVE options to Add & Save records in DATABASE.

9) Open DataBase fees.mdb with fields: -
Name, class, fees Using Visual Data Manager. Use Data control for connectivity.
Develop a menu driven application in V.B. to: -
I) Compute total fees class wise
II) Search a record of a particular student belonging to a particular class.



10) Create a DataBase College.mdb containing fields:-

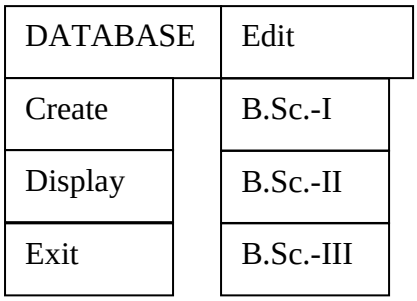
Name, Class, Marks in phy, Comp. Sc., Maths and Percentage Using Visual Data Manager.Connect database to vb application using Data Control.

Develop a Menu driven application in V.B. to

I) Edit a records class wise.

II) Calculate class wise passing percentage where a student is declared "pass", if he/she gets percentage > = 45.

Display Class wise list of students who are placed in Ist Division. (Percentage>=60)



11) Create a table book.mdb using VDM containing fields:-

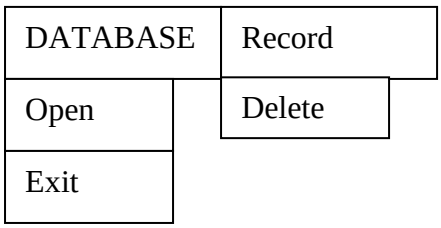
Name of book, subject, price, date of purchase, Name of publication,

Develop a menu driven application in V.B. to: -

I) Open Database

I) Delete a record of book.

II) Display subject wise list of book in proper format.



Use DataControl for connectivity.

12) Create a table using VDM to store required information for computing Electricity Bill.

Charges are as follows

1) 1.25 /units for 1st 30 units
2) 2.90 / units from 31 to 300 units
3) 4.0 /units from 301 to onwards.

Develop a menu driven application . to: -

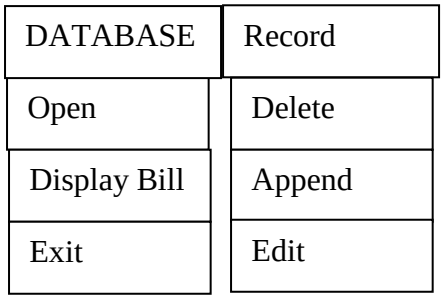
I) Open Database

II) Display Electricity Bill in proper format.

III) Delete a record of book

IV) Append a record

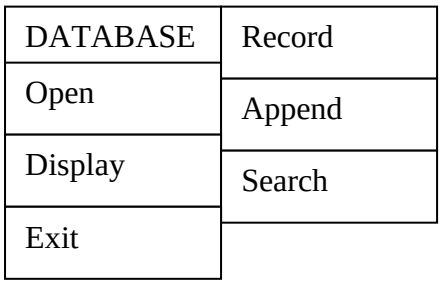
V) Edit record



Use ADODC to achieve connectivity.

13) Create the database emp.mdb having table emp_biodata directly through MSACCESS and Display records using datagrid control.
Develop a menu driven application . to: -

I) Open Database II) **Display records using datagrid control**.
III) Search a record IV) Append a record

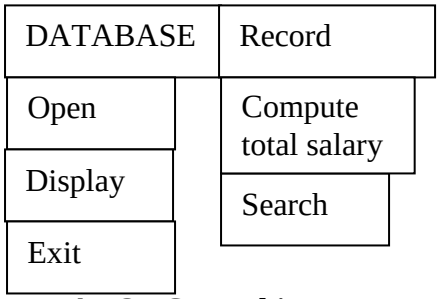


Use ADODC to achieve connectivity.

14) Create an application for employee salary sheet.

IF BASIC >5000
HRA=40 % OF BASIC
DA=50 % OF BASIC
IF BASIC >= 2500
HRA = 35 % OF BASIC
DA=45 % OF BASIC
IF BASIC >=1500
HRA = 30 % OF BASIC
DA=40 % OF BASIC
OTHER WISE
HRA= 20 % OF BASIC
DA =30 % OF BASIC
TA= 150
PF= 15 % OF BASIC
PT = 18% OF BASIC

Develop a menu driven application in V.B. to: -Compute total Salary
Search a record of a particular employee belonging to a particular department.



Use ADODC to achieve connectivity.

Note -: While designing menu MDI forms are expected wherever required.

B.Sc. Final Semester VI
Paper I

COMPILER CONSTRUCTION

UNIT - I :
Compilers and translators, need, the structure of a compiler, Lexical Analysis, Syntax analysis, Intermediate code Generation, Optimization, Code Generation, Book keeping, Error Handling

UNIT - II :
High Level programming languages, Definitions of programming languages, The lexical and syntactic structure of a language, Data elements, structures, Operators, Assignment Statements, Data Environments, Parameter transmission, Storage management.

UNIT - III :
The role of the lexical analyzer, Approach to the design of lexical analyzer, Implementation of lexical analyzer, Context free grammars, Derivations and parse trees, Ambiguous grammar.

UNIT - IV :
Parsers, Shift-reduce parsing, Operator precedence parsing, Top-down parsing, predictive parsers, Symbol Table , Code Optimization: The principal source optimization, Loop optimization, The DAG representation of basic blocks, Code Generation : A machine model, a simple code generator, Register Allocation and assignment.

TEXT BOOKS :
1. Principles of Compiler Design - A.V. Aho, J. D.Ullman : Pearson Education.

Reference Books:
1. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.
2. Engineering a Compiler-Cooper & Linda, Elsevier.
3. Compiler Construction, Louden, Thomson.

B.Sc. Final Semester VI

Paper II

SQL AND PL/SQL

UNIT - I :

CODD'S Rules, Oracle Database Objects, Sub Languages of SQL, Data types, Operators. **DDL Statement**: Creating Tables, Deriving Table from existing table, Altering, Dropping Tables. Integrity Constraints, Specifying Names for the Constraints, Viewing Integrity Constraints, Adding and Dropping Constraints. DML Statements: SELECT statement, Insert, Update, Delete, Working with Sequences and Synonyms. Built-in functions: Arithmetic, Date, Character, Conversion, Single row, Aggregate, Decode.
Joins, Set Operators and Sub queries. DCL and TCL Statements: Grant, Revoke, Commit, Rollback and Savepoints.

UNIT - II :

VIEWS: Creating Views, Dropping Views, Inserting, Updating and Deleting Data using Views, Types of Views. PL/SQL Programming: PL/SQL Data Types, Identifiers, Operators and Expressions, Iterative Statements, Conditional Statements, emphasis on Problems

UNIT - III :

Exception Handling : Predefined Exceptions, User defined Exceptions. Cursors: Declaring Cursors, Opening and Retrieving Records, Closing cursors. Attributes of Explicit and Implicit Cursors, Parameter Passing in Cursors. Procedures : Create and Drop Procedure, Creating Procedures with Parameters, Calling Procedures, Granting the EXECUTE Permission Problems on Exception Handling, Cursors and Procedures.

UNIT - IV :

Function: Creating and Dropping Function, Purity Levels in Functions, Executing Functions. **Triggers:** Create Triggers, Type of Triggers, Creating BEFORE and AFTER Triggers, INSTEAD-OF Triggers, Trigger Predicates, Inserting, Updating and Deleting Triggers, Enabling , Disabling and Dropping Triggers. Problems on Functions and Triggers

Text Books:

1. Understanding ORACLE By Ivan Bayross [BPB Publication]

Reference :

1. Database System Using Oracle: A Simplified Guide to SQL & PL-SQL: Nilesh Shah, PHI Publication.
2. Database Management Systems (Complete practical approach) by Sharad Maheshwari & Ruchin Jain, Firewall media
3. Dr. P.S.Deshpande SQL & PL/SQL for Oracle 10g Black Book
4. Scott Urman Programming PL/SQL TMH

B.Sc.Final Semester VI
Practical List

SQL and PL/SQL (ORACLE)

1) DDL Statements :

1.a) **Create the table Invoice** with fields inv_no(char, Primary key), mv_no(number), cust_id(char), issue_date(date), return_date(date).

Insert data in the table invoice as follows:

Inv_no	mv_no	cust_id	issue_date	return_date
I01	1	a01	21-Dec-06	25-Dec-06
I02	3	a02	19-Oct-06	30-Oct-06
I03	5	a03	14-Jul-06	1-Aug-06
I04	5	a04	15-Sep-06	30-Sept-06
I05	6	a05	19-Oct-06	21-Oct-06
I06	7	a06	1-Jan-06	15-Jan-06
I07	8	a07	15-Aug-06	30-Aug-06
I08	2	a05	1-Oct-06	15-Oct-06
I09	4	a01	12-sep-06	19-Sep-06
I10	9	a02	1-Dec-06	15-Dec-06
I11	6	a05	2-feb-06	14-feb-06
I12	3	a06	1-Jan-06	10-Jan-06

1.b) Modifying Table Structure by adding the new field price (number) and increasing the size of inv_no.

1.c) Add and Drop Constraints

i) Add primary key constraint
ii) Drop primary key constraint
iii) Add Unique key constraint
iv) Drop Unique key constraint
v) Add check constraint

2) DML Statements:

2.a) Add a records in above table

2.b) i)Change inv_no of I12 with 'I111'.
ii)Change issue_date of customer of cust_id 'a01' to '22-Dec-06'.
iii)Change movie no of cust_id 'a05' to 11.
iv)Display all movies with issue_date between 01-jan-06 to 01-sep-06
v)Display information for cust_id 'a01' & 'a02'.

2.c) i) Delete records with inv_no 'I11'from invoice table.
ii)Delete records having return date <='20-Jan-06'.

3**)** DCL and TCL Statements

i) Grant insertion and deletion privileges on invoice table to another user XYZ.
ii) revoke the deletion privileges from user XYZ.
iii) after insertion of 2 records in invoice table create savepoint A.
iv) delete a record and create savepoint B.
v) rollback to A

4) Create the table **Movie** with fields mv_no(number, Primary Key), title(Char), Type(char), star(char), price(number), releasedate(date)

i) Add few records in above table
ii) Count total number of customer
iii) Calculate total price of all the movies.
iv) Calculate average price of all the movies.
v) Determine the maximum & minimum movies prices and rename the title as MAX-PRICE and MIN-PRICE.

vi) Count the number of movies having price greater than or equal to 150.
vii) display total no. of movies released in the current year.
viii) display all the movie which start with letter 'K'.

5) i) **Create a View** of table Invoice with following column inv_no(char, Primary key), mv_no(number), cust_id(char)
ii) Insert and delete records
iii) drop view

6) PL/SQL Programming:

Write a PL/SQL block
i) to find largest of 2 numbers
ii) to reverse the number

7) **Cursor**
i) Write a Cursor to fetch all rows of table invoice
ii) Write a Cursor to display all movies with issue_date between 01-jan-06 to 01-sep-06. If no record found then use Exception to display proper message.
iii) Write a Pl/SQL to accept the name and age of student and insert into table STUD after validating age not less than 18 otherwise raise exception

8) **Create Procedure**
i) to swap two values
ii) to display the cust_id, mv_no and call the procedure through main program

9) **Create Function**
i) to find gcd of two numbers.
ii) to find the total price of all the movie start with letter 'K' and call the function through main program

10) **Create Trigger**
i) that restricts the user from performing a DML on movie table on 'Monday'
ii) Covert all the movie name into the upper case on insertion of each row.

BIOTECHNOLOGY
B. Sc. Semester Pattern Syllabus
B. Sc. Part I – Semester I
BIOTECHNOLOGY
(With effect from academic session 2013-14)

1) The examination shall comprise two theory papers, an Internal assessment and a practical. Each theory paper shall be of three hours duration and carry 50 marks. The practical shall be of 6 hours duration and carry 30 marks. Internal assessment carry 20 marks.

Theory Paper I	50 marks
Theory Paper II	50 marks
Practical	30 marks
Internal Assessment	20 marks

	Total - 150 marks
	---

2) The distribution of marks in practical shall be as follows.

[A] Experiments,	20 marks
[B] Practical record	05 marks
[C] Viva	05 marks

	Total - 30 marks
	---

3) The syllabus is based on six theory periods and six practical periods per week. Candidates are required to pass separately in theory, internal assessment and practical examination.
4) Students are expected to perform all the practicals mentioned in the syllabus.
5) Internal assessment: There shall be one internal assessment based on two theory papers for 10 Marks each. Total 20 Marks. The Internal assessment shall be conducted by the University approved teachers in the relevant subjects. The internal assessment shall be done by the respective college one month prior to the final exam of each semester. The Marks shall be sent to the university immediately after the internal assessment is over.
6) At the beginning of each semester, every teacher / department / college shall inform his / her students unambiguously the method teacher / department / college propose to adopt a scheme of marking for internal assessment.
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B. Sc. Part I – Semester I - PAPER I
MICROBIOLOGY

UNIT I
History, Development and Microscopy

History and development of microbiology: contributions of Louis Pasteur, Robert Koch and Edward Jenner.
Microscopy: Compound microscopy: Numerical aperture and its importance, resolving power, oil immersion objectives and their significance, principles and applications of dark field, phase contrast, fluorescent microscopy.
Electron microscopy: Principle, ray diagram and applications, TEM and SEM, comparison between optical and electron microscope, limitations of electron microscopy.
Stains and staining procedures: Acidic, basic and neutral stains, Gram staining, Acid fast staining, Flagella staining, Endospore staining.

UNIT II
Bacteria:

Bacterial morphology and subcellular structures, general morphology of bacteria, shapes and sizes, generalized diagram of typical bacterial cell.
Slime layer and capsule, difference between the structure, function and the position of the two structures.
Cell wall of gram +ve and Gram -ve cells.
General account of flagella and fimbriae.

Chromatin material, plasmids; definition and kind of plasmids (conjugative and non-conjugative) F, R, and Col plasmids.
Endospores: Detailed study of endospore structure and its formation, germination, basis of resistance.

UNIT III

A. A brief idea Bergey's manual. Morphology of archaea, archaeal cell membrane (differences between bacterial and archaeal cell membrane), other cell structures, concept of the three distinct archaea groups.
B. **Viruses**: General characteristics of viruses, difference between virus and typical microbial cell, structure, different shapes and symmetries with one example of each type, classification of viruses on the basis of nucleic acids, phage and animal cell viruses, example of each and their importance. Brief idea of lytic cycle and lysogeny.

UNIT IV

Nutrition: Basic nutritional requirements: Basic idea of such nutrients as water, carbon, nitrogen, sulfur and vitamins etc., natural and synthetic media, nutritional classification of bacteria. Selective and Differential media, Enriched media, Enrichment media.

B. Sc. Part I – Semester I - PAPER II
(MACROMOLEULES)

UNIT I

Nucleic Acids

Chemical structure and base composition of nucleic acids, Chargaff's rules, Watson Crick Model (B-DNA), deviations from Watson-Crick model, other forms of DNA (A- and Z-DNA), forces stabilizing nucleic acid structures, (hydrogen bonds and hydrophobic associations, base stacking). Maxam and Gilbert DNA sequencing, structure of t-RNA.

UNIT II

Chromosomes, Concept of Genes and Nucleosomes

Concept of prokaryotic genes and eukaryotic genes: Definition of a gene, concept of split genes, introns, exons, spacers, C-value and C-value paradox, basic idea of Cot curves.
Chromatin structure: Nucleosome structure (10 nm fibre, experiments leading to discovery of nucleosomal structure, types of histones, arrangement of histones in the octamer, H1 histone and its role, role and length of linker DNA), 30 nm fibers (arrangement of nucleosome in a helical structure), domain and loop structure (further compacting of 30 nm fibre, role of scaffolding proteins). Role of telomere and centromere, telomeric and centromeric repeat sequences.

UNIT III

Amino acids: Structure of amino acids occurring in proteins, classification of amino acids (pH based, polarity based and nutrition based), Physico-chemical properties of amino acids (solubility, boiling and melting points, reactions like Edman's, Sanger's, Dansyl chloride, ninhydrin). Titration curves of neutral, basic and acidic amino acids.
Primary structure of proteins: Determination of primary structure (end group analysis, cleavage of disulfide bonds, amino acid composition, use of endopeptidase specificity, sequence determination, assignment of disulfide position).

UNIT IV

Secondary structure of proteins: The α-helix, β-structures (parallel, antiparallel, mixed, β-turn).
Tertiary structure of proteins: Forces that stabilize the structure (electrostatic forces, hydrogen and disulfide bonds, hydrophobic associations), myoglobin as an example of tertiary structure, concept of domains, protein denaturation.
Quaternary structure of proteins: Forces stabilizing quaternary structure, advantages of oligomeric proteins.

B.Sc. I
SEMESTER I PRACTICALS
Biotechnology
Microbiology & Macromolecules

1. Formol titration of glycine.
2. Quantitative Estimation of proteins by Biuret method
3. Determination of albumin & A/G retion in serum.
4. Estimation of DNA by Diphenylamine method
5. Estimation of RNA by Orcinol method
6. Quantitative estimation of amino acids using Ninhydrin reaction.
7. Demonstration, use and care of microbiological equipments.
8. Preparation of media, sterilization and isolation of bacteria.
9. Isolation of Bacteriophage from sewage / other sources.
10. Demonstration of motility of Bacteria.
11. Simple staining of bacteria
12. Gram staining of Bacteria
13. Acid fast staining of Bacteria
14. Endospore staining.
15. Demonstration of starch hydrolysis by bacterial cultures
16. Growth of fecal coliforms on selective media.

Note: - Mandatory to perform atleast 6 practical

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BIOTECHNOLOGY
B. Sc. Semester Pattern Syllabus
B. Sc. Part I – Semester II
BIOTECHNOLOGY
(With effect from academic session 2013-14)

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B. Sc. Part I – Semester II - PAPER I
MICROBIOLOGY & CELL BIOLOGY

UNIT I
Microbial Growth
Growth: Growth rate and generation time, details of growth curve and its various phases.
Concept of synchronous cultures, continuous and batch cultures (chemostat and turbidostat). Measurement of growth.
Physical conditions required for growth: Temperature (classification of microorganisms on the basis of temperature requirements), Ph etc. Pure cultures and cultural characteristics. Maintenance of pure culture.

UNIT II:
B. Microbial Control
Microbial Control: Terminologies - Sterilization, disinfection, antiseptic, sanitization, germicide, microbistasis, preservative and antimicrobial agents.
Mechanism of cell injury: Damage to cell wall, cell membrane, denaturation of proteins, inhibition of protein synthesis, transcription, replication, other metabolic reactions and change in supercoiling of DNA.
Physical control: Temperature (moist heat, autoclave, dry heat, hot air oven and incinerators), dessication, surface tension, osmotic pressure, radiation, UV light, electricity, ultrasonic sound waves, filtration.
Chemical control: Antiseptics and disinfectants (halogens, alcohol, gaseous sterilization.
Concept of biological control.

UNIT III
Cell Biology
Eukaryotic Cell - Structure and function of the following: nucleus, nuclear membrane, nucleoplasm, nucleolus, golgi complex, endoplasmic reticulum, lysosomes, peroxisomes, glyoxisomes and vacuoles.

UNIT IV
Plant cell wall.
Cytoskeleton (actin, microtubules) and cell locomotion.
Mitosis and meiosis. Brief idea of cell cycle.
Muscle and nerve cell structure, synaptic transmission and neuromuscular junctions.

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B. Sc. Part I – Semester II - PAPER II
(CELL CONSTITUENTS & ENZYMOLOGY)

UNIT I
Carbohydrates
Definition, classification, nomenclature of carbohydrates, structures of monosaccharides, disaccharides and polysaccharides (structures of starch and glycogen as examples of homopolysaccharides). Concept and examples of heteropolysaccharides.

UNIT II
Lipids
Types of lipids, structures of saturated and unsaturated fatty acids, triglycerides, phospholipids, plasmalogens, gangliosides and sphingolipids. Terpenoids and isoprenoids - definition and representative structures, steroids. Concept of acid value, saponification value and iodine value.

UNIT III
Enzymes
Terminology: Active site, allosteric site, Holoenzyme, apoenzyme, coenzyme, substrate, inhibitor, activator, modulator etc.

Classification and nomenclature.
Concept of isoenzymes (example Lactate Dehydrogenase) and multienzymes (example pyruvate dehydrogenase)
Substrate Specificity (bond specificity, group specificity, absolute specificity, stereo-specificity, proof-reading mechanism), lock and key and induced fit models.
Concept of allosteric enzymes (brief idea of ATCase as an example)
Mechanisms of catalysis: Acid-base, covalent and metal ion catalysis.

UNIT IV
Assay of Enzymes: Concept of activity, specific activity, turnover number, units of enzyme activity (katal, international unit), spectrophotometric methods of assay of enzymes (simple and coupled assay), very brief idea of other methods.
Enzyme kinetics: Michaelis-Menten equation, effect of substrate concentration, effect of enzyme concentration, effect of Ph and temperature, temperature quotient, single reciprocal(Eadie-Hoffstee equation) and double reciprocal plots(Lineweaver-Burke plots), enzyme inhibition kinetics (reversible inhibition types – competitive, uncompetitive and non-competitive), brief idea of irreversible inhibition.

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B.Sc. I
SEMESTER II PRACTICALS
Biotechnology
Microbiology, Cell constituents & Enzymology

1. Qualitative Analysis of sugars and proteins.
2. Quantitative estimation of sugars (Dinitrosalicylic acid method).
3. Estimation of glucose by Benedict's quantitative method
4. Quantitative estimation of proteins by Lowry's method.
5. Extraction and quantification of total lipids.
6. Determination of saponification value of Fats
7. Determination of Acid Value of Fats
8. Isolation of urease and demonstration of its activity
9. Assay of protease activity.
10. Preparation of starch from Potato and its hydrolysis by salivary amylase.
11. Assay of alkaline phosphatase
12. Immobilization of enzymes / cells by entrapment in alginate gel
13. Effect of temperature / pH on enzyme activity
14. Isolation of pure culture by pour plate method
15. Isolation of pure culture by streak plate method.
16. Anaerobic cultivation of microorganisms.
17. Cultivation of yeast and moulds.
18. Antibiotic sensitivity assay.
19. Oligodynamic action of metals.
20. To study germicidal effect of UV light on bacterial growth.
21. Stages of mitosis.
22. Stages of meiosis.

Note: - Mandatory to perform atleast 6 practical.

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B. Sc. Semester Pattern Syllabus
B. Sc. Part II – Semester III
BIOTECHNOLOGY
(With effect from academic session 2014-15)

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B. Sc. Part II – Semester III - PAPER - I
(METABOLISM)

UNIT I

Bioenergetics: Concept of free energy, Entropy, Enthalpy & Redox Potential. Concept of high energy bonds as related to the structure of ATP, Phosphoenolpyruvate, Creatine phosphate etc.
Glycolysis (pathway, entry of other monosachharides and disaccharides, regulation, inhibitors)
Gluconeogenesis: Bypass reactions.

UNIT II

Structure of mitochondria.
TCA cycle: Detailed account, regulation, amphibolic nature and anaplerosis.
Electron Transport Chain: Components of the chain, sites of ATP synthesis, chemiosmotic theory of oxidative phosphorylation.

UNIT III

Lipid Metabolism

β-oxidation of fatty acids, role of carnitine, oxidation of unsaturated fatty acids & odd carbon fatty acids. Regulation.
Ketogenesis, Ketosis & ketoacidosis in physiology & pathology.

Biosynthesis of fatty acids, fatty acid synthase complex, regulation, Microsomal & Mitochondrial system of chain elongation & synthesis of unsaturated fatty acids.

UNIT IV

Metabolism of Nitrogenous Compounds

Transamination (mechanism). Oxidative & Non-oxidative deamination.

Urea cycle: Detailed account, linkage of urea & TCA cycle, compartmentation of urea cycle, regulation, metabolic disorders of urea cycle.

Transmethylation & Decarboxylation, physiologically important products of decarboxylation.

Biosynthesis of purines and pyrimidines: Salvage pathways.

B. Sc. Part II – Semester III - PAPER – II
(BIOPHYSICAL TECHNIQUES I)

UNIT – I:

Spectrophotometry: Concept of electromagnetic radiation, spectrum of light, absorption of electromagnetic radiations, Concept of chromophores and auxochromes, involvement of orbitals in absorption of electromagnetic radiations, Absorption spectrum and its uses, Beer's law - derivation and deviations, extinction coefficient. Difference between spectrophotometer and colorimeter. Instrumentation of UV and visible spectrophotometry

Double beam spectrometer; dual-wavelength spectrometer

UNIT II:

a) Applications of UV and visible spectrophotometry.
b) Spectrofluorometry: principle, instrumentation and applications. Absorption & emission flame photometry: principle, instrumentation and application.
c) Principles of IR and Mass spectrometry

UNIT III:

Chromatography: Partition principle, partition coefficient, nature of partition forces, brief account of paper chromatography.

Thin layer chromatography and column chromatography.

Gel filtration: Concept of distribution coefficient, types of gels and glass beads, applications.

UNIT IV

Ion-exchange chromatography: Principle, types of resins, choice of buffers, applications including amino acid analyzer.

Affinity chromatography: Principle, selection of ligand, brief idea of ligand attachment, specific and non-specific elution, applications.

Elements of high pressure liquid chromatography.

B.Sc. II
SEMESTER III PRACTICALS
Biotechnology
Metabolism & Biophysical Techniques

1. Spectrophotometric analysis of DNA denaturation.
2. Determination of absorption spectrum of oxy- and deoxyhemoglobin and methemoglobin.
3. Protein estimation by E280/E260 method.
4. Paper chromatography of amino acids/sugars.
5. TLC of sugars/amino acids.
6. Cellular fractionation and separation of cell organelles using centrifuge.
7. Isolation of mitochondria and assay of marker enzyme.
8. Estimation of Urea by diacetyle monoxime method
9. Estimation of Sugars by Folin Wu method
10. Validity of Beer’s law for colorimetric estimation of creatinine.
11. Absorption spectrum of NAD & NADH
12. Preparation of standard buffers and determination of pH of a solution
13. Titration of a mixture of strong & weak acid

Note: - Mandatory to perform atleast 6 practical

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B. Sc. Semester Pattern Syllabus
B. Sc. Part II – Semester IV
BIOTECHNOLOGY
(With effect from academic session 2014-15)

1) The examination shall comprise two theory papers, an Internal assessment and a practical. Each theory paper shall be of three hours duration and carry 50 marks. The practical shall be of 6 hours duration and carry 30 marks. Internal assessment carry 20 marks.

Theory Paper I	50 marks
Theory Paper II	50 marks
Practical	30 marks
Internal Assessment	20 marks

	Total - 150 marks
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2) The distribution of marks in practical shall be as follows.

[A] Experiments,	20 marks
[B] Practical record	05 marks
[C] Viva	05 marks

	Total - 30 marks
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3) The syllabus is based on six theory periods and six practical periods per week. Candidates are required to pass separately in theory, internal assessment and practical examination.
4) Students are expected to perform all the practicals mentioned in the syllabus.
5) Internal assessment: There shall be one internal assessment based on two theory papers for 10 Marks each. Total 20 Marks. The Internal assessment shall be conducted by the University approved teachers in the relevant subjects. The internal assessment shall be done by the respective college one month prior to the final exam of each semester. The Marks shall be sent to the university immediately after the internal assessment is over.
6) At the beginning of each semester, every teacher / department / college shall inform his / her students unambiguously the method teacher / department / college propose to adopt a scheme of marking for internal assessment.
7) The internal assessment marks assigned to each theory paper shall be awarded on the basis of attendance / home assignment / class test / Project assignment / seminar / any other innovative practice / activity.
8) The concerned teacher / department / college shall have to keep the record of all the above activities till six months after the declaration of result of that semester.

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B. Sc. Part II – Semester IV - PAPER - I
(IMMUNOLOGY)

UNIT I

Immune system, Organs and cells of immune system
Immunity, innate immune mechanism
Acquired immune mechanism, Antigen, Antigenecity (factors affecting antigenecity)
Humoral immunity, main pathways of complement system.

UNIT II

Antibody structure and classes.
Cell mediated immunity: TC mediated immunity, NK cell mediated immunity, ADCC, delayed type hypersensitivity, cytokines and brief idea of MHC.

UNIT III

Hypersensitivity and vaccination : General features of hypersensitivity, various types of hypersensitivity, Vaccination: Discovery, principles, significance. Concept of autoimmunity.

UNIT IV

Immunological Techniques:Antigen-antibody reactions: Precipitation, agglutination, complement fixation, immunodiffusion, ELISA.
Hybridoma technology: Monoclonal antibodies and their applications in immunodiagnosis.

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B. Sc. Part II – Semester IV - PAPER – II
(BIOSTASTICS & BIOPHYSICAL TECHNIQUES II)

UNIT – I:

a) Migration of ions in electric field, Factors affecting electrophoretic mobility.
b) Paper electrophoresis: - Electrophoretic run, Detection techniques, Cellulose acetate electrophoresis, High voltage electrophoresis.
c) Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & Estimation of macromolecules.

UNIT II

a) SDS-PAGE Electrophoresis: - applications (determination of molecular weight of proteins, determination of subunit stoichiometry, molecular biology applications).
b) Isoelectric focussing, Principle, Establishing pH amd density gradients, Procedures & applications.
c) Pulsed-field gel electrophoresis.

UNIT – III:

Isotopic tracer technique: -

a) Radioactive & stable isotopes, rate of radioactive decay. Units of radioactivity.
b) Measurement of radioactivity: - Ionization chambers, proportional counters, Geiger- Muller counter, Solid and liquid scintillation counters (basic principle, instrumentation and technique), Cerenkov radiation.
c) Measurement of Stable isotopes: Falling drop method for deuterium measurement, Mass spectrometry.
d) Principles of tracer technique, advantages and limitations, applications of isotopes in biotechnology (distribution studies, metabolic studies, isotope dilution technique, metabolic studies, clinical applications, autoradiography).

UNIT IV

Centrifugation:

a) Basic principles, concept of RCF, types of centrifuges (clinical, high speed and ultracentrifuges).
b) Preparative centrifugation: Differential and density gradient centrifugation, applications (Isolation of cell components).
c) Analytical centrifugation: Sedimentation coefficient, determination of molecular weight by sedimentation velocity and sedimentation equilibrium methods.

Biostatistics

Basic concepts of mean, median, mode, Standard deviation and Standard error

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B.Sc. II
SEMESTER IV PRACTICALS
Biotechnology
Immunology & Biophysical techniques

1. Antigen – antibody reaction – determination of Blood group
2. Pregnancy test
3. Widal test
4. Ouchterloney immunodiffusion
5. Radial immunodiffusion
6. ELISA
7. Isolation of casein by isoelectric precipitation
8. Paper electrophoresis of proteins
9. Gel electrophoresis of proteins.
10. SDS-PAGE of an oligomeric protein.
11. Calculation of mean, median, and mode (manual/computer aided).
12. Calculation of standard deviation and standard error (manual/computer aided).
13. Biostatistical problem based on standard deviation.

Note: - Mandatory to perform atleast 6 practical

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B. Sc. Semester Pattern Syllabus
B. Sc. Part III – Semester V
BIOTECHNOLOGY
(With effect from academic session 2015-16)

1) The examination shall comprise two theory papers, an Internal assessment and a practical. Each theory paper shall be of three hours duration and carry 50 marks. The practical shall be of 6 hours duration and carry 30 marks. Internal assessment carry 20 marks.

Theory Paper I	50 marks
Theory Paper II	50 marks
Practical	30 marks
Internal Assessment	20 marks

	Total - 150 marks
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2) The distribution of marks in practical shall be as follows.

[A] Experiments,	20 marks
[B] Practical record	05 marks
[C] Viva	05 marks

	Total - 30 marks
	----------

3) The syllabus is based on six theory periods and six practical periods per week. Candidates are required to pass separately in theory, internal assessment and practical examination.
4) Students are expected to perform all the practicals mentioned in the syllabus.
5) Internal assessment: There shall be one internal assessment based on two theory papers for 10 Marks each. Total 20 Marks. The Internal assessment shall be conducted by the University approved teachers in the relevant subjects. The internal assessment shall be done by the respective college one month prior to the final exam of each semester. The Marks shall be sent to the university immediately after the internal assessment is over.
6) At the beginning of each semester, every teacher / department / college shall inform his / her students unambiguously the method teacher / department / college propose to adopt a scheme of marking for internal assessment.
7) The internal assessment marks assigned to each theory paper shall be awarded on the basis of attendance / home assignment / class test / Project assignment / seminar / any other innovative practice / activity.
8) The concerned teacher / department / college shall have to keep the record of all the above activities till six months after the declaration of result of that semester.

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B. Sc. Part III –Semester V - PAPER – I
(MOLECULAR BIOLOGY)

UNIT I
DNA Replication

Enzymology of replication (detailed treatment of DNA polymerase I, brief treatment of pol II and III, helicases, topoisomerases, single strand binding proteins, DNA melting proteins, primase and RNA primers, distributive and processive properties of DNA polymerase I and III, importance of the β-subunit in polymerase III), proof for semiconservative replication, discontinuous replication and Okazaki fragments, Replication origins, initiation, primosome formation, elongation, and termination. Use of DNA replication mutants in the study of replication.

UNIT II
Mutations & DNA Repair

Gene mutations: Missense, nonsense and frameshift mutations.
Mutagens: Physical and chemical mutagens.
Repair: Mismatch repair, NER, BER, light induced repair, SOS repair.

UNIT III

Transcription

Enzymatic synthesis of RNA: Basic features of transcription, structure of prokaryotic RNA polymerase (core enzyme and holoenzyme, significance of σ factor), concept of promoter (Pribnow box, -10 and -35 sequences and their significance), auxiliary proteins of transcription, role of NusA.

Four steps of transcription (promoter binding and activation, RNA chain initiation and promoter escape, chain elongation, termination and release).

UNIT IV

Details of initiation, elongation, and termination (intrinsic and rho factor mediated termination).

Brief idea of reverse transcription.

Regulation of Transcription in Prokaryotes: Basic idea of lac- and trp-operons.

B. Sc. Part III – Semester V - PAPER – II
(MOLECULAR BIOLOGY & rDNA TECHNOLOGY)

UNIT I

Genetic Code

Genetic code: Argument for triplet code, experimental elucidation of codons, identification of start and stop codons, universality, degeneracy and commaless nature of codons.

The decoding system: aminoacyl synthetases, brief structure of tRNA, the adaptor hypothesis, attachment of amino acids to tRNA.

Codon-anticodon interaction - the wobble hypothesis.

Selection of initiation codon - Shine and Dalgarno sequence and the 16S rRNA.

UNIT II

Protein synthesis:

Initiation, elongation, and termination.

Regulation of translation: Autogenous control of r-proteins, phage T4 protein p32 translational regulation. Antibiotics affecting translation.

UNIT III

rDNA Technology

DNA cloning: Basics of genetic engineering, restriction endonucleases, other enzymes of DNA manipulation.

Vectors: Plasmid vectors (pBR322 and pUC 18/19)

Phage vector: Lambda replacement and insertion vectors

Cosmids, phagemids, and YAC.

Cutting and joining DNA (cohesive end ligation, methods of blunt end ligation). Transfection and transformation. Selection of transformed cells. Screening methods.

UNIT IV

Genomic DNA library and cDNA library – concept and methods of creating these libraries. Advantages and disadvantages of cDNA library over genomic DNA library.

General consideration of Polymerase chain reaction, designing of primers for PCR.

Expression of cloned genes: General features of an expression vector. Expression of a eukaryotic gene in prokaryotes – advantages and problems. Applications of recombinant DNA technology:

B.Sc. III
SEMESTER V PRACTICALS
Biotechnology
Molecular Biology & rDNA technology

1. To measure concentration of DNA & RNA by UV spectrophotometry
2. Estimation of proteins by Bradford method
3. Isolation of genomic DNA.
4. Isolation of Plasmid DNA.
5. Isolation of chloroplast DNA.
6. Restriction digestion of DNA.
7. Demonstration of Replica plating technique

8. Identification of Lac+ bacteria by blue white screening using IPTG
9. Ligation of DNA
10. Demonstration of Southern blotting
11. Demonstration of western blotting
12. Chemical mutagenesis and production of microbial mutants.

Note: - Mandatory to perform atleast 6 practical

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B. Sc. Semester Pattern Syllabus
B. Sc. Part III – Semester VI
BIOTECHNOLOGY
(With effect from academic session 2015-16)

1) The examination shall comprise two theory papers, an Internal assessment and a practical. Each theory paper shall be of three hours duration and carry 50 marks. The practical shall be of 6 hours duration and carry 30 marks. Internal assessment carry 20 marks.

Theory Paper I	50 marks
Theory Paper II	50 marks
Practical	30 marks
Internal Assessment	20 marks

	Total - 150 marks
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2) The distribution of marks in practical shall be as follows.

[A] Experiments,	20 marks
[B] Practical record	05 marks
[C] Viva	05 marks

	Total - 30 marks
	---

3) The syllabus is based on six theory periods and six practical periods per week. Candidates are required to pass separately in theory, internal assessment and practical examination.
4) Students are expected to perform all the practicals mentioned in the syllabus.
5) Internal assessment: There shall be one internal assessment based on two theory papers for 10 Marks each. Total 20 Marks. The Internal assessment shall be conducted by the University approved teachers in the relevant subjects. The internal assessment shall be done by the respective college one month prior to the final exam of each semester. The Marks shall be sent to the university immediately after the internal assessment is over.
6) At the beginning of each semester, every teacher / department / college shall inform his / her students unambiguously the method teacher / department / college propose to adopt a scheme of marking for internal assessment.
7) The internal assessment marks assigned to each theory paper shall be awarded on the basis of attendance / home assignment / class test / Project assignment / seminar / any other innovative practice / activity.
8) The concerned teacher / department / college shall have to keep the record of all the above activities till six months after the declaration of result of that semester.

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B. Sc. Part III –Semester VI - PAPER – I
(APPLICATIONS OF BIOTECHNOLOGY)

UNIT I
Environmental Biotechnology
Water and waste water treatment process: Current community drinking water treatment process, disinfection of water (chlorination and ozonation), primary, secondary and advanced treatment of sewage (domestic waste water),
Definition and concept of: biodegradation, biodeterioration and biotransformation.

UNIT II

Xenobiotic and recalcitrant compounds. Bioaccumulation and biomagnification.

Assessment of water and wastewater quality: Concept of COD,DO and BOD. Indicators of faecal pollution and MPN and MF technique for coloforms. Significance and principal of IMViC.

UNIT III

Industrial Biotechnology

Basic Principles of Industrial Biotechnology: Important commercial products produced by microorganisms and GMOs and their applications, design of typical submerged fermentor, significance of various parts and provisions of fermentor, isolation of industrially important microorganisms – primary and secondary screening.

UNIT IV

Food Biotechnology

Food Biotechnology: Production and types of cheese, microorganisms as food – production of mushroom and spirulina, assessment of microbiological quality of various foods.

Industrial awareness: Quality control and quality assurance in food and pharamaceutical industry, concept of current good manufacturing practices in pharmaceutical industry

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B. Sc. Part III – Semester VI - PAPER – II
(PLANT & ANIMAL BIOTECHNOLOGY)

UNIT I:

a) Introduction to cell and Tissue culture. Tissue culture as a technique to produce novel plants and hybrids, Laboratory facilities
b) Tissue culture media (composition and preparation)
c) Callus and suspension cultures: initiation and maintenance of callus and suspension cultures; single cell clones.

UNIT II:

a) Tissue and micropropagation, suspension culture, callus formation, regeneration, production of haploids, protoplast culture and somatic hybridization
b) Cloning in plants - Ti plasmid.
c) Concept of transgenic plants
d) Bt cotton and other plant applications.

UNIT III:

a) Various techniques of animal cell and tissue culture, Culture media, growth factors, laboratory facilities.
b) Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication etc.; Cell senescence; cell and tissue response to trophic factors.
c) Primary culture, immortal cells, cell lines.
d) Maintenance of cell lines in the laboratory.

UNIT IV:

a) Brief idea about recombinant DNA products in medicine (insulin, somatostatin, vaccines), Concept of Gene therapy,
b) Production of recombinant vaccines – hepatitis.
c) Concept of transgenic animals
d) In vitro fertilization and embryo transfer in humans and farm animals.

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B.Sc. III
SEMESTER VI PRACTICALS
Biotechnology
Animal, Plant, Industrial & Environmental Biotechnology

1. Establishing a plant cell culture (both in solid and liquid media) – seed germination, callus culture, suspension cell culture, regeneration from callus cells.
2. Anther culture, embryo culture, suspension culture.

3. Cell count by hemocytometer.
4. Cytology of callus.
5. Establishing primary cell culture of chicken embryo fibroblasts.
6. Animal tissue culture – maintenance of established cell lines.
7. Animal tissue culture – virus cultivation.
8. Measurement of cell size.
9. Microphotography.
10. IMViC test.
11. Determination of COD
12. Testing of chlorine demand of water
13. Microbiological quality assurance of any of the commercially available foods.
14. Bioassay of penicillin/vitamin B12
15. Determination of fecal coliforms by MPN technique/MF technique
16. Isolation of azotobacter and rhizobium.
17. Sterility testing of injectibles.
18. Assay of amylase
19. Determination of seed viability.

Note: - Mandatory to perform atleast 6 practical

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CURRICULUM FOR THE COURSE ENVIRONMENTAL STUDIES

(At Undergraduate level, compulsory for all faculties)
(50 Lectures Course, spread over 6 months, at the rate of 4 lectures/week)

Unit I : Introduction (2)*

Definition, scope and importance; Need for public awareness – institutions in environment, people in environment.

Unit II : Natural Resources (2)

Renewable and non-renewable and associated problems; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

Unit III : Ecosystems (8)

Concept of an ecosystem – understanding ecosystems, ecosystem degradation, resource utilization.

Structure and functions of an ecosystem – producers, consumers and decomposers.

Energy flow in the ecosystem – water, carbon, oxygen, nitrogen and energy cycles, integration of cycles in nature.

Ecological succession; Food chains, food webs and ecological pyramids; Ecosystem types – characteristic features, structure and functions of forest, grassland, desert and aquatic ecosystems.

Unit IV : Bio-diversity (10)

Introduction – biodiversity at genetic, species and ecosystem levels

Bio-geographic classification of India

Value of biodiversity – Consumptive use value, productive use value, social, ethical, moral, aesthetic and optional value of biodiversity.

India as a mega-diversity nation; hotspots of biodiversity

Threats to bio-diversity – habitat loss, poaching of wildlife, man-wild life conflicts.

Common endangered and endemic plant and animal species of India.

Insitu and Exsitu conservation of biodiversity

Unit V : Pollution (6)

Definition; Causes, effects and control measures of air, water, soil, marine, noise and thermal pollutions and nuclear hazards.

Solid waste management – Causes, effects and control measures of urban and industrial waste.

Role of individual and institutions in prevention of pollution.

Disaster management – Floods, earthquake, cyclone, landslides

Unit VI : Social Issues and the Environment (12)

Unsustainable to sustainable development; Urban problems related to energy; Water conservation, rainwater harvesting, watershed management; Problems and concerns of resettlement and rehabilitation of affected people.

Environmental ethics – issues and possible solutions – Resource consumption patterns and need for equitable utilization; Equity disparity in Western and Eastern countries; Urban and rural equity issues; need for gender equity.

Preserving resources for future generations. The rights of animals; Ethical basis of environment education and awareness; Conservation ethics and traditional value systems of India.

Climate change, global warming, acid rain, Ozone layer depletion, nuclear accidents and holocasts.

Wasteland Reclamation; Consumerism and Waste products.

Environment legislations –The Environment (protection) Act; The water (Prevention and Control of Pollution) Act; The Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislations – environment impact assessment (EIA), Citizens actions and action groups.

Public awareness – Using an environmental calendar of activities, self initiation.

Unit VII : Human Population and the Environment (10)

Global population growth, variation among nations. Population explosion; Family Welfare Programmes – methods of sterilization; Urbanization.

Environment and human health – Climate and health, infectious diseases, water-related diseases, risk due to chemicals in food, Cancer and environment.

Human rights – Equity, Nutrition and health rights, Intellectual property rights (IPRS), Community Biodiversity registers (CBRs).

Value education – environmental values, valuing nature, valuing cultures, social justice, human heritage, equitable use of resources, common property resources, ecological degradation.

HIV/AIDS; Women and Child Welfare; Information technology in environment and human health.

*(Number of lectures suggested)

Scope and depth of each unit taught would be as per UGC Publication "a Text Book of Environmental Studies for Undergraduate Courses by Erach Bharucha", published by Universities Press (India) Pvt.Ltd., Hyderabad – 500 029..

Students be exposed to atleast 4 local field visits to record observations on the Ecosystem Structure, Common Plant and Animal Species, Pollution sites, Desertified areas etc. The field notebook maintained by the student would be evaluated for 25 marks at the end of the course period.

Guidelines for Implementation :

I. The theory question paper would carry
75 marks – 50 for objective type questions covering various aspects of the syllabus
(50 questions, each of one mark) and 25 marks for one essay type question.

At the end of the course the student would be evaluated for 100 marks with distribution as below –

Field note book	-	25
Objective Questions	-	50
Essay type question	-	25
Passing marks	-	40

The result would be declared in grades –

Grade O : above 75; A : 61-75; B : 51-60; C : 40-50

II A fee of Rs.100/- per student be charged and its utilization is as : Rs.20/- will be sent to the university and Rs.16/- to Principal to be utilized for infrastructure and administrative expenses pertinent to the course. However the final fee structure may be decided by the appropriate authority of the University.

III The Principal would appoint Coordinator and Assistant Coordinator as per need to coordinate the teaching of the course, appoint contributory teachers, if necessary. At the end of the course, the college would conduct the examination. It will appoint paper setters and examiners. The final grades of candidates should be informed to the university. The expenditure for all the required manpower be met from the remaining amount of fees.

IV Qualifications of a Teacher : A teacher in any subject possessing knowledge to teach the "Course on Environmental Studies" shall be eligible.

V The course should be taught in second year and can be cleared in third year in case the student remains absent or fails to clear the course.

VI The candidate will have to pass in the examination of this course in order to obtain degree certificate from the University.

OR for batch 2020

In view of entire course the student may be assigned a project work Encompassing Community/Biodiversity Register (CBR) of ary Gram-Panchyat as per format of ~~National~~ Biodiversity Authority of India under the guidance of a teacher. This CBR should be evaluated for 100 marks.

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

NOTIFICATION

No. Acad/140.

Date :4th June, 2014

To,

The Principal
of all the affiliated Science Colleges
of Rashtrasant Tukadoji Maharaj
Nagpur University, Nagpur

Subject:- Direction No. 4 of 2014.

Sir/Madam,

I am forwarding herewith a copy of the Direction No. 4 of 2014 issued by the Hon'ble Vice-Chancellor under Section 14(8) of Maharashtra Universities Act, 1994 **'Direction governing examination leading to the Degree Of Bachelor of Computer Application (Three Years Degree Course – Semester Pattern)"** and Examination Scheme to be implemented from Academic Session 2014-2015.

You are requested to kindly bring it to the notice of all teachers and students of your college.

Thanking you,

Yours faithfully,

Encl: As above.

Sd/-
(**Dr. A.V. Gomashe**)
Registrar,
Rashtrasant Tukadoji Maharaj
Nagpur University, Nagpur.

No. Acad/140 Nagpur dated the 4th June, 2014

Copy for information and necessary action along with the Direction and Scheme as mentioned above to :-

1. The Dean, Faculty of Science, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
2. The Chairman, Board of Studies in Computer Science, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.
3. The Controller of Examinations, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
4. The Director, B.C.U.D., Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
5. The Deputy Registrar (Examinations) Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.
6. The Deputy Registrar (Coll. Sec.) Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
7. The Asstt. Registrar (Prof. Exam.), Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
8. The Asstt. Registrar (Conf.), Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

9. The Asstt. Registrar (Exams & Enqury.), Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
10. The Asstt. Registrar University's Sub-Centre at Gadchiroli, R.T.M. Nagpur University, Nagpur.
11. The Officer-in-Charge, Publication Section, R.T.M. Nagpur University, Nagpur.
12. The Asstt. Registrar, Ordinance Section, R.T.M. Nagpur University, Nagpur
13. The P. A. to the Hon'ble Vice-Chancellor, R.T.M. Nagpur University, Nagpur
14. The P. A. to the Hon'ble Pro-Vice-Chancellor, R.T.M. Nagpur University, Nagpur
15. The P. A. to the Registar, R.T.M. Nagpur University, Nagpur
16. Mrs. Veena Prakashe, Information Scientist, R.T.M. Nagpur University, Nagpur

Sd/-
(**Puran Meshram**)
Deputy Registrar(Acad.)
Rashtrasant Tukadoji Maharaj
Nagpur University, Nagpur.

RASHTRASANT TUKDOJI MAHARAJ
NAGPUR UNIVERSITY,
NAGPUR

FACULTY OF SCIENCE

BOARD OF STUDIES IN COMPUTER SCIENCE

SYLLABUS FOR

B.C.A. Three Years (SIX SEMESTER) DEGREE COURSE

(FROM SESSION 2014-15)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FACULTY OF SCIENCE

DIRECTION NO. 4 OF 2014

DIRECTION GOVERNING THE EXAMINATION LEADING TO THE DEGREE OF BACHELOR OF COMPUTER APPLICATIONS

(THREE YEARS DEGREE COURSE – SEMESTER PATTERN)

(Issued under Section 14(8) of the Maharashtra Universities Act,1994)

Whereas, Maharashtra Universities Act No. XXXV has come into force with effect from 22nd July, 1994 and further amended by Maharashtra Universities (Amendment and Continuance)Act, 2003, hereinafter referred as 'Act' has come into force from 8th August 2003.

AND

Whereas, the University Grants Commission, New Delhi vide letter No.D.O.No.F 1-2/2008/(XI Plan), dated.31 Jan.2008 regarding new initiatives under the XIth Plan – Academic Reforms in the University has suggested for improving quality of higher education and to initiate the Academic Reforms at the earliest.

AND

Whereas, the Board of Studies in all the Science subjects in their meeting held during 28.6.2013 prepared the syllabi and scheme of examination for the B.C.A. degree course and recommended for starting of the semester pattern in Faculty of Science from the academic session 2014-15,

AND

Whereas, the recommendations of various Board of Studies in the faculty of Science regarding Up-gradation and Revision of various syllabi and introduction and implementation of Semester Pattern Examination System at under graduate level was considered by the faculty of Science in its meeting held on 9.7.2013 and constituted a Committee to decide the policy decision regarding semester pattern examination system.

AND

Whereas, the Dean, Faculty of Science has consented to the syllabi and the scheme of examination for the award of B.C.A. degree in Faculty of Science,

AND

Whereas, the faculty of Science in its meeting held on 9.7.2013 vide item No. 35, has considered, accepted and recommended to Academic Council, the policy decision regarding introduction of Semester pattern and the draft syllabi of B.C.A. Semester-I & VI along with draft direction and other details.

AND

Whereas, the new scheme of examination as per semester pattern is to be implemented from the Academic Session 2014-15 for B.C.A. First Year & onwards which is to be regulated by this direction and as such there is no direction issued and in existence and framing of an Ordinance for the above examination is a time consuming process.

AND

Whereas, the admission of students in the semester pattern at B.C.A. First Year are to be made in the Academic Session 2014-15.

Now, therefore, I, Anoop Kumar, Vice Chancellor of Rashtrasant Tukadoji Maharaj Nagpur University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called, **"Examination leading to the Degree of Bachelor of Computer Applications (Three Year Degree Course-Semester Pattern).**

2. This direction shall come into force with effect from the date of its issuance.

3. (i) The following shall be the examination leading to the Degree of Bachelor of Computer Applications in the faculty of Science namely:

a. The B.C.A. Semester-I Examination;

b. The B.C.A. Semester-II Examination;

c. The B.C.A. Semester-III Examination;

d. The B.C.A. Semester-IV Examination;

e. The B.C.A. Semester-V Examination; and

f. The B.C.A. Semester-VI Examination.

(ii) The period of Academic Session shall be such, as may be notified by the University.

4. The theory examination of Semester-I, II, III, IV, V and VI shall be conducted by the University and shall be held separately at the end of each semester at such places and dates as may be decided by the University and shall be held as per the schedule given in Table 1.

Table 1

Sr. No	Name of the Examination	Main Examination	Supplementary Examination
1	Semester I, III and V	Winter	Summer
2	Semester II, IV, and VI	Summer	Winter

5. Subject to compliance with the provisions of this Direction and of other Ordinances in force from time to time, the following persons shall be eligible for admission to the examinations:-

(a) A student who has prosecuted a regular course of study for not less than one academic year prior to that examination;

(b) A teacher in an Educational Institution eligible under the provisions of Ordinance No. 18, and

(c) A women candidate who has not pursued a regular course of study.

Provided that in the case of the persons eligible under clauses (b) and (c), an applicant to the examination shall have attended a full course of laboratory instructions in a College in the subject in which laboratory work is prescribed. The candidate shall submit a Certificate to that effect signed by the Principal of the college.

6. Eligibility of every applicant for admission to B.C.A. Semester course shall:-

A)In case of the B.C.A. Semester I examination:-

The candidate should have passed the 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education with English and other Modern Indian Languages together with mathematics or an examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed.

Provided that students passing the 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education and offering Vocational Stream with mathematics shall be eligible for admission to the B.C.A. Semester I course.

B) In case of the B.C.A. Semester II, III, IV, V and VI Examinations:- The student should have attended a minimum of 90 days in the respective semester and passed the previous semester examination as per the rules of ATKT as mentioned in Para 7 of this direction.

7) The ATKT rules for admission for the B.C.A. Course **(Theory and Practical as separate passing head and on calculation fraction, if any, shall be ignored)** shall be as given in the following Table- 2.

Table 2

Admission to Semester	**The student should have attended the Session / term satisfactorily**	**Candidates should have passed at least one half of the passing heads of the following examinations (Theory and Practical as separate passing head and on calculation fraction, if any, shall be ignored)**
1	2	3
B.C.A. Semester I	Semester I and admitted As per para 6 of this Direction	---------
B.C.A. Semester II	Semester II	---------
B.C.A. Semester III	Semester III	One half of the total head prescribed for Sem I and Sem II examination
B.C.A. Semester IV	Semester IV	---------
B.C.A. Semester V	Semester V	a) Passed Sem I & II examination and b) One half of the total head prescribed for Sem III & IV examination
B.C.A. Semester VI	Semester VI	---------

8. a) Without prejudice to the other provisions of Ordinance No. 6 relating to the Examinations in General, the provisions of Paragraph 5, 8, 10 and 31 of the said ordinance shall apply to every candidate.

b)The students admitted to this Degree course shall be governed by the general Ordinances / Directions of the University which are applicable to all the regular or ex-students. These Ordinances includes complete as well as relevant provision of Ordinance No. 1, 2, 6, 7-A, 9, 10, 19, 109, Ordinance No. 30 of 2006, (amended Ordinance No. 4 of 2006), Direction 9 of 2008, Direction 5 of 2004 wherever applicable accordingly AND

Direction / Ordinance of ATKT as well as reassessment / provisional admission as issued from time to time.

9. The fee for each Semester examination shall be as prescribed by the University from time to time.

10. Every examinee for the B.C.A. Semester I & II examination shall be examined in:

i)Compulsory English

ii)Any one of the following Languages

Marathi, Hindi, Urdu, Supplementary English, Gujarati, Bengali, Telugu, Sanskrit, French, German, Russian, Persian, Arabic, Pali and Prakrit or Latin

iii) six papers and three practicals at respective semester.

11. The Scope of the subjects of all semesters of B.C.A. examination shall be as indicated in the respective syllabi in force from time to time. The medium of instruction and examination shall be English, except for the courses in Languages.

12. The maximum marks allotted to each subject and the minimum marks which an examinee must obtain in order to pass the examination shall be as per the Appendix **A** appended to this Direction.

13. The practical examination of all semesters shall be conducted at the end of each semester as indicated in Table 3 given below.

Table 3

S. No	Name of the Examination	Main Examination	Supplementary Examination
1	Semester I, III and V	Winter	Summer
2	Semester II, IV, and VI	Summer	Winter

14. The scheme of awarding internal marks shall be as per Appendix- **B** appended with this Direction.

15. Successful examinees at the B.C.A. Sem-VI Examination who obtained not less than 60% marks (aggregate of Sem-I, II, III, IV, V & VI Examinations taken together, excluding Languages) shall be placed in First Division, those obtaining less than 60% but not less than 45% in Second Division, and all other successful examinees in the Third Division.

Explanation :

Division at the B.C.A. Examination shall be declared on the basis of the marks obtained only in the Subjects other than languages at the Sem-I, II, III, IV, V & VI Examinations taken together.

16. There shall be no classification of successful examinees at the Sem-I to Sem-V Examinations.

17. An examinee successful in the minimum period prescribed for the examination, obtaining not less than 75% of the maximum marks prescribed in the subject shall be declared to have passed the examination with Distinction in that subject.

Explanation :

(1) Distinction shall be awarded only in the Science Subjects.

(2) Distinction at the B.C.A. Examination shall be awarded on the basis of the marks obtained at the B.C.A. Semester - I, II, III, IV, V and Semester VI Examination taken together.

(3) Distinction shall not be awarded to an examinee availing of the provision of the exemptions and compartments at any of the examination.

18. Provisions of Ordinance No 7-A relating to the Condonation of Deficiency of Marks for passing an examination and compartment as amended up-to-date vide ordinance No. 45 of 1983 shall apply to the examinations under this Direction.

19. As soon as possible after the examinations, the Board of Examinations shall publish a list of successful examinees at the B.C.A. Sem-I & II; B.C.A. Sem-III & IV and B.C.A. Sem-V & VI Examinations. Such list at the B.C.A. Semester VI Examination shall be arranged in three Divisions. The names of the examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in First or Second Division shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No. 6. While preparing the Merit list for the B.C.A. Examination the marks secured by the candidate in the compulsory languages at their Semester I & II Examination will be taken into consideration in addition to the marks scored by them in their optional subjects.

20. No Person shall be admitted to B.C.A. Sem-I, II, III, IV, V and VI Examinations, if he/she has already passed the corresponding or an equivalent examination of any other Statutory University.

21. Successful examinees at the B.C.A. Sem I, II, III, IV, and V Examinations shall be entitled to receive a **Certificate** signed by the **Registrar** and successful examinees at the end of B.C.A. Sem VI examination shall, on payment of prescribed fees, receive a Degree in the prescribed format, signed by the Vice-Chancellor.

22. The provisions of direction no. 3 of 2007 for the award of grace marks for passing an examination, securing higher grade in subject(s) as updated from time to time shall apply to the examination under this direction.

23. **Absorption Scheme:**

a) While switching over to semester pattern, the failure students of annual pattern will be given three chances to clear the examination.

b) The candidates who have cleared first year annual pattern examination in the subject shall get admission to third semester directly by matchable scheme. However, candidates who are allowed to keep term will not be eligible for admission to third semester unless they clear all the papers and practicals of first year annual pattern examination.

c) The candidates who have cleared second year annual pattern examination in the subject shall get admission to fifth semester directly by matchable scheme.. However, candidates who are allowed to keep term will not be eligible for admission to fifth semester unless they clear all the papers and practicals of second year annual pattern examination.

d) The unsuccessful students of old course (Yearly pattern) shall be permitted to appear for higher class as per the new course (Semester Pattern) examination of the Bachelor of Computer Applications programme (Semester Pattern) provided that they submit a certificate from the Head of the Department/Principal of the College stating that they have satisfactorily undergone a course of study in all the subjects of the new course.

e) The absorption scheme of the Bachelor of Computer Applications programme (Semester Pattern) will be effective till the introduction of new syllabus with the new absorption scheme.
f) For other Statutory University candidates with similar yearly pattern program point No. 23 ‘a’, ‘b’ and ‘c’ shall be applicable.
g) For other Statutory University candidates with Semester pattern Bachelor of Computer Applications program the Candidates shall be admitted to next higher semester provided that he/she shall have cleared previous semester and a R.T.M. Nagpur University Committee constituted form time to time for the purpose shall scrutinize and clear the case on the basis of subject and syllabus contents of his / her previous semester exam of the other Statutory University.

Sd/-

Nagpur (**Anoop Kumar)**

Date : 16.5.2014 **Vice-Chancellor**

Appendix - B:
Guidelines for Internal Assessment, Theory paper pattern and Practical

1. Each semester shall comprise of minimum 90 teaching days.
2. Each semester will comprise
    a. six theory papers – 50 Marks each
    b. internal assessment for each paper - 10 Marks each.
    c. three practicals –30 marks each
3. In addition to the above, Semester I and II will have
    a. One compulsory English paper of 60 marks with 15 marks internal assessment, Total 75 marks.
    b. One second language paper (Marathi, Hindi, Urdu, Supplementary English, Gujarati, Bengali,Telugu, Sanskrit, French, German, Russian, Persian, Arabic, Pali and Prakrit or Latin) of 60 Marks with 15 marks internal assessment, Total 75 marks.

Internal Assessment:

4. The internal assessment shall be done by the College at least 15 days prior to the final examination of each semester. The Marks shall be sent to the University immediately after the Assessment in the prescribed format.
5. Guidelines for Internal Assessment are appended herewith.

a) The internal assessment marks assigned to each theory paper as mentioned in Appendix - A shall be awarded on the basis of assignments like class test, attendance, project assignments, seminar, study tour, industrial visits, visit to educational institutions and research organizations, field work, group discussions or any other innovative practice / activity.

b) There shall be one / two assignments (as described above) per Theory paper.

c) There shall be no separate / extra allotment of work load to the teacher concerned. He/ She shall conduct the Internal assessment activity during the regular teaching days / periods as a part of regular teaching activity.

d) The concerned teacher / department / college shall have to keep the record of all the above activities until six months after the declaration of the results of that semester.

e) At the beginning of each semester, every teacher shall inform his / her students unambiguously the method he / she proposes to adopt and the scheme of marking for internal assessment.

f) Teacher shall announce the schedule of activity for internal assessment in advance in consultation with HOD / principal.

g) Final submission of internal marks to the University shall be before the commencement of the University Theory examinations.

Theory Papers:

6. All Theory papers shall be divided into four units.
7. The theory question papers shall be of 3 hours duration and comprise of 5 questions with equal weightage to all units.
8. The pattern of question papers is appended herewith.

Each theory paper will be of 50 marks each. All questions are compulsory and will carry equal marks.

Question paper for any theory paper will comprise of five questions of 10 marks each. Question No. 1 to 4 will be will be from four units each with an internal choice. The questions can be asked in the form of long answer type for 10 marks.

Question No. 5 shall be compulsory with three questions / notes of very short answer type from

each of the four units having 1 mark each. The student shall have an option of answering any 10
questions out of the 12 questions.

Practical:

9. Practical exam shall be of 4 hours duration.
10. The Practical Record of every student shall carry a certificate as shown below, duly signed by the teacher-in-charge and the Head of the Department.
11. If the student fails to submit his / her certified Practical Record duly signed by the Teacher-In-Charge and the Head of the Department, he / she shall not be allowed to appear for the Practical Examination and no Marks shall be allotted to the student.
12. The certificate template shall be as follows:

C E R T I F I C A T E

Name of the college / institution _
Name of the Department: _

This is to certify that this Practical Record contains the bonafide record of the Practical work of Shri / Kumari /
Shrimati _ of _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ Semester _ _ _ _ _ _
_ _ _ during the academic year _ _ _ _ _ _ _ _. The candidate has satisfactorily completed the experiments
prescribed by Rashtrasant Tukdoji Maharaj Nagpur University for the subject _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Dated _ _ _ / _ _ _ / _ _ _ _ _

Signature of the teacher who taught the examinee
1. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
2. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Head of the Department

Appendix-A
Teaching & Examination Scheme
Bachelor of Computer Application (B.C.A.)
Three Year (SIX SEMESTER) DEGREE COURSE
B.C.A. Part I (Semester I)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	-	English	4+1	-	4+1	3	60	15	75	30	-	-		75
2.	-	Marathi/Hindi/Urdu/Gujarati/ Sanskrit / Suppl. English	3	-	3	3	60	15	75	30	-	-		75
3.	Paper-I	Computer Fundamentals	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-II	"C" Programming	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-III	Statistical Methods	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-IV	Discrete Mathematics – I	3	-	3	3	50	10	60	24	-	-	-	60
7.	Paper-V	Operating Systems	3	-	3	3	50	10	60	24	-	-	-	60
8.	Paper-VI	Office Automation	3	-	3	3	50	10	60	24	-	-	-	60
9.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
10.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
11.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:
1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester I: 450 + 150 = TOTAL = 600 Marks.

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.
- Details of Course of Languages shall be as per B.Sc. I

Teaching & Examination Scheme

Bachelor of Computer Application (B.C.A.)

Three Year (SIX SEMESTER) DEGREE COURSE

B.C.A. Part I (Semester II)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	-	English	4+1	-	4+1	3	60	15	75	30	-	-		75
2.	-	Marathi/Hindi/Urdu, Gujarati, Sanskrit / Suppl. English	3	-	3	3	60	15	75	30	-	-		75
3.	Paper-I	Programming In 'C++'	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-II	System Analysis And Design	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-III	Numerical Methods	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-IV	Discrete Mathematics – II	3	-	3	3	50	10	60	24	-	-	-	60
7.	Paper-V	Linux Operating System	3	-	3	3	50	10	60	24	-	-	-	60
8.	Paper-VI	E Commerce	3	-	3	3	50	10	60	24	-	-	-	60
9.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
10.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
11.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:

1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester II : 450 + 150 = TOTAL = 600 Marks.

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.
- Details of Course of Languages shall be as per B.Sc. I

Teaching & Examination Scheme

Bachelor of Computer Application (B.C.A.)

Three Year (SIX SEMESTER) DEGREE COURSE

B.C.A. Part II (Semester III)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	Paper-I	Visual Basic Programming	3	-	3	3	50	10	60	24	-	-	-	60
2.	Paper-II	Data Base Management System	3	-	3	3	50	10	60	24	-	-	-	60
3.	Paper-III	Data Structures	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-IV	Operations Research – I	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-V	Web Technology - I	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-VI	Digital Electronics – I	3	-	3	3	50	10	60	24	-	-	-	60
7.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
8.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
9.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:

1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester III: 450

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.

Teaching & Examination Scheme

Bachelor of Computer Application (B.C.A.)

Three Year (SIX SEMESTER) DEGREE COURSE

B.C.A. Part II (Semester IV)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	Paper-I	Software Engineering-I	3	-	3	3	50	10	60	24	-	-	-	60
2.	Paper-II	Sql And Pl/Sql	3	-	3	3	50	10	60	24	-	-	-	60
3.	Paper-III	Theory Of Computation	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-IV	Operations Research - II	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-V	Web Technology - II	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-VI	Digital Electronics – II	3	-	3	3	50	10	60	24	-	-	-	60
7.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
8.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
9.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:

1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester IV: 450

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.

Teaching & Examination Scheme

Bachelor of Computer Application (B.C.A.)

Three Year (SIX SEMESTER) DEGREE COURSE

B.C.A. Final (Semester V)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	Paper-I	Computer Graphics - I	3	-	3	3	50	10	60	24	-	-	-	60
2.	Paper-II	Compiler Construction	3	-	3	3	50	10	60	24	-	-	-	60
3.	Paper-III	VB.Net	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-IV	Software Engineering - II	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-V	PHP - I	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-VI	Data Communication And Network - I	3	-	3	3	50	10	60	24	-	-	-	60
7.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
8.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
9.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:

1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester V: 450

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.

Teaching & Examination Scheme

Bachelor of Computer Application (B.C.A.)

Three Year (SIX SEMESTER) DEGREE COURSE

B.C.A. Final (Semester VI)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	Paper-I	Computer Graphics - II	3	-	3	3	50	10	60	24	-	-	-	60
2.	Paper-II	Programming In Java	3	-	3	3	50	10	60	24	-	-	-	60
3.	Paper-III	ASP.Net	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-IV	Software Testing	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-V	PHP - II	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-VI	Data Communication And Network - II	3	-	3	3	50	10	60	24	-	-	-	60
7.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
8.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
9.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:

1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester VI: 450.

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.

Valuation Pattern for practical examination:-

The valuation scheme of practical examination will be as under.

Record - 6

Viva	- 6
Writing	- 09
Execution	- 09
TOTAL	**- 30**

B.C.A. Part I Semester I (From 2014-2015)

B.C.A. Part I Semester I

Paper I

COMPUTER FUNDAMENTALS

UNIT - I :

Basic Components of Digital Computers: Block Diagram**. CPU:** Functions of Each Unit: Primary Memory, ALU and CU, Instruction format. **Bus**: Data, Control and Address Bus **Number Systems:** Binary, Octal, Decimal, HexaDecimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC**.**

Language Evolution : Generation of Languages : Machine, Assembly, High Level Languages. Characteristics of Good Language **Translators :** Compiler, Interpreter and Assembler. Source and Object Program.

UNIT - II :

Memory: Static & dynamic, RAM, ROM, PROM, EPROM, EEPROM, flash and Cache.
Storage Devices: Hard Disk, Zip Disk and Optical Disk. Pen Drive, Blue Ray

UNIT - III :

Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input , MICR, OCR, OMR, Barcode Reader and Flatbed Scanner.
Output Devices: VDU, Printers: Dot Matrix, Laser and Inkjet.
Plotters: Drum, Flat-Bed and Inkjet.

UNIT - IV :

Network: Network terminology, Topologies : Linear, Circular, Tree and Mesh. Types of Networks: LAN, WAN, MAN. Repeaters, Bridge, Routers, Brouters and Gateway. Modem for Communication between pc's, wi-fi network, Introduction of Bluetooth and Infrared devices. Network protocols. Architecture **:** Peer-to-Peer, Client/Server.

Reference Books:

1. Information technology concepts by Dr. Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology By Alexis And Mathews Leon
[Leon Press, Chennai & Vikas Publishing House Pvt Ltd, New Delhi]

B.C.A. Part I Semester I

Paper II

'C' PROGRAMMING

UNIT- I :

Programming Structure : Sequence, Selection, Iteration and Modular. **Problem Solving techniques**: Development Tools**:** Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) **Developing Algorithm and Drawing flowcharts**

UNIT- II :

C Character set, Tokens, Identifier, Keywords, Variables**,** Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions. : Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do..while, Nested loops, Jump statement: break, continue, goto. (Special emphasis on problem solving)

UNIT- III :

Arrays: Need, Types: Single and Two Dimensional Array.
Strings: Strings Manipulation, Arrays of Strings, Evaluation order
Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT- IV:

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.
Union: Unions, Differences between Structure and Union
Pointer: Introduction, Address Operator (&), Pointer variables, Void pointers, Pointer Arithmetic, Pointers to Pointers.
File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Reference Books:

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming - Kernighen Ritche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

B.C.A. Part I Semester I

Paper III

STATISTICAL METHODS

UNIT- I:

Introduction - Definition of Statistics, Importance and scope of Statistics, Limitations of statistics, Distrust of Statistics. Statistical Data Collection - Primary and Secondary data, Methods of Collecting Primary data, Sources and Secondary Data, Census and Sample Investigation. Presentation of statistical Data - Classification, Tabulation, Frequency Distribution, Diagrams and Graphs. Frequency Distributions and

UNIT- II :

Measures of Central Tendency - Frequency Distribution, Continuous Frequency Distribution, Graphic Representation of a Frequency Distribution Average or Measures of Central Tendency or Measures of Locations, Requisites for an ideal Measure of Central Tendency Arithmetic: Mean Median, Mode, Geometric Mean and Harmonic Mean, Weighted Average, Relationship amongst different Averages.

UNIT- III:

Measures of Dispersion, Skewness and Kurtosis - Meaning and Significance of Dispersion, Methods of Measuring Dispersion - Range, Quartile, Mean Deviation, Standard Deviation, Coefficient of Skewness, Kurtosis, Coefficient of Dispersion, Coefficient of Variation.

UNIT- IV:

Correlation and Regression - Definition of Correlation, . Scatter Diagram, Karl Pearson Coefficient of Correlation, Limits for Correlation Coefficient, Definition of Regression, Lines of Regression, Regression Curves, Regression coefficients, properties of Regression coefficients, Correlation Analysis vs. Regression Analysis.

Reference Books:

1.S Sastry Introduction to Numerical Analysis

2.Y. Rajaraman, Computer Oriented Numerical Methods - Prentice Hall Publication

3.Gupta and Kapoor Fundamental of Mathematical Statistics

4.Brian Flowers Introduction to Numerical Methods in C++ By. (Oxford)

5.E. Balaguruswamy, Numerical Methods - Tata McGraw Hill Publication

6.Srimanta Pal Numerical Methods (Oxford)

7.K Sankara Rao Numerical Methods for Scientists & Engineers [PIlI].

8.Manish Goyal Computer Based Numerical And Statistical Techniques (Laxmi)

B.C.A. Part I Semester I

Paper IV

DISCRETE MATHEMATICS – I

UNIT- I:

Propositional Calculus:

Connectives, Negation, conjunction, Disjunction, statement formulas and truth tables, conditional and Bi-conditional, well formed formulas, Tautologies, Equivalence of formulas, duality law, Tautologies implications, Functionally complete set of, other connectives,

UNIT- II:

Disjunctive normal forms, connective normal forms, Principal disjunctive normal form, Principal conjunctive normal form.

UNIT- III:

Predicate Calculus:

The theory of Inference for statement Calculus, validity using truth tables, Rules of inference, consistency of premises and indirect method of Proof

UNIT- IV:

The statement function, variables and quantifier, Predicate formulas, Free and Bound variables, The universe of Discourse, Theory of inference for predicate calculus.

Reference Books:

1. Discrete Mathematical Structures with applications to computer Science By J,P.Tremblay & R. Manohar, (TMH)
2. Discrete Mathematical Structures by Kolman Busby and Ross (pearson)
3. Discrete Mathematics By Norman Biggs. (Oxford).
4. Logic and Discrete Mathematics : Grassmann, Tremblay (Pearson)
5. Introduction to Automata Theory, Languages, and computation :Hopcroft, Motwani and Ullman(Pearson)
6. An introduction to the theory of computer science , languages and machines : Sudkamp
7. Kenneth H Rosen Discrite Mathematics & it's Applications TMH

B.C.A. Part I Semester I
Paper V
OPERATING SYSTEMS

UNIT - I:
Structure of Operating System, Operating System functions, Characteristics of Modern OS. **Process Management**: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels
CPU Scheduling: Schedulers, Scheduling Methodology, CPU Scheduling Algorithm: FCFS, SJF, RR, Priority Scheduling.

UNIT – II:
Performance comparison : Deterministic Modeling , Queuing analysis, Simulators.
Deadlock and Starvation: Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

UNIT - III:
Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, Segmentation with paging. Protection.

UNIT - IV:
I/O Management: I/O hardware, I/O Buffering, Disk I/O, Raid, Disk Cache. **File Management:** File Management system, File Accessing Methods, File Directories, File Allocation Methods, File Space Management, Disk Space Management, Record blocking. **Protection Mechanisms**: Cryptography, Digital Signature, User Authentication.

Reference Books:

1. Operating Systems by P. Balakrishna Prasad [Scitech Publication]
2. Operating System Concept : Silbershaz (Addision Education)
3. Operating Systems - H.M. Deitel - Addision Wesley.
4. Operating Systems- John J. Donoven.
5. Operating System : A.S.Godbole (TMH)
6. Modern Operating Systems : Tenenenbaum (Pearson Education)
7. Operating System : Peterson.

B.C.A. Part I Semester I
Paper VI
OFFICE AUTOMATION

UNIT – I

Introduction to windows Operating System

Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows, new features in windows XP/Vista versions.

UNIT - 2

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT - 3

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT – 4

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Reference Books:

1. MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2. MS-Office 2000(for Windows) By Steve Sagman
3. A First Course in Computers – Sanjay Saxena

B.C.A. Part I Semester II

Paper I

PROGRAMMING IN 'C++'

UNIT - I :

Object Oriented Methodology:

Elements of Object Oriented programming, Objects, Classes, OOPs features.

Classes & Objects: Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access Specifiers: Private, Protected and Public Members.

UNIT - II :

CONSTRUCTORS & DESTRUCTORS: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors.

OPERATOR OVERLOADING: Definition, Overloadable Operators, Unary Operator Overloading, Unary & Binary overloading, Rules for Operators Overloading.

UNIT - III :

DYNAMIC OBJECTS: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer**.**

INHERITANCE: Defining, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

UNIT - IV :

VIRTUAL FUNCTIONS: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions.

EXCEPTION HANDLING: Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Reference Books:

1. Mastering C++ by K R Venugopal Tata McGraw-Hill , New Delhi.
2. The C++ Programming Language –Bjarne Stroustrup
3. Programming with C++ - Ravichandran
4. Programming with C++ - Robert Lafore
5. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

B.C.A. Part I Semester II
Paper II
SYSTEM ANALYSIS AND DESIGN

UNIT - I :

Introduction : System, Subsystems, Components of Computerized Information System, Systems Analysts, SDLC, Prototyping.

Feasibility Study and Analysis: Identifying Problems, Organizing Feasibility Analysis: Economic, Financial, Organizational and Technological. Feasibility Decision, Choice of a solution.

Data Collection: Interviews, Brain Storming, Questionnaires, Document Search, Observation.

UNIT - II :

Structured tools and techniques of Data analysis : Structured English, Process Charts, SOP, Decision Tables and Decision Trees, Data Flow Diagram, Data Dictionary.
(Special emphasis on problem solving)

System Design : Input design: Input Validation, Human factor Consideration, Messages, System Tolerance. Output design: Categories of output, Design Principles, Control of Output. Forms: Principles of Form Design, Ways to ensure Quality Forms.

Codes: Types, Physical Representation of Codes, Principle of Code Design.

UNIT - III :

Implementation: Training, Operational Training and Related Activities, Planning to Implement Change, Change Strategies.

Testing: Preparation for Testing, Test Execution: Levels of Testing, Component, Function, Subsystem, System, Test Evaluation, Acceptance.

Conversion: Cold Turkey, Parallel, Pilot, Modular and Sequential Methods. Conversion Period Length. **System Evaluation.**

UNIT - IV :

Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, **Scheduling:** Work Breakdown Structure, Activity Networks and CPM, Gantt Charts, PERT Charts, Project Monitoring and Control. Risk Management, Software Configuration Management: Necessity, Configuring Management Activities

Software Reliability and Quality Management: Software Reliability, Software Quality, ISO 9000. Software Maintenance: Characteristics of Software Maintenance, Maintenance Process Models, Estimation of Maintenance Cost.

Software Reuse: What can be reused, Why no reuse so far, Basic Issues.

Reference Books:

1. Information Systems Analysis, Design and Implementation By K. M. Hussain Donna Hussain [Tata McGraw-Hill Publishing Company Ltd, New Delhi]
2. Fundamentals of Software Engineering by Rajib Mall [PHI Publication]
3. Workbook on Systems Analysis & Design by V. Garg [PHI Publication]
4. System Analysis and Design- Don Yeates, shiebls, Helmy (M).
5. System Analysis & Design - Edward –TMH
6. System Analysis and Design – Satzinger, Robert Jackson and Stephen Burd, Thomson Learning
7. Introduction to Systems Analysis Design, Igor Hawryszkiewycz, PHI

B.C.A. Part I Semester II

Paper III

NUMERICAL METHODS

UNIT - I :

Roots of Non-Linear Equations : Algebraic equation, Polynomial equation, Transcendental equation, Iterative method, Starting & Stopping Iterative method, Bisection Method, False Position method, Newton Raphson Method: Secant Method, Determining all possible roots, Multiple roots of polynomial, Complex Roots using Muller's Method.

UNIT - II :

Solution to Linear Equations Existence of solution, Gauss Elimination Method, Gauss elimination with pivoting, Gauss Jordan Method, Round off errors and refinement, m Conditioned system, Matrix inversion method.

UNIT - III :

Linear interpolation, Lagrange Interpolation, Spline Interpolation, Interpolation with equidistant points, Least Square regression Fitting, Transcendental equations, Multiple linear regression, m conditioning in Least square

UNIT - IV :

Integration & Differentiation : Trapezoidal Rule, Simpson 1/3 Rule, Simpson 3/8 rule, Gaussian Integration, Solution to differential equation (using Runge-Kutta second and fourth order methods, Multistep method for differential equations (Milne-Simpson method, Adams-bashforth-

Reference Books:

1.S Sastry Introduction to Numerical Analysis

2.Y. Rajaraman, Computer Oriented Numerical Methods - Prentice Hall Publication

3.Gupta and Kapoor Fundamental of Mathematical Statistics

4.Brian Flowers Introduction to Numerical Methods in C++ By. (Oxford)

5.E. Balaguruswamy, Numerical Methods - Tata McGraw Hill Publication

6.Srimanta Pal Numerical Methods (Oxford)

7.K Sankara Rao Numerical Methods for Scientists & Engineers [PIlI].

8.Manish Goyal Computer Based Numerical And Statistical Techniques (Laxmi)

B.C.A. Part I Semester II

Paper IV

DISCRETE MATHEMATICS – 2

UNIT - I :

Set Theory:

Set, Subsets operations on set, Venn diagram, algebra on sets, Cartesian product of sets, Binary relations, Properties of binary relation, Relation matrix and the graph of relation, Partial order relations, Equivalence relations, Equivalence Classes, Composition of relations.

UNIT - II :

Functions - definition, types of function, Invertible functions composition of functions.

Counting - Permutation, Combinations, The pigeonhole principle, recurrence relation, Mathematical Induction.

UNIT - III :

Algebraic Structures

Semi groups & groups: Binary operations, Semi groups, isomorphism and Homomorphism, Product and Quotient of semi groups, Groups, subgroups, products and Quotient of groups.

Lattices: - Lattice concepts, isomorphic Lattices, Properties of lattices, Finite Boolean algebras.

UNIT - IV :

Graph Theory: Basic concepts, types of graphs, Representation of graph in memory, Euler path and circuits, Hamiltonian Path and circuits.

Trees:- Basic concepts, Libeled trees, Undirected trees.

Reference Books:

1. Discrete Mathematical Structures with applications to computer Science By J,P.Tremblay & R. Manohar, (TMH)
2. Discrete Mathematical Structures by Kolman Busby and Ross (pearson)
3. Discrete Mathematics By Norman Biggs. (Oxford).
4. Logic and Discrete Mathematics : Grassmann, Tremblay (Pearson)
5. Introduction to Automata Theory, Languages, and computation :Hopcroft, Motwani and Ullman(Pearson)
6. An introduction to the theory of computer science , languages and machines : Sudkamp
7. Kenneth H Rosen Discrite Mathematics & it's Applications TMH

B.C.A. Part I Semester II

Paper V

LINUX OPERATING SYSTEM

UNIT - I :

Logging In and Logging Out, Anatomy of Linux OS, Directory Structure, /usr Directory, File Types: User datafiles, System data files, Executable files. Naming files and directories, Spawning Processes. **Shell:** Creating User Account, Shell Program, bash shell, Changing shell prompt. **Commands:** Basic Syntax for a command, Exploring the Home Directory, ls, mkdir, rmdir, stat, cat, rm, mv, cp

UNIT - II :

Editor: Vi editor. **Hooking up Hardware Devices:** Formatting a Floppy Disk**,** Gathering important system information. Backing Up and restoring the File **System:** Simple Backup, gzip, gunzip, tar. **Printing files:** Print Spool directory, Sending files to Printer.

UNIT - III :

Sharing Files with other Users: Maintaining User Accounts, Changing Password, Creating Group Accounts, Granting Access to files, Changing File Ownership, Protecting Files, Making a File Read-Only. Working with Processes**:** Types of processes, ps Command, Creating process, killing process, free command and top utility.

UNIT - IV :

Managing Disk Space: df, du commands, Creating Additional Free Disk Space, Locating Unused Files, Setting System Clock. Communication Utilities: who, who am i, finger, mesg, write, wall, talk, Creating a message of the day. X Window System, Graphical User Interfaces: KDE and GNOME Desktop Environment.

Reference Books:

1. SAMS Teach Yourself Linux by Craig and Coletta Witherspoon [Techmedia]
2. LINUX complete reference by Richard Peterson

B.C.A. Part I Semester II

Paper VI

E COMMERCE

UNIT - I :

Introduction to e-Commerce, Scope of electronic commerce, definition, e-Commerce and Trade Cycle, e- Markets, Internet e-Commerce in perspective. Value chain, Supply chain, Porters value chain model, Inter organizational value chains.

UNIT - II :

Business strategy in electronic age: Competitive advantages, Strategy, Porters model, First Movers advantages, Advantages using e-Commerce. Introduction to business strategy, Strategic implications of IT, Technology, Business environment, Business capability, Existing business strategy, Strategy formulation and implementation planning, e-Commerce implementation, e-Commerce evaluation.

UNIT - III :

Business to Business e-Commerce: Inter organizational transactions, The credit transaction trade cycle, A variety of transaction, Pens and things, Electronics Market, Usage of e-Market, Advantages and disadvantages of e-Market, Future of e-Market, EDI, introduction, EDI and Business.

UNIT - IV :

Business to Consumer Electronic Commerce: Consumer trade transaction, Internet e-Commerce, e-Shop, Other e-Commerce technologies, Advantages and disadvantages of comsumer e-Commerce. Elements of e-Commerce: elements, e-Visibility, e-Shop, Online payments, Internet e-Commerce security.

Reference Books:

01. E-Commerce, Strategy, Technologies and Applications By: David Whiteley Tata McGraw-Hill Edition.

B.C.A. Part II Semester III
Paper I
VISUAL BASIC PROGRAMMING

UNIT-I :
Working with Visual Basic Window Components: Menu Bar, Tool Bar, Project Explorer Window, Form Layout Window, properties Window, Toolbox, Code Editor Window **Working with Forms:** Properties, Events, Methods Working with Basic Controls:Label, CommandButton, TextBox, OptionButton, Frame, CheckBox, ListBox, ComboBox, Image, Scroll, Picture, Timer, DriveListBox, DirListBox, FileListBox and Shape Controls. **Basic Programming Fundamentals:** Variables, Data types, Constant, Conversion Function. Scope of Variable: Public, Private Static. Operators: Logical, Arithmetic, Concatenation, Comparison. Decision Structure: If.. Then, If..Then..Else, Select Case.. End Case. Loop Structure: Do..While, While.. Wend, For.. Next, With..EndWith. DoEvents()

UNIT-II :
Arrays: Dynamic Array, Preserve and Control arrays. **Procedure:** General procedure, General Methods for Passing Arguments to a Procedure, **Functions:** User-Interaction, String, Math, Date, Conversion Functions.
Modules: Form, Standard.

UNIT-III :
Menus: Creating, Adding Menu Items, Creating Shortcut, Adding Separators Bars, Submenus, Code for Menus. Creating Popup Menu: System, Custom. **Database Handling:** Database Concepts, Creating and Accessing Database, Using Data Control.
Using DAO: Creating Search Programs, Numeric Search and Complex Search Programs.

UNIT-IV :
Using ADO Data Control, Data Link, ODBC Data Source name, Using Connection String, Creating Navigating buttons. Working with Advanced Data Controls **:** DataList Control, DataCombo Control, DataGrid Control and Msflexgrid Control. **Handling Errors** : Run Time, Trapping and Handling Error, ERR Object. Data Environment and Data Reports.

Reference Books:

1. VISUAL BASIC – to Advance by Soma Dasgupta [BPB Publication]
2. Evangelos Petroutsos, Mastering Visual Basic 6.0 BPB Publication.
3. VISUAL BASIC 6 COMPLETE REFRENCE (TMH PUB)
4. Visual Basic 6 Deitel & Deitel (Pearson Education)
5. Mastering VB 6.0 Black Book -Peter - Norton-Techmedia.

B.C.A. Part II Semester III

Paper II

DATA BASE MANAGEMENT SYSTEM

UNIT- I :

DBMS : Definition: Databases, DBMS, Problems with traditional file processing system, Objectives of the database systems, Three level architectures of DBMS, Component of DBMS, Database Administrator, Database Users, Data model, Different types of data models, Concepts of Hierarchical, Network Models.

UNIT-II :

E-R Models : Basic Concepts, Entity, Attributes, Relation Ship, Mapping, Keys, Weak and Strong Entity Set, Problems on E-R Diagrams, Extended E-R Features: Specialization, Generalization, Aggregation, Problems on Reduction of an E-R Schema to Tables, Tabular representation of Strong, Weak entity Sets and Relationship Sets.

UNIT-III :

Relational Model: Structure, Relational Algebra, Fundamental Operations, Set – Intersection, Natural Join, Division and Assignment Operation. Extended Relational Algebra Operations, Aggregate Functions.

UNIT–IV :

Functional Dependency: Functional Dependency, Fully Functional Dependency, Partial Dependency, Transitive Dependency, Multi Valued Dependency.
Normalization, Normal Forms (1NF, 2NF, 3NF, BCNF, 4NF, 5NF). Problems on Normal forms.

Reference Books:

1. Data Base System Concepts By A SilbersChatz By Henry Korth And S.Sudarshan [Mcgraw-Hill ltd. New Delhi] 3rd Edition.
2. Introduction to Data Base Management by NAVEEN PRAKASH [Tata McGrawHill ltd.]
3. Bipin C. Desai, An Introduction to Database Systems, Galgotia Publications.
4. Raghu Ramakrishnan & Johannes Gerhrke, "Data Base Management Systems", Mc Graw Hill International Edition, 2000
5. Muzumdar, Introduction to Database Management Systems. TMH

B.C.A. Part II Semester III
Paper III
DATA STRUCTURES

UNIT - I :
LINKED LIST : Linked List, Representation of Single, Double, Header, Circular Single and Double Linked list, All possible operations on Single and Double linked List using Dynamic representation, Polynomial Representation and its Manipulation.

UNIT - II :
STACKS : Stacks terminology, Representation of Stacks in Memory, Operation on Stacks, Polish Notations, Translation of infix to postfix & prefix expression, Infix to Postfix Conversion, Evaluation of Postfix Expression, Recursion, Problems on Recursion, Quick Sort and Tower of Hanoi Problem.

UNIT - III :
QUEUE : Representation of Queues in Memory, Circular Queue. Dequeue and Priority Queue. Operations of above Structure using Array and Linked Representation.
SORTING AND SEARCHING: Selection Sort, Insertion Sort, Merge Sort, Efficiency of Sorting Methods, Big-O Notations.
Hash Tables, Hashing Technique, Collision Resolution Technique.

UNIT - IV :
TREES : Basic Terminologies, Representation of Binary Trees in Memory, Traversing of Binary tree, Binary Search Tree, Operation on Binary Search Tree, Heap Tree, Operation on Heap Tree, Heap Sort Method
GRAPHS : Basic Terminologies, Definition and Representation of Graphs in Memory: Linked List and Matrix Representation. Traversing graphs : BSF, DFS Method.

Reference Books:

1. Classical Data Structures : D. Samanta. PHI, New Delhi.
2. DATA STRUCTURE : LIPSCTUZ SCHUM OUTLINE SERIES
3. Data structure Using C++ : Y. Kanetkar
4. Data Structures Using C++: Tennenbaum
5. Data structures by Tremblay Sorenson
6. Data structures by Bhagat singh Naps

B.C.A. Part II Semester III

Paper IV

OPERATIONS RESEARCH – I

UNIT - I :

Introduction to Operation Research (OR) Origin and development of OR, Nature of OR, Characteristics of OR, Classification of Problems in OR, Models in OR, Phases of OR, Uses and Limitations of OR, Methodologies of OR, Applications in OR. Linear Programming – Concepts of Linear Programming Model, Mathematical Formulation of the Problem, Graphical solution methods.

UNIT - II :

Linear Programming Methods – Simplex Methods, Big M methods, Dual Simplex Method, TwoPhase methods. Duality in Linear Programming – Formulation of Dual Problem, Application of Duality.

UNIT - III :

Transportation Problem

Mathematical model for Transportation Problem, Types of Transportation Problem.

UNIT - IV :

Assignment Problem – Zero-One Programming Model for Assignment Problem, Types of Assignment Problem, Hungarian Method, Branch and Bound Technique for Assignment Problem.

Reference Books:

1. Operation Research by Kanti Swarup, P. K. Gupta, Man Mohan [Sultan]
2. Operation Research by R. Panneerselvam [PHI}
3. Introduction to Operation Research by Billy E. Gillet [TMH]
4. Operation Research by Hira Gupta
5. Operation Research Problems and Solutions by Sharma J. K. [MacMillan]
6. Operation Research Theory and Application by Sharma J. K., [MacMillan]

B.C.A. Part II Semester III

Paper V

WEB TECHNOLOGY - I

UNIT - I :

Introduction to Internet, History of Internet, Internet users, Internet working, Information on Internet, Requirements for connecting to Internet, Basic Internet Terms, Introduction to world wide web, Evaluation of world wide web, basic features, web browsers, popular web browsers, web servers, HTTP, URL, Search Engines, Search Engines categories, how to use Search Engines, Searching criterion.

UNIT - II :

HTML: Introduction, Objective, HTML Browsers, Windows Switching, HTML Command Tags, URLs, links, new web page creation, main body of the text, putting headers, adding paragraph , formatting text in HTML and font mechanism, Color settings, superscripts and subscripts and other manipulations on text and paragraphs, using directory and menu lists, creation of links, inserting graphics, using images, all manipulations on tables and its display, Detailed working with forms, allowing visitors to upload files, active images ,working with frames & framesets, Frames handling, scroll bars, alternatives to frames,

UNIT - III :

Introduction to browsers, Working with e-mail, Parts of e-mail text, working with messages.

DHTML: using DHTML in internet explorer, heading and horizontal line, hidden message, the message at the center of the page, moving boxes ,changeable box.

UNIT - IV :

Cascading style sheets

Introduction to css, creating style sheets, common tasks with CSS, Colors, the font -family, font metrics ,length units ,absolute units ,relative units ,the pixel unit ,percentages as values ,keywords as values, various properties such as the font -size property, font -size property etc, Assigning classes ,tags and attributes for applying classes, applying classes to an HTML tag, applying classes to other document parts ,the layer tag, CSS Tags

Reference Books:

1. Internet and web design by R Bangia, Second edition , firewall media
2. Multimedia and Wed technology by R Bangia
3. Internet and web designing by ITELS (Macmillan)
4. Web Enabled Commercial Application Development Using HTML, DHTML, JS, Perl by Ivan Bayross
5. Deitel, Deitel & Nieto, Internet and Worldwide Web how to Program, Pearson Education, PHI.
6. Internmet Programming with VBScript and Java Script.
   Kathhleen Kalata, (Thomsaon Publication)
7. Programming the World Wide Web By. Robert W. Sebesta. (Pearson)
8. Web Technology Theory and Practice By: M Srinivasan (Pearson Publication)

B.C.A. Part II Semester III

Paper VI

DIGITAL ELECTRONICS – I

UNIT - I :

Number System and Data Representation

Number System : Binary, Octal, Decimal and Hexadecimal number system and their interconvertion.

Binary Codes : BCD, Excess3 , Parity, Gray, ASCII, EBCDIC codes and their advantages and disadvantages.

UNIT - II:

Binary Arithmetic

Data Representation: Positive, negative, maximum and minimum number representation (related to 8 bit number), real number representation, underflow, overflow, range and accuracy. **Binary Arithmetic:** Binary addition, binary subtraction using 1's and 2's compliment.

UNIT - III:

Logic gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gates.

UNIT - IV:

Boolean Algebra.

Laws and Identities of Boolean algebra, DeMorgan's Theorem , use of Boolean Algebra for simplification of logic expression, K-Map for 2,3,4 variables, simplification of SOP and POS logic expression using K-Map.

Reference Books:

1. Digital Electronics by Gothman(PHI)
2. Digital and analogue technique by Navaneeth, Kale and Gokhale
3. Modern Digital Electronics by R. P. Jain

B.C.A. Part II Semester IV

Paper I

SOFTWARE ENGINEERING - I

UNIT - I :

Introduction to Software Engineering : The evolving role of software, Changing Nature of Software, Software myths.

A Generic view of process : Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

UNIT - II :

Process models : The waterfall model, Incremental process models, Evolutionary process models, The Unified process. **Software Requirements :** Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

UNIT - III :

Requirements engineering process : Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

System models : Context Models, Behavioral models, Data models, Object models, structured methods.

UNIT - IV :

Design Engineering : Design process and Design quality, Design concepts, the design model.

Reference Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition.McGrawHill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson education.
3. Software Engineering- K.K. Agarwal & Yogesh Singh, New Age International Publishers
4. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiely.
5. Systems Analysis and Design- Shely Cashman Rosenblatt,Thomson Publications.
6. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.

B.C.A. Part II Semester IV
Paper II
SQL AND PL/SQL

UNIT - I :
CODD'S Rules, Oracle Database Objects, Sub Languages of SQL, Data types, Operators. **DDL Statement**: Creating Tables, Deriving Table from existing table, Altering, Dropping Tables. Integrity Constraints, Specifying Names for the Constraints, Viewing Integrity Constraints, Adding and Dropping Constraints. DML Statements: SELECT statement, Insert, Update, Delete, Working with Sequences and Synonyms. Built-in functions: Arithmetic, Date, Character, Conversion, Single row, Aggregate, Decode.
Joins, Set Operators and Sub queries. DCL and TCL Statements: Grant, Revoke, Commit, Rollback and Savepoints.

UNIT - II :
VIEWS: Creating Views, Dropping Views, Inserting, Updating and Deleting Data using Views, Types of Views. PL/SQL Programming: PL/SQL Data Types, Identifiers, Operators and Expressions, Iterative Statements, Conditional Statements, emphasis on Problems

UNIT - III :
Exception Handling : Predefined Exceptions, User defined Exceptions. Cursors: Declaring Cursors, Opening and Retrieving Records, Closing cursors. Attributes of Explicit and Implicit Cursors, Parameter Passing in Cursors. Procedures : Create and Drop Procedure, Creating Procedures with Parameters, Calling Procedures, Granting the EXECUTE Permission Problems on Exception Handling, Cursors and Procedures.

UNIT - IV :
Function: Creating and Dropping Function, Purity Levels in Functions, Executing Functions. **Triggers:** Create Triggers, Type of Triggers, Creating BEFORE and AFTER Triggers, INSTEAD-OF Triggers, Trigger Predicates, Inserting, Updating and Deleting Triggers, Enabling , Disabling and Dropping Triggers. Problems on Functions and Triggers

Reference Books:

1. Understanding ORACLE By Ivan Bayross [BPB Publication]
2. Database System Using Oracle: A Simplified Guide to SQL & PL-SQL: Nilesh Shah, PHI Publication.
3. Database Management Systems (Complete practical approach) by Sharad Maheshwari & Ruchin Jain, Firewall media
4. Dr. P.S.Deshpande SQL & PL/SQL for Oracle 10g Black Book
5. Scott Urman Programming PL/SQL TMH

B.C.A. Part II Semester IV
Paper III
THEORY OF COMPUTATION

UNIT - I :
Finite Automation and Regular Expression : Finite State systems, Basic Definitions, Non -deterministic finite Automata, Finite Automata with moves, Regular Expressions, Two way finite automata, Finite automata with output, Application on Finite Automata.

UNIT - II :
Properties of Regular Sets : The pumping lemma for Regular Sets, Close properties of Regular sets, Decision Algorithms for Regular Sets. Context Free Grammars, Context Free Grammar, Derivation Tree,

UNIT - III :
Simplification of context Free Grammars, Chomsky Normal form, Greibach normal form, The existence of inherently ambiguous context free languages. Properties of Context free languages : The pumping lemma for CFL's , Closure properties of CFL's,

UNIT - IV :
Push Down Automata : Informal description, Definitions, Push – Down Automata & Context free languages.

Reference Books:

1. Introduction to Automata Theory, Languages and Computation: John E. Hoperott & Jeffery D. Ullman
2. Theory of Computer Science : E. V. Krishmamoorty. .
3. Theory of computer Science : K. L. P. Mishra.

B.C.A. Part II Semester IV
Paper IV
OPERATIONS RESEARCH - II

UNIT - I :
Game Theory – Terminologies of Game Theory, Two Person Zero-Sum Games, The Maximin-Minimax Principle, Games without Saddle points-Mixed Strategies, Graphical Solution of 2x n and m x 2 games, Dominance Property. Introduction, Decision under Certainty, Decision under Risk, Decision under Uncertainty,
Decision Tree.

UNIT - II :
Network Scheduling by CPM/PERT – Introduction, Basic Concept,
Constraints in Network, Critical Path Method (CPM), PERT Network, PERT calculations, Time-Cost trade-off aspects in Network Technique, Advantage of Network (PERT/CPM).

UNIT - III :
Inventory Control
Introduction, Inventory Control, Selective Control Techniques, Types of Inventory, Economic Lot Size Problem, Problem of EOQ with shortage, Inventory Control Techniques – Uncertainty Demand, Stochastic Problem, Inventory Control with Price Breaks.

UNIT - IV :
Queuing Theory
Introduction, Terminologies in Queuing System, Characteristics of Queuing System, Poisson Process and Exponential Distribution, Classification of Queues, Definition of Transient and Steady states, Poisson Queues, Non-Poisson Queuing Systems, Cost-Profit Models in Queuing, Queuing Control.

Reference Books:
1. Operation Research by Kanti Swarup, P. K. Gupta, Man Mohan [Sultan]
2. Operation Research by R. Panneerselvam [PHI}
3. Introduction to Operation Research by Billy E. Gillet [TMH]
4. Operation Research by Hira Gupta
5. Operation Research Problems and Solutions by Sharma J. K. [MacMillan]
6. Operation Research Theory and Application by Sharma J. K., [MacMillan]

B.C.A. Part II Semester IV

Paper V

WEB TECHNOLOGY - II

UNIT - I :

Introduction, JSP lifecycles, Elements in JSP Pages , values and variables, operators, loops and various statements in java script, Date object, Math object, string object, window events, working with forms, document object, screen object, navigator object, images and animation.

UNIT - II :

Java script objects, Implicit JSP Objects, JSP Object scopes, JSP Tags, Declarations, Directives, JSP Tags, JSP Exceptions, Expressions, Scriptlet, Actions, Expression Language, JSP Standard Tag library, JSP Custom Tag library, Java Script security.

UNIT - III :

VB Script:

Adding VB Script code to HTML, Adding script to your document, Data types, Arrays in script, Messages, Subroutines, functions, if..then..else, for..next loop, do while or do until, Select case construct, Manage your web site with Task and Reports : Keep track of work eith tasks, Check your site with your web site report, Publishing web site to a WPP host server.

UNIT - IV :

Web Services :

Ev0lution of the concept, Purpose, standards, Use cases, programming models, SOAP Based web services, WSDL,, SOAP, Structure of SOAP messages, REST based Web Services, REST principles, Resource Orientation, SOAP vs. REST.

Reference Books:

1. Internet and web design by R Bangia, Second edition , firewall media
2. Multimedia and Wed technology by R Bangia
3. Internet and web designing by ITELS (Macmillan)
4. Web Enabled Commercial Application Development Using HTML, DHTML, JS, Perl by Ivan Bayross
5. Deitel, Deitel & Nieto, Internet and Worldwide Web how to Program, Pearson
    a. Education, PHI.
6. Internmet Programming with VBScript and Java Script. Kathhleen Kalata, (Thomsaon Publication)
7. Programming the World Wide Web By. Robert W. Sebesta. (Pearson)
8. Web Technology Theory and Practice By: M Srinivasan (Pearson Publication)

B.C.A. Part II Semester IV

Paper VI

DIGITAL ELECTRONICS – II

UNIT - I :

Combinational / Sequential Circuits

Combinational circuits: Half adder, Full Adder, Parallel adder, Half subtractor, Full Subtractor, 4-bit binary adder subtractor, Multiplexer, Demultiplexer, Decoder, Encoder, Parity detector.

UNIT - II :

Sequential Circuits: Flip-Flops : Construction and working of RSFF, CkRSFF, DFF, TFF, JKFF, and JKMSFF . **Counters:** Construction and working of asynchronous, synchronous, up-down counter, shift registers and their types.

UNIT - III :

Architecture of 8086 and Assembly Language Programming Block diagram of 8086, Pin diagram of 8086, Addressing modes,

UNIT - IV :

Instruction set: Data transfer, Arithmetic, Logical, String manipulations, Control Transfer, Unconditional branch, Conditional branch, Flag, Processor control. Assembler directives and operators, simple assembly programs.

Reference Books:

1. Digital Electronics by Gothman(PHI)
2. Digital and analogue technique by Navaneeth, Kale and Gokhale
3. Fundamental of Microprocessor by B Ram
4. Microcomputers Systems: The 8086/8088 family by Liu. Gibson
5. Introduction to Microprocessor by Duglas V Hall (McGraw Hill.)

B.C.A. Final Semester V

Paper I

COMPUTER GRAPHICS - I

UNIT - I :

Introduction and Primitives

Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices

UNIT - II :

Output primitives : Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms .

UNIT - III :

2D Transformations

2-D geometrical transforms : Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

UNIT - IV :

2-D viewing : The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

Reference Books:

1. "Computer Graphics Principles & practice", second edition in C, Foley, VanDam, Feiner and Hughes, Pearson Education.
2. "Computer Graphics", second Edition, Donald Hearn and M.Pauline Baker, PHI/Pearson Education.
3. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
4. "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
5. Computer Graphics, Amrendra N Sinha,Arun D Udai TMH
6. Computer Graphics, Steven Harrington, TMH

B.C.A. Final Semester V
Paper II
COMPILER CONSTRUCTION

UNIT - I :
Compilers and translators, need, the structure of a compiler, Lexical Analysis, Syntax analysis, Intermediate code Generation, Optimization, Code Generation, Book keeping, Error Handling

UNIT - II :
High Level programming languages, Definitions of programming languages, The lexical and syntactic structure of a language, Data elements, structures, Operators, Assignment Statements, Data Environments, Parameter transmission, Storage management.

UNIT - III :
The role of the lexical analyzer, Approach to the design of lexical analyzer, Implementation of lexical analyzer, Context free grammars, Derivations and parse trees, Ambiguous grammar.

UNIT - IV :
Parsers, Shift-reduce parsing, Operator precedence parsing, Top-down parsing, predictive parsers, Symbol Table , Code Optimization: The principal source optimization, Loop optimization, The DAG representation of basic blocks, Code Generation : A machine model, a simple code generator, Register Allocation and assignment.

Reference Books:

1. Principles of Compiler Design - A.V. Aho, J. D.Ullman : Pearson Education.
2. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.
3. Engineering a Compiler-Cooper & Linda, Elsevier.
4. Compiler Construction, Louden, Thomson.

B.C.A. Final Semester V

Paper III

VB.NET

UNIT - I :

VB.NET

Introduction to .Net, The .NET framework, The .NET Programming Framework, .NET Language, The Class .NET Library, Vb.NET, Windows Application using VB .NET

Class: Creating a New Class, defining and using a New Object, Constructor & Destructor

Inheritance: Inheritance Properties and Methods, Inheriting Constructors, Overriding Methods, Creating a Derived Class

UNIT - II :

Interface Design & Implement: Abstraction & Interfaces on Object Oriented Software Design, Interface & Inheritance, Realizing the benefits of Interfaces, Implicit Interface, Explicit Interface – Abstract Class of Explicit Interface, Implementing Interfaces – Interface Implementation Semantics, Implementing ICloneable, Implementing IComparable, Accessing & using the Implement, Compound Interfaces

UNIT - III :

User Interface: Helper Forms, Message Process, Dialog Process, Owned Forms

Menus: Creating a Menu, Functionality to the Menu Items, Enhancing the Menu, Disabling Items on the Windows Form Menus, Creating Context Menu – Step by Step, Add Functionality to the Menu Items

Toolbar: Adding the Toolbar and buttons, Defining an Icon for the Toolbar and Buttons, Defining an ICON for a Toolbar Button, Adding Functionality to the Toolbar

MDI Application: The Basics, Building an MDI Application, Building – In Capabilities of MDI Applications, Accessing Child Forms, Ending an MDI Applications, A Scrollable PictureBox

UNIT - IV :

Advanced Interface Patterns, Adapters, Delegates & Events: Adapters & Wrappers, Interfaces Adaptation in Action – COM - .NET interop, The Adapter Pattern in .NET, The Adapter Pattern Event – Model, Delegates – Understanding Delegates, Declaration of the Delegates, Early Bound Delegates Declares, Late Bound Delegates Declares, Sorting Data with Delegates, Multicast Delegates, .NET Framework Event Model – Delegates & Events, Delegates Events verses Adapter Events, Delegates verses Function Pointers

Error Handling & Prevention: Types of Errors – Design Time Error, Runtime Error, Logic Error

Structured Exception Handling: Exception Structured verses Unstructured Exception Handling, Try……Catch…..Finally Statement, Exception Class.

Debugging: Break Mode, Starting Debugging, Controlling the Flow during Debugging, Debugging Tools

Reference Books:

1. Evangelos Petroutsos, Mastering Visual Basic 6.0 BPB Publication.
2. John Smiley Learn Program with Visual Basic 6
3. Wallace Wang Visual Basic 6 for Dummies (for Windows)
4. VISUAL BASIC 6 COMPLETE REFRENCE (TMH PUB)
5. Deitel & Deitel Visual Basic 6 (Pearson Education)
6. Bradly, VB.Net TMH

B.C.A. Final Semester V

Paper IV

SOFTWARE ENGINEERING - II

UNIT - I :

Creating an architectural design : Software architecture, Data design, Architectural styles and patterns, Architectural Design.

UNIT - II :

Testing Strategies : A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging.

UNIT - III :

Product metrics : Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.

Metrics for Process and Products : Software Measurement, Metrics for software quality.

UNIT - IV :

Risk management : Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

Quality Management : Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.

Reference Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition.McGrawHill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson education.
3. Software Engineering- K.K. Agarwal & Yogesh Singh, New Age International Publishers
4. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiely.
5. Systems Analysis and Design- Shely Cashman Rosenblatt,Thomson Publications.
6. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.

B.C.A. Final Semester V

Paper V

PHP - I

UNIT - I :

Introduction to PHP: What Does PHP Do, A Brief History of PHP, Installing PHP, A Walk Through PHP Language **Basics:** Lexical Structure, Data Types, Variables, Expressions and Operators, Flow-Control Statements, Including Code, Embedding PHP in Web Pages, Installing and Configuring PHP on Windows and Linux Platforms

UNIT - II :

Functions: Calling a Function, Defining a Function, Variable Scope, Function Parameters,
Return Values, Variable Functions, Anonymous Functions, Strings: Quoting String Constants, Printing Strings, Accessing Individual Characters, Cleaning Strings, Encoding and Escaping, Comparing Strings, Manipulating and Searching Strings, Regular Expressions, POSIX-Style Regular Expressions, Perl-Compatible Regular Expressions,

UNIT - III :

Arrays: Indexed Versus Associative Arrays, Identifying Elements of an Array, Storing Data in Arrays, Multidimensional Arrays, Extracting Multiple Values, Converting Between Arrays and Variables, Traversing Arrays, Sorting, Acting on Entire Arrays, Using Arrays

UNIT - IV :

Reading data in web pages: Setting Up Web Pages to Communicate with PHP, Handling Text Fields, Text Areas, Check Boxes, Radio Buttons, List Boxes, Password Controls, Hidden Controls, Image Maps, File Uploads. **Handling Buttons:** Making Button Data Persist, Using Submit Buttons as HTML Buttons.

Reference Books:

1. PHP 5.1 for beginners by Evan Bayross and Sharman Shah, SPD Publications
2. PHP 5.2 The Complete Reference by Steven Holzner, Mc Graw Hill Edition 2008.
3. Programming PHP by Rasmus Lerdorf and Kevin Tatroe, Orilly Publications

B.C.A. Final Semester V

Paper VI

DATA COMMUNICATION AND NETWORK - I

UNIT - I :

Data Communication

Data Transmission- Concept and Terminology, Analog & Digital Data Transmission, Transmission Impairment, Transmission Media.

Data Encoding- Digital Data, Analog Data, Digital Signal, Analog Signal.

UNIT - II :

Digital Data Communication: Asynchronous and Synchronous transmission, Error detection technique, Interfacing.

Data Link Control: Line configurations, Flow control, Error control, Data link control protocols. Multiplexing-Frequency division multiplexing, Synchronous Time Division Multiplexing.

UNIT - III :

Circuit Switching: Communication Networks, Circuit switching, Single Node network, Digital switching concept, Control Signaling.

UNIT - IV :

Packet Switching: Packet switching principles, Virtual circuits and diagrams, Routing, Traffic control, X.25. LAN & MAN- LAN,MAN technology, Bus, Tree, Star and Hybrid Topologies, Optical fiber Bus, Ring Topology, Medium Access Control Protocols, LAN/MAN standards.

Reference Books:

1. William Stalling, Data and Computer Communication, PHI Publication.
2. Forouzan, Data Communication and Networks, Tata McGraw Hill.
3. Godbole, Data Communication and Network, TMH
4. Tanenbum, Computer Networks , ,PHI Publication.
5. Comer Internetworking with TCP/IP Vol-1, PHI Publication

B.C.A. Final Semester VI

Paper I

COMPUTER GRAPHICS - II

UNIT - I :

3D Transformations

3-D object representation : Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods.

UNIT - II :

3-D Geometric transformations : Translation, rotation, scaling, reflection and shear transformations, composite transformations.

3-D viewing : Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping

UNIT - III :

Visible surface detection methods : Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods

UNIT - IV :

Computer animation : Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

Reference Books:

1. "Computer Graphics Principles & practice", second edition in C, Foley, VanDam, Feiner and Hughes, Pearson Education.
2. "Computer Graphics", second Edition, Donald Hearn and M.Pauline Baker, PHI/Pearson Education.
3. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
4. "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
5. Computer Graphics, Amrendra N Sinha,Arun D Udai TMH
6. Computer Graphics, Steven Harrington, TMH

B.C.A. Final Semester VI

Paper II

PROGRMMING IN JAVA

UNIT - I :

Introduction to Java: -History of Java, features of Java, getting started with Java. **Java programs**:-Introduction of Application & Applets. **Variables**: -Variable naming, variable initialization, assign values, Rules of variables, Scope of variable. **Operators**: - Arithmetic, Assignment, Unary, Comparison, Shift, Bit- Wise, Logical, Conditional, New, Special, Relational. Data types:-Integers, Char, String, Float etc. Typecasting: **Tokens**: -Java tokens Order of precedence of operators Streams: - Input and output.

UNIT - II :

Creating a class & subclass: -Declaring a class, Naming class, Rules to assign Class & Subclass, Creating a new object, Class of an object. **Data members**: -Declaring data member, Naming variables, using class members. **Methods**: -Using data members, Invoke a method, passing arguments to a method, calling method. **Access Specifier & Modifiers**: -Public, Private, Protected, Static & Final. **Overloading**: -Method overloading, Constructor overloading. **Java class library**: - Different types of classes. **Decision making & loops**:-If-then-else, Switch,? : operator, While-loop, do-while loop, for. **Array**: -Creating an array, one-dimensional array, two-dimensional array. **String**: - String array, string methods. **Inheritance**: -Single & multiple inheritances **Interfaces**: - Defining interfaces, extending interfaces, implementing interfaces.

UNIT - III :

Packages: -Java API packages, creating packages, accessing packages, adding a class to packages. **Import statement**: - Introduction & implementation of import statement. **Applets**:-Introduction to Applets & Application, how applets application are different creating An applet. Applets life cycle, designing a web page, creating an executable applet, running the applet, applet tags, passing a parameter to applet, HTML tag, Converting applet to application. **Threads**:-Overview of threads, single & multiple threads, lift cycle of threads, stopping & blocking threads, working with threads, priority to thread, synchronization. **Exceptions & Errors**:-Introduction, types of error, exception, syntax of exception, handling techniques, exception for Debugging.

UNIT - IV :

Event: -Event driven programming**,** handling an (AWT) events**. Graphic class:-** Introduction, the graphic classes, drawing & filling of lines, rectangle, circle & ellipse, arcs, polygons, text & fonts, creating a font class, font objects, text, coloring object. **Streams:**-Introduction, Abstract stream classes, file input & output. **AWI Applications**: -Creating a GUI using AWT toolkit, using component class, frames. **Components & Control: -**Textfield, textarea class, label, button, choice, list, checkbox, class, and combo. **Menus: -**Creating a popup menus. **Image**: - Type of image, Properties of an image, Displaying an image. **Layouts**: -Using Window Listener interface, Different types of Layout, Layout manager, Flow manager, Grid manager. **Container**: -Different types of container (Frame, Dialog, Panel)

Reference Books:

1. Programming with Java a primer II edition:-E Balaguruswamy(Tata McGraw-Hill)
2. Java Programming (For absolute beginners) Russell PHI
3. Black Book on Java
4. Java-Complete References

B.C.A. Final Semester VI

Paper III

ASP.NET

UNIT - IV :

Introduction to XML

Introduction to XML, creating DTD,elements and attributes definitions.XML schema.Defining simple and complex types.Namespaaces,Schemas and validation. Cascading style sheets(CSS) L and XML, Anatomy of a style,creating and calling style sheets for an XML/HTML document.Layout with CSS. Setting up various properties of elements using CSS.Formatting text with CSS,XML schemas, writing Simple sheets using XSLT,SAX and DOM Parsers, SOAP introduction.

UNIT - II :

Introduction to ASP .NET

Inroduction to ASP .Net, Types,Object and Namespaces, Setting up ASP .NET and IIS,ASP .NET configuration, ASP .NET Application,Web form Fundamentals, Web Controls,Global.asax Application File,Responding to PostBack Events in ASP .NET.

UNIT - III :

ASP .NET Validations and Rich Controls:Calendar Control,AdRotator,Advertisement File and AdRotator Class, Server-side Validation,Client –side Validation,Validation Controls,Validated Customer Form.Stat Management, Tracing,Logging and Error Handling.

UNIT - IV :

Accessing Data with ADO.NET Relational Databases and SQL,ADO .NET Object model, Working with Data –Bound Controls, Populating a DataGrid, DataList and Repeater, Customizing DataSet and Combining Data Tables,Changing Database records accessing,Updating,Deleting and Creating records, Difference between ADO .NET and XML,Adding Controls, Data binding, Database Connectivity.

Reference Books:

1. Biginning XML By Wrox Press
2. XML how to program By Deitel and Deitel
3. Web Enabled Commercial Application Develeopement using HTML, DHTML, JAVA Script, and PERL-CGI By Ivan Bayross
4. The Complete Reference By Thomas Powell Tata MacGraw Hill
5. ASP .NET-The Complete Reference Tata MacGraw Hill

B.C.A. Final Semester VI

Paper IV

SOFTWARE TESTING

UNIT - I:

Introduction: Testing as an Engineering Activity, Testing as a Process, testing axioms, Basic Definitions Software Testing Principles, The Tester's Role in a Software Development Organization, Origins of Defects, cost of defects, Defect Classes, The Defect Repository and Test Design, Defect Examples, Developer/Tester Support for Developing a Defect Repository, Defect Prevention Strategies.

UNIT - II:

Test Case Design : Test Case Design Strategies, Using Black Box Approach to Test Case Design, Random Testing, Requirements based testing, Boundary Value Analysis, Decision tables, Equivalence Class Partitioning, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, User documentation testing, Domain testing

Using White Box Approach to Test design, Test Adequacy Criteria, static testing vs. structural testing, code functional testing, Coverage and Control Flow Graphs, Covering Code Logic, Paths, Their Role in White–box Based Test Design, code complexity testing, Evaluating Test Adequacy Criteria.

UNIT - III:

Levels Of Testing : The Need for Levels of Testing, Unit Test, Unit Test Planning, Designing the Unit Tests, The Test Harness, Running the Unit tests and Recording results, Integration tests, Designing Integration Tests, Integration Test Planning, Scenario testing, Defect bash elimination.

System Testing, Acceptance testing, Performance testing, Regression Testing, Internationalization testing, Ad-hoc testing - Alpha , Beta Tests, testing OO systems, Usability and Accessibility testing, Configuration testing, Compatibility testing, Testing the documentation, Website testing

UNIT - IV:

Test Management : People and organizational issues in testing, organization structures for testing teams, testing services, Test Planning , Test Plan Components, Test Plan Attachments, Locating Test Items – test management, test process, Reporting Test Results, The role of three groups in Test Planning and Policy Development, Introducing the test specialist, Skills needed by a test specialist, Building a Testing Group.

Reference Books:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson education, 2006.
2. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
3. Ron Patton, " Software Testing", Second Edition, Sams Publishing, Pearson education, 2007
4. Renu Rajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw Hill, 2004.
5. Edward Kit, "Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
6. Boris Beizer, "Software Testing Techniques" – 2nd Edition, Van Nostrand Reinhold New York, 1990.
7. Aditya P. Mathur, "Foundations of Software Testing – Fundamental algorithms and techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

B.C.A. Final Semester VI

Paper V

PHP - II

UNIT - I :

PHP Browser-Handling Power: Using PHP's Server Variables, Using HTTP Headers, Getting the User's Browser Type, Redirecting Browsers with HTTP Headers, Dumping a Form's Data All at Once, Handling Form Data with Custom Arrays, Putting It All in One Page.

Data Validation: Performing Data Validation, Checking if the User Entered Required Data, Requiring Text, Persisting User Data, Client-Side Data Validation, Handling HTML Tags In User Input.

UNIT - II :

Classes and Objects: Terminology, Creating an Object, Accessing Properties and Methods, Declaring a Class, Introspection, Serialization, Web Techniques: HTTP Basics, Variables, Server Variables, Server Information, Processing Forms, Setting Response Headers, Session, cookies, files, Maintaining State, SSL.

UNIT - III :

Working With Database: Using PHP to Access a Database: Relational Databases and SQL, Mysql database Basics, Execute SQL Queries In PHP, Accessing The Database In PHP: Connecting To The Database, Reading, Displaying, Closing Connection, Database Manipulation: Inserting, Updating, Sorting and Deleting Records. Advanced Database Techniques.

UNIT - IV :

Setting a Cookie, Reading a Cookie, setting cookies Expiration, Deleting Cookies. Working with FTP: Downloading with FTP, Uploading files with FTP, Deleting a file with FTP, Creating and Removing Directories with FTP, Sending E-mail, Advanced E-mail, Adding Attachments to E-mail, Storing Data in Sessions, Writing a Hit Counter Using Sessions. PHP Code,
Shell Commands.

Reference Books:

1. PHP 5.1 for beginners by Evan Bayross and Sharman Shah, SPD Publications
2. PHP 5.2 The Complete Reference by Steven Holzner, Mc Graw Hill Edition 2008.
3. Programming PHP by Rasmus Lerdorf and Kevin Tatroe, Orilly Publications

B.C.A. Final Semester VI

Paper VI

DATA COMMUNICATION AND NETWORK - II

UNIT - I :

Communication Architecture

Protocols & Architecture: Protocols, The Layers Approach, OSI Model, TCP/IP protocol suite, System Network Architecture.

Internetworking: Principles of Internetworking, Bridges, Routers, Repeaters, Gateways, Connection Oriented Internetworking, Connectionless Internetworking, Connectionless Internetwork Protocol, Router-level protocol.

UNIT - II :

Transport Protocols- Transport services, Protocol Mechanism, Network services, ISO Transport Standards, TCP, UDP, TCP and UDP Packet format, Lightweight Transport Protocol.

UNIT - III :

Session Services & Protocols- Session Characteristics, OSI Session Services, Definition, OSI Session Protocol definition. DNS, FTP, HTTP.

UNIT - IV :

Digital Network

ISDN & Broadband ISDN : Overview of ISDN, Architecture and Interfaces of ISDN, Transmission structure, User Access, ISDN protocols, Broadband ISDN(B-ISDN).

Reference Books:

1. William Stalling, Data and Computer Communication, PHI Publication.
2. Forouzan, Data Communication and Networks, Tata McGraw Hill.
3. Godbole, Data Communication and Network, TMH
4. Tanenbum, Computer Networks, PHI Publication.
5. Comer Internetworking with TCP/IP Vol-1, PHI Publication

Rashtrasant Tukadoji Maharaj
Nagpur University, Nagpur

Detail Syllabus for

Bachelor of Vocation

(B.Voc)

Skill Development Component

Software Development

(Faculty of Science & Technology)

(WITH EFFECT FROM 2020-2021 ONWARDS)

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
(Semester I)
Paper – I
Computer Fundamentals & Networking

NSQF : LEVEL - 4

JOB ROLE : JUNIOR SOFTWARE DEVELOPER

Title	Details
Brief Job Role Description	Individuals in this job are assigned one of the many entry level roles in the software industry including support and help desk, testing, user interaction design, maintenance, enhancement, development and documentation. They are responsible for assisting in performing the key activities and tasks involved in the assigned role.
Knowledge Description	To be competent, you must be able to: 1. demonstrate basic computer and internet literacy including operating a computer, describing its major components and how they work, using Windows and Linux OS, operating a browser, searching the internet, managing mails and using social internet media. 2. demonstrate aptitude for analyzing information and making logical conclusions. 3. demonstrate knowledge of the foundational mathematical concepts in computing. 4. design algorithms to solve problems and convert them into code using the appropriate programming language constructs. 5. read and execute a test case and record the outcome in the appropriate template. 6. be able to communicate effectively with appropriate people w.r.t. assigned roles in simple English – both oral and written.

UNIT - I:

Basic Components of Digital Computers: Block Diagram, Types: Digital, Analog, Hybrid. Generation of Computers.

Number Systems: Binary, Octal, Decimal, Hexa Decimal, their Conversions, Binary Arithmetic, ASCII, BCD, EBCDIC**.**

Generation of Languages: Machine, Assembly, High Level Languages.

Translators: Compiler, Interpreter and Assembler, Source and Object Program.

UNIT - II:

Memory: Static & dynamic, RAM, ROM, PROM, EPROM, EEPROM, flash and Cache.

Storage Devices: Hard Disk, Zip Disk and Optical Disk, Pen Drive, Blu Ray.

Input Devices: Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner.

Output Devices: VDU, Printers: Dot Matrix, Laser and Inkjet.

Plotters: Drum, Flat-Bed and Inkjet.

UNIT - III:

DOS and WINDOWS OPERATING SYSTEMS:

Introduction to OS: Functions and Classification,

DOS: warm booting & cold booting, Types of commands: Internal & External, command format, directory, file management, disk management and general commands, file naming conventions, dos editor, batch file.

WINDOWS OS: Introduction & features

MODULES : Program, File and Print Managers, Control Panel, Icons, switching between applications, running MS Dos application , Help and Recycle bin.

Windows accessories : Notepad, Paint and Calculator.

UNIT - IV:

Network: Network terminology, Topologies: Linear, Circular, Tree and Mesh.

Types of Networks: LAN, WAN, MAN. Repeaters, Bridge, Routers, Brouters and Gateway. Modem for Communication between pc's, wi-fi network, Introduction of Bluetooth and Infrared devices.

Network Protocol Architecture : OSI Model & their layers ,TCP/IP Model & their layers, Addressing in TCP/IP

Internet: Brief history of internet, World Wide Web, Websites, URL, Browsers, Email & its features.

Reference Books:

1. Information technology concepts by Dr. Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology by Alexis And Mathews Leon [Leon Press, Chennai & Vikas Publishing House Pvt. Ltd., New Delhi]
3. Computer Fundamentals by P. K. Sinha.
4. Data Communications & Networking by B. A. Forouzan.
5. Data & Computer Communications by William Staliings.

List of Practical's:

Sr. No.	List of Practical's
1	Demonstrate the working of following General Purpose commands in Disk Operating System 1. CLS 2. VER 3. VOL 4. DATE 5. TIME
2	Demonstrate the working of DIR commands along with the switches used with the command in Disk Operating System
3	Demonstrate the working of following File Management Commands in Disk Operating System 1. COPY CON 2. TYPE 3. COPY 4. REN 5. DEL
4	Demonstrate the working of following Directory Management Commands in Disk Operating System 1. MD 2. CD 3. RD
5	Demonstrate the working of following External commands in Disk Operating System 1. MORE 2. MEM 3. SYS 4. XCOPY 5. MOVE 6. FC 7. CHKDSK 8. SORT 9. FIND 10.DISKCOPY
6	Demonstrate the Working of Recycle Bin in Windows Operating System a)Restore a Single deleted file from recycle Bin b)Restore all deleted files from Recycle Bin c)Empty recycle bin d)Resizing Recycle Bin
7	Demonstrate the use of wildcard Character in DOS.
8	Demonstrate Calculator Facilities in Windows Accessories. a)Using Simple Calculator b) Using Scientific Calculator.
9	Demonstrate Notepad Facilities in Windows Accessories. a)Creating Simple Text file b) Creating Batch file.
10	Demonstrate Paint Facilities in Windows Accessories. Draw a picture using all the tools in the tool box.
11	Demonstrate the Display Properties of Control Panel. a)Change The Wallpaper of the desktop to image sunset.jpeg b) Set The Screen Saver of the desktop to time duration 1 min.
12	Demonstrate the Search Option in Windows Operating System.
13	Demonstrate the use of shortcut facility in Windows Operating System.

	a)Creating Shortcut b)Renaming Shortcut c) Deleting Shortcut.
14	Demonstrate the Disk Clean up utility in Windows Accessories.
15	Demonstrate the MS-editor of Disk operating System. a) Create a BAT file using Editor and run that file through command prompt.
16	Demonstrate Backup Status and Configuration Utility of Windows Accesories.
17	Demonstrate the use of add or remove hardware utility of control panel. A CD is provided for printer installation. Install printer using control panel.
18	Demonstrate user account facility of control panel. a) Create an account name "Students" b) Assign limited privileges to user "Students"
19	Set the home page of default browser to "http:\\www.dbscience.org" Using network and internet connection facility of control panel.
20	Demonstrate user account facility of control panel. a)Create an account name "Admin" b) Assign system administrator privileges to user "Admin" c) Create a password "dbsciorg" for user "Admin"
21	Explain Network Devices in detail a) Repeater b) Bridge c) Router d) Gateway
22	To study Bluetooth technology

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
(Semester I)
Paper – II
C Programming

NSQF : LEVEL - 4

JOB ROLE : JUNIOR SOFTWARE DEVELOPER

Title	Details
Brief Job Role Description	Individuals in this job are assigned one of the many entry level roles in the software industry including support and help desk, testing, user interaction design, maintenance, enhancement, development and documentation. They are responsible for assisting in performing the key activities and tasks involved in the assigned role.
Knowledge Description	To be competent, you must be able to: 1. demonstrate basic computer and internet literacy including operating a computer, describing its major components and how they work, using Windows and Linux OS, operating a browser, searching the internet, managing mails and using social internet media. 2. demonstrate aptitude for analyzing information and making logical conclusions. 3. demonstrate knowledge of the foundational mathematical concepts in computing. 4. design algorithms to solve problems and convert them into code using the appropriate programming language constructs. 5. read and execute a test case and record the outcome in the appropriate template. 6. be able to communicate effectively with appropriate people w.r.t. assigned roles in simple English – both oral and written.

UNIT- I:

Problem Solving: Problem Identification, Analysis, Flowcharts, algorithms and Pseudocode, Flowcharting symbols, Converting algorithms to flowcharts.

Control structures : Sequence, Selection, Iteration & Modular.

UNIT- II :

Introduction to C: Character set, C Tokens, Identifier, Keywords, Variables**,** Data types, Constants, Operators and Expressions, Character Strings, Enumerated Data Types, Operator Precedence and Associativity.

Decision making & Branching: if, if..else, nesting of if..else if..else ladder, switch statement, goto statement.

Decision making & Looping: while loop, do while, for loop, Nested loops.

UNIT- III:

Arrays: Single and Two Dimensional Array.

Strings: Strings Manipulation, Arrays of Strings.

Functions: Definition, Return values & their types, function call, recursion, passing Arrays to Functions, Storage classes.

UNIT- IV:

Structure: Declaration, Accessing structure members, Structure initialization, Structure & Functions, Array of Structures.

Union: Unions, Differences between Structure and Union.

Pointer: Introduction, accessing the address of variable, declaring & initializing pointer variables, accessing variables through pointers, void pointers.

File management in C: Introduction, Defining & Opening a file , closing a file, Input/Output operations on file, Random Access to files, Command Line arguments.

Reference Books:

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming - Kernighen and Ritche.
4. Let us C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.
7. Programming in C by Kamthane Ashok.

List of Practical's:

Sr. No.	List of Practical's
1	A five digit number is input through a keyboard. Write a program in C to reverse the number and to determine whether the original and reversed numbers are equal or not.
2	WAP in C to determine whether the pressed key is upper case letter or lower case letter or digits or any special symbol by using following table. Character ASCII Values A-Z 65-95 a-z 97-120 0-9 48-57
3	Program to compute Sine and cosine series : sin x = x- x^3/3!+ x^5/5! –x^7/7! + ---------
4	WAP in C to find if a given no. is prime or not
5	WAP in C to compute Fibonacci series
6	WAP in C to insert an element in one dimensional array at a given position
7	WAP in C to delete an element from one dimensional array
8	WAP in C to search the element in an array of N element using Linear search.
9	WAP in C to search the element in an array of N element using Binary search.
10	WAP in C to multiply a 3*3 matrix.
11	WAP in C to find largest element in TDA(3*3)
12	WAP in C to check if given string is palindrome or not.
13	WAP in C using function to find sum of two numbers with no argument & no return value
14	WAP in C using function to find sum of two numbers with argument & return value
15	WAP in C to factorial of a given number using recursive function
16	WAP in C to swap values of two variables by passing pointers.
17	WAP in C to add two complex no. By passing structure to a function.
18	Program to Read two integers and determine bigger of the two with the help of function big() returning an integer pointer.
19	WAP in C to create a sequential file and perform the following operation fields are Roll No., Name, M1, M2, M3. a) Process & display output.
20	WAP to accept Marks of 'N' Students in three subjects and print average and Grade of each student
21	Write a *C Program* to *reverse the* entered *string* from *command line* arguments

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
(Semester II)
Paper –I
OPERATING SYSTEM CONCEPTS & LINUX

NSQF : LEVEL - 5
JOB ROLE : WEB DEVELOPER

Title	Details
Brief Job Role Description	After completing this programme, participants will be able to: Contribute to the design of software products and applications Develop media content and graphic designs for software products and Applications
Knowledge Description	To be competent, you must be able in: 1. Programming for the Web 2. Analysis and Design of Web based Applications 3. Media Content and Graphics Design

UNIT- I:

Operating system: Introduction, computer system organisation and architecture, operating system structure and functions.

Management: Process, Memory and Storage.

System structures: Operating system Services, system calls & Types of system call.

Process scheduling: Introduction, Scheduling algorithms- First Come First served scheduling, Shortest job first scheduling, Priority scheduling, Round Robin scheduling

Unit- II:

Memory management: Introduction, swapping , contigous memory allocation, paging, segmentation, Segmentation with paging.

I/O Management: I/O hardware, I/O Buffering, Disk I/O, Raid, Disk Cache.

File Management: File Management system, File Accessing Methods, File Directories, File Allocation Methods, File Space Management, Disk Space Management.

UNIT- III :

Linux OS : Introduction, Logging In and Logging Out, Anatomy of Linux OS, Directory Structure, /usr Directory, File Types.

Commands: Basic Syntax for a command, Home Directory, ls, mkdir, rmdir, stat, cat, rm, mv, cp.

Editor: Vi editor.

System: Simple Backup, gzip, gunzip, tar.

UNIT- IV:

Working with Processes: Types of processes, ps Command, Creating process, killing process, free command and top utility.

Managing Disk Space: df, du commands, Creating Additional Free Disk Space, Locating Unused Files, Setting System Clock.

Communication Utilities: who, who am i, finger, mesg, write, wall, talk.

Reference Books:

1. Operating Systems by P. Balakrishna Prasad [Scitech Publication]
2. Operating System Concepts : Silbershatz, Galvin, Gagne (Addision Education)
3. Operating Systems - H.M. Deitel - Addision Wesley.
4. Operating Systems- John J. Donoven.
5. Modern Operating Systems : Tenenenbaum. (Pearson Education)
6. SAMS Teach Yourself Linux by Craig and Coletta Witherspoon.[Techmedia]
7. LINUX complete reference by Richard Peterson.

List of Practice's

SR. NO.	NAME OF PRACTICALS
1.	Create a directory called stud. Change to the stud directory. Verify you have actually changed to stud directory. Return to your original directory. Also create a file called top. Display the first three and last three lines of the file top in the same directory.
2.	Change to stud directory. Create a directory under stud directory called "marks". Copy any two files from home directory to "marks". Delete the directory marks using –iroption. Change to home directory copy any two files from current directory to stud directory. create additional names for them.
3.	Create a directory called Target .Move any two files to directory Target. Display the contents of the above mentioned file .Remove the file .List the contents of the directory and change to home directory.
4.	Redirect the contents of ls –p to a file called dir. Give the command to redirect the output of long listing files and append it to the file dir. Change the mode of those file which begin with "s" in such a way that the owner has read and execute permission ,the group has read and write permission and others only read permission (use octadecimal representation).
5.	What command will display the list of all files starting from our current directory? Display the names of all ordinary files from the current directory and all its sub directories whose name ends in "ing" and which have been modified within last 3 days
6.	Display the details (including permission of read/write/execute) of the files /directories whose names begin with "s".Also display the contents of directories at home directory
7.	List the names of the files according to their last access time along with their creation date and time. Also give the command to extract the links, file owner and the file name only in the current directory/
8.	What is the command to display the entire text of file into uppercase and vice versa.
9.	Write Script to see current date, time, username, and current directory
10.	Write shell script to display the following details in a payslip PAY SLIP DETAILS 1.House Rent Allowance 2.Dearness Allowance 3.Provident Fund HRA is to be calculated at the rate of 20% of the basic. DAIs to be calculated 40% of the basic and PF is calculated 40% of the basic echo "Please enter your basic"
11.	How to write shell script that will add two nos, which are supplied as command line argument, and if this two nos are not given show error and its usage
12.	Write Script to find out biggest number from given three nos
13.	Write script to print given numbers sum of all digit, For eg. If no is 123 it's sum of all digit will be 1+2+3 = 6.
14.	Write script to determine whether given file exist or not, file name is supplied as command line argument, also check for sufficient number of command line argument
15.	Write shell script using for loop to print the following patterns on screen  Write script to print nos as 5,4,3,2,1 using while loop.

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
(SEMESTER-II)
Paper – II
Programming in 'C++'

NSQF : LEVEL - 5

JOB ROLE : WEB DEVELOPER

Title	Details
Brief Job Role Description	After completing this programme, participants will be able to: Contribute to the design of software products and applications Develop media content and graphic designs for software products and Applications
Knowledge Description	To be competent, you must be able in: 1. Programming for the Web 2. Analysis and Design of Web based Applications 3. Media Content and Graphics Design

Unit - I:

OBJECT ORIENTED PROGRAMMING: Object-Oriented Programming Paradigm, Basic concepts of OOPS and Benefits of OOPS.

CLASSES AND OBJECTS: Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Array of objects, friendly function .

ACCESS SPECIFIERS: Private, Protected and Public Members.

UNIT - II:

CONSTRUCTORS & DESTRUCTORS: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Dynamic Constructor, Destructor.

OPERATOR OVERLOADING: Definition, Overloadable Operators, Overloading Unary Operator, Overloading Binary Operator, Rules for Operators Overloading.

UNIT - III:

INHERITANCE: Defining derived classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, virtual base class, Abstract classes, Constructor and Destructor in Derived Classes.

DYNAMIC OBJECTS: Introduction, Pointers to Objects, this Pointer, Creating and Deleting Dynamic Objects, New and Delete operators.

UNIT - IV:

VIRTUAL FUNCTIONS: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions.

EXCEPTION HANDLING: Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Reference books:

1. Mastering C++ by K R Venugopal Tata McGraw-Hill , New Delhi.
2. The C++ Programming Language –Bjarne Stroustrup
3. Programming with C++ - Ravichandran
4. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill
5. Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, Pearson

List of Practical's

Sr. No.	List of Practical's
1.	WAP to find average of two number
2.	WAP to find no. is prime or not and factorial of a no.
3.	WAP to accept the distance between city 1st&2nd,city 2nd&3rd. Calculate the distance between city 1st &3rd. Define a class road with private data member km,m,d1,d2,d3 containing member function getdata to accept values of d1,d2 and calculate for calculating distance
4.	WAP to demonstrate nesting of member function.
5.	WAP to demonstrate static class member.
6.	WAP to demonstrate object as argument.
7.	WAP to demonstrate Class with constructors
8.	WAP to demonstrate the usage of constructor and destructor. 1) Define a class data with data member acct-no., balance constructor data to initialize data member and a member function display for output.
9.	WAP demonstrate usage of a constructor and destructor function. Declare a class with public data member count. The class containing one constructor and destructor to maintain update information about active objects i,e. 1.No. of object created. 2.No. of objects destroyed.
10.	WAP to demonstrate copy constructor
11.	WAP using function to find the sum of two no. with argument and return value
12.	WAP to demonstrate overloading Binary operators.
13.	WAP to demonstrate overloading unary minus.
14.	WAP to illustrate array of objects in classes
15.	WAP for pointer to object, pointing to dynamically created objects.
16.	WAP to implement Hierarchical inheritance using parameterized constructor in classes..
17.	WAP to illustrate hybrid inheritance.
18.	WAP to find out square and cube of given no. using multilevel inheritance
19.	WAP for Student details using multiple inheritance
20.	WAP to demonstrate a pure virtual function, and invoked from the object of derived class through the pointer of the base class.
21.	WAP to find out maximum number using This pointer.
22.	WAP to demonstrate use of virtual functions .
23.	WAP for payroll system using single inheritance
24.	WAP to perform exception handling with multiple catch.

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
(SEMESTER-III)
Paper – I
DATA STRUCTURES

NSQF : LEVEL – 6
JOB ROLE : MASTER TRAINER FOR JUNIOR SOFTWARE DEVELOPER

Title	Details
Brief Job Role Description	Master Trainer for Junior Software Developer will be accountable to train and equip students of 0 to 2 years' experience. Major responsibility being to prepare trainees and enable them to procure, and perform to a reasonable extent, at entry level jobs that exist in the IT Services Industry.
Knowledge Description	To be competent, you must be able to: 1. demonstrate basic computer and internet literacy including operating a computer, describing its major components and how they work, using Windows and Linux OS, operating a browser, searching the internet, managing mails and using social internet media. 2. demonstrate aptitude for analyzing information and making logical conclusions. 3. demonstrate knowledge of the foundational mathematical concepts in computing. 4. design algorithms to solve problems and convert them into code using the appropriate programming language constructs. 5. read and execute a test case and record the outcome in the appropriate template. be able to communicate effectively with appropriate people w.r.t. assigned roles in simple English – both oral and written.

Unit I:

INTRODUCTION: Basic principle of Data structure ,Abstract data type.

ALGORITHMS: Complexity, Time space Trade-offs.

SEARCHING TECHNIQUES: Linear search, Binary search.

SORTING TECHNIQUES: Bubble sort, Insertion sort, Selection sort, Merge sort.

HASHING : Hash Tables, Hashing Technique, Collision Resolution Technique.

Unit II:

LINKED LIST: Introduction, Representation of Linked list in memory, All possible operations on Single and Double linked List using Dynamic representation, Header linked lists.

Unit III:

STACKS : Stacks terminology, Representation of Stacks in Memory, Operation on Stacks, Polish Notations, Quick Sort-an application of stacks

RECURSION: Problems on Recursion and Tower of Hanoi Problem.

QUEUE: Introduction to queue, Linked Representation of Queue, Circular Queue, Dequeue and Priority Queues in Memory.

Unit IV:

TREES: Basic Terminologies, Representation of Binary Trees in Memory, Traversing of Binary tree, Binary Search Tree, Operation on Binary Search Tree: Searching, inserting & deleting, Heap Tree, Operation on Heap Tree, Heap Sort Method.

GRAPHS : Graph theory terminologies, Sequential representation of Graphs : Adjacency & Path Matrix, Shortest Path algorithm: Warshall's Algorithm, Linked representation of graph, Traversing graphs : BSF, DFS Method.

Reference books:

1. Classical Data Structures : D. Samanta. PHI, New Delhi.
2. DATA STRUCTURE : LIPSCTUZ SCHUM OUTLINE SERIES.
3. Data structure Using C++ : Y. Kanetkar.
4. Data Structures Using C++: Tennenbaum.
5. Handbook of Data Structures and Applications by Dinesh mehta and Sartaj sahni.

List of Practical's

Sr. No.	List of Practical's
1.	Program to insert a node at the beginning, at the end and in the middle of the given linked list.
2.	Program to delete a node at the beginning, at the end and in the middle of the given linked list.
3.	Program to create a linked list of customer names and their telephone numbers. (Using Menu Driven and include features of adding a new Customer and deleting an existing Customer.)
4.	Program to reverse a linked list.
5.	Program to search a value in the given linked list.
6.	Program to insert a node at the beginning, at the end or in the middle of a given doubly linked list.
7.	Program to delete a node from the beginning, at the end or in the middle of a given doubly linked list.
8.	Prog. to create, insert & delete a node in Circular linked list.
9.	Program to push and pop an element into / from a stack implemented using linked list.
10.	Program to push and pop an element into / from a stack implemented using Array.
11.	Program to evaluate postfix expression.
12.	Program to sort an array using quick sort.
13.	Program to solve Towers of Hanoi problems using recursion.
14.	Program to perform insertion and deletion operation in linear queues.
15.	Program to perform insertion and deletion operation on circular queues.
16.	Program to sort an array using Insertion sort.
17.	Program to sort an array using Selection sort.
18.	Program to insert an element in a binary search tree.
19.	Program to traverse inorder of a binary tree.
20.	Program to traverse preorder of a binary tree.
21.	Program to traverse postorder of a binary tree.

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
Semester III
Paper – II
Web Designing

NSQF : LEVEL – 6
JOB ROLE : MASTER TRAINER FOR JUNIOR SOFTWARE DEVELOPER

Title	Details
Brief Job Role Description	Master Trainer for Junior Software Developer will be accountable to train and equip students of 0 to 2 years' experience. Major responsibility being to prepare trainees and enable them to procure, and perform to a reasonable extent, at entry level jobs that exist in the IT Services Industry.
Knowledge Description	To be competent, you must be able to: 1. demonstrate basic computer and internet literacy including operating a computer, describing its major components and how they work, using Windows and Linux OS, operating a browser, searching the internet, managing mails and using social internet media. 2. demonstrate aptitude for analyzing information and making logical conclusions. 3. demonstrate knowledge of the foundational mathematical concepts in computing. 4. design algorithms to solve problems and convert them into code using the appropriate programming language constructs. 5. read and execute a test case and record the outcome in the appropriate template. be able to communicate effectively with appropriate people w.r.t. assigned roles in simple English – both oral and written.

UNIT - I :

HTML: Introduction, Objective, HTML Browsers, Windows Switching, HTML Command Tags, URLs, links, new web page creation, main body of the text, putting headers, adding paragraph , formatting text in HTML and font mechanism, Color settings, superscripts and subscripts and other manipulations on text and paragraphs, using directory and menu lists, creation of links, inserting graphics, using images, all manipulations on tables and its display, Detailed working with forms, allowing visitors to upload files, active images ,working with frames & framesets, Frames handling, scroll bars, alternatives to frames

UNIT - II :

HTML5: Introduction, Media, Audio, Video.

DHTML: using DHTML in internet explorer, heading and horizontal line, hidden message, the message at the center of the page, moving boxes ,changeable box. Introduction to browsers, Working with e-mail, Parts of e-mail text, working with messages.

UNIT - III :

Cascading style sheets: Introduction to CSS, creating style sheets, common tasks with CSS, Colors, the font -family, font metrics ,length units ,absolute units ,relative units ,the pixel unit ,percentages as values, keywords as values, various properties such as the font -size property, font -size property etc, Assigning classes ,tags and attributes for applying classes, applying classes to an HTML tag, applying classes to other document parts ,the layer tag, CSS Tags.

UNIT IV:

JavaScript: Variables, Operators, Functions, Conditional Statements, Looping, Built-in objects: String, Arrays, Date, Math. Document Object, Method of document object, Handling events in Javascript. Introduction to Jquery

Graphic Design :Introduction to Adobe Photoshop and Adobe Dreamweaver

Reference Books:

1. JavaScript & jQuery: The Missing Manual, 2nd Edition By David Sawyer McFarland Publisher: O'Reilly Media.
2. Javascript : the definitive guide ,By David Flanagan.
3. Internet and web designing by ITELS (Macmillan).
4. Web Enabled Commercial Application Development Using HTML, DHTML, JS, Perl by Ivan Bayross.
5. Deitel, Deitel & Nieto, Internet and Worldwide Web how to Program, Pearson Education, PHI.
6. Internet Programming with VBScript and Java Script. Kathhleen Kalata (Thomson Publication)
7. Programming the World Wide Web by Robert W. Sebesta. (Pearson)
8. Internet and web design by R Bangia, Second edition , firewall media.
9. Multimedia and Web technology by R Bangia.
10. Adobe Photoshop CS6 : Classroom in a Book by Brie Gyncild
11. Adobe Dreamweaver CS6 : Classroom in a book by James J. Maivald

List of Practical's

SR.NO	List of Practical's
1.	Write a Program to demonstrate the use of heading tag in html.
2.	Write a Program to demonstrate the use of table in html document and also explain their various related table tags (TD, TR and TH).
3.	Write a Program to demonstrate the use of table with different style using id in html.
4.	Write a Program to demonstrate the use of horizontal and vertical table heading in html.
5.	Write a Program to demonstrate to create hyperlink on a web page using client side image mapping in html.
6.	Write a Program to demonstrate to show image height and width using both in html.
7.	Write a Program to demonstrate the use of form in html.
8.	Write a Program to demonstrate the use of FRAMESET in html.
9.	Write a Program to demonstrate the use of horizontal list Menu in html.
10.	Write a Program to demonstrate the use of send Email for a form in html.
11.	Write a Program to demonstrate the use of HTML5 audio and video element
12.	Write a Program to demonstrate the CSS using the font in html.
13.	Write a Program to demonstrate the CSS using the class attributes in html.
14.	Write a Program to demonstrate using CSS(Internal) in html.
15.	Write a Program to demonstrate using CSS(External) in html
16.	Write a Program to demonstrate the use of element defines the base URL for all URLs in html.
17.	Write a Program to demonstrate the use of All Arithmetic operation in Javascript
18.	Write a Program to search an element in an array of size "n"in Javascript
19.	Write a program to compute the gcd of 2 numbers using function in javascript
20.	Write a program to illustrate different in-built string functions in javascript
21.	Write a program to demonstrates how to get content with the jQuery text() and html() methods
22.	Write a program to demonstrate how to set content with the jQuery text(), html(), and val() methods

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
Semester IV
Paper- I
Database management system

NSQF : LEVEL – 6

JOB ROLE : MASTER TRAINER FOR JUNIOR SOFTWARE DEVELOPER

Title	Details
Brief Job Role Description	Master Trainer for Junior Software Developer will be accountable to train and equip students of 0 to 2 years' experience. Major responsibility being to prepare trainees and enable them to procure, and perform to a reasonable extent, at entry level jobs that exist in the IT Services Industry.
Knowledge Description	To be competent, you must be able to: 1. demonstrate basic computer and internet literacy including operating a computer, describing its major components and how they work, using Windows and Linux OS, operating a browser, searching the internet, managing mails and using social internet media. 2. demonstrate aptitude for analyzing information and making logical conclusions. 3. demonstrate knowledge of the foundational mathematical concepts in computing. 4. design algorithms to solve problems and convert them into code using the appropriate programming language constructs. 5. read and execute a test case and record the outcome in the appropriate template. be able to communicate effectively with appropriate people w.r.t. assigned roles in simple English – both oral and written.

Unit-I:

Database concept: what is database, what is database management system,benefit of DBMS, what is relational database management system, codd's rule for RDBMS,DBMS vs RDBMS, Normalization, introduction to Oracle, introduction to structured query language.

Table fundamentals: Oracle data type, basic data type, dml, ddl, tcl, drl.

Unit- II:

Interactive SQL- I : Create command ,viewing data in the tables, eliminating duplicate rows when using a select statement, creating a table from a Table, inserting data into a table from another table, delete operation, update the contents of a table, modifying the structure of a table, rename table , truncate table destroying table, data constraints ,types of data constraint , the primary key constraint, the foreign key constraint ,the unique constraint ,business rule constraint , dropping constraint.

Unit- III:

Interactive SQL- II : Computation done on table data, Oracle function, group data from table, subqueries, joins using the union intersect and minus clause, Dynamic SQL, Dynamic SQL statement using DBMS SQL , Indexes, views, clusters, sequence .

Unit- IV:

Introduction to PL SQL: Advantage of PL/ SQL, the generic pl/sql block, the PL/ SQL execution environment , control structure.

PL/ SQL database object: Database triggers, types of triggers, deleting a triggers.

Reference books:

1.Understanding ORACLE By Ivan Bayross [BPB Publication]

2. Database System Using Oracle: A Simplified Guide to SQL & PL-SQL: Nilesh Shah, PHI Publication.

3. Database Management Systems (Complete practical approach) by Sharad Maheshwari & Ruchin Jain, Firewall media.

4. Dr. P.S.Deshpande SQL & PL/SQL for Oracle 10g Black Book.

5. Scott Urman Programming PL/SQL TMH

List of Practical's

Sr. No.	List of Practical's
1	Create a table "Route_Header" containing fields. (Route_id number(8), Route_no number(8), Cat_code number(8), Origin varchar2(8), Destination varchar2(8), Distance number(8), Capacity number(8), fare number(8))
2	Insert the data into "Route_Header" table.
3	Write a query to add the field description whose data type is varchar2.
4	Describe structure of Route_Header.
5	Display only distinct category code in descending manner.
6	Alter the table to modify the length of column "distance "in the table to 10.
7	Delete only those rows that have DESTINATION as cochin and ORIGIN as Madurai.
8	Display any those rows whose ORIGIN with 'm%'.
9	Display any those rows fare ranges from 30 and 40.
10	Show the last name job and commission of those employee who earn commission and sort the data by salary in descending order.
11	Show the employee that have an commission with 10% in this salary.
12	Create table emp1 with same structure as the table EMP. Insert row into using select clause.
13	Write a query to display the name of employee who join the organization between 04-dec- 14 and 05-dec-15.
14	Write a pl/sql block to display the even and odd numbers starting from 100.
15	Write query to display the following grouping a) DEPARTMENT_ID and JOB_ID b) The query should calculate maximum salary for the above group.
16	Update the table Route_Header set distance of Madurai to mumbai to 2589
17	Display the destination origin starts with 'p%''
18	Show all the data of employees who have been hired before 1997?
19	How many employees have name that end with n.
20	Show the department name, location,job titles, lastname and salary of employees to work in location 1800
21	List maximum, minimum, average and sum of salary.
22	List the maximum salary and number of employees working as Salesman.
23	Create Procedure to swap two values
24	Create Trigger that restricts the user from performing a DML on movie table on 'Monday'
25	Explain Codd's rules for relational database models.
26	Write a PL/SQL program to check number is palindrome or not
27	Write a PL/SQL program to find number is Armstrong or not
28	Write a PL/SQL program to generate Fibonacci series
29	Write a PL/SQL program to find reverse of a string
30	Write a PL/SQL program to calculate total and percentage of marks of the students in four subjects.

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
Semester IV
Paper – II
Web development in PHP

NSQF : LEVEL – 6
JOB ROLE : MASTER TRAINER FOR JUNIOR SOFTWARE DEVELOPER

Title	Details
Brief Job Role Description	Master Trainer for Junior Software Developer will be accountable to train and equip students of 0 to 2 years' experience. Major responsibility being to prepare trainees and enable them to procure, and perform to a reasonable extent, at entry level jobs that exist in the IT Services Industry.
Knowledge Description	To be competent, you must be able to: 1. demonstrate basic computer and internet literacy including operating a computer, describing its major components and how they work, using Windows and Linux OS, operating a browser, searching the internet, managing mails and using social internet media. 2. demonstrate aptitude for analyzing information and making logical conclusions. 3. demonstrate knowledge of the foundational mathematical concepts in computing. 4. design algorithms to solve problems and convert them into code using the appropriate programming language constructs. 5. read and execute a test case and record the outcome in the appropriate template. be able to communicate effectively with appropriate people w.r.t. assigned roles in simple English – both oral and written.

Unit I:

Introduction to PHP: PHP Introduction-Installing PHP

Building blocks of PHP: PHP Variables, PHP Data Types, PHP Strings, PHP Constants, PHP Operators, PHP Programming Loops, PHP Functions, PHP Arrays

Control flow functions: if, else, else if, switch,Loops: for,while, do while.

Unit II:

Functions: Definition, Calling function, defining a function , returning Values from User-Defined Functions, Variable Scope, Accessing Variables with the global Statement From, setting default values for arguments, passing variable reference.

Arrays : Definition, Creating Arrays: Associative Arrays & Multidimensional Arrays, Array-Related Constructs and Functions.

Objects: Working with Objects,the basic structure of an object ,creating and manipulating objects and the data.

Working with Strings: Formatting Strings, String functions.

Unit III:

Working with Forms: Creating Form, Form elements: Text Box, Text Area, Password, Radio Button, Checkbox, The Combo Box, Hidden Field and image.

Working with Cookies and Sessions: Introducing Cookies, Setting a Cookie with PHP, Deleting a Cookie with PHP, Session Function, Starting a Session, Working with Session Variables.

Unit IV:

PHP with Mysql: Creating PHP Mysql Database, creating new table, putting data into new database, accessing Database in PHP, updating databases, PHP Creating Records, PHP Selecting Records, PHP Deleting Records.

Reference books:

1. Sams teach yourself PHP, MySQL and Apache : all in one by julie C.Meloni.
2. PHP: The Complete Reference by Steven Holzner.
3. Mastering PHP, WebTech Solutions, Khanna Publishing House.
4. Learning PHP, Ramesh Bangia, Khanna Publishing House.

List of Practical's

SR.NO	List of Practical's
1.	Create a PHP program to find odd or even number from given number.
2.	Write a PHP program to swap two numbers with and without using third variable.
3.	Write a PHP program to print Fibonacci series without using recursion and using recursion.
4.	Write a PHP Program to demonstrate the variable function: Gettype()
5.	Write a PHP Program to demonstrate the variable function: Settype()
6.	Write a PHP Program to demonstrate the variable function: isset()
7.	Write a PHP Program to demonstrate the variable function: unset()
8.	Give the example of variable function:strval()
9.	Give the example of variable function:floatval()
10.	Give the example of variable function:intval()
11.	Give the example of variable function: print_r()
12.	Give the example of variable function: var_dump()
13.	Give the example of string function: substr()
14.	Give the example of string function: strcmp()
15.	Give the example of string function: strpos()
16.	Write a PHP program that demonstrate form element(input elements).
17.	Write a PHP program that demonstrate passing variable using URL.
18.	Write a PHP program that demonstrate use of session.
19.	Write a program that demonstrate use of cookies.
20.	Write a PHP program to create a database using MySQL.
21.	Write a PHP program to drop a database using MySQL.
22.	Write a PHP program to create a table in MySQL.
23.	Write a PHP program to insert record into a table using MySQL.
24.	Write a PHP program to drop table using MySQL.
25.	Write a PHP program to update table
26.	Write a PHP program to select data and show into table format.
27.	Create a student Registration in PHP and Save and Display the student Records.

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
Semester V
Paper – I
System Analysis & Software Engineering

NSQF : LEVEL – 7
JOB ROLE : SOFTWARE DEVELOPER

Title	Details
Brief Job Role Description	After completing this programme, participants will be able to: • Contribute to the design of software products and applications Develop software code to specification.
Knowledge Description	To be competent, you must be able to: 1. Design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD 2. Check the understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people 3. Check the understanding of the Software Requirements Specification (SRS) with appropriate people 4. Check their understanding of High Level Design (HLD) with appropriate people 5. Review their designs with appropriate people & Analyse inputs from appropriate people to identify, resolve and record design defects and inform future designs 6. Document designs using standard templates and tools Comply with organization's policies, procedures and guidelines when contributing to the design of software products and applications

UNIT - I:

Introduction: System, Types, Components of Computerized Information System, Systems Analysts: Duties, Role. SDLC.

Feasibility Study and Analysis: Identifying Problems, Organizing Feasibility Analysis, Feasibility Decision, Choice of a solution.

Data Collection: Interviews, Brain Storming, Questionnaires, Document Search, Observation.

Structured tools and techniques of Data analysis: Structured English, Decision Tables and Decision Trees, Data Flow Diagram, Data Dictionary.

Unit- II:

THE NATURE OF SOFTWARE: The Nature of Software , The Changing Nature of Software..

SOFTWARE ENGINEERING: Defining the Discipline, The Software Process, Software Engineering Practice, Software Development Myths.

PROCESS MODELS: Prescriptive Process Models, The Unified Process.

AGILE DEVELOPMENT: What is agility? Agility and the Cost of Change, What Is an Agile Process?, Extreme Programming.

Unit -III:

UNDERSTANDING REQUIREMENTS : Requirements Engineering, Developing Use case.

DESIGN CONCEPTS: Design within the Context of Software Engineering, Design Concepts, The Design Model.

ARCHITECTURAL DESIGN: Software Architecture, Architectural Genres, Architectural Styles.

COMPONENT-LEVEL DESIGN: What is a Component?, Designing Class-Based Components.

USER INTERFACE DESIGN : The Golden Rules, User Interface Analysis and Design.

QUALITY CONCEPTS: What Is Quality?, Software Quality.

Unit- IV:

SOFTWARE TESTING STRATEGIES: A Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging.

TESTING CONVENTIONAL APPLICATIONS: Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing, Control Structure Testing, Black-Box Testing .

SOFTWARE REENGINEERING: Reengineering, Business Process Reengineering, Reverse Engineering, The CMMI.

Reference books:

1. Software Engineering A Practitioner's Approach eighth edition by Roger Pressman and Bruce R. Maxim.
2. Information Systems Analysis, Design and Implementation by K. M. Hussain, Donna Hussain
[Tata McGraw-Hill Publishing Company Ltd, New Delhi]
3. Fundamentals of Software Engineering by Rajib Mall [PHI Publication]
4. Workbook on Systems Analysis & Design by V. Garg [PHI Publication]

List of Practical's

Sr. No.	List of Practical's
1.	Write note on Structured English.
2.	To buy a computer science book follow the steps and write the Structured English a. Pick out a desirable book. b. Take it to the sells counter. c. Pay cash for the book. d. Collect cash receipt. e. Collect the book and leave the store.
3.	Write note on decision table.
4.	Draw decision table for an insurance company uses the following rule to determine the eligibility of a driver for insurance. The driver will be insured if: 1. The driver lives in the city with population less than 5000 and he is married man. 2. The driver lives in the city with population less than 5000 and he is married and age is over 30 years old. 3. The driver lives in the city with population is 5000 or more and it is married female. 4. The driver is male over 30. 5. The driver is married and under 30.
5.	Draw a decision table for a company with three people A, B, C whose share in the company are 50%, 20%, 30% sequentially. Any low arises in the company will be passed if it is supported by shareholders and whose shareholding exceed 2/3 of the total shares.
6.	Study following conditions and draw a decision table If product code=A And customer type=1 And the order amount<=700 Then 5% discount allowed If product code=A And customer type=2 And the order amount<=700 Then 7.5% discount allowed If product code=A And customer type=1 And the order amount>=700 Then 7.5% discount allowed If product code=A And customer type=2 And the order amount>700 Then 10% discount allowed A flat discount of 5% on product code=B regardless of customer type and the order amount
7.	Write note on Decision Tree.
	Draw a decision tree for policy followed by a company in giving discount to its customers as follows. 1. If transaction is on credit and customer's record is good the order will be accepted but do not give any discount.

<table>
<tr><td></td><td>If customer’s record is not good do not accept any order.
2. If transaction is on cash and sells amount is more than 100 rupees discount will be given 20%.
3. If transaction is on cash and sells amount is between 50 & 100 rupees than discount will be given 10%.
4. If transaction is on cash and sells amount is less than 50 rupees, order is accepted but no discount will be made.</td></tr>
<tr><td>8.</td><td>A Co-operating bank xyz granted loan under following conditions draw decision table and tree
1. If a customer has a account with the bank and has no loan outstanding (no dues), loan will be granted.
2. If a customer has an account is outstanding from previous loan, loan will be granted if special management approval is obtained.
3. Reject loan application in all other cases.</td></tr>
<tr><td>9.</td><td>Write note on Data Flow Diagram (DFD)</td></tr>
<tr><td>10.</td><td>Draw DFD for Food Ordering System.</td></tr>
<tr><td>11.</td><td>Write note on Data Dictionary.</td></tr>
<tr><td>12.</td><td>Develop Data dictionary for data element Employee code in dictionary</td></tr>
<tr><td>13.</td><td>Calculate Overall risk exposure for the software reliability</td></tr>
<tr><td>14.</td><td>Write a program using html for implementing online banking system including
i) Deposit Funds in Saving Account
ii) Withdraw Funds from Saving Account</td></tr>
<tr><td>15.</td><td>Write a program using html for implementing online Hotel Management System.</td></tr>
<tr><td>16.</td><td>Write a program using html for online Library Management System.</td></tr>
<tr><td>17.</td><td>Design a Registration form for workshop on Computer Maintenance web designing(HTML)</td></tr>
<tr><td>18.</td><td>Create a decision table using MS-Excel
<table>
<tr><td>ACTIONS:</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Serve cocktails</td><td></td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>Charge for cocktails</td><td></td><td>X</td><td></td><td>X</td></tr>
<tr><td>CONDITIONS:</td><td></td><td></td><td></td><td></td></tr>
<tr><td>SeatsOccupied > SeatsCapacity / 2</td><td>n</td><td>y</td><td>y</td><td>y</td></tr>
<tr><td>FlightType = "domestic"</td><td>-</td><td>n</td><td>n</td><td>y</td></tr>
<tr><td>SeatCost > 350</td><td>-</td><td>n</td><td>y</td><td>-</td></tr>
</table></td></tr>
<tr><td>19.</td><td>Draw the following basic UML Class diagram Notation
i. Class
ii. Abstract class
iii. Object
iv. Inheritance (is-a) relationship
v. Aggregation and Composition (has-a) relationship
vi. Association (uses, interacts-with) relationship
vii. Multiplicity in Aggregation, Composition, or Association</td></tr>
<tr><td>20.</td><td>Draw Use case diagram for order management system to show actors, use case and relationship</td></tr>
<tr><td>21.</td><td>Draw basic UML Sequence Diagram Notation</td></tr>
<tr><td>22.</td><td>Draw class diagram for order management system</td></tr>
<tr><td>23.</td><td>Draw sequence diagram for order management system</td></tr>
</table>

24.	Draw Activity Diagram for order management system
25.	Study system specifications and report the various bugs of ATM system
26.	Write the test cases for Banking application
27.	Study of Any Testing Tool (Win Runner)

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
(SEMESTER-V)
Paper – II
Java Programming

NSQF : LEVEL – 7
JOB ROLE : SOFTWARE DEVELOPER

Title	Details
Brief Job Role Description	After completing this programme, participants will be able to: • Contribute to the design of software products and applications Develop software code to specification.
Knowledge Description	To be competent, you must be able to: 1. Design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD 2. Check the understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people 3. Check the understanding of the Software Requirements Specification (SRS) with appropriate people 4. Check their understanding of High Level Design (HLD) with appropriate people 5. Review their designs with appropriate people & Analyse inputs from appropriate people to identify, resolve and record design defects and inform future designs 6. Document designs using standard templates and tools Comply with organization's policies, procedures and guidelines when contributing to the design of software products and applications

UNIT - I :

INTRODUCTION TO JAVA: Java history, Java features, Java environment. Java program structure, Java Tokens, Java Statements, Java virtual machine, Constants, Variables, Data Types, Declaration of Variables, Scope of Variables, Symbolic Constants, Type Casting.

UNIT - II :

CLASS & OBJECTS: Defining a Class, field declaration, method declaration, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods.

INHERITANCE: Extending a Class, Overriding Methods, Final Variables and Methods, Final Classes, Finalize Methods, Abstract methods and Classes, Visibility Control.

INTERFACES : Defining interfaces, extending interfaces, implementing interfaces.

UNIT - III :

PACKAGES : Creating Packages, accessing & using a Packages , using System Package, adding a class to packages, hiding Classes.

EXCEPTION HANDLING AND MULTITHREADING: Creating Threads, Extending the Threads Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the Runnable Interface, Types of error, exception handling techniques, using exception for Debugging.

UNIT - IV :

APPLETS: Introduction to Applets , how applets differ from application, writing an applet. Applets life cycle, creating an executable applet, designing a web page, running the applet, applet tags, adding applet to HTML file ,running the applet passing a parameter to applet, , Converting applet to application.

GRAPHIC PROGRAMMING: Introduction to AWT Package, Layout Managers, Handling events on AWT Component, Introduction to swing package, Components & Containers.

Reference Books:

1. Programming with Java a primer II edition by E. Balaguruswamy (Tata McGraw-Hill).
2. Java Programming (For absolute beginners) by Russell PHI.
3. Black Book on Java.
4. Java: A beginner's Guide by Herbert Schildt.
5. Java2- The Complete References by Herbert Schildt.

List of Practical's

Sr. No.	List of Practical's
1.	Write a program that declares a class, object and also it access the data member of it's class.
2.	Write an applet that accepts a value from the user and display it.
3.	Write a program that accept marks of 5 subject, calculate total, percentage and display the grade according to their percentage.
4.	Write a program that will print the multiplication table from 1 to 10.
5.	Write an program to accept a set of values from the user into an array, display the values as well as their average.
6.	Accept string into a text field, sort the characters in the string and display the sorted string in another text field.
7.	Write a program to demonstrate the overloading & constructor.
8.	Write an applet that accepts two numbers from the user and display all the numbers between them.
9.	Write a program to demonstrate the single inheritance.
10.	Write an applet to accept ten numbers into array sort the array and display the sorted array. Accept the ten numbers into the ten different text fields.
11.	Write a program to create a multiple selection list and also display the list of items selected by the user.
12.	Write an applet to demonstrate the user menu Bar.
	Write a sample program that will convert the applet to application.
13.	Write a program to demonstrate the Interfaces.
14.	Write a program for exception handling that accept two no as textfields, the values are added & their sum is displayed. The code traps the error when user could enter text instead of an numbers.
15.	Write a program that would accept it input for the user & store it in a file called Test. java.
16.	Write a program to implement graphic class draw (line, rectangle, fill rectangle, Circle, oval).
17.	Write an applet that display a choice menu of three buttons (Add, Modify, Delete) selecting a choice from the menu should display the appropriate button Use the show () method of the layout Manager.
18.	Write a java program to read & display the information from the file ABC. dat.
19.	Write a program to implement the concept of loading & displaying images.
20.	Write a program to demonstrate the Animation in Java.

Bachelor of Vocation (B. Voc)
Skill Development Component
Software Development
SEMESTER-VI

IT Integrated Industry Based Project

- Project Work
- Project Seminar

Rashtrasant Tukadoji Maharaj
Nagpur University, Nagpur

Detail Syllabus for
Bachelor of Vocation
(B.Voc)

Skill Development Component
Food Processing and Engineering

(Faculty of Science & Technology)

(WITH EFFECT FROM 2020-2021 ONWARDS)

DETAIL OF JOB ROLE

B.VOC (BACHELOR OF VOCATION) FOOD PROCESSING AND ENGINEERING

Sr. No.	Programmed	Semester	NSQF Level	Job Role	Learning Outcomes
1.	Certificate	IST	4th	Assistant Lab Technician - Food and Agricultural Commodities	1. Prepare and maintain work area and equipment's for food lab testing. 2. Prepare quality analysis and manage housekeeping for food lab activities. 3. Sampling and quality analysis for food lab activities. 4. Complete documentation and record keeping related to performing food lab activities. 5. Food safety, hygiene and sanitation for food lab testing.
2.	Diploma	IIND	5	Dairy Product Processor	1. Prepare and maintain work area and process machineries for processing dairy products. 2. Prepare for processing dairy products. 3. Process dairy products. 4. Complete documentation and record keeping related to processing dairy products. Food 5. safety, hygiene and sanitation for processing food products. Manage and lead the team.
3	Advance Diploma	IIIRD IVTH	6	Quality Assurance Manager	1. Lead quality function in food processing units. 2. Manage quality in food processing units. 3. Manage audit and implement health and safety system in food processing uni
4	B.Voc Degree	VTH VITH	7	Production Manager	1. Manage production process in food processing unit. 2. Manage production optimization and cost efficiency in food processing unit. 3. Manage documentation system and implement safety and environmental policies in food processing unit.

Bachelor of Vocation (B. Voc)
Skill Development Component
Food Processing & Engineering
(Semester I)
Paper – I
FUNDAMENTALS OF FOOD & NUTRITION

NSQF : LEVEL - 4

JOB ROLE: ASSISTANT LAB TECHNICIAN - FOOD AND AGRICULTURAL COMMODITIES

UNIT NO.	CONTENT
I	**Introduction of Nutrition**
	▪ Definition of nutrition and health, Nutritive value of foods, Nutritive classification of foods, Macronutrients and micronutrients- Classification and functions, Inter-relationship between nutrition and health, Basic five food groups and Balance Diet, Malnutrition: Definition and types, Reference man and reference women, Food in relation to health and diseases, Digestion, absorption of nutrients (carbohydrates, proteins and fats) in human system, Inborn errors of metabolis, Hypovitaminosis and Hypdervitaminosis, Losses of vitamins and minerals due to food processing, Food pattern. Food policies – applied nutrition programme, Food Adulteration: Definition, types of adulterants and their detection
II	**Food and water**
	▪ Concept of food and food science - Objectives of food - Functions of food ▪ Definition of food, classification of foods based on origin, pH, nutritive value. food guide pyramid. ▪ Functions of foods. New concepts of food: ▪ **Methods of cooking** - Traditional cooking methods - Modern cooking methods - Objectives and importance of cooking ▪ **Food Preparation and storage:** - Basic terms used in food preparation - Pre-preparation for cooking - Storage of raw and cooked food ▪ Health foods, ethnic foods, organic foods, functional foods, nutraceuticals, fabricated foods, extruded foods, convenience foods, junk foods, GM foods and proprietary foods. ▪ Water quality - water standards and analysis of physical, chemical and microbiological characteristics of water. Waste treatment - fundamentals of physical, biological & chemical waste treatments
III	**Nutritional Composition of Food**
	Food constituents - Definition, occurrence, properties and metabolism of Protein, Carbohydrate and Lipids **Carbohydrates** ▪ Nomenclature, composition, sources, structure, reactions, ▪ Functions and classification - **Proteins** ▪ Nomenclature, sources, structure, functions, classification - ▪ essential and nonessential amino acids,

	Fats and oils ▪ Nomenclature, composition, sources, structure, functions and Classification **Vitamins** ▪ Classification, structure, function, sources, general causes for loss in foods, Units of measurement. ▪ Deficiency and toxicity disorders Enzymes - Definition, classification, enzyme kinetics. Browning reactions in foods: i. Non enzymic browning: Maillard reaction, browning of ascorbic acid, caramelization of sugars. ii. Enzymic browning: Definition, mechanism, control measures.
IV	**Food Hygiene and Sanitation**
	Minerals and Energy ▪ Classification of minerals. Functions, sources, bioavailability and deficiency of the following minerals- Calcium, Iron, Iodine, Fluorine, Sodium, Potassium. **Energy** Units of energy, food as a source of energy, basal metabolic rate, factors effecting BMR, total energy Requirement. **Hygiene and Sanitation** :Principles of hygiene and its relation to food preparation, General hygienic and sanitary practices to be followed by different food business operators - fruits and vegetable, milk and milk product, meat and meat product, catering etc. General hygienic and sanitary requirements for different areas - location and surroundings, layout and design of food establishment premises, equipment & containers, facilities, food operations and controls, management and supervision, food testing facilities, audit, documentation and records, sanitation and maintenance of establishment premises, personal hygiene, product information and consumer awareness, training.

References Book:

1. Manay, N.S. Shadaksharaswamy, M. (2004), "Foods- Facts and Principles", Newge international publishers, New Delhi.
2. Meyer, L.H. (2002), "Food Chemistry". CBS publishers and Distributors, NewDelhi.
3. Robert J Cousins, (2006), "Modern Nutrition in Health and Disease", Lippincott Williams al Wilkins.
4. Michael J Gibney, Ian A Macdonald and Helen M Roche (2003) "Nutrition and Metabolism", The Nutrition Society Textbook Series, Blackwell Publishing, First Edition.
5. Food plant sanitation – Packer and Litchfield (Reinhold Publ.)
6. Handbook of analysis and quality control for fruits and vegetables products by S. Ranganna, Mcgraw Hill Pub. Co. New York.

LIST OF PRACTICAL

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	SR. NO.	NAME OF PRACTICAL
I	**PRACTICAL:-I (FUNDAMENTALS FOOD & NUTRITION)**	1.	Introduction to various method of sampling of food samples.
		2	To determine pH of provided food sample
		3(A)	Determination of titrable acidity of food sample (Mango juice)
		3(B)	Determination of titrable acidity of food sample (Milk)
		3(C)	Determination of titrable acidity of food sample (Tomato sauce)
		4	To determine salt content (NaCl) of provided food Sample
		5	To determine the total solids as soluble and insoluble in food sample
		6	Determination of Total dissolved solid of sewage water & fresh water
		7	Determination of moisture content in food sample by Hot air oven method
		8 A)	To determine specific gravity of the solids by density bottle method
		8 (B)	To determine specific gravity of the liquid by Hydrometer
		9	Estimation of fat by Soxhlet Extraction method
		1 0	Detection of protein by Ninhydrine methods.
		11	Estimations of amino acids in foods.
		12	Preparation and sterilization of culture media
		13	Demonstration of the Kjeldahl's method for estimation of protein content
		14	Preparation and sterilization of culture media using the autoclave/pressure cooker

Bachelor of Vocation (B. Voc)
Skill Development Component
Food Processing & Engineering
(Semester I)
Paper – II
(INTRODUCTION TO FOOD PROCESSING)

NSQF : LEVEL - 4

JOB ROLE: ASSISTANT LAB TECHNICIAN - FOOD AND AGRICULTURAL COMMODITIES

UNIT NO.	CONTENT
I	**Introduction of Food processing**
	Introduction: Definition and scope of Food Science and Technology, Sources of food, scope and benefit of industrial food preservation, perishable, non perishable food. Natural toxins. Contaminants formed during processing: – nitrosamines, acrylamide etc. natural food contaminants and contaminants form packaging materials. Sweeteners:- Introduction, importance, classification- natural and artificial, chemistry, technology and toxicology, consideration for choosing sweetening agents. Antimicrobial agents:-Nitrites, sulphides, sulphur-di-oxide, sodium chloride, hydrogen peroxide. Antioxidants:- Introduction, mechanism of action, natural and synthetic anti-oxidants, technological aspect of antioxidants. Food Spoilage: Definition, types of spoilage - physical, enzymatic, chemical and biological spoilage. causes of food spoilage causes of food spoilage. Mechanism of spoilage and its end products, shelf life determination.
II	**Food preservation**
	Definition, Importance of Food preservation. Thermal processing methods ofpreservation: Principle: Canning, blanching, pasteurization, sterilization, evaporation. Use of low temperature: Principle and effect on quality. Chilling, cold storage, freezing. Preservation by drying dehydration and concentration: Principle, Methods and effect on quality. Preservation by radiation: Definition, Methods of Irradiation, Direct & Indirect effect, measurement of radiation dose, dose distribution, effect on microorganisms. Presentation of foods by Preservatives: chemicals, antioxidants, mould inhibiters, antibodies, acidulates etc. Preservation by salt & sugar: Principle, Method and effect on food quality. Preservation by fermentation: Definition, Advantages, disadvantages. Recent methods in preservation: Pulsed electric field processing, High pressure processing, processing using ultrasound, dielectric, ohmic and infrared heating
III	**Food Processing Equipments**
	Food Processing equipments: Types and Principle of dryers. Types of heat exchanger, Principle of heat Exchangers and pasteurizer, Blancher, Retortsand boilers. Evaporation: Needs, basic principles, Calculations, Single and multiple effect evaporation, elevation, Falling film, climbing film tubular evaporators, plate evaporators, thin film and scraped surface evaporators. Distillation: Distillation, Steam distillation, applications and equipment Low Temperature processing equipment: Refrigeration system and freezer. Material handling equipment's like belt conveyor, screw conveyor, bucket elevator

	and pneumatic conveyors. Mechanical separation: filtration, sieving, centrifugation sedimentation. Equipment's for size reduction, Mixing, and Extrusion etc. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing.
IV	**Waste Management and Effluent Treatment**
	Selection of sanitizing agents for cleaning, packaging sanitation, food storage sanitation, transport sanitation and water sanitation. Characterization of food industry wastes e.g., BOD, COD and total organic content, floatable and suspended solids in water. Pretreatment, secondary treatments of solid waste, sludge volume index, advanced techniques activated biofiltration, biological fluidized bed reactor, dried bacteria culture process. Tertiary treatments or advanced waste water treatment system (AWT); polishing ponds, DAF Techniques, micro trainers treatment and disposal of sludge, sand filters, removal of nitrogen, phosphorus, sulphur, physical chemical treatment process. Introduction : Plant design concepts - situations giving rise to plant design problems - differences in design of food processing and non-food processing plants, Plant layout : Importance, Flow Patterns, Basic Types of plant layouts, Product or line layout, Process or functional layout, Cellular or group layout, and Fixed position layout, Plant Layout factors, Layout design Procedure., Maintenance of Food Plant Building

Reference Books:

1) Food Processing Technology by P. J. Fellows, Woodhead publishing ltd.
2) Food Science by N.N. Potter, CBS publishing.
3) Physical principles of Food Preservation. Vol. II by M. Karel, O.R. Fenema and D.B. Lurd, Maroel, Dekker Inc. New York.
4) The technology of food preservation by N.W. Desrosier and J.N. Desrosier, CBS publishing.
5) S. K. Sharma, S.J. Mulvaney, and S.S.H. Rizvi, Food Process Engineering: Theory and Laboratory Experiments, Wiley and Sons, 2000
6) H. Pandey, H.K. Sharma, R.C. Chouhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004 □
7) M.A. Rao, S.S. H. Rizvi and A.K. Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005.
8) Energy Conservation through Waste Utilization, American Society of Mechanical Engineers, New York.
9) Z. B. Maroulis and G. D. Saravacos, Food Process Design, Marcel Dekker 2003.
10) Prakash Triveni : Food Preservation, Aadi Publication, Delhi.
11) M. ShafiurRahman : Hand Book of Food Preservation, Marcel Dekker Inc, New york.
12) McWillims and Paine : Modern Food Preservation, Surjeet Publication.
13) Manay, N.S. Shadaksharaswamy, M. (2004), "Foods- Facts and Principles", New age international publishers, New Delhi.
14) Srilakshmi, B. (2003), "Food Science", New Age International Publishers, New Delhi.
15) Subalakshmi, G and Udipi, S.A. (2001), "Food processing and preservation". NewAge International Publishers, New Delhi.

List Of practical

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	SR. NO.	NAME OF PRACTICAL
I	**PRACTICAL:-II (INTRODUCTION TO FOOD PROCESSING)**	1	Determination of Ash Content of provided food sample
		2	Detection of Carbohydrate from food sample by Anthrone method**.**
		3	To detect the presence of carbohydrate in given sample by Molisch's test.
		4	To detect the presence of polysaccharides (Starch and Glycogen) in the given food sample by Iodine test
		5	To detect the presence of Reducing sugar in The given samples by Benedict's Test.
		6	To detect the presence of starch in given samples by anthrone reagent Materials
		7	To detect the presence of protein in terms of peptide bonds in the given sample by Biuret test.
		8	Estimate the protein content of provided food sample by Folin/ Ciocalteau method.
		9	Determine Saponification value of rancid fat & oil Sample
		10	Determine Iodine value of rancid fat & oil sample
		11(A)	Determination of peroxide value from rancid fat (soyabean oil)
		11 (B)	Determination of peroxide value from rancid fat (mustard oil)
		12	Determination of free fatty acid value from rancid fat & Oil
		13	Determination of acid value from rancid fat & oil
		14	Determination of acid number from rancid fat & oil
		15	Determine Vitamin A content of provided food sample
		16	Determine Vitamin C (Ascorbic acid) content of provided food sample by Volumetric method
		17	Determine Anthocyanin content of provided food sample
		18	Determine Chlorophyll content of provided food sample

Bachelor of Vocation (B. Voc)
Skill Development Component
Food Processing & Engineering
(Semester II)
Paper – I
(FOOD MICROBIOLOGY)

NSQF : LEVEL - 5

JOB ROLE: DAIRY PRODUCT PROCESSOR

UNIT NO.	CONTENT
I	**Food Microbiology**
	Introduction of microbiology- definition, History and significance of food microbiology. Types of microorganisms normally associated with food- bacteria, yeast and moulds. ii.Spoilage of food; factors affecting spoilage of foods and associated microflora. iii.Biochemical changes caused by microorganisms- putrefaction, lipolysis, etc. **Factors affecting growth and survival of microorganisms:** i. Extrinsic factors- relative humidity, gaseous atmosphere. ii. Intrinsic factors- nutrient content, water activity, oxidation reduction potential. iii. Sources of contamination. Contamination of food-stuff, vegetables, fruits, cereals, pulses, oilseeds, milk and meat during handling and processing **Deterioration and spoilage of various types of food products-** i. Fruits, vegetables, cereal and cereal products, meat and meat products, fish and other sea foods ii. Prevention of spoilage of these foods Thermal inactivation of microbes: pasteurization, sterilization etc. concept of TDT, F, Z and D values. Factors affecting heat resistance Antimicrobial agents: mechanism and action
II	**Principles of food preservation-I**
	Principles of Food Preservation, microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of micro-organisms. **Food Preservation by Low temperature : Freezing and Refrigeration :**Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food. **Food Preservation by high temperature: Thermal Processing-** Commercial heat preservation methods: Sterilization, commercial sterilization, Pasteurization, and blanching. **Preservation using sugar, salt and acids: Sugar** – Introduction, factors affecting osmotic pressure of sugar solution, foods preserved using sugar; salt: introduction, antimicrobial activity of salt, estimation of salt, food products preserved using salt; acid – Introduction, mechanism, common foods preserved using acids
III	**Principles of food preservation-II**
	Food Preservation by Moisture control **Drying and Dehydration -** Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry.

	Evaporation – Definition, factors affecting evaporation, names of evaporators used in food industry. **Food Preservation by Irradiation** Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization. **Preservation by use of chemicals:** Introduction; objectives; factors affecting antimicrobial activity of preservatives; type of chemical preservatives; sulphur dioxide, benzoic acid, etc; use of other chemicals like acidulants, antioxidants, mold inhibitors, antibodies, etc. **Preservatives** :Defination, Characteristics of the ideal antimicrobial preservatives, Grouping of preservatives
IV	**Food contamination and public health:**
	Food Fermentations: Fermentation –definition and types • Microorganisms used in food fermentations • Dairy Fermentations-starter cultures and their types , concept of probiotics, Fermentated Foods-types, methods of manufacture for vinegar, sauerkraut, tempeh, miso , soya sauce ,beer, wine and traditional indian foods. Classification of food based on pH, Food infection, food intoxication, definition of shelf life, perishable foods, semi perishable foods, shelf stable foods Food borne infections and food poisoning**:** *i.* Bacterial with examples of infective and toxic types- *Clostridium*, *Salmonella*, *Shigella*, *Staphyllococci*, *Campilobacter*, *Escerichia, etc*.. ii. Mycotoxins in food with reference to *Aspergillus species*. P*rotozoa*. Prevention of food borne diseases. Food Poisoning, Chemical changes caused by microorganisms Indicator organisms, microbiological quality assurance systems in food industry, GMP, use of HACCP to ensure microbiological safety of food, food regulations and standards

Reference Books:

1) Food Microbiology by M.R. Adams and M.O. Moss
2) Food Microbiology by W.C. Frazier
3) Dairy Microbiology by E .M. Foster.
4) Modern food Microbiology by James M. Jay.
5) Food borne bacterial pathogens by M.P. Doyle
6) Basic Food Microbiology by G.J. Banwart
7) Food microbiology by V. Ramesh, MJP publishing.
8) Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
9) Modern Food Microbiology, J.M. Jay. CBS publisher.
10) Preservation of fruits and vegetables by LallG. Siddhappa,G.V and Tandon, J. L , Indian council of agricultural research, New Delhi.
11) Food storage and preservation by Vijayakhader
12) Fruit & vegetables preservation and practice by K. Sanjeev & Srivastava R.P
13) Fruit and vegetable preservation. Principles and practices by Srivastava, R.P. and Sanjeev kumar

List of Practical

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	NAME OF PRACTICAL
II	**PRACTICAL:-I (FOOD MICROBIOLOGY**)	**Section: A** 1. An introduction to microbiology, aseptic technique and safety 2. Preparation of culture media. 3. To sterilize the media and equipment. 4. To prepare serial dilutions. 5. Plating techniques 6. Determination of acidity of the given sample of water. 7. Determination of alkalinity of the given sample of water. 8. Determination of the total hardness of Water. 9. Determination of pH of the given sample of Water. 10. Determination of Conductivity of the given sample of Water. 11. Determination of Total Solids of the given sample of Water. 12. Determination of Total Dissolved Solids of the given sample of Water. **13.** Determination of Turbidity of the given sample of Water. **Section: B Quality analysis of preserve food and impact of preservation Techniques** 14.To determination the effect of salt concentration on growth of M/O present in food. 15.Determination of salt Content (NaCl) from the provided food sample 16.Qualitative and Quantitative determination of Benzoic acid in food sample 17.Qualitative and Quantitative determination of sulphur dioxide in food sample 18.Determination of Ascorbic acid (Vita. C) of provided food sample 19.To detect the presence of carbohydrate in the given food sample by Anthrone test. 20. Estimation of protein content of a provided food sample 21.Determination of Ash content of provided food sample 22.Estimate the fat content of a provided food sample by Soxhlet extraction method

Bachelor of Vocation (B. Voc)
Skill Development Component
Food Processing & Engineering
(Semester II)
Paper – II
DAIRY TECHNOLOGY

NSQF : LEVEL - 5

JOB ROLE: DAIRY PRODUCT PROCESSOR

UNIT NO.	CONTENT
I	**Dairy Chemistry and Microbiology**
	Present status of milk & milk products in India, Composition of milk and nutritive value and grading of milk. Factors influencing raw milk quality. Milk - Definition, sources, factors effecting composition of milk. physiochemical properties of milk: Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, OR, electrical conductivity. Grading of milk-definition and types of grades, collection and Transportation of milk. Lactose: Lactose (alpha and beta forms). Significances of lactose in dairy industry. Milk fat: Composition and structure, and physical properties, crystallization, structure of fat granules, lipolysis, autoxidation, fat constants (saponification value, iodine value, RM value, Polenske value, peroxide value). Protein and Enzymes: General structure, amphoteric nature, difference between casein and serum protein, Different types of casein (acid and rennet), uses of casein, fractionation of protein. Enzymes- catalase, alkaline phosphatase, lipases and proteases Buying and collection of milk, transportation of milk, milk reception, Milk reception in dairies. Quality and Quantity tests at reception.
II	**Milk and dairy products**
	Unit operations in liquid milk processing: (pasteurization, sterilization, homogenization, drying, Colling and freezing, membrane separation process). **Processing of market milk:** Flowchart of milk processing, Market milk industry and milk products: Systems of collection of milk, Reception, Platform testing, Different types of cooling systems. Various stages of processing: Filtration, Clarification, Standardization -Pearson's square method ,Homogenization, Pasteurization -LTLT, HTST and UHT process-continuous pasteuriser, Sterilization, separation- centrifugal cream separator, bactofugation. Definition, composition and, manufacturing of butter, defects in butter and Ghee, Manufacturing of Whole and skimmed milk powder, defects in milk powder. Definition, composition, classification and manufacturing of Cheddar Cheese, Cheese defects and their control. Definition, composition, manufacturing of ice cream and defects in icecream. Manufacture of khoa, channa, paneer and toned milk,
III	**Fermented dairy products**
	Yogurt: Definition, composition and Nutritional value, manufacturing process Dahi/ Curd making and Misti Dahi: Definition, composition and Nutritional value, manufacturing process, types, packaging, storage Sour milk: Definition, composition and Nutritional value, manufacturing process, packaging, storage Shrikhand and Amrakhand: Definition, composition and Nutritional value, manufacturing process, packaging, storage

	Lassi: Definition, composition and Nutritional value, manufacturing process, packaging, storage. Contamination of milk and milk products: Preservation of Dairy Products. Spoilage of milk Products, Utilisation of dairy industry by-products.
IV	**Dairy Plant sanitation**
	Sanitation and the food industry: Sanitation, sanitation laws and regulations and guidelines, establishment of sanitary, potential risks of food borne bioterrorism, bioterrorismprotection measures and role of pest management in bio-security **In-Plant cleaning system:** Introduction to Cleaning in- place (CIP) system - cleaning procedure, Cleaning efficiency, Methods of cleaning in food industry, cleaning solutions – Detergents. SIP system of dairy plant. Sanitizers, sanitizing methods, sanitation equipment, waste product handling, solid waste disposal and liquid waste disposal; Soil types and properties of cleaning agents. Personal hygiene and sanitary food handling: Role of HACCP in sanitation, quality assurance for sanitation cleaning compounds, handling and storage precautions. Pest control: Insect infestation, cockroaches, insect destruction, rodents, birds, use of pesticides and integrated pest management. FSS Regulations: Regulations on Licensing and Registration, Regulations on Contaminants, toxins and residues, FSS Regulations on Food product standards and food additives, FSS Regulations on Laboratory and sampling analysis; FSS Regulations on Packaging and Labelling; FSS Regulations on Prohibition and Restriction on sales.

Reference Books

1. Aneja RP, Mathur BN, Chandhan RC & Banerjee AK. 2002. Technology of Indian Milk Products. Dairy India Publ., Delhi.
2. De S. 1980. Outlines of Dairy Technology. Oxford Univ. Press Publ., New Delhi.
3. Smit G. 2003. Dairy Processing – Improving Quality. CRC-Woodhead Publ.
4. Walstra P, Geurts TJ, Noomen A, Jellema A & Van Boekel MAJS. 1999. Dairy Technology – Principles of
5. Milk Properties and Processes. Marcel Dekker.
6. Joshi.V.K. (2015),"Indigenous Fermented Foods of South Asia", CRC Press.
7. Alan H. Varnam, (2012), "Milk and Milk Products: Technology, chemistry and microbiology", Springer Science & Business Media Publishers.
8. Robinson, R. K., (2012), "Modern Dairy Technology: Volume 2 Advances in Milk Products", Springer Science & Business Media Publishers.
9. Food Safety and Standards Act, 2006 by Commercials Law ublications, New Delhi

List of Practical

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	NAME OF PRACTICAL
II	**PRACTICAL:-II (DAIRY TECHNOLOGY)**	1) Perform the sensory evolution of milk (general appearance, consistency, flavor and aroma) on reception of milk at the plant. 2) Perform SNF 3) To estimate milk protein by Folin method 4) To estimate milk fat by Gerber plate form test of milk (Acidity, MBRT, Specific gravity method) 5) Simple test for detection of common adulterants: formaldehyde, starch, cane sugar, hydrogen peroxide, sodium bicarbonate in milk. 6) Study of pasteurization of milk. 7) Determination of efficiency of pasteurization of milk liquid by alkaline phosphates test 8) Preparation of Butter, Cheese and indigenous milk product such as khoa, chhana, paneer, shrikhand, butter, milk etc. 9) Product of dried milk by spray dryer. 10) Determination of acidity of butter 11) Determination of moisture content of butter 12) Determination of salt content of Butter 13) Determination of Fat content of Butter 14) To estimate skim milk protein by titration method

Bachelor of Vocation (B. Voc)

Skill Development Component
Food Processing & Engineering
(Semester III)
Paper – I

(BAKERY AND CONFECTIONERY)

NSQF : LEVEL - 6

JOB ROLE: QUALITY ASSURANCE MANAGER

UNIT NO.	CONTENT
I	**Introduction of fast food**
	Status of bakery and confectionery industries in India. Raw materials used in Bakery and their function in bread making Bakery unit operations-- Mixing, Fermentation, Proofing and Baking. Equipment used in bakery and confectionary industry: Construction and working of various equipments like Mixers, proofing chambers, dough dividers, moulder and sheeter, baking ovens, cooling chamber, sealing and packaging machines, Rolling and cutting machines. Extrusion Cooking: definition, introduction to extruders, principles and types, Uses of extruders in the food industry, Types of Extruder. Ready to eat breakfast cereals by extrusion cooking
II	**Bakery products technology**
	Major baking ingredients and their functions, role of baking ingredients in improving the quality of bread. Characteristics of good flour used for making bread, biscuits and cakes. **Bread** - Principle involved in bread production Different types of breads (Panatoni Bread, Focaccia Bread,) and their uses Ingredients used for bread manufacture, methods of mixing the ingredients, dough development methods - straight dough, sponge dough, moulding, proofing, baking, packing, spoilage, bread staling, methods to reduce bread staling and spoilage. - **Cake** - Principle involved in cake production - Different types of cakes and their uses (Black Forest Cake, Orange Chiffon Cake, Christmas Fruit Cake, Chocolate Butter Cake, Torta Di Apple Cake, Butter Cake) - Ingredients used in cake production Flow diagram **- Biscuits and Cookies** - Principle involved in biscuits and cookies production - Different types of biscuits and cookies and their uses Ingredients used in biscuits and cookies production Flow diagram Spoilage in cakes and biscuits
III	**Technology of Confectionery products**
	Characteristics of confectionary products Types of confectionary products - Ingredients used in confectionary products

	Characteristics of confectionary products Types of confectionary products - Ingredients used in confectionary products **Classification of confectionery** Sugar boiled confectionery- crystalline and amorphous confectionery, rock candy, hard candy, lemon drop, china balls, soft candy, lollypop, marshmallows, fudge, cream, caramel, toffee, lozenges, gumdrops, honeycomb candy. **Manufacturing of confectionary products:** Flow diagram for manufacture of following Characteristics and processing of raw material; Technology of manufacturing of toffee, chocolate, hard boiled candies, bars, chewing gums, bubble gums and Characteristics of finished products. Quality control: Standards/ Regulations to be followed in the Bakery Industry and packaging requirements
IV	**Sensory Evaluation**
	Texture: classification, role of firmness, yielding quality, juiciness, chewiness, fibrousness, grittiness, mealiness, stickiness,, measurement of texture/ kinesthetic characteristics.- by compression, mechanical thumb, puncture tester, succulometer, shearing by tenderometer, texturometer, maturometer, fibro meter, moisture content, by barbender moisture tester, alcohol insoluble solids, color, consistency & sound measurement for kinesthetics. **Flavour:** Definition and its role in food quality, Taste, classification, taste qualities, relative intensity, reaction time, effect of disease, temperature, and taste medium on taste, basic tastes and interaction of tastes. Odour : definition, Classification, neutral - mechanisms, Olfactory abnormalities, odor testing, techniques, thresholds, odor intensities. Factors influencing the food qualities: Soil, field practices, harvesting practices, procedures, packaging, transportation, storage, conditions, processing conditions, packaging and storage conditions of finished products.

Suggested Reading Books

SR. NO.	BOOK	YEAR	AUTHOR	PUBLICATION
1	Sensory Evaluation Techniques	2015	Civillie and Carr	CRC Press,
2	Snack Food Technology	1985	Matz S.A.	Springer, ISBN: 9780870554605
3	Chocolate, Cocoa and Confectionery: Science and Technology	1999	Bernard W. Minifie	Springer, ISBN: 9780834213012
4	Snack Food Processing	2001	Lusas EW and Rooney LW	CRC Press, ISBN: 9781420012545
5	Industrial Chocolate Manufactory and Use	, 2012	S. T. Beckett	Springer, ISBN: 9781461521112

6	The Complete Technology Book on Snack Foods	2013	Panda H	NIIR Project Consultancy Services, 2013 ISBN: 9789381039243
7	Snack Food	2012	Booth RG	Springer, 2012 ISBN: 9781461314776
8	Basic Baking. The Society of Indian Bakers	2002	Dubey SC.	New delhi
9	Wiley Encyclopedia of Food Science & Technology	2000	Francis FJ.	John Wiley
10	Technology of Biscuits, Crackers & Cookies	2000	Manley D.	2nd Ed. CRC Press.
11	A professional text to bakery and confectionary		John Kingslee	New Age International Publication.
12	NIIR Board: The complete technology book on bakery Products			
13	Science of Bakery Products		W.P. Edwards	
14	Chocolate science and Technology		EmmanuealObene	
15	"Bakery Products Science and Technology"	2014	Zhou. W, HuiY, H;	2nd Edition, Wiley Blackwell Publishers
16	"Baking Science & Technology"	2009	Pyler, E. J. and	Fourth Edition, Sosland
	Vol.1		Gorton, L.A.	Publications
	"Baked Products: Science Technology and Practice".	2008	Stanley P. Cauvain, Linda S. Young,	John Wiley & Sons Publishers

LIST OF PRACTICAL

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	NAME OF PRACTICAL
III	**PRACTICAL:-I (BAKERY AND CONFECTIONERY)**	**SECTION: I** **PREPARATION OF BAKERY PRODUCTS** 1) To study composition and standards of wheat flour as well as significance of fictional test to predict the quality of flour 2) Preparation of Bread 3) Preparation of Biscuit 4) Preparation of Cakes **SECTION: II** **QUALITY TESTING OF WHEAT FLOUR FOR BAKERY PRODUCTS** 5) Quality testing of Wheat flour it's moisture content 6) Quality testing of Wheat flour it's Ash content 7) Quality testing of Wheat flour it's Gluten content 8) Quality testing of Wheat flour it's alcoholic acidity % as H_2SO_4 **SECTION: III** **QUALITY TESTING OF YEAST** 9) Testing for dough raising capacity of yeast **SECTION: III** **QUALITY TESTING OF BREAD** 10) Quality testing of Bread it's moisture content 11) Quality testing of Bread it's Ash content 12) Quality testing of Bread it's alcoholic acidity 13) Quality testing of Bread it's pH **SECTION: IV** **QUALITY TESTING OF BISCUIT** 14) Quality testing of Biscuit it's moisture content 15) Quality testing of Biscuit it's Ash content 16) Quality testing of Biscuit it's alcoholic acidity **SECTION: V** **QUALITY TESTING OF CAKE** 17) Quality testing of Cake it's moisture conten 18) Quality testing of cake it's Ash content 19) Quality testing of Cake it's alcoholic acidity t

Bachelor of Vocation (B. Voc)
Skill Development Component
Food Processing & Engineering
(Semester III)
Paper – II
(Emerging Technologies in Food Industry)

NSQF : LEVEL - 6

JOB ROLE: QUALITY ASSURANCE MANAGER

UNIT NO.	CONTENT
I	**High pressure processing and microwave heating**
	Microwave heating of foods- Mechanism of Heat Generation-Working of microwave oven, High Pressure processing: Concept-Equipment for HPP Treatment-Mechanism of Microbial Inactivation and its Application in Food , dielectric heating of foods. Irradiation and PEF and ohmic heating:- Pulsed electric field – equipment –mechanism of PEF-advantages, Ohmic heating of foods- mechanism- principle-advantages, applications. Irradiation- principle- types of irradiation-advantages-applications
II	**Osmotic dehydration of foods and minimal processing:**
	Principle – Mechanism of osmotic dehydration – Effect of process parameters on mass transfer – Methods to increase the rate of mass transfer – Applications – Limitations of osmotic dehydration – Management of osmotic solutions. Minimal proceesing-principle-methods- advantages. Ultrasonic processing: Properties of ultrasonic, types of equipment, effect of ultrasonic treatment on microbial inactivation, oil yield etc. Hurdle technology: Types of preservation techniques and their principles, concept of hurdle technology and its application. Applications of enzyme in food Processing, Milling and baking, Starch, starch syrups and dextrose, Fruit, fruit products and wine, Meat and Other Proteinaceous Foods, Candy, Cacao, Chocolate, Coffee, Flavors and other applications
III	**Mechanical Operations in food processing**
	Mixing: Filtration: Centrifugation. Distillation: Crystallization: Dehydration: Evaporation: Freezer types Principle, instrumentation, types, applications of following instruments in food analysis.: UV/Vis and atomic absorption spectrophotometers Electrophoresis Fluorimetry Refractometry Adsorption, column, partition, affinity, ion exchange, GCand HPL Chromatography

IV	**Spray and drum drying**
	Theory of drying, estimation of drying rates and drying time, drying equipments, particle size calculation, design of spray and drum dryer, skim milk and whole milk powders manufacturing methods. Fluidized bed drying, Principle s of fluidized bed method, Types of fluidized bed drier, Drying and cooling times in fluidized bed; Freeze drying;- Agglomeration, Problems of reconstitution, Methods of Agglomeration, The effect of drying on milk products. Recent advances in drying. Design data, performance and selection and design of dryer. Good Hygienic Practices (GHP), Good Manufacturing Practices (GMP), Food Safety Plan, Food Safety Management Risk Analysis. Traceability, food product recall. Food safety Management Systems: ISO 22000: Importance of implementing a HACCP system and how it can be applied to various products, develop a HACCP plan including a HACCP team, produce product workflow diagrams for a range of products and their verification processes etc. Audits: Introduction, objectives, documentation, responsibilities, management review, audit citification and its importance etc

Suggested Readings:

SR. NO.	BOOK	YEAR	AUTHOR	PUBLICATION
1	Hurdle Technologies – Combination treatments for food stability safety and quality	2002	Leistner L. and Gould G.	Kluwer Academics / Plenum Publishers, New York
2	Novel Food Processing Technologies(Food Science and Technology Series)	2004,	Gustavo V. Barbosa- Canovas, Maria S. Tapia, M. Soledad Tapia, M. Pilar Cano	Publisher: CRC PressISBN- 13: 9780824753337
3	Thermal Technologies in Food Processing	**2001**	P Richardson	Campden and Chorleywood Food Research Association, UK, Woodhead Publishing Limited
4	Food analysis: theory and Practice	200	Pomeranz, Y. and Meloan, C.E	CBS Publishers, New Delhi, India
5	Hand Book of Microwave Technology for Food Applications	1999	Dutta AK & Anantheswaran RC	
6	The Technology of Extrusion Cooking	200	Blackie. Gould GW	
7	Enzymes and Immobilized Cells in Biotechnology		Allen I. Laskin	TheBenjamin/Cummings Publishing Company, INC., California.
8	Fermentation Microbiology and Biotechnology		Mansi El-Mansi & Charlie Bryce, Taylor & Francis	
9	Industrial Biotechnology		S. N. Jogdand	Himalaya Publishing House, Mumbai
10	Fundamentals of Enzymology		Nicholes C. Price and Lewis Stevens	Price and Lewis Stevens, Oxford Univ. Press.
11	Enzymes in Food Processing			Gerald Reed, academic press New York and London

LIST OF PRACTICAL

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	NAME OF PRACTICAL
III	**PRACTICAL:-II (EMERGING TECHNOLOGIES IN FOOD INDUSTRY)**	**Section: A** **Techniques of preservation** **1)** To Study Cold Storages Design, Construction and Working **2)** To Study sensory evaluation of products stored under RT and Refrigerated condition **3)** To study preservation of fruit and Vegetables blanching **4)** To study preservation of fruit and vegetables by mechanical dehydration **5)** To study preservation of fruit and vegetables by Canning **6)** To study preservation of grain, fruit and vegetables in cold storage unit. **Section: B** **7)** Estimation of phosphorous acid from soft drink **8)** Determination of salt content of provided food sample **9)** To determine the Total Dissolved Solid of Waste water **10)** To determine the Suspended Solid of Waste water **11)** To determine the BOD of Sewage water **12)** To determine the COD of Sewage water **13)** To determine the DO of Sewage water. **14)** Estimate the fat content of provided food sample by Soxhlet Extraction method.

Bachelor of Vocation (B. Voc)
Skill Development Component
Food Processing & Engineering
(Semester IV)
Paper – I
Fruits, Vegetables and Post Harvest Technology

NSQF : LEVEL - 6

JOB ROLE: QUALITY ASSURANCE MANAGER

UNIT NO.	CONTENT
1.	**Microbiology of fruits and vegetables**
	Introduction to fruit processing: Status and scope of Fruits and vegetables Production and processing industry in India, role of processed fruits, Chemical composition and nutritive value of fruits and vegetables, factors influencing composition and quality of fruits and vegetables. Contamination of fruits and vegetables, Spoilage of fruits and vegetables, Sensory evaluation methods for fruit and vegetables. Postharvest Technology, Post harvest management of fruits and vegetables-control of losses in harvesting, and handling operations, Post harvest field operations. , Pre and postharvest infection. Storage practices: Modified & Controlled atmospheric storage, hypobaric storage, cools storage
2.	**Fruit juices and beverages**
	Introduction, Fruit juice processing; Orange and tangerine, Lemon and lime juice, Apple juice, Grape juice, pulpy juices, tropical blends, Vegetable juices:- (selection, juice extraction, deaeration, straining, filtration and clarification), Various juice extraction methods, various handling and processing equipments for fruit juices, juice packaging materials and equipments. Preservation of fruits and vegetables:- Removal of micro organisms, Use of high temperature, Use of low temperature, drying, Use of preservatives and Irradiation preservation of fruit juices:- (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation). Manufacture of non-fermented, fermented and carbonated beverages: -processing of squashes, cordials, nectars. Technology of Frozen Foods**:** Glass transitions in frozen foods and biomaterials, Microbiology of frozen foods, Thermophysical properties of frozen foods, Freezing loads and Freezing time, calculation, Innovations in freezing process, Freezing methods and equipment, Cold store design and maintenance, Transportation of frozen foods
3.	**Fruit and vegetable products**
	Technology of Jam and Jelly:- Introduction, Jam: Constituents, selection of fruits, processing & technology, Jelly: Essential constituents(Role of pectin, ratio), Theory of jelly formation, Processing & technology, defects in jelly. Marmalade **:** Types, processing & technology, defects Candied and Glazed fruits: -Preparation Pickles - Types of Pickles, Method of pickling, Problems/ spoilage in pickles. Dehydration of fruits and vegetables:- types (Sun drying & mechanical dehydration), process, machinery, operation, packing and storage, fruits juice powder, soup powder, nuggets, flakes, raisins preparation, Osmo dehydrated products. Problems related to storage of dehydrated products, Processing of potato chips, wafers,

	Freezing of fruits and vegetables: Criterion of selection for fruit and vegetables freezing, Various methods of freezing, frozen fruits, changes during freezing. Tomato products :-Selection of tomatoes, pulping& processing of tomato juice, tomato puree, paste, ketchup, sauce and soup Vinegar: Types, General methods of preparation
4.	**Thermal processing of fruits & Vegetables and Packaging**
	Thermal Processing:- Various types of techniques of thermal processing of fruits and vegetables, Types of cans and containers, their selection, preparation of syrups and brines. Canning: Introduction, can manufacture, canning process - selection of fruits and vegetables, grading, washing, peeling, cutting, blanching, cooling, filling, exhausting, sealing, processing, cooling and storage; types of canning- pressure canning and water bath canning, common causes of spoilage in canning of foods and Aseptic packaging. Minimally processed fruits and vegetables: Modified atmosphere packaging (MAP): Introduction, gases used in MAP, role of N2, O2 & Co2, Principles of MAP, Types of MAP-active packaging & passive packaging, factors affecting MAP, graphical representation, application of MAP, effect of MAP on shelf-life, future research needed, advantages and disadvantages. Controlled atmosphere packaging (CAP): Introduction, gases used in CAP, factors affecting CAP- Temperature control, humidity control and gas control, advantages and disadvantages

Suggested Readings:

SR. NO.	BOOK	YEAR	AUTHOR	PUBLICATION
1	Handbook of food additives Vol I and Vol II.	1980	Furia, T.E.	
2	Preservation of fruits and vegetables	1967	Lall G., Siddhappa,G.V and Tandon, J. L,	Indian council of agricultural research, New Delhi
3	Complete Technology Book on Processing, Dehydration Canning and Preservation of Fruit & vegetables , NIIR			
4	Fruit & vegetables preservation and practice		K. Sanjeev & Srivastava R.P	
5	Post harvest technology of fruits & vegetables (Vol I & II).	2000.	Verma, L.R and Joshi, V.K.	Indus publishing company, New Delhi.
6	Fruit and vegetable preservation. Principles and practices.	1994	Srivastava, R.P. and Sanjeev kumar.	International book Distributing Co., Lucknow.
7	Food Engineering Fundamentals	1983.	Batty, J.C. and Folkman, S.L.	John wiley and Sons, New York
8	Principles of Food Science: Part-II	1985	Fennema O.R.	
9	Hand book of Food Engineering		Aeldmam & Lunde	
10	Food Engineering Fundamentals	1983	Batty, J.C. and Folkman, S.L	John Wiley and Sons, New York
11	Hand book of food Engineering		R.P. Singh	

List of Practical

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	NAME OF PRACTICAL
IV	**PRACTICAL:-I (FRUITS, VEGETABLES AND POST HARVEST TECHNOLOGY)**	1. Determination of pH contain of fruit juice, Lemon Juice . 2. Determination of pH Contain of Jam, Jelly, Pickle, Sauce 3. Determination of Titrable Acidity of fruit juice, Jam, Jelly Pickle Sauce 4. Determination of Salt contain pickle and Sauce 5. Determination of Protein contain of fruit juice & Jam 6. Determination of Carbohydrate by folin ciocautue method of food sample 7. Determination of moisture contain of dehydrated food sample 8. Determination of Total soluble solids (TSS) of food sample 9. Estimation of Blanching from fruits and vegetable 10. Production of fruit juice 11. Production of jam 12 Production of Jelly 13. Production of Mango and Lemon Pickle 14. Production of Tomato Sauce 15. Determination of Ash contain from provided food sample

Bachelor of Vocation (B. Voc)

Skill Development Component
Food Processing & Engineering
(Semester IV)
Paper – II BEVERAGES PROCESSING

NSQF : LEVEL - 6

JOB ROLE: QUALITY ASSURANCE MANAGER

UNIT No.	CONTENT
I	**Introduction to beverages**
	Introduction of brewing, history of brewing; Raw materials: barley, hops, water, yeast; Adjuncts for beer production: Maize, rice, millet, wheat, sugar etc. Types of beverages and their importance, status of beverage industry in India, Manufacturing technology for juice-based beverages, synthetic beverages; technology of still, carbonated, low-calorie and dry beverages, isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks. Enzymes in beverage: Application of enzymes in tea and cocoa processing, Application of enzymes in alcoholic beverages as beer, whisky, wine and ciders., Role of the enzymes in fruit juice production, factors affecting the enzymatic activity. Enzymatic clarification of apple and guava juices, factors affecting the clarity of fruit juices. Processing of black and white varieties of grapes: Worth formation, Fermentation and packaging of wine, study over different type of wine like sherry, Port type of wine on basis of alcoholic content.
II	**Alcoholic Beverages**
	Malt production, role of enzymes for malting; Barley storage, steeping, germination, kilning, cooling, storage; Malt from other cereals, caramel malt, roasted malt, smoked malt, malt extract; Malt quality evaluation. Wort production, malt milling, Mashing, Mashing vessels; Wort boiling, clarification, cooling and aeration. Enzyme properties, starch degradation, b-glucan degradation; Conversion of fatty matter, Biological acidification. Introduction, types, role, manufacturing and types of wine, beer and distilled spirits and quality evaluation. Beer defects and Spoilage, Wine defects and spoilage. Manufacture and quality evaluation of distilled beverages including whisky, brandy, rum and gin, Vodka. Manufacturing process of beverages**:** Beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, Dairy-based beverages. Brewing Equipments. Grain mill, kettles, siphons, carboys, fermentation equipment, wort chillers, pumps beer bottles, cans, labels, bottle caps, sanitation equipments
III	**Packaged drinking water and Food laws**
	Definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water. Recycle technologies: Effluent treatment, Tertiary treatment, Advanced treatment, Biological treatment, (Clarification, Filtration, Adsorption, Membrane Bio-reactor, Ultra filtration, Nanofiltration (NF), Reverse osmosis, Photo Chemical Oxidation (PCO), Ion exchange process. Use of ozone in packaged drinking water disinfection and purification. The use of distillation technology in the bottled water industry. Food laws & Microbiological criteria for various food products: FAO, Codex Alimentarius, ISO, Indian food laws and standards, Prevention of Food adulteration (PFA)act, Fruit Products Order(FPO), Meat product order (MPO), Cold storage order (CSO),BIS, Agmark
IV	**Sugars Technology**
	Introduction, Raw Sugar production process : Extraction of juice, Purification of juices,

	Clarification stages, Treatment of clarified juice, Evaporation, Crystallization, Washing of sugar crystals and centrifugal separation/dewatering of sugar and other related processes, Sugar Refining, Sugar analysis. Production of liquid Sugar, Production of Glucose and fructose syrups. Sugar recovery. Sugar plant sanitation. By Products of cane sugar processing: Alcohol production, production of Animal feed, production of pulp & paper, production of agglomerated products. Water/effluent treatment plant in the food processing industries.

Suggested Readings

SR. NO.	BOOK	YEAR	AUTHOR	PUBLICATION
1	Technology of Bottled water	2011	Nicholas Dege	Blackwell publishing Ltd UK
2	Foods- Facts and Principles	2004	Manay, N.S, Shandaksharaswamy, M	New Age International Publishers, New Delhi
3	Chemistry & Technology of soft drinks & fruit juices	1998	Philip R Ashurst	Blackwell Publishers
4	Formulation and production of carbonated soft drinks	1997	Mitchel A J.	Blackwell Publishers
5	The soft drinks ompanions: A technical handbook for the beverage industry	2000	Shachman, M.	CRC Press Taylor & Francis Group, Boca Raton, Florida, USA
6	Beverages: technology, chemistry and Microbiology	1999	Varnam, H.A. and Sutherland, J.M.	CRC Press Taylor & Francis Group, Boca Raton, Florida, USA
7	Industrial Microbiology		Prescott & Dunn	
8	Industrial Microbiology		L. E. Casida	
9	Food Microbiology		W.C. Frazier and D.C. Westhoff	
10	Food analysis: theory and practice	2000	. Pomeranz, Y. and Meloan, C.E	CBS Publishers, New Delhi, India
11	Official methods of analysis of AOAC	2007	Association of Official Analytical Chemists, Arlington, USA.	
12	Sugar Processing and By-products of the Sugar Industry		By Antonio Valdes Delgado, Carlos de Armas Casanova	Food and Agriculture Organization of the United Nations
13	Technology Of Water And Packaged Drinking Water (Hand Book)		EIRI	

List of Practical

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	NAME OF PRACTICAL
IV	**PRACTICAL:-II (BEVERAGES PROCESSING)**	1. Determination of pH contain of Alcoholic Beverages. 2. Determination of pH Contain of non Alcoholic Beverages. 3. Determination of Volatile Acidity of Wine, Whiskey, Rum 4. Determination of Terrible Acidity of Wine, Whiskey, Rum ,Beer 5. Determination of Protein contain of fruit juice. 6. Determination of Protein contain of Wine, Whiskey, Rum. 7. Determination of Carbohydrate by folin ciocautue method of Beverages sample 8. Determination of Sulpher dioxide from provided Beverages sample 9. Determination of Calcium contain provided Beverages sample

Bachelor of Vocation (B. Voc)

Skill Development Component
Food Processing & Engineering
(Semester V)
Paper – I (Technology of animal foods)

NSQF : LEVEL - 7

JOB ROLE: PRODUCTION MANAGER

UNIT No.	CONTENT
I	**Compositional and Nutritional aspect of Animal foods**
	Livestock and poultry population in India, Development of meat and poultry industry in India and its need in nation's economy, Glossary of live market terms for animals and birds, Sources and developments of meat and poultry industries in India and importance in national economy. **Fish** - Classification of fish (fresh water and marine), composition, spoilage of fish - microbiological, physiological, biochemical. **Meat** - Definition of carcass, concept ofred meat and white meat, composition of meat, marbling in meat, post mortem changes in meat - rigor mortis, tenderization of meat, ageing of meat. **Egg:-**composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, preservation and safe handling of eggs. By-product utilisation: By-products and wastes from meat, fish and poultry industry
II	**Meat processing**
	Slaughtering of meat -- Scientific or Humane slaughter, Ritual slaughter, Dressing techniques for different animals, Meat cutting and packing, Grading of meat and packaging of meat, Meat tenderization. – principles an methods Meat products: Sausages - processing, RTE meat products Sausages - processing, RTE meat products. Preservation of meat -Refrigeration and freezing, thermal processing - canning of meat, dehydration, meat curing), Spoilage of meat. Meat quality**:** Effects of feed, breed and environment on production of meat animals and their quality Meat Quality-color, flavor, texture, Water-Holding Capacity(WHC),Emulsification capacity of meat.
III	**Fish Processing**
	Fishery products: Process, traditional and modern production lines, quality of products. Fish protein concentrates (FPC), fish protein extracts (FPE). Preservation of fish- High and low temperature, Preservatives , Irradiation and drying, salting - salting methods: brining, pickling, curing and canning of fish. Smoking - smoke production, smoke components, quality, safety and nutritive value of smoked fish, pre - smoking processes, smoking process control
IV	**Poultry and Egg processing**
	Handling, Transport and dressing of a poultry bird: Inspection of birds, poultry slaughter and dressing, factors affecting quality of poultry. Spoilage of poultry meat, Preservation of poultry meat. Egg and egg products: Structure and composition of eggs, changes in egg due to aging, abnormalities in egg, functions of egg in food system, inspection and grading for egg quality, coagulation of eggs, egg powder and egg based products, Factors affecting egg quality.

	Egg products– Egg powder, egg foams , frozen egg pulp, designer eggs Preservation and maintenance of eggs:-Removal of microorganisms, Use of heat , Chilling , Preservatives , Irradiation, and drying, Refrigeration and freezing, thermal processing, dehydration, coating. Microbial spoilage of eggs

SUGGESTED READINGS:

SR. NO.	BOOK	YEAR	AUTHOR	PUBLICATION
1	Fish Processing Technology	2012	George M. Hall	Springer Science & Business Media Publication.
2	Handbook of Meat Processing	2010	Fidel Toldra	John Wiley & Sons Publication.
3	Fundamentals of food Engineering	2010	Rao D.G	PHI Learning Pvt. Ltd
4	Handbook of Poultry Science and Technology, Secondary Processing	2010	Isabel Guerrero-Legarreta	John Wiley and Sons Publication
5	Poultry Meat Processing	2010	Casey M. Owens	Second Edition, CRC Press
6	Advanced Technologies For Meat Processing	2006	Leo M.L. Nollet and Fidel Toldra	CRC Press.
7	Essentials of food science. 2nd edition	2003	Vaclavik V.A. and Christian E.W	Springer International
8	" Meat Science. 6th edition	1998	Laurie R.A Lawrie	Woodhead Publishing Ltd
9	Egg science and technology	2001	Stadelman W.J. and Cotterill O.J.	CBS Publishers
10	A Text Book of Fish and Fisheries Technology		K P Biswas	
11	Meat Processing		Joseph Kerry, John Kerry and David Ledwood	Wood head Publishing Limited (CRC Press 2002)
12	Post Harvest Technology of Fish and Fish Products	2001	Balachandran, K.K	Daya Publishing House, New Delh
13	Poultry Meat and Egg Production	1997	Parkhurst & Mountney	CBS Publication, New Delhi
14	Egg Science and Technology 4th Ed	2002	Stadelman WJ, Owen J Cotterill	CBS Publication New Delhi
15	Poultry Products Processing	2005	Shai Barbut	CRC Press

LIST OF PRACTICAL

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	NAME OF PRACTICAL
V	**PRACTICAL:-I (TECHNOLOGY OF ANIMAL FOODS)**	**Gradation of Meat Based on Physiochemical Quality** Total protein of meat (kejeldahal method Physicochemical quality of meat and meat product Determination of Extract Release Volume Determination of Meat Swelling Capacity. Determination of Picric Acid Turbidity (PAT) **Determination of Nutritive Value & Composition of Provided fish flesh** Determination of Moisture from Fish. Determination of Sodium Chloride from Fish. Determination of Ash insoluble in dilute Hydrochloric acid from Fish Determination of Acidity of Brine from Fish Determination of Ascorbic acid from Fish Determination of Polyphosphates from Fish **Study of Microbial Spoilage of Meat** Determination of dye reduction capacity Determination of Microbial load in meat and meat products **Determination of Egg Quality Based on Physiochemical Analysis** Estimation of protein by Folin Lowery method from Egg Estimation of protein by Biuret method from Egg Detection of Carbohydrate from egg by Anthrone method Estimation of fat by Soxhlet Extraction method from Egg. Estimation of moisture content of meat Cutout analysis of canned meats/retort pouches Estimation of protein content of meat Analysis of frozen meat/meat emulsion products To study shelf-life of eggs by different methods of preservation Evaluation of eggs for quality parameters(market eggs,branded eggs) To perform freezing of yolk/albumen Meat/Egg product formulation

Bachelor of Vocation (B. Voc)

Skill Development Component
Food Processing & Engineering
(Semester V)
Paper – II
(Cereals, Pulses, Oilseed Technology and Food Business)

NSQF : LEVEL - 7

JOB ROLE: PRODUCTION MANAGER

UNIT NO.	CONTENT
I	**Rice and Wheat Milling**
	General introduction to cereals , Major Pulses grown in the country and their application, Engineering properties of food grains. Rice Milling**:** Defination**,** composition and nutritional value, Modern rice milling process - Cleaning, Dehusking, rubber roll Shellers ,Husk separation, Paddy separation, Polishers - Cone polishers, glazing and Grading operations and their related equipments, Extraction of rice bran oil and uses of rice bran in food industry. Parboiling and Processed products from rice: Defination, Application, Disadvantage**,** composition and nutritional value, Methods of parboiling of paddy, Ageing of Rice, Enriched Rice, Rice Fortification, Milling of Wheat, Dhal milling process.
II	**Oil seed processing**
	Introduction, raw material preparation, Oil extraction methods- hydraulic press- screw press, ram press, oil extraction- principle and working, solvent. Process of refining:- Clarification, degumming, neutralization, bleaching, deodorization techniques/process, blending of oils. Hydrogenation, Fractionation, Winterization. Processing of Ground nut oil, soyabean, Rapseed and mustered, sunflower, Linseed
III	**Food packaging technology**
	Definition of Package, Packaging, Packing. , Levels of Packaging. Functions of packaging. Packaging Materials and their properties, Rigid containers- Glass, Wooden boxes, metal cans- Aluminium and tin plate, containers, Semi rigid containers- paperboard cartons, Flexible packaging- paper, plastic pouches- Low density polyethylene, High density polyethylene and Polypropylene. Packaging materials for dairy products, bakery and confectionary, granular products, fruits and vegetables Types of packages, package design and. Special Packaging: Aseptic packaging, Active packaging, Intelligent packaging, Modified atmospheric packaging and controlled atmospheric packaging, Shrink packaging, stretch packaging, Biodegradable packaging, Edible packaging, Tetrapacks, Machineries used in Food Packaging , Package testing-Thickness – Paper density - Basis weight – Grammage - Tensile Strength - Gas Transmission Rate (GTR) - Water Vapour Transmission Rate (WVTR).
IV	**Entrepreneurship and Marketing Management**
	Meaning, definition and concepts, characteristics, functions, role of entrepreneur in economic development, factors affecting entrepreneurial growth. Types of entrepreneurs – Intrapreneurship, Classification of small, medium and large scale manufacturing industries.

	Entrepreneurial skills:Preparing, planning, establishing, managing, operating and evaluating relevant resources in small business. Role of institutions/schemes in entrepreneurial development**:** SIDCO, SIDBI, NIESBUD, EDII, SISI, DIC,PMEGP,CMEGP, Rozgar Yojana Schemes. Types of Market. Difference between Selling and Marketing Price: Concept of Pricing. Promotion and Advertising. Basic concepts of economics: Utility, Income, Wealth, Saving, Investment and Value. Demand and supply Factors of production: Land, Labour, Capital, Organization.

SUGGESTED READINGS:

SR. NO.	BOOK	AUTHOR	YEAR	PUBLICATION
1	Post Harvest Technology of Fish and Fish Products.	Balachandran, K.K.	2001.	Daya Publishing House, New Delhi
2	Egg Science and Technology, 4th Ed.	Stadelman WJ, Owen J Cotterill	2002	CBS Publication New Delhi
3	*Food Packaging Materials..*	Mahadeviah M & Gowramma RV	1996	Tata McGraw Hill
4	Entrepreneurial Development	Sarwate		Everest Publication
5	Agricultural Marketing in India –,	Sivarama Prasad. A	1985.	Mittal Publications, New Delhi
6	Oilseeos Processing Technology	Dr. Banshi D Shukia, Dr. Prabhat K Srivastava, Er. Ram K Gupta	1992	The book is published under the Technology Mission on Oliseeds by the Central Institute of Agricultural Engineering, Nabi Bagh
7	Chemistry and Technology of Oils and Fats	Chakrabarty M M	2003	
8	Cereal and Cereal Products	Dendy DAV & Dobraszczyk BJ	2001	Aspen
9	Principles of Cereal Science and Technology, Hoseney RS	Hoseney RS	1994	
10	Unit Operations of Agricultural Processing	K.M. Sahay & K.K. Singh		Vikas Publishing

LIST OF PRACTICAL

SEMESTER	PRACTICAL BASEND ON SKILL COMPONENET PAPER	NAME OF PRACTICAL
V	**PRACTICAL:-II (CEREALS, PULSES, OILSEED TECHNOLOGY AND FOOD BUSINESS)**	Study of quality control of Cereals and Pulses Determination of Physical property of Paddy and Rice Determination of size and L/B ratio of Paddy and Rice Determination of Angle of Repose and porosity of grain Determination of Bulk and True density of grain Determination of physical property of Pulses Determination of Size of Pulses. Determination of Bulk and True density of grain Determination of Bulk and True density of grain Determination of Sphericity of grain sample (Pulses) Determination of moisture content of cereals and Pulses grain Determination of percent of Ash content of provided food sample Determination of Ash insoluble in dil. Hcl Determination of hydrocyanic acid in beans Determination of calcium carbonate in Fortified Atta Determination of Talc in Rice and Pulses Determination of Kesari dal powder (Lathyrus Sativas) in besan Determination of Gluten content in Wheat flour Determination of wheat flour its Alcoholic acidity % as H_2SO_4 Determination of Total protein in protein Rich Atta by Kjeldahl Digestion method To detect presence of protein in terms of peptide bond in the given sample of wheat flour by Biuret test To determine the particle size analysis of flour by vibratory sieve shaker method.

Bachelor of Vocation (B. Voc)
Skill Development Component
Food Processing & Engineering
(Semester VI)

NSQF : LEVEL - 7

JOB ROLE: PRODUCTION MANAGER

Industry Training Based Project

- **Project Work**
- **Project Seminar**

SYLLABUS for M. Sc. CHEMISTRY
Choice Based Credit System (Semester Pattern)
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Effective from 2018-2019

Candidates opting for this course are advised to go through the direction relating to the course "DIRECTION RELATING TO THE EXAMINATION LEADING TO THE DEGREE OF MASTER OF SCIENCE, SEMESTER PATTERN (CHOICE BASED CREDIT SYSTEM) AND DEGREE OF MASTER OF SCIENCE AND TECHNOLOGY (APPLIED GEOLOGY). SEMESTER PATTERN, (CHOICE BASED CREDIT SYSTEM) (FACULTY OF SCIENCE & TECHNOLOGY)" which is available on R. T. M. Nagpur University website.

The direction will provide details on admission criteria, rules for ATKT, scheme of examination, absorption scheme for CBS students into CBCS pattern, elective papers, foundation course papers, subject centric papers, coding pattern, pattern of question papers, practicals, distribution of marks, seminars, project work, internal assessment, calculation of SGPA and CGPA, etc.

Scheme of teaching and examination under semester pattern Choice Based Credit System **(**CBCS**)** for M.Sc. Program in Chemistry

M. Sc. Chemistry Semester I												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
		Th	Pract	Total		Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
							External Marks	Internal Ass		Th	Pract
(1T1**)**	Paper 1: Inorganic Chemistry	4	-	4	4	3	80	20	100	40	
(1T2**)**	Paper 2: Organic Chemistry	4	-	4	4	3	80	20	100	40	
(1T3**)**	Paper 3: Physical Chemistry	4	-	4	4	3	80	20	100	40	
(1T4**)**	Paper 4: Analytical Chemistry	4	-	4	4	3	80	20	100	40	
Pract. **(**1P1**)**	Practical 1: Inorganic Chemistry	-	8	8	4	3-8*	100**	-	100		40
Pract. **(**1P3**)**	Practical 2: Physical Chemistry	-	8	8	4	3-8*	100**	-	100		40
Seminar 1 **(**1S1**)**	Seminar 1	2	-	2	1			25	25	10	
	TOTAL	18	16	34	25		520	105	625	170	80

M. Sc. Chemistry Semester II												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract	
(2T1)	Paper 5: Inorganic Chemistry	4	-	4	4	3	80	20	100	40		
(2T2)	Paper 6: Organic Chemistry	4	-	4	4	3	80	20	100	40		
(2T3)	Paper 7: Physical Chemistry	4	-	4	4	3	80	20	100	40		
(2T4)	Paper 8: Analytical Chemistry	4	-	4	4	3	80	20	100	40		
Pract. (2P2)	Practical 3: Organic Chemistry	-	8	8	4	3-8*	100**	-	100		40	
Pract. (2P4)	Practical 4: Analytical Chemistry	-	8	8	4	3-8*	100**	-	100		40	
Seminar 2 (2S1)	Seminar 2	2	-	2	1			25	25	10		
	TOTAL	18	16	34	25		520	105	625	170	80	

M. Sc. Chemistry Semester III												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
		Th	Pract	Total		Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
							External Marks	Internal Ass		Th	Pract
(3T1)	Paper 9: Special – I (Inorganic/ Organic / Physical / Analytical) Chemistry	4	-	4	4	3	80	20	100	40	
(3T2)	Paper 10: Special – II (Inorganic/ Organic / Physical / Analytical) Chemistry	4	-	4	4	3	80	20	100	40	
Elective 1 (3T3)	Paper 11: A) NuclearChemistry I (3T3A) ORB) Environmental Chemistry I (3T3B) ORC) Polymer Chemistry I(3T3C) ORD) Medicinal Chemisrty I(3T3D)	4	-	4	4	3	80	20	100	40	
Foundation Course 1 / Core Subject Centric 1 (3T4)	Paper 12: Applied AnalyticalChemistry-I / Spectroscopy I	4	-	4	4	3	80	20	100	40	
Pract. Core 9 & 10 (3P1)	Practical 5: Special (Inorganic/ Organic / Physical / Analytical) Chemistry	-	8	8	4	3-8*	100**	-	100		40
Pract. Core Elective 1 (3P3)	Practical 6: A) Nuclear Chemistry I ORB) Environmental Chemistry I ORC) Polymer Chemistry I ORD) Medicinal Chemisrty I	-	8	8	4	3-8*	100**	-	100		40
Seminar 3 (3S1)	Seminar 3	2	-	2	1			25	25	10	
	TOTAL	18	16	34	25		520	105	625	170	80

M. Sc. Chemistry Semester IV				
Code	Theory / Practical	Teaching scheme	Credits	Examination Scheme

		(Hours / Week)									
		Th	Pract	Total		Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
							External Marks	Internal Ass		Th	Pract
(4T1)	Paper 13: Special – I (Inorganic/ Organic / Physical / Analytical) Chemistry	4	-	4	4	3	80	20	100	40	
(4T2)	Paper 14: Special – II (Inorganic/ Organic / Physical / Analytical) Chemistry	4	-	4	4	3	80	20	100	40	
Elective 2 (4T3)	Paper 15: A) Nuclear Chemistry II ORB) Environmental Chemistry II ORC) Polymer Chemistry II ORD) Medicinal Chemisrty II	4	-	4	4	3	80	20	100	40	
Foundation Course 2 / Subject Centric 2 (4T4)	Paper 16: Applied Analytical Chemistry II / Spectroscopy II	4	-	4	4	3	80	20	100	40	
Pract. (4P1)	Practical 7: Special (Inorganic/ Organic / Physical / Analytical) Chemistry	-	8	8	4	3-8*	100**	-	100		40
Project (4PROJ1)	Project	-	8	8	4	3-8*	100**	-	100		40
Seminar 4 (4S1)	Seminar 4	2	-	2	1			25	25	10	
	TOTAL	18	16	34	25		520	105	625	170	80

NOTE Sem III & IV:

Foundation Course: Candidate can opt for any one foundation course paper in the semester III and IV. However, Student shall opt for this paper from any other subject other than his / her main subject for postgraduation. If the candidate decides to opt for foundation course papers then he/she shall not be eligible to opt for Core (Subject Centric) papers in their respective subjects.

Core (Subject Centric): Candidate can opt for this paper as shown in the semester III and IV in their main subject of postgraduation only. If the candidate decides to opt for Core (Subject Centric) papers in their main subject of

postgraduation then he**/**she shall not be eligible to opt for foundation course papers neither in their own subject nor in any other subject**).**

- General Scheme for Distribution of Marks in Practical Examination in Chemistry
  Time:8-9h (One day Examination) Marks:100

Exercise-1	- 30 Marks	- Evaluated jointly by Internal and External Examiner
Exercise-2	- 30 Marks	- Evaluated jointly by Internal and External Examiner
Record	-20 Marks	- Evaluated by Internal
Viva-Voce	-20 Marks	- Evaluated by External
Total	**-** 100 Marks	

- General Scheme for Distribution of Marks in Project Examination in Chemisrty
  The project work will carry total 100 marks and will be evaluated by both external and internal examiners in the respective Department / Center/ Affiliated College.
  The examiners will evaluate the experimental project work taking into account the coverage of subject matter, presentation, references etc.

For written Project work	- 40 Marks	-	Evaluated jointly by External and Internal
For Presentation	- 20 Marks	-	Evaluated jointly by External and Internal
ForViva-Voce	- 20 Marks	-	Evaluated by External Examiner
Internal Assessment	- 20 Marks	-	Evaluated by Internal Examiner
Total	**-** 100 Marks		

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SYLLABUS for M. Sc. CHEMISTRY
Choice Based Credit System (Semester Pattern)
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Effective from 2015-2016

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Semester I
Paper – I (Code: 1T1)
Inorganic Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I 5h

A) Stereochemistry and Bonding in Main Group Compound:VSEPER-Shape of simple inorganic molecules and ions containing lone pairs, various stereo chemical rules and resultant geometry of the compounds of non-transitional elements, short coming of VSEPR model. Bent's rule and energetics of hybridization.

B) Metal – Ligand Bonding: 10h

Crystal Field Theory: Splitting of d-orbital in tetragonal, square planar and trigonal bipyramidcomplexes. John teller effect, spectrochemical series, nephelauxetic effect. Limitaion of crystal field theory. M.O.Theory for octahedral, tetrahedral & square planar complexes with and without π-bonding.

Unit-II

A) Metal – Ligand Equilibria in Solution: 5h

Stepwise and overall formation constants; trends in stepwise formation constants; factors affecting stability of metal complexes with reference to nature of metal ion, ligand, chelate effect and thermodyanamic origin. Determination of formation constant by :

(1) spectrophotometric method (Job's and Mole ratio method)

(2) Potentiometric method (Irving-Rossotti Method)

B) Reaction Mechanism of Transition metal complexes: 10h

Energy Profile of a reaction, reactivity of metal complexes, Inert and Labile complexes, Kinetics of Octahedral substitution: Acid hydrolysis, factors affecting acid hydrolysis, Stereochmistry of intermidiates in SN^1& SN^2 , Base hydrolysis, Conjugate base mechanism, Direct and indirect evidences in favour of conjugate mechanism, Annation reaction, reaction without metal-ligand bond breaking.

Unit-III: Cluster- I 15h

Boron hydrides: Classification, nomenclature, structure, bonding and topology of boranes, 4-digit coding (s, t, y, x) numbers for higher boranes and their utilities. Chemistry of diboranes: Study of Metalloboranes, Carboranes and Metallocarboranes with reference to preparations and structures.

Unit – IV: Cluster-2

A) Metal-Metal bonds: 10h

Occurrence of metal-metal bond, Classification of metal clusters, Binuclear, trinuclear, tetranuclear, pentanuclear and hexanuclear with reference to halide, oxide, alkoxide and acetate clusters.

B) Isopoly, Heteropoly acids and their anions. 5h

List of Books

1) S. F. A. Kettle, J. N. Murral and S. T. Teddler: Valency Theory
2) C. A. Coulson: Valency

3) J. E. Huheey :Inorganic Chemistry
4) F .A. Cottonand G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5thand 6th Editions.
5) A. F. Willims: Theoretical Approach in inorganic chemistry.
6) A. Mannas Chanda: Atomic Structure and chemical Bonding
7) L. E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Edition.
8) J. J. Logowski: Modern Inorganic Chemistry
9) B.Durrant and P.J.Durrant: Advanced Inorganic Chemistry
10) J. C. Bailar: Chemistry of coordination compounds.
11) W. L. Jolly: Modern Inorganic Chemistry
12) R. S. Drago: Physical methods in inorganic chemistry.
13) Waddington: Nonaqueous solvents.
14) Sisler: Chemistry of nonaqueous solvents.
15) A. K. Barnard: Therotical Inorganic Chemistry
16) Emeleus and Sharpe: Modern Aspect of Inorganic Chemistry.
17) F. A. Cotton: Chemical Applications of Group theory.
18) Jones: Elementary Coordination chemistry.
19) B. N. Figgis: Introduction to Ligand field.
20) S. F. A. Kettle: Coordination chemistry.
21) M.C.Day and J.Selbin: Theoretical Inorganic Chemistry.
22) J. Lewin and Wilkins: Modern Coordination Chemistry.
23) Gowarikar, Vishwanathan and Sheedar: Polymer science.
24) H. H. Jattey and M. Orchin: Symmetry in chemistry.
25) D. Schonaland: Molecular Symmetry in chemistry.
26) L. H. Hall: Group theory and Symmetry in chemistry
27) H. H. Jattey and M. Orchin: Symmetry in chemistry
28) R.L.Dutta and A.Symal: Elements of magneto chemistry
29) Inorganic Chemistry 4th Edition, P.Atkins, Oxford University Press.
30) Essential Trends in Inorganic Chemistry, D.M.P.Mingos, Oxford University Press.

Semester I

Paper II (Code: 1T2)

Organic Chemistry

60 h (4 h per week): 15 h per unit — 80 Marks

Unit-I: 15 h

A] Nature and Bonding in Organic Molecule**:**Delocalized chemical bonding, conjugation, cross conjugation, resonance, hyper-conjugation, bonding in fullerenes. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons Huckel's rule, energy level of π-molecules orbitals, annulenes, antiaromaticity, homo-aromoaticity. Aromatic character and chemistry of cyclopentadienyl anion, tropylium cation, tropone and tropolone. Bonds weaker than covalent-addition compounds, crown ether complexes and cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes

B] Reactive Intermediates**:** Generation, structure, stability and chemical reactions involving carbocations, carbanions, free radical, carbenes, and nitrenes

Unit-II: 15 h

Streochemistry**:** Conformational analysis of cycloalkanes **(**5**-**8 membered rings**)**, substituted cyclohexanes, mono substituted, disubstituted and trisubstituted cyclohexanes, decalines, effect of conformation on reactivity, Cahn**-**Ingold**-**Prelog System to describe configuration at chiral centers**.** Elements of symmetry, chirality, molecules with more than one chiral center, meso compounds, threo and erythro isomers, method of resolution, optical purity, enantiotopic and distereotopic atoms, groups and faces, prochirality, addition**-**elimination reactions, stereospecific and

steroselective synthesis**.** Asymmetrical synthesis, optical activity in absence of chiral carbon **(**biphenyl and allenes**)**

Unit**-**III**:** 15 h

A**]** Reaction mechanism**:** Structure and Reactivity**:** Types of mechanism, Types of reaction, thermodynamics and kinetics requirements, kinetic and thermodynamic control, Hammond**'**s postulate, Curtin**-**Hammett principle, Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects, Hard and soft acids and bases**.**

B**]** Aliphatic nucleophilic substitution**:** The SN^1, SN^2, mixed SN^1, SN^2 and SET and SN_i mechanisms**.** Nucleophilicty, effect of leaving group, ambient nucleophiles and ambient substrates regiospecificity, substitution at allylic and vinylic carbon atoms, phase transfer catalysis

C**]** Concept of neighboring group participation Anchimeric assistance with mechanism, neighboring group participation by π and σ bonds, classical and non classical carbocations, Intramolecular displacement by hydrogen, oxygen, nitrogen, sulphur and halogen**.** Alkyl, cycloalkyl, aryl participation, participation in bicyclic system, migartory aptitude, carbocation rearrangements and related rearrangements in neighboring group participation**.**

Unit IV**:** 15h

A**]** Aromatic Nucleophilic Substitution

A general introduction to different mechanisms of aromatic nucleophilic substitution S_NAr, SN^1, benzyne and $S_{RN}1$ mechanisms, arynes as reaction intermediate, Reactivity - effect of substrate structure leaving group and attacking nucleophile. The Von Richter, Sommlet-Hauser and Smiles rearrangements.

B**]** Aromatic electrophilic substitution

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The o/p ratio, ipso attack, orientation in benzene ring with more than one substituents, orientation in other ring system. Friedel-Crafts reaction, Vilsmeir-Hack reaction, Gatterman-Koch reaction, Pechman reaction, Reimer-Tieman reaction, Diazonium coupling.

C**]** Effect of Structure on reactivity**:** Resonance and field effects, Steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft Equation.

List of books

1] Advanced Organic Chemistry –Reaction mechanism and structure. Jerry March, John Wiley
2] Advanced Organic Chemistry- F.A. Carey and R. J. Sunberg, Plenum
3] A Guidebook to Mechanism in Organic Chemistry-Peter Skyes, Longman
4] Structure and Mechanism in Organic Chemistry-C.K. Gold, Cornell University Press
5] Organic Chemistry, R.T. Morrison Boyd. Prentice Hall
6] Modern Organic Chemistry-H.O. House, Benjamin
7] Principal of Organic Chemistry-R.O.C. Norman and J.M. Coxon, Blackie Academic and Professional
8] Reaction Mechanism in Organic Chemistry-S.M. Mukharji and S.P. Singh, Macmilan
9] Stereochemistry of Organic Compounds- D. Nasipuri, New Age International
10] Stereochemistry of Organic Compounds- P. S. Kalsi, New Age International
11] Frontier Orbitals and Organic Chemical Reactions-I. Fleming
12] Orbital Symmetry – R. E. Lehr and A. P. Marchand
13] Reactive Intermediate in Organic Chemistry-N. S. Isaacs
14] Stereochemistry of Carbon Compounds- E. L. Eliel
15] Physical Organic Chemistry-J. Hine
16] Name Reaction in Organic chemistry –Surrey
17] Advanced Organic Chemistry – L. F. Fieser and M. Fieser.
18] Organic Chemistry Vol. I and II - I. L. Finar
19] Modern Organic Chemistry- J.D. Roberts and M. C. Caserio
20] The Search for Organic Reaction Pathways (Longmann), Peter Skyes

21] Organic Chemistry 5th Edition (McGraw Hill), S. H. Pine
22] Organic Chemistry (Willard Grant Press Botcon), John Mcmurry
23] A Textbook of Organic Chemistry- R. K. Bansal New Age International
24] New Trends in Green Chemistry –V. K. Ahluwalia and M. Kidwai, Anamaya publishers New Delhi
25] Organic Chemistry, J. Clayden, N. Greeves, S. Warren and P. Wothers, Oxford University Press
26] Organic Chemistry, 4th Edition, G Marc Loudon, Oxford University Press

Semester I
Paper III (Code: 1T3)
Physical Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

UNIT I: CLASSICAL THEMODYNAMICS 15h

A] Recapitulation of Laws of thermodynamics, Exact and inexact differentials, condition of exactness, Ptaff differential expression and equations, Applications of Ptaff differential equations to first and second law of thermodynamics, Carathéodory's principle and its equivalence to the Kelvin Plank and Clausius statement of the Second law of Thermodynamics, Homogeneous functions of degree 0 and 1, extensive and intensive properties, derivation of thermodynamic equations of state, Maxwell's relations.

B] Third law of thermodynamics, Nernst Heat Theorem, unattainability of absolute zero, calculation of entropy based on third law of thermodynamics, residual entropy and its application. Virial equation of state.

UNIT II: GIBBS FUNCTION AND PHASE EQUILIBRIA 15h

A] Partial molar quantities: Determination of partial molar quantities, chemical potential, partial molar volume, Gibbs Duhem equation, Gibbs Duhem Mergules equation, Extent of advancement of reaction (ξ), thermodynamic criteria of chemical equilibrium.

B] Gibbs Phase rule and its derivation, calculation of degrees of freedom, reduced phase rule, construction of phase diagram, one component systems (Helium, carbon), 1st and 2nd order phase transition, lambda line, two component systems forming solid solutions having congruent and incongruent melting point, partially miscible solid phase, three component systems, graphical presentation, influence of temperature, systems with 1, 2, 3 pairs of partially miscible liquids, transition points.

UNIT III: SURFACE PHENOMENA AND MACROMOLECULES 15h

A] Recapitulation of Surface tension, Adsorption: Freundlich adsorption isotherm, Langmuir theory, Gibbs adsorption isotherm, BET theory and estimation of surface area, enthalpy and entropy of adsorption. Surface film on liquids and catalytic activity, Electro-kinetic phenomena, Surface active agents, hydrophobic interactions, micellization, Critical Micelle Concentration (CMC), mass action model and phase separation model of micelle formation, shape and structure of micelles, factors affecting CMC, micro-emulsion and reverse micelles.

B] Macromolecules: Definitions, Number and mass average molecular weights, molecular mass determination by Osmometry, Viscometry, Sedimentation, Diffusion, light scattering method, Numerical.

UNIT IV: CHEMICAL KINETICS 15h

A] Temperature dependence of chemical reaction rates, Arrhenius equation, Energy of activation, pre-exponential factor and its limitations, Collision theory and its limitations, steric factors, Transition State theory of gas and liquid phase bimolecular reactions, comparison of three theories of reaction rates.

B] Bodeinstein steady state approximation and its application in consecutive reactions, Dynamics of unimolecular reactions: Lindeman-Hinshelwood mechanism, RRKM theory, Thermodynamic formulation of transition state theory, Enthalpy, Gibbs free energy and enthalpy of activation.

List of books

1. R. P. Rastogi and R. R. Mishra, An Introduction to Chemical Thermodynamics, Vikas Publication, Gorakhpur, 2010.
2. P. W. Atkins and D. Paula, Physical Chemistry, 8th Edition, Oxford University Press, 2010.
3. E. N. Yenemin, Fundamentals of Chemical Thermodynamics, MIR, Publications.
4. G. K. Vemulapalli, Physical Chemistry, Prentice – Hall of India, 1997.
5. S. Glasstone andDe Van No Strand, Thermodynamics for Chemists, 1965.
6. S. M. Blinder, Advanced Physical Chemistry,
7. D. Mcquarie and J. Simon, Physical Chemistry – A Molecular Approach, University Press, 2000
8. G. M. Barrow, Physical Chemistry, Tata Mc-Graw Hill, V edition 2003.
9. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
10. G.M.Panchenkov and V.P.Labadev, " Chemical Kinetics and catalysis", MIR Publishing
11. E.A. Moelwyn- Hughes, " Chemical Kinetics and Kinetics of Solutions", Academic
12. K.J.Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York.
13. J.Raja Ram and J.C.Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan IndianLtd., New Delhi (1993)
14. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, Vol 1., Elsevier Publications, New York, 1969.
15. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, Vol 2., Elsevier Publications, New York, 1969.
16. S. Glasstone, K. J. Laidler and H. Eyring, The Theory of Rate Processes, Mc-Graw Hill, New York, 1941.
17. A. Findley, The Phase Rule and its Applications, Longmans Green and Co., Mumbai.
18. K. S. Birdi, Surface Chemistry Essentials, CRC Press, New York, 2014.
19. Eric Keightley Rideal, An Introduction to Surface Chemistry, Cambridge University Press, 1926.
20. D. M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, NewYork, 1984.
21. A. W. Adamson, A. P. Gasi, Physical Chemistry of Surfaces, Wiley, 2007.
22. P. C. Hiemenz and R. Rajagopalan, Principles of Colloid and Surface Chemistry, CRC Taylor and Fransis, 2007.
23. P. D. Hede and S. P. Beier, Inorganic and Applied Chemistry, e-Book, 2007.
24. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
25. E.M. Mc Cash, *Surface Chemistry*, Oxford University Press, Oxford (2001).
26. G. K. Agrawal, Basic Chemical Kinetics, Tata-Mc-Graw Hill, 1990.
27. N. B. Singh, N. S. Gajbhiye, S. S. Das, Comprehensive Physical Chemistry, New Age International, 2014.
28. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.

Semester I

Paper IV (Code: 1T4)

Analytical Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: Introduction and statistical analysis 15h

Introduction to analytical chemistry: Types of analysis-qualitative and quantitative. Classification of analytical methods- classical and instrumental, basis of their classification with examples.

Statistical analysis and validation: Errors in chemical analysis. Classification of errors-systematic and random, additive and proportional, absolute and relative. Accuracy and precision. Mean, median, average deviation and standard deviation. Significant figures and rules to determine significant figures. Calculations involving significant figures. Confidence limit, correlation coefficient and regression analysis. Comparison of methods: F-test and T-test. Rejection of data based on Q-test. Least squares method for deriving calibration graph. Application of Microsoft

Excel in statistical analysis (statistical functions and spreadsheets in MS-Excel). Validation of newly developed analytical method. Certified reference materials (CRMs). Numerical problems.

Unit II: Separation techniques 15h

*Chromatography:*Definition and Classification. Techniques used in Paper, Thin Layer and Column chromatography. Applications in qualitative and quantitative analysis.

*Ion exchange:*Principle and technique. Types of ion exchangers. Ion exchange equilibria. Ion exchange capacity. Effect of complexing ions. Zeolites as ion-exchangers. Applications.

*Solvent extraction:*Principle and techniques. Distribution ratio and distribution coefficient. Factors affecting extraction efficiency: Ion association complexes, chelation, synergistic extraction, pH. Numericals based on multiple extractions. Role of chelating ligands, crown ethers, calixarenes and cryptands in solvent extraction. Introduction to Solid phase extraction (SPE) and Microwave assisted extraction (MAE), Applications.

Unit III: Classical methods of analysis 15h

Volumetric analysis: General principle. Criteria for reactions used in titrations. Primary standards and secondary standards. Theory of indicators. Types of titrations with examples- Acid-base, precipitation, redox and complexometric. Titration curves for monoprotic and polyprotic acids and bases. Indicators used in various types of titrations. Masking and demasking agents.

Gravimetric analysis: General principles and conditions of precipitation. Concepts of solubility, solubility product and precipitation equilibria. Steps involved in gravimetric analysis. Purity of precipitate: Co-precipitation and post-precipitation. Fractional precipitation. Precipitation from homogeneous solution. Particle size, crystal growth, colloidal state, aging and peptization phenomena. Ignition of precipitates.

Unit IV: Electrochemical methods of analysis-I 15h

Conductometry: Concepts of electrical resistance, conductance, resistivity and conductivity. Specific, molar and equivalent conductance and effect of dilution on them. Measurement of conductance. Kohlrausch's law, Applications of conductometry in determination of dissociation constant, solubility product. Conductometric titrations. High frequency titrations. Numerical problems.

Potentiometry: Circuit diagram of simple potentiometer. Indicator electrodes: hydrogen electrode, quinhydrone electrode, antimony electrode and glass electrode. Reference electrodes: Calomel electrode and Ag/AgCl electrode. Theory of potentiometric titrations. Acid-base, redox, precipitation and complexometric titrations. Nernst equation, standard electrode potential, Determination of cell potential, n, K_f and K_{sp}. pH titrations. Buffers and buffer capacity. pH of buffer mixtures based on Henderson-Hasselbalch equation.

List of books:

1. Quantitative analysis: Day and Underwood (Prentice-Hall of India)
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry: Gary D. Christian (Wiley, India).
4. Instrumental Methods of Analysis: Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
6. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
7. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
8. Analytical Chemistry: Problems and Solution- S. M. Khopkar (New Age International Publication)
9. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
10. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
11. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)
12. Fundamentals of Analytical Chemistry: S. A. Skoog and D. W. West
13. Instrumental Methods of Chemical Analysis: G. W. Ewing

Semester I
Practical-I (Code: 1P1)

Inorganic Chemistry

12 h /week Marks:100

I. Preparation of Inorganic Complexes and their characterization by:

Elemental analysis and physico-chemical methods (Electronic and IR Spectra, magnetic susceptibility measurements, Thermal analysis and Molar conductance studies).

1. K_3 [Al $(C_2O_4)_3$]$(H_2O)_3$ 2. [VO (acac) $_2$] 3. Na [Cr $(NH_3)_2(SCN)_4$]
4. $K_3[Cr(SCN)_6]$. 5. [Mn (acac) $_3$] 6. K_3 [Fe $(C_2O_4)_3$]
7. Hg [Co (SCN) $_4$] 8. [Co (Py) $_2$ Cl_2] 9. [Cu_2 $(CH_3COO)_4(H_2O)_2$]
10. [Ni (DMG) $_2$] 11.$[Ni(NH_3)_6]Cl_2$ 12. $[Cu(NH_3)_4(H_2O)_2]SO_4$

II. Quantitative Analysis:

Separation and determination of two metal ions from the following alloys involving:
Volumetric, Gravimetric and Spectrophotometric methods

i) Copper (II) and Nickel (II)
ii) Copper (II) and Zinc (II)
iii) Nickel (II)—Zinc (II) and
iv) Copper (II)—Iron (III)

III. Qualitative analysis of radicals:

Semi-micro Analysis of inorganic mixture containing four cations out of which two will be rare metal ions such as W, Mo,Se,Ti,Zr,Ce,Th,V and U.(Spot Test for individual cations should be performed)

Semester I

Practical-II (Code: 1P3)

Physical Chemistry

12 h /week Marks: 100

It is expected to perform minimum 14 experiments in a semester.

1. To study the variation of volume contraction with mole fraction of alcohol in alcohol -water system
2. To determine the activation parameters of viscous flow for a given liquid.
3. To Determine the critical micelle concentration (CMC) of a given surfactant / soap / shampoo by surface tension measurements.
4. Determination of molecular mass of a polymer by viscometry method.
5. To determine integral heat of KNO_3, at two different conc. and calculation of heat of dilution.
6. Effect of 1% NaCl, 1% succinic acid, 0.5% naphthalene on CST in phenol-water systems.
7. Distribution of succinic acid in H_2O- benzene, H_2O-ether and comparison of distribution coefficient.
8. To construct the phase diagrams of two components system (phenol- urea, diphenyl aminebenzophenone; a-naphtyl amine-phenol) forming compounds with congruent melting points.
9. To study the mutual solubility of glycerol-m-toluidine and to determine congruent points.
10. To study kinetics of hydrolysis of an ester by NaOH reaction.
11. To determine equilibrium constant of the equation $KI+I_2=KI_3$ by distribution method.
12. To study the kinetics of the reaction between potassium persulphate and potassium iodide.
13. Determination of order of reaction of oxidation of ethyl alcohol by acid dichromate.
14. To titrate conductometrically monobasic and dibasic acids with NaOH and determine the strength of given acid.
15. To determine equivalent conductance of weak electrolyte at infinite dilution by kaulrausch's method.
16. Determination of heat of reaction, entropy change and equilibrium constant of the reaction between metallic zinc and Cu^{+2} ions in solution.
17. Determination of thermodynamic constants G, H, S for $Zn^{+2}+H_2SO_4 \rightarrow ZnSO_4+ 2H^+$ by emf measurement.

18. Titration of Ferrous Ammonium Sulphate against ceric sulphate and hence the formal redox potential of $Fe^{2+} \rightleftharpoons Fe^{3+}$ and $Ce^{3+} \rightleftharpoons Ce^{4+}$ systems.
19. To determine the pH of a buffer solutions using a quinhydrone electrode
20. Complexometric titrations (EDTA based)

List of Books

1. Vogel A,IIIrd Edition : A Textbook Of Quantitative Inorganic Analysis, Longman
2. J. B. Yadav, Practical Physical Chemistry
3. Das and Behra, Practical Physical Chemistry
4. Carl W. Garland, Joseph W. Nibler and David P. Shoemaker, Experiments in Physical Chemistry, Mc-Graw Hill, 8th Edition, 2009.
5. Farrington Daniels, Joseph Howard Mathews, John Warren Williams, Paul Bender, Robert A. Alberty, Experimental Physical Chemistry, Mc-Graw Hill, Fifth Edition, 1956.
6. John W. Shriver and Michael George, Experimental Physical Chemistry, Lab Manual and Data Analysis, The University of Alabama in Huntsville, Fall 2006
7. Day And Underwood :Quantitative Analysis
8. Merits And Thomas:Advanced Analytical Chemistry
9. Ewing, G. W. : Instrumental Methods Of Chemical Analysis, Mcgraw-Hill
10. Drago, R.S:Physical Methoods In Inorganic Chemistry
11. Christain G.D:Analytical Chemistry
12. Khopkar S.M.:Basic Concept of Analytical Chemistry
13. Koltath And Ligane:Polorography
14. Braun:Instrumental Methods of Chemical Analysis
15. Willard, Merritt And Dean: Instrumental Methods of Chemical Analysis ,Van Nostrand
16. Strouts,Crifi;Llan And Wisin: Analytiacl Chemistry
17. Skoog S.A. And West D. W.:Fundamental Of Analytical Chemistry
18. Dilts R.V.: Analytiacl Chemistry
19. Jahgirdar D.V :Experiments In Chemistry
20. Chondhekar T.K: Systematic Experiments In Physical Chemistry, Rajbog S.W., Aniali Pubn.
21. Wlehov G. J: Standard Methods Of Chemicalanalysis 6th Ed
22. Akjmetov, N :General And Inorganic Chemistry

Semester I

Seminar-I (Code: 1S1)

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25marks (1credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

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M.Sc. Chemistry
Semester II
Paper V (Code: 2T1)
Inorganic Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

A) Electronic spectra of Transition Metal complexes 10h

Determining the Energy terms, Spin-orbit (L-S) coupling scheme, Hund's rule, Hole Formulation, Derivation of the term symbol for a d^2 configuration, Electronic spectra of transition metal complexes – Laporte 'orbital' selection rule,spin selection rule. Orgel diagrams for octahedral metal complexes. Charge transfer spectra, Racah parameters, calculations of 10Dq, B, β parameters.Tanabe- Sugano Diagrams of octahedral complexes with d^2& d^8 configuration.

B) Magnetic Properties of Transition Metal complexes 5h

Abnormal magnetic properties, orbital contributions and quenching of orbital angular momentum, spin-orbit coupling. Magnetic moment, electronic spectra and structure of tetrahalocobalt(II) complexes, tetrahedral and octahedral Ni(II) complexes. High spin-low spins crossover.

Unit – II 15h

Reaction mechanism of Transition Metal Complexres-II: Substitution reaction in square planer complexes: the trans effect, cis effect, steric effect, solvent effect, effect of leaving group, effect of charge, effect of nucleophile, effect oftemperature. Trans effect theories, uses of trans-effect, mechanism of substitution reactions in Pt(II) complexes.Electron transfer reactions. Types of electron transferreactions, conditions of electron transfer, and mechanism of one-electron transfer reactions, outer sphere and inner sphere mechanisms, two electron transfer reactions complimentary and non-complimentary reactions. Tunneling effect, cross-reaction, Marcus-Hush theory, bridged activated mechanism.

Unit-III: Metal pi-Complexes - I 15h

Metal carbonyls: Structure and bonding, vibrational spectra of metal carbonyls for bonding and structure elucidation, important reaction of metal carbonyls.Metal carbonyl clusters with reference to classification, EAN rule, synthesis and structures.

Unit – IV: Metal pi-Complexes – II 15h

Metal nitrosyls: Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and X-ray diffraction studies of transition metal nitrosyls for bonding and structureelucidation, important reactions of transition metal nitrosyls, structure and bonding. Dinitrogen and dioxygen complexes. Wilkinson's catalyst and Vaska's compound.

List of Books

1. J.E.Huheey :Inorganic Chemistry
2. F.A.Cottonand G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5th and 6th Editions.
3. A.F. Willims: Theoretical Approach in inorganic chemistry.
4. Mannas Chanda: Atomic Structure and chemical Bonding
5. L. E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Edition.
6. J. J. Logowski: Modern Inorganic Chemistry
7. B.Durrant and P.J.Durrant: Advanced Inorganic Chemistry
8. J C. Bailar: Chemistry of coordination compounds.
9. W. L. Jolly: Modern Inorganic ChemistryJones: Elementry Coordination chemistry.
10. B. N. Figgis: Introduction to Ligand field.
11. M.C.Day and J.Selbin: Therotical Inorganic Chemistry.
12. J. Lewin and Wilkins: Modern Co-ordination chemistry.
13. Purcell and Kotz: Inorganic Chemistry.

14. D. Banerjea: Co-ordination chemistry, Tata Mc. Graw. Pub.
15. A.F. Wells: Structural inorganic chemistry, 5th Edition, Oxford.
16. S. G. Davies: Organotransition metal chemistry applications to organic synthesis.
17. R. C. Mehrotra: Organometallic chemistry Tata McGraw Hill. Pub.
18. G. S. Manku: Thereotical priciples of inorganic chemistry
19. A. B. P. Lever: Inorganic electronic spectroscopy.
20. R.C.Maurya:Synthesis and charecterisation of novel nitrosyls compounds, Pioneer Pub. Jabalpur2000.
21. R.H.Crabtree:The Organometalic chemistry of Transition metals, John Wiley.
22. D.N.Styanaryan:Electronic Absorption Spectroscopy and related techniques, University Press.
23. R. S. Drago: Physical methods in inorganic chemistry
24. F.Basolo andG.Pearson: Inorganic Reaction Mechanism
25. Organometallics II and I complexes with transition metal- carbon bonds: Manfred Bochmann- Oxford Press.
26. Advanced Inorganic Chemistry Vol I and II – Satyaprakash, Tuli, Bassu and Madan- S Chand.
27. M.Tsusui,M.Nlevy,M.Ichikwa and K.Mori:Introduction to metal pi-complexe chemistry,Plenum press,NY
28. A.E.Martel;Coordination Chemistry-VolIandII,VNR.

Semester II

Paper VI (Code: 2T2)

Organic Chemistry

2T2

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I 15 h

A] Addition to carbon-carbon multiple bond: Mechanistic and stereochemical aspects of addition reaction involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, Orientation and stereochemistry, Addition to cyclopropanes, Hydrogenation of double bond and triple bonds. Hydrogenation of aromatic rings, hydroboration, Michael reaction, Robinson annulation

B] Addition to carbon-hetero atom multiple bond: Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters, and nitriles, Addition of Grignard reagents, organozinc and organolithium reagents to carbonyls and unsaturated carbonyl compounds, Wittig reaction, Mechanisms of condensation reactions involving enolates- Aldol, Knoevengel, Claisen, Mannich, Benzoin, Perkin, Stobbe reaction, Hydrolysis of esters and amide.

Unit-II 15 h

A] Mechanism of molecular rearrangement: Classification and General mechanistic treatment of electrophilic, nucleophilic and free radical moleculer rearrangement. Mechanism of the following rearrangement –Wagner-Meerwin, Pinacol-Pinacolone, Tiffenev –Demjnov ring expansion, benzil-benzilic acid, Favorski, Wolff, Arndt-Eistert synthesis, Curtius Lossen, Beckman, Hoffman, Schmidt rearrangement.

B] Elimination reactions: The E_1, E_2 and E_1CB mechanisms and orientation of the double bond, Saytzeff and Hoffman's rule, Effect of substrate structure, attacking base, leaving group and medium, Mechanism and orientation in pyrolytic elimination

UNIT-III

Free radical reactions: Generation of free radicals, Type of free radical reactions, free radical substitution mechanism at an aromatic substrate, aliphatic substrate, reactivity at a bridgehead position. Neighbouring group assistance, reactivity for aliphatic and aromatic substrates, reactivity in attacking radicals, effect of solvent on reactivity.Halogenation at an alkyl carbon, allylic carbon (NBS), hydroxylation at an aromatic carbon by means of Fenton's reagent. Auto-oxidation,

chlorosulphonation (Reed Reaction) Coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction, Free radical rearrangement, Hunsdiecker reaction, iododecarboxylation, Barton reaction, Hoffmann-Loefler-Freytag reaction

Unit IV: Green chemistry 15 h

Green chemistry: Basic principles of green chemistry, calculation of atom economy of rearrangements, addition, substitution and elimination reaction with suitable examples, Case study of Bhopal gas tragedy and Seveso disaster, Synthesis involving basic principles of green chemistry-paracetamol, Ibuprofen, hydroquinone, adipic acid, ε-caprolactum, styrene, urethanes, Free radical bromination, Multi-component reactions (Biginelli, Ugi and Passerini reaction), Prevention or minimization of hazardous products, choice of solvents. Sonochemistry, microvave induced reactions, polymer supported reagents, reactions in aqueous medium, zeolites and ionic liquid supported reaction, Solvent free reactions, electrochemical reactions, Biocatalysts in Organic synthesis.

List of books

1] Books as Suggested in Semester I for Organic Chemistry
2] A Textbook of organic chemistry- R.K. Bansal
3] New trends in green chemistry –V.K. Ahluwalia and M. Kidwai, Anamaya publishers New Delhi
4] Heterocyclic Chemistry, John Joule, Oxford University Press
5] Books as Suggested in Semester I for Organic Chemistry
6] A Textbook of organic chemistry- R.K. Bansal
7] New trends in green chemistry –V.K. Ahluwalia and M. Kidwai, Anamaya publishers New Delhi
8] Heterocyclic Chemistry, John Joule, Oxford University Press

Semester II

Paper VII (Code: 2T3)

Physical Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

UNIT I: FORMULATION OF QUANTUM MECHANICS

15h

A] Introduction of Quantum Mechanics, Wave Function, Acceptability of Wave Functions, Normalized and Orthogonal Wave Functions, Operators, Operator Algebra, Eigen Functions and Eigen Values of Quantum Mechanical Properties (e.g. Linear, Angular momentum, etc.), Hermitian Operators, Orbital and generalized Angular Momentum, Postulates of Quantum Mechanics, Problems on Operator algebra, Eigen Values and Average Values of quantities.

B] Application of Schrödinger Wave Equation to Simple Systems: Degeneracy in 3-Dimensional Box, Rigid Rotor, Potential Well of Finite Depth (Tunneling Effect), Simple Harmonic Oscillator, The Hydrogen Atom.

UNIT II: THERMODYNAMICS

15h

A] Ideal and Non-ideal Systems: Concept of fugacity, determination of fugacity, excess functions for non ideal solutions, Entropy of mixing, Enthalpy of mixing, Activity and activity coefficients, Concept of ion atmosphere and electrophoretic effect, Debye Hückel theory for activity coefficients of electrolytic solutions, determination of activity and activity coefficients, ionic strength and dependence of activity coefficients on ionic strength, numericals.

B] Nonequilibrium Thermodynamics: Conservation of mass and energy in time dependent closed and open systems, Thermodynamic criteria of irreversibility, rate of entropy production and entropy exchange in irreversible processes. The generation of the concept of Chemical Affinity and the

extent of advancement of chemical reactions, Thermodynamic constraints on the signs of chemical affinity and the velocity of chemical reaction, application to any one coupled reaction.

UNIT III: SOLID STATE CHEMISTRY 15h

A] Introduction to crystals, Unit Cell and lattice parameters, Symmetry elements in crystals, Absence of fivefold axis, Space groups, The Bravais Lattices, Miller Indices, Bragg's Equation, seven crystal system, Packing in crystals, Hexagonal Closest Packing (HCP) Cubic Closest Packing (CCP), Voids, packing fraction, Numericals.

B] Crystal Defects and Non-stiochiometry: Perfect and imperfect crystals, point defects, line and plane defects. Thermodynamics of Schottky and Frenkel defect formation, colour centers, non-stiochiometry and defects.

UNIT IV: STATISTICAL THERMODYNAMICS AND NUCLEAR CHEMISTRY 15h

A] Statistical thermodynamics: Lagrange's Method of Undetermined Multipliers (Conditional Maximization), Stirling Approximation, Concept of Distribution, Thermodynamic Probability and most probable distribution, Maxwell Boltzmann, Bose Einestein, Fermi Dirac statistics, comparison between three statistics.

B] Nuclear Chemistry: Introduction, radioactive decay and equilibrium, thermonuclear reactions, photonuclear reactions, Radiometric titration, isotopic dilution analysis, NAA. Counters: Proportional counter, GM counter, Scintillation counter, Ionization chamber counter.

List of books

1. Ira .N. Levine, Quantum Chemistry, 5th edition(2000), Pearson educ., Inc.New Delhi
2. A.K.Chandra, Introductory Quantum Chemistry, 4th edition (1994), Tata Mcgraw Hill, New Delhi.
3. M.W.Hanna, " Quantum Mechanics in Chemistry", Benjamin
4. L. Pualing and E. B. Wilson, Introduction to Quantum Mechanics with Applications to Chemistry, McGraw Hill, New York (1935).
5. R. K. Prasad, Quantum Chemistry, New Age International, Delhi.
6. R. K. Prasad, Quantum Chemistry through problems and solutions, New Age International, New Delhi, 2009.
7. B. C. Reed, Quantum Mechanics, Jones and Bartlett, New Delhi, 2010.
8. R. P. Rastogi and R. R. Mishra, An Introduction to Chemical Thermodynamics, Vikas Publication, Gorakhpur, 2010.
9. P. W. Atkins'and D. Paula, Physical Chemistry, 8th Edition, Oxford University Press, 2010.
10. G. K. Vemulapalli, Physical Chemistry, Prentice – Hall of India, 1997.
11. S. Glasstone, An Introduction to Electrochemistry, East-West Press Pvt. Ltd., New Delhi, 2004.
12. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
13. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
14. N. B. Hanny, Treaties in Solid State Chemistry,
15. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
16. I Prigogine and R. Defay, Chemical Thermodynamics, Longmans, London, 1954.
17. S. R. DeGroot and P. Mazoor, Non-Equilibrium Thermodynamics, North-Holland Co., Amsterdam, 1969.
18. G. Lebon, D. Jou and Casa Vazquez, Understanding Non-equilibrium Thermodynamics, Springer, 2008.
19. I.Prigoggine, "An Introduction to Thermodynamics of Irreversible Processes," Wiley-Interscience.
20. R. P. Rastogi, Introduction to Non-equilibrium Physical Chemistry, Elsevier, Amsterdam, 2008.
21. G. A. Somorjai, Introduction to Surface Chemistry and Catalysis, Wiley, 2010.
22. M. C. Gupta, Statistical Thermodynamics, New Age International.
23. K. Huang, Statistical Mechanics, Wiley, New Delhi, 2003.
24. Andrew Maczek, *Statistical Thermodynamics,* Oxford University Press Inc., New York (1998).
25. C.N.Rao. Nuclear Chemistry

26. B. G. Harvey, *Introduction to Nuclear Physics and Chemistry,* Prentice Hall, Inc. (1969).
27. H.J. Arnikar, *Essentials of Nuclear Chemistry*, 4th Edition (1995), Wiely-Eastern Ltd., New Delhi.
28. C.Kittel, " Introduction to solid state Physics",Wiley
29. L.V.Azaroff, " Introduction to solids", McGraw Hill
30. L. E. Smart and E. A. Moore, Solid State Chemistry-An Introduction, CRC Tylor and Fransis, 2005.
31. D. D. Sood, A. V. R. Reddy, Fundamentals of Radiochemistry, Indian Association of Nuclear Chemists and Allied Scientists, 2007.
32. C. N. R. Rao and Gopalakrishnan, "New Directions in Solid State Chemistry " Second Edition, Cambridge University Press.
33. Anthony R. West, "Solid State Chemistry and its Applications" Wiley India Edition.
34. C. Kalidas and M. V. Sangaranarayana, Non-Equilibrium Thermodynamics.
35. D. K. Chakravorty, Solid State, New Age International.

Semester II

Paper VIII (Code: 2T4)

Analytical Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Sampling and quantification 15h

A] *Sampling and sample treatment*: Criteria for representative sample. Techniques of sampling of gases (ambient air and exhaust gases), liquids (water and milk samples), solids (soil and coal samples) and particulates. Hazards in sampling. Safety aspects in handling hazardous chemicals.Sample dissolution methods for elemental analysis: Dry and wet ashing, acid digestion, fusion processes and dissolution of organic samples.

B] *Detection and quantification*: Concepts and difference between sensitivity, limit of detection and limit of quantification, role of noise in determination of detection limit of analytical techniques.Units in chemical analysis and their interconversion.

C] *Stoichiometry:* Stoichiometric and sub-stoichiometric reactions and calculations.

Unit-II: Modern separation techniques 15h

A] *Gas Chromatography*: Principle including concept of theoretical plates and van-Deemter equation. Instrumental set up- carrier gas, sampling system, column and detector. Types of columns, their advantages and limitations. Detectors in GC analysis. Temperature programmed GC. Factors affecting retention, peak resolution and peak broadening.

B] *Liquid chromatography*: Principle, Instrumentation, Advantages and applications of HPLC. Types of columns and detectors. Principle and applications of size exclusion, gel permeation, ion retardation, normal phase and reverse phase chromatography.

C] *Supercritical fluid chromatography*: Introduction and applications.

Unit III: Optical methods of analysis-I 15h

A] Spectrophotometry and Colorimetry: Principle of colorimetry. Beer's law, its verification and deviations. Instrumentation in colorimetry and spectrophotometry (single and double beam). Sensitivity and analytical significance of molar extinction coefficient and λ_{max}. Comparison method, calibration curve method and standard addition method for quantitative estimation. Role of organic ligands in spectrophotometric analysis of metal ions. Ringbom plot and Sandell's sensitivity. Photometric titrations. Determination of pK value of indicator. Simultaneous determination. Composition and stability constant of complex by Job's and mole ratio methods. Derivative spectrophotometry. Numerical problems.

B] Flame photometry: Principle. Instrumentation and types of burners. Factors affecting flame photometric determination. Limitations of flame photometry. Interferences in flame photometry. Applications.

Unit-IV: Electrochemical methods of analysis-II 15h

A] *Polarography*: Principle of DC polarography. Instrumentation in polarography. Advantages and limitations of DME. Types of currents- residual current, migration current, diffusion current, limiting current, adsorption current, kinetic current and catalytic current. Ilkovic equation-diffusion current constant and capillary characteristics. Derivation of equation of polarographic wave and half wave potential. Experimental determination of half wave potential. Reversible, quasi reversible and irreversible electrode reactions. Polarographic maxima and maximum suppressor. Oxygen interference and deaeration. Introduction to pulse, a.c. and oscillographic techniques and their advantages. Applications of polarography in determination of dissolved oxygen, metal ion quantification and speciation, simultaneous determination of metal ions, analysis of organic compounds. Limitations of polarography.

B] Amperometric titrations**:** Principle, types and applications in analytical chemistry.

List of books**:**

1. Quantitative analysis**:** Day and Underwood **(**Prentice**-**Hall of India**)**
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry**:** Gary D**.** Christian **(**Wiley India**).**
4. Instrumental Methods of Analysis**:** Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Sample Pre-treatment and Separation: R. Anderson (John Wiley and Sons)
6. Stoichiometry: B.I.Bhatt and S.M. Vora, 2nd Edition (Tata Mc-Graw Hill publication)
7. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
8. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
9. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
10. Analytical Chemistry: Problems and Solution- S. M. Khopkar (New Age International Publication)
11. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
12. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
13. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)
14. Fundamental of Analytical Chemistry: S. A. Skoog and D. W. West
15. Instrumental Methods of Chemical Analysis: G. W. Ewing
16. Polarography: Koltoff and Ligane
17. Electroanalytical Chemistry: Sane and Joshi (Quest Publications)

Semester II
Practical**-**III **(**Code**:** 2P2**)**
Organic Chemistry

12 h /week Marks: 100

[A**]** Qualitative Analysis**:** Separation, purification and identification of the mixture of two organic compounds (binary mixture with two solid, one solid one liquid and two liquids) using chemical methods or physical techniques.
Minimum 8-10 mixtures to be analyzed.
Purification of the compounds by crystallization, TLC and chromatographic techniques.

[B**]** Organic preparations**:**Student is expected to carry out minimum of 5-6 two stage organic preparation and 5-6 single stage preparation from the following lists.

[1] Oxidation: Adipic acid by chromic acid oxidation of cyclohexanol.
[2] Benzophenone → benzhydrol
[3] Aldol condensation: Dibenzal acetone from benzaldehyde.
[4] Sandmeyer reaction: *p*- chlorotoluene from *p*-toluidine
[5] Cannizzaro reaction
[6] Friedel Crafts Reaction: β-Benzoyl propionic acid from succinic anhydride and benzene.
[7] Benzil → 2,4,5-triphenyl imidizole

[8] Sucrose → Oxalic acid
[9] Methyl acetoacetate → 5-methyl-isoxazol-3-ol
[10] Ethyl acetoacetate →4-aryl-6-methyl-3,4-dihydro-2(1*H*)-pyrimidinone ester
[11] Ethyl acetoacetate → Diethyl 1,4-dihydro-2,6-dimethyl-4-phenylpyridine-3,-5dicarboxylate
[12] Dye prepartion : Sulphanilic acid → Methyl orange
[13] Dye prepartion : p-nitroaniline → p-red
[14] Acetanilide →*p*-nitroacetanilide →*p*-nitroaniline
[15] Aniline → 2,4,6-tribromo aniline → 2,4,6-tribromoacetanilide
[16] Nitrobenzene →*m*-dinitrobenzene →*m*-nitroaniline
[17] toluene →p-nitrotoluene →*p*-nitrobenzoic acid
[18] Glycine → Benzoyl glycine → 4-benzilidene-2-phenyl oxazole

Semester II

Practical-IV (Code: 2P4)

Analytical Chemistry

12 h /week Marks: 100

Section (A): Classical methods and separation techniques: Calibration, validation and computers

1. Calibration of pipette and burette.
2. Statistical analysis of data.
3. Use of MS-Excel in statistical analysis of data and curve fitting.

Volumetry

1. Determination of Na_2CO_3 in washing soda.
2. Determination of NaOH and Na_2CO_3 in a mixture.
3. Estimation of nickel in given solution by direct complexometric titration with EDTA using bromopyrogallol red.
4. Estimation of nickel in given solution by complexometric back-titration with EDTA.
5. Estimation of chloride in given solution by Mohr's titration.
6. Estimation of chloride in given solution by Volhard's titration.
7. Determination of volume strength of commercial hydrogen peroxide by redox titration with $KMnO_4$.
8. Estimation of phenol/ aniline by bromination method.
9. Estimation of glucose.
10. Estimation of acetone.
11. Estimation of formaldehyde.
12. Estimation of Mn in the presence of Fe using masking phenomenon (ferromanganese alloy).

Gravimetry

1. Estimation of barium as barium sulphate.
2. Estimation of calcium as calcium oxalate/ calcium carbonate/ calcium oxide.

Separation techniques

1. Qualitative separation of metal ions by paper chromatography for 2/3 components.
2. Determination of ion-exchange capacity of resin.
3. Separation of ions by ion exchange.

Section (B): Instrumental techniques: Electroanalytical techniques

1. Analysis of commercial vinegar by conductometric titration.
2. Estimation of phenol by conductometric titration with NaOH.
3. Determination of strength of HCl and CH_3COOH in a mixture conductometrically.

4. Determination of strength of HCl and oxalic acid in a mixture conductometrically.
5. Determination of strength of oxalic acid and CH_3COOH in a mixture conductometrically.
6. Determination of degree of dissociation and dissociation constant of acetic acid conductometrically.
7. Estimation of phenol in dilute solution by conductometric titration with NaOH.
8. Determination of strength of HCl and CH_3COOH individually and in a mixture potentiometrically.
9. Determination of Fe(II) by potentiometric titration with $K_2Cr_2O_7$.
10. Determination of three dissociation constants of H_3PO_4 by pH-metric/ potentiometric titration.

Optical methods

1. Determination of pK of indicator by colorimetry.
2. To estimate the amount of NH_4Cl colorimetrically using Nesseler's Reagent.
3. To study the complex formation between Fe(III) and salicylic acid and find the formula and stability constant of the complex colorimetrically (Job's method).
4. To determine the dissociation constant of phenolphthalein colorimetrically.
5. Estimation of iron in wastewater sample using 1,10-phenanthroline.

Note: One experiment from each section should be performed in the examination.

Semester II

Seminar-II (Code: 2S1)

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 Credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

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M.Sc. Chemistry
Semester III
INORGANIC CHEMISTRY SPECILIZATION
Paper IX (Code: 3T1)
Special I-Inorganic Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit -I 15h

A) Essential and trace metals in biological systems: Biological functions of inorganic elements, biological ligands for metal ions. Coordination by proteins, Tetrapyrrole ligands and other macrocycle. Influence of excess and difficiency of V, Cr, Mn, Fe, Co, Cu,& Zn. Genetic defects in the absorption of trace elements. Regulation and storage of trace elements. Role of minerals. Toxic effects of metals.

B) Metal storage, transport and biomineralization with respect to Ferritin, Transferrin and Siderophores, Na^+ /K^+ pump. Role of Ca in transport and regulation in living cells.

C) Medicinal use of metal complexes as antibacterial, anticancer, use of cis-platin as antitumor drug, antibiotics & related compounds. Metal used for dignosis and chemotherapy with particular reference to anti cancer drugs.

Unit-II 15h

A) Bio-energetics and ATP cycle: DNA polymerization, metal complexes in transmission of energy, chlorophylls, photosystem I and photosystem II in cleavage of water, Model systems.

B) Electron transfer in Biology: Structure and functions of metalloproteins in electron transfer proteins, cytochromes & Fe-S proteins, Non-heme iron proteins; Rubredoxins, Synthetic models. Biological Nitrogen fixation (in vitro and in vivo)

Unit-III

15h

Transport & Storage of Dioxygen: Heme proteins & oxygen uptake, structure and functions of haemoglobin, myoglobin, hemocyanins & hemerythrin. Perutz mechanism showing structural changes in porphyrin ring system. Oxygenation and deoxygenation. Model compounds. Cyanide poisoningand treatment. Vanadium storage and transport.

Unit-IV 15h

Metallo enzymes: Apoenzymes, Haloenzyme & Coenzyme. The principle involved and role of various metals ini) Zn-enzyme:- Carboxyl peptidase & Carbonic anhydrase. ii) Fe-enzyme:-Catalase Peroxidase & Cytochrome P-450 iii) Cu-enzyme:-Super Oxide dismutase iv) Molybdenum:-Oxatransferase enzymes, Xanthine oxidase,Co-enzyme Vit.B12, Structure of vitamin B12 Co-C bond cleavage, Mutaseactivity of co- Enzyme B-12, Alkylation reactions of Methyl Cobalamin. Synthetc model of enzyme action, stability and ageing of enzyme.

List of Books:

1. Akhmetov, N.: General and Inorganic Chemistry.
2. Aylett, B. and Smith, B.: Problems in Inorganic Chemistry, (English University Press)
3. Bertini, et al: Bioinorganic Chemistry (Viva)
4. Charlot, G and Bezier, D.: Quantitative Inorganic Analysis (johnWiley).
5. Douglas, B. E. McDanirl, D. H. et al: Concept and Models of Inorganic Chemistry (4th edt.) J. Wiley
6. Dutt P. K.: General and Inorganic Chemistry.(Sarat Books House)
7. Fenton, David E.: Biocoordination chemistry, Oxford

8. Jolly, W. L. : Inorganic Chemistry (4th edn.) Addison-Wesley.
9. Katakis, D. and Gordon, G.: Mechanism of Inorganic Reactions.(J.Wiley).

Semester III

Paper X (Code: 3T2)

Special II-Inorganic Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I 15 h

Crystal Structure of Some Simple Compounds:

i) Ionic Crystals &Their structures, radius ratio rule, effect of polarization on crystals.
ii) Covalent structure type- Sphalerite & Wurtzite.
iii) Geometry of simple crystal AB type: NaCl, CsCl & NiAs, reasons for preference for a particular structure in above AB type of compounds.
iv) AB_2 type: Fluorite, antifluorites, Rutile structures. Li_2O, Na_2O,,$CdCl_2$, CdI_2 structures.
v) Ternary Compounds ABO_3 type: Perovskite, Barium titanate, lead titanate, $CaTiO_3$, Tolerance factor, charge neutrality & deviation structures. $FeTiO_3$.

Unit-II 15h

A) AB_2O_4 type- compounds: Normal & inverse,2-3 and 4-2 spinel,packing of oxygen in tetrahedral & octahedral sites, sites occupancy number of site surrounding each oxygen,application of charge neutrality principles, site preferences in spinel, distorted spinel.Hausmannite(Jahn-Teller distortions),Factors causing distortion in spinel.

B) Lattice Defects: Per fect &Imperfect crystals, point defects, Interstitial, Schottky defect, Frenkel defect, line defect & other entities, thermodynamics of Schottky & Frankel defects. Dissociation, theory of dislocation, plane defects- Lineage boundary, grain boundary, stacking fault, 3D defects, Defects & their concentrations, ionic conductivity in solids, Non stoichiometric compounds. Electronicproperties of Non-stoichiometric oxides.

Unit-III 15h

Glasses, Ceramics and composite:Glasses, Ceramics Composites and Nano-materials: Glassy state, glass formers and GlassModifiers. Glasses, Ceramics, Clay products, Refractories with reference to: preparation, Properties and applications. Microscopic composites, dispersion, strengtheried and particlereinforced, fibre reinforced Composites, microscopic composites, nanocrystaline phase, preparation procedure, special properties and applications.

Unit-IV

15 h

Liquid Crystals: Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematics & smectic mesophases; smectic-Nematic transition clearing temperature-homeotrpic, planer & schlieren textures twisted nematics, chiral nematics, molecular arrngement insmectic A & smectic C phases, optical properties of liquid crystals. Dielectric susceptibility & dielectric constants. Lyotropic phases & their description of ordering in liquid crystals.

List of Books:

1. Akhmetov, N.: General and Inorganic Chemistry.
2. Aylett, B. and Smith, B.: Problems in Inorganic Chemistry, (English University Press)
3. Bertini, et al: Bioinorganic Chemistry (Viva)
4. Charlot, G and Bezier, D.: Quantitative Inorganic Analysis (johnWiley).

5. Douglas, B. E. McDanirl, D. H. et al: Concept and Models of Inorganic Chemistry (4th edt.) J. Wiley
6. Dutt P. K.: General and Inorganic Chemistry.(Sarat Books House)
7. Fenton, David E.: Biocoordination chemistry, Oxford
8. Jolly, W. L. : Inorganic Chemistry (4th edn.) Addison-Wesley.
9. Katakis, D. and Gordon, G.: Mechanism of Inorganic Reactions.(J.Wiley).
10. Peter J. Collings, Liquid Crystals-Nature's delicate Phase of Matter, New Age International.
11. S. Chandrasekhar, Liquid Crystals, Cambidge University Press.

Semester III

Practical-V (Code: 3P1)

Inorganic Chemistry Special

12 h /week Marks: 100

A INSTRUMENTAL METHODS

I pH METRY:

1. Stepwise proton ligand and metal ligand constant of complexes by Irving Rossetti method

II COLORIMETRY AND SPECTROPHOTOMETRY

1. simultaneous determination of manganese (KMnO$_4$) and chromium ($K_2Cr_2O_7$)
2. simultaneous determination of cobalt (II) and nickel(II)
3. Determination of composition and stability constant of complexes by Job's method of continuous variation , mole ratio method and slope ratio method

III POTENTIOMETRY

1. Estimation of halide in a mixture by potentiometry
2. Determination of stepwise stability constant of silver thiosulphate complex by potentiometrically

IV CONDUCTOMETRY

1. Estimation of amount of acid in a mixture by conductometric titration

B INORGANIC REACTION MECHANISM

Kinetics and mechanism of following reactions:

1. Substitution reactions in octahedral complexes (acid/base hydrolysis)
2. Redox reactions in octahedral complexes
3. Isomerization reaction of octahedral complexes

C BIOINORGANIC CHEMISTRY (CHLOROPHYLL

1. Extraction and absorption spectral study of chlorophyll from green leaves of student choice
2. separation of chlorophyll and their electronic spectral studies
3. Complexation study of metal ions with biologically important amino acids

List of Books

1. Day And Underwood :Quantitative Analysis
2. Vogel A : A Textbook Of Quantitative Inorganic Analysis, Longman
3. Flaschka : Edta Titration
4. Merits And Thomas:Advanced Analytical Chemistry
5. Ewing, G. W. : Instrumental Methods Of Chemical Analysis, Mcgraw-Hill
6. Drago, R.S:Physical Methoods In Inorganic Chemistry
7. Christain G.D:Analytical Chemistry
8. Khopkar S.M.:Basic Concept Of Analytical Chemistry
9. Koltath And Ligane:Polorography

10. Braun:Instrumental Methods Of Chemical Analysis
11. Willard, Merritt And Dean: Instrumental Methods Of Chemical Analysis ,Van Nostrand
12. Strouts,Crifi;Llan And Wisin: Analytiacl Chemistry
13. Skoog S.A. And West D. W.:Fundamental Of Analytical Chemistry
14. Dilts R.V.: Analytiacl Chemistry
15. Jahgirdar D.V :Experiments In Chemistry
16. Chondhekar T.K: Systematic Experiments In Physical Chemistry, Rajbog S.W., Aniali Pubn.
17. Wlehov G. J: Standard Methods Of Chemicalanalysis 6th Ed
18. Ramesh Rand Anbu M , Chemical Methods For Envirnmental Analysis : Watewr And Sedient , Macmillion India
19. Akjmetov, N :General And Inorganic Chemistry
20. Aylett, B. And Smith , B. :Problems In Inorganic Chemistry
21. Charlot, G. And Bezier, D.: Quantitative Inorganic Analysis (John Wilry)
22. Douglas, B. E. Mcdanirl, D. H. Et Al : Concept Amd Models Of Inorganic Chemistry (4th Ed) J Wiley
23. Dutt P. K.:General And Inorganic Chemistry (Sarat Book House)
24. Fenton, David E.:Biocoordination Chemistry, Oxford
25. Jolly, W. L. :Inorganic Chemistryu (4 Th Ed) Addison-Wesley
26. Bertini, Et Al:Bioinorganic Chemistry (Viva)
27. Katakis, D. And Gordon, G :Mechanism Of Inorganic Reactions (J. Wiley)

Semester III

ORGANIC CHEMISTRY SPECIALIZATION

Paper IX (Code: 3T1)

Special I-Organic Chemistry

60h (4h/week) 15h/ unit 80 Marks

UnitI: Photochemistry 15 h

Interaction of radiation with matter, types of excitation, rate of excited molecules, quenching, Quantum efficiency, quantum yield, transfer of excitation energy, singlet and triplet states, experimental methods in photochemistry of carbonyl compounds, and transition, Norrish type I and Norrish type II reactions Paterno–Buchi reaction, Photoreduction, Photochemistry of enones, Hydrogen abstraction rearrangement of unsaturated ketones and cyclohexadienones, Photochemistry of parabenzoquinones, photochemistry of Aromatic compounds with reference to isomerisation additon and substitution Photochemical isomerization of cis and trans alkenes, Photochemical cyclization of reaction, Photo-Fries rearrangement, di-pi methane rearrangement, Photo theory reaction of anilides, photochemistry of vision, Applications of photochemical methods in synthesis: Isocomene, Cedrene, Hirsutene

Unit II: Pericyclic Reactions 15 h

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1, 3, 5-hexatriene, allyl system, classification of pericyclic reaction. FMO approach, Woodward-Hoffman correlation diagram method and Perturbation of Molecular Orbital (PMO) approach of pericyclic reaction under thermal and photochemical conditions Electrocyclic reactions, conrotatary and disrotatary motion 4n and (4n+2) systems, Cycloaddition reaction with more emphasis on [2+2] and [4+2], Cycloaddition of ketones Secondary effects in [4+2] cycloaddition. Stereochemical effects and effect of substituents on rate of cycloaddition reaction, Diels-Alder reaction, 1,3-dipolar cycloaddition and chelotropic reaction. Sigmotropic rearrangement, suprafacial, and antarafacial shift involving carbon moieties, retention and inversion of configuration, [3,3] and [3,5] sigmotropic rearrangements, Claisen, Cope, Sommelet-Hauser rearrangements, Ene reaction.

Unit III 15 h

A] Oxidation: Oxidation of alkanes, aromatic hydrocarbons and alkenes, Dehydrogenation with S, Se, Fremy's salt, DDQ, chloranil and $PhI(OAc)_2$, Oxidation with SeO_2, Epoxidation of olefins, Synthetic

application of epoxides, Sharpless asymmetric epoxidation, Dihydroxylation of olefins using $KMnO_4$, OsO_4, Woodward and Prevost dihydroxylation, Oxidative cleavage of olefins, Ozonolysis

a) Oxidation of alcohols: Chromium reagents, pyridinium chlorochromate (PCC), pyridinium dichromate (PDC), Collin and Jones reagent, Combination of DMSO with DCC, $(COCl)_2$, NCS and $(CH_3CO)_2O$ for oxidation of alcohols, Oxidation with MnO_2, Oppenauer oxidation
b) Oxidation of aldehydes and ketones, Conversion of ketones to α, β-unsaturated ketones and α-hydroxy ketones, Baeyer-Villiger oxidation , Chemistry and synthetic applications of $Pb(OAc)_4$, Dess-Martin periiodinane, IBX

B**]** Reduction**:** Catalytic heterogeneous and homogeneous hydrogenation, Hydrogenation of alkenes, alkynes and arenes, Selectivity of reduction, Mechanism and stereochemistry of reduction, Raney Ni-catalyst, Adam catalyst, Lindlar catalyst, Wilkinson catalyst.

a) Reduction by dissolving metals, Reduction of carbonyl compounds, conjugated systems, aromatic compounds and alkynes. Birch reduction, Hydrogenolysis
b) Reduction by hydride transfer reagents, Meerwein-Pondorff-Verley reduction, Reduction with $LiAlH_4$ and $NaBH_4$, stereochemical aspects of hydride addition, Derivatives of $LiAlH_4$ and $NaBH_4$, Selectivity issues, Diisobutylaluminium hydride (DIBAL-H), Sodium cyanoborohydride, Reduction with boranes and derivatives Reduction with Bu_3SnH., Reduction of carbonyl group to methylene, Reduction with diimide and trialkylsilanes

Unit IV**:** Chemistry of P, S, Si,and Boron compounds 15 h

a) Phosphours and sulphur ylide: Preperation and their synthetic application along with stereochemistry
b) Umpolung concept: Dipole inversion, generation of acyl anion, use of 1,3-dithiane, ethylmethylthiomethylsulphoxide, bis-phenylthiomethane, metallated enol ethers, alkylidene dithiane, ketone thioacetals, 2-propenethiobismethyl thioallyl anion, thiamine hydrochloride based generation of acyl anion
c) Organoboranes- preparation and properties of organoborane reagents e.g. RBH_2, R_2BH, R_3B, 9-BBN, catechol borane. Thexyl borane, cyclohexyl borane, $ICPBH_2$, IPC_2BH, Hydrboration-mechanism, stereo and regeoselectivity, uses in synthesis of primary, secondary tertiary alcohols, aldehydes, ketones, alkenes, Synthesis of EE, EZ, ZZ dienes and alkyenes. Mechanism of addition of IPC_2BH. Allyl boranes- synthesis, mechanism and uses
d) Organo silicon compounds in organic synthesis, Me_3SiCl, Me_3SiH and Paterson synthesis

List of books

1] Books as suggested in Semester I for organic chemistry
2] Organic Synthesis, The disconnection approach-S. Warren
3] Designing Organic Synthesis-S. Warren
4] Some Modern Methods of Organic Synthesis-W. Carruthers
5] Advance Organic Chemistry Part-B-F. A. Caray and R. J. Sundberg Plenum Press
6] Protective Group in Organic Synthesis-T. W. Greene and PGM
7] The Chemistry of Organo Phosphorous-A. J. Kirbi and S.G. Warren
8] Organo Silicon Compound-C. Eabon
9] Organic Synthesis via Boranes-H. C. Brown
10] Organo Borane Chemistry-T. P. Onak
11] Organic Chemistry of Boron-W. Gerrard
12] Fundamentals of Photochemistry-K. K. Rohatgi-Mukharji, Wiley Eastern Limited
13] Photochemistry-Cundau and Gilbert
14] Aspects of Organic Photochemistry-W. M. Horspoot
15] Photochemistry-J. D. Calvert
16] Photochemistry-R. P. Wayne

Semester III
Paper X (Code: 3T2)
SpecialII-Organic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit – I

15 h

A] Terpenoids: Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, and synthesis of the following representative molecules: Citral, Geraniol, α-terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β-carotene, Vitamin A Genesis of biological isoprene unit, Biosynthesis (ONLY) of the following tepenoids: myrecene, linalool, geraniol, α-terpeneol, limonene, camphor, α-pinene, β-pinene, farnesol, β-bisabolene and squelene

B] Porphyrins: Structure and synthesis of Haemoglobin and Chlorophyll

Unit II 15 h

A] Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants Structure, stereochemistry, and synthesis of the following: Ephedrine, (+)-coniine, Nicotine, Atropine, Quinine, Reserpine and Morphine,
Biosynthesis (ONLY) of the followings: hygrine, tropinone, nicotine, pelletierine, conine

B] Prostaglandins: Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE_2 and $PGF_{2\alpha}$

Unit-III 15 h

A] Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone and Aldosterone.
Biosynthesis of steroids (lanosterol)

B] Plant Pigments: Occurrence, nomenclature and general methods of structure determination, isolation and synthesis of Apigenin, Luteolin, Quercetin, Myrcetin, Quercetin-3-glucoside, Vitexin, Diadzein, Butein, Cyanidin-7-arabinoside, Cyanidin, Hirsutidin.
Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway

Unit IV: 15 h

A] Carbohydrate: Types of naturally occurring sugars, deoxy sugars, amino sugars, branched chain sugars, methyl ethers and acid derivatives of sugars, general methods of structure and ring size determination with reference to maltose, lactose, sucrose, Chemistry of starch and cellulose.

B] Amino acids, protein and peptides: Amino acids, structural characteristics, acid base property, stereochemistry of amino acids, optical resolution, Stecker synthesis, peptide and proteins structure of peptide and protein, primary, secondary, tertiary and quaternary structure. Reaction of polypeptide, structure determination of polypeptide, Solid phase peptide synthesis, end group analysis.

List of books

1] Chemistry of Alkloids-S. W. Pelletier
2] Chemistry of Steroids-L. F. Fisher and M. Fisher
3] The Molecules of Nature-J. B. Hendricsion
4] Biogenesis of Natural Compound - Benfield
5] Natural Product Chemistry and Biological Significance- J. Mann, R. S Devison, J. B. Hobbs, D. V. Banthripde and J. B. Horborne
6] Introduction to Flavonoids-B. A. Bohm, Harwood
7] Chemistry of Naturally Occurring Quinines-R. H. Thomson
8] The Systematic Identification of Flavonoids- Marby, Markham, and Thomos

9] Text Book of Organic Medicinal Chemistry-Wilson, Geswold
10] Medicinal Chemistry Vol I and II-Burger
11] Synthetic Organic Chemistry -Gurudeep Chatwal.
12] Organic Chemistry of Natural Products Vol I and II-O. P. Agrawal
13] Organic Chemistry of Natural Products -Gurudeep Chatwal
14] A Textbook of Pharmaceutical Chemistry-Jayshree Ghosh
15] Synthetic Dyes Series -Venkatraman
16] Chemistry Process Industries-Shreve and Brink
17] Principal of Modern Heterocyclic Chemistry-L. A. Paquelte
18] Heterocyclic Chemistry-J. Joule and G. Smith
19] Heterocyclic Chemistry-Morton
20] An Introduction to Chemistry of Heterocyclic Compound-J. B. Acheson
21] Introduction to Medicinal Chemistry-A. Gringuadge
22] Wilson and Gisvold Text Book of Organic Medicinal and Pharmaceutical Chemistry-Ed. Robert F Dorge
23] An Introduction to Drug Design-S. S. Pandey and J. R. Demmock
24] Polymer Science-V. Govarikar
25] Principle of Polymer Chemistry-P. J. Flory
26] An Outline of Polymer Chemistry-James Q. Allen
27] Organic Polymer Chemistry-K. J. Saunders

Semester III

Practical-V (Code: 3P1)
Organic Chemistry Special)

12 h /week Marks: 100

[A**]** Quantitative Analysis

Student is expected to carry out following estimations (minimum 6 estimations.)

1. Estimation of Vitamin "C" Iodometry.
2. Estimation of Phenol by $KBrO_3$-KBr.
3. Estimation of Amine by Bromate/ Bromide solution.
4. Estimation of Formaldyde by Iodometry.
5. Estimation of Glucose by Benedict's solution.
6. Estimation of given carbonyl compound by hydrazone formation.
7. Estimation of Aldehyde by Oxidation method.
8. Determination of percentage of number of hydroxyl group in an organic compound by acetylation method.

[B**]** Isolation of Organic Compounds from Natural Source **(**Any six**)**

a) Isolation of caffeine from tea leaves.
b) Isolation of casein from milk (the students are required to try some typical colour reactions of proteins)
c) Isolation of lactose from milk (purity of sugar should be checked by TLC and PC and Rf value reported.)
d) Isolation of nicotine dipicrate from tobacco
e) Isolation of cinchonine from cinchona bark
f) Isolation of piperine from black pepper
g) Isolation of lycopene from tomatoes
h) Isolation of β-carotene from carrots
i) Isolation of cysteine from hair
j) Isolation of oleic acid from olive oil (involving the preparation of complex with urea and separation of linoleic acid
k) Isolation of eugenol from cloves

l) Isolation of (+) limonine from citrus rinds

[C**]** QUALITATIVE ANALYSIS

Separation of the components of a mixture of three organic compounds (three solids, two solids and one liquid, two liquids and one solid, all three liquids and identification of any two components using chemical methods or physical techniques. Minimum 10-12 mixtures to be analyzed.

Semester III

PHYSICAL CHEMISTRY SPECIALIZATION

Paper IX **(**Code**:** 3T1**)**

Special I**-**Physical Chemistry

60h *(*4h/week*)* 15h/unit 80 Marks

UNIT I **:** STATISTICAL THERMODYNAMICS 15h

A**]** Statistical thermodynamics**:** Atomic and Molecular quantum levels, Significance of Boltzmann Distribution law, partition Functions and ensembles, ensemble averaging, postulates of ensemble averaging, canonical, grand canonical and micro canonical ensembles, corresponding distribution laws using Lagranges method of undetermined multipliers*. Ortho and para hydrogen, principle of equipartition of energy, calculation of average energy*

B**]** Partition function, Translational partition function, Rotational partition function, Vibrational partition function, Electronic partition function, Applications of partition functions, Numericals**.**

UNIT II**:** ELECTROCHEMISTRY OF INTERFACES 15h

A**]** Electrode Interfaces**:** Quantum aspects of charge transfer at electrode**-**solution interfaces, quantization of charge transfer, tunneling**.** Semiconductor interfaces**:** Theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces, effect of light at semiconductor solution interface**.**

B**]** Electro catalysis**:** Comparison of electro catalytic activity, importance of oxygen reduction and hydrogen evolution reactions, and their mechanism, volcanoes**.**

C**]** Bio**-**electrochemistry**:** Threshold membrane phenomena, Nernst Plank equation, Hodges Huxley equations, core conductor models, electrocardiography**.**

UNIT III**:** CHEMICAL DYNAMICS **-** I 15h

A**]** Dynamics of complex reactions**:** reversible, parallel, consecutive, concurrent and branching reactions, free radical and chain reactions, reaction between Hydrogen **–** Bromine and Hydrogen **–** Chlorine **(**thermal and photochemical**)**, decomposition of ethane, acetaldehyde, N_2O_5, Rice Herzfeld mechanism, Oscillatory autocatalytic and Belousov**-**Zhabotinsky reactions**.**

B**]** Fast Reactions**:** relaxation methods, flow methods, flash photolysis, magnetic resonance method, relaxation time and numericals**.**

UNIT IV**:** PHOTOCHEMISTRY 15h

A**]** Photophysical phenomenon**:** Introduction, photo and photochemical excitation and de**-**excitation, fluorescence, delayed fluorescence, and phosphorescence, fluorescence quenching**:** concentration quenching, quenching by excimer and exciplex emission, fluorescence resonance energy transfer between photoexcited donor and acceptor systems**.** Stern**-**Volmer relation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisions, quenching and Stern**-**Volmer equation**.**

B**]** Photochemical reactions**:** photoreduction, photooxidation, photodimerization, photochemical substitution, photoisomerization, photosenitisation, chemiluminescence, photochemistry of environment**:** Green house effect**.**

List of books:

1. G. M. Panchenkov and V. P. Labadev, " Chemical Kinetics and catalysis", MIR Publishing
2. E.A. Moelwyn- Hughes, "Chemical Kinetics and Kinetics of Solutions", Academic
3. K. J. Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York
4. J. Raja Ram and J. C. Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan Indian Ltd., New Delhi (1993)
5. J.G. Calvert and J.N. Pitts, Jr., *Photochemistry,* John Wiley and Sons, New York (1966).
6. K. K. Rohtagi-Mukherjee, *Fundamentals of Photochemistry,* New Age International, New Delhi(1986).
7. R. P. Wayne, *Principles and Applications of Photochemistry,* Oxford University Press, Oxford(1988).
8. N. J. Turro, *Modern Molecular Photochemistry,* Univ. Science Books, Sansalito (1991).
9. J. F. L. Lakowicz, *Principles of Fluorescence Spectroscopy,* 2nd Edition (1999), PlenumPublishers, NewYork.
10. F.W.Sears, " Introdction to Thermodynamics, Kinetic Theory of Gases and statistical mechanics".AddisonWesley
11. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
12. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
13. N. J. Turro, V. Ramamurthy and J. C. Scaiano, Principles of Photochemistry – An Introduction, Viva Books, New Delhi, 2015.
14. G. A. Somorjai, Introduction to Surface Chemistry and Catalysis, Wiley, 2010.
15. M. C. Gupta, Statistical Thermodynamics, New Age International.
16. K. Huang, Statistical Mechanics, Wiley, New Delhi, 2003.
17. Andrew Maczek, *Statistical Thermodynamics,* Oxford University Press Inc., New York (1998).
18. B. K. Agarwal and M. Eisner, *Statistical Mechanics*, Wiley Eastern, New Delhi (1988).
19. D. A. McQuarrie, *Statistical mechanics*, Harper and Row Publishers, New York (1976).
20. J.O.M.Bokris and A.K.N.Reddy, "Modern Elcrtrochemistry". Wiley
21. S. Glasstone, "Introduction to Electrochemistry" Affilisated East West Press, New Delhi.
22. D. R. Crow, " The Principle of electrochemistry", Chapman Hall
23. G. K. Agrawal, Basic Chemical Kinetics, Tata-Mc-Graw Hill Pvt., Ltd. 1990
24. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.

Semester III

Paper X (Code: 3T2)

Special II-Physical Chemistry

60h *(4h/week)* 15h/unit 80 Marks

UNIT-I: QUANTUM MECHANICS - II 15h

A] Applications of Quantum Mechanics: Approximate methods, variation principle, its application in Linear and non-linear functions, MO theory applied to H_2^+ molecule and H_2 molecule (calculation of energy), perturbation theory, application of perturbation theory to helium atom, generation of the concept of resonance.

B] Electronic structure of atoms: Russel Sanders terms and coupling schemes, Slater determinents, term separation energies of the p^n configuration, term separation energies for d^n configuration, magnetic effects: spin orbit coupling and Zeeman splitting.

C] Hybridization, hybrid orbitals in terms of wave functions of s and p orbitals, sp and sp^2 hybridizations, Simple Hückel theory applied to: ethylene, butadiene, cyclobutadiene, cyclopropenyl radical.

Unit II: SOLID STATE REACTIONS AND NANOPARTICLES 15h

A] Solid State Reactions: General principle, types of reactions: Additive, decomposition and phase transition reactions, tarnish reactions, kinetics of solid state reactions, factors affecting the solid state reactions. photographic process.

B] Nanoparticles and Nanostructural materials: Introduction, methods of preparation, physical properties, and chemical properties, sol-gel chemistry of metal alkoxide, application of Nanoparticles, Charecterization of Nanoparticles by SEM and TEM. Nanoporous Materials: Introduction, Zeolites and molecular sieves, determination of surface acidity, porous lamellar solids, composition-structure, preparation and applications.

UNIT-III: ELECTROCHEMISTRY OF SOLUTION 15h

A] Metal/Electrolyte interface: OHP and IHP, potential profile across double layer region, potential difference across electrified interface; Structure of the double layer : Helmholtz-Perrin, Gouy Chapman model, Stern region, Graham Devanathan- Mottwatts, Tobin, Bockris, Devnathan Models.

B] Over potentials, exchange current density, derivation of Butler Volmer equation under near equilibrium and non-equilibrium conditions, Tafel plot

C] Electrical double lever, theories of double layer, electro-capillary phenomena, electro-capillary curve. Electro-osmosis, electrophoreses. Streaming and Sedimentation potentials. Zeta potentials and its determination by electrophoresis, influence of ions on Zeta potential.

UNIT IV: IRREVERSIBLE THERMODYNAMICS 15h

A] Microscopic reversibility and Onsager reciprocity relation, phenomenological equations, Transformation of generalized fluxes and forces. The cyclic version of Clausius' inequality and its integrated form and their correspondence with time's arrow and irreversibility, Clausius' uncompensated heat. Derivation of the differential form of Clausius' inequality.

B] Rate of entropy production and the concept of Chemical affinity and its application to the cases of chemical reactions, coupled reactions, electrochemical reactions. Derivation of Gibbs relation and its DeDonderian version (time rate form) for spatially uniform chemically reacting closed systems, entropy production in spatially non-uniform systems like heat flow, Electrokinetic effect – Saxen relation.

List of books:

1. Ira .N. Levine, Quantum Chemistry, 5th edition(2000), Pearson educ., Inc.New Delhi
2. A.K.Chandra, Introductory Quantum Chemistry, 4th edition (1994), Tata Mcgraw Hill, New Delhi.
3. M.W.Hanna, " Quantum Mechanics in Chemistry", Benjamin
4. L. Pualing and E. B. Wilson, Introduction to Quantum Mechanics with Applications to Chemistry, McGraw Hill, New York (1935).
5. R. K. Prasad, Quantum Chemistry, New Age International, Delhi.
6. R. K. Prasad, Quantum Chemistry through problems and solutions, New Age International, New Delhi, 2009.
7. B. C. Reed, Quantum Mechanics, Jones and Bartlett, New Delhi, 2010.
8. S. Glasstone, An Introduction to Electrochemistry, East-West Press Pvt. Ltd., New Delhi, 2004.
9. D. Mcquarie and J. Simon, Physical Chemistry – A Molecular Approach, University Press, 2000
10. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
11. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
12. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
13. I Prigogine and R. Defay, Chemical Thermodynamics, Longmans, London, 1954.
14. S. R. DeGroot and P. Mazoor, Non-Equilibrium Thermodynamics, North-Holland Co., Amsterdam, 1969.
15. G. Lebon, D. Jou and Casa Vazquez, Understanding Non-equilibrium Thermodynamics, Springer, 2008.
16. I.Prigoggine, "An Introduction to Thermodynamics of Irreversible Processes," Wiley-Interscience.
17. R. P. Rastogi, Introduction to Non-equilibrium Physical Chemistry, Elsevier, Amsterdam, 2008.
18. J.O.M.Bokris and A.K.N.Reddy, "Modern Elcrtrochemistry". Wiley
19. S. Glasstone, "Introduction to Electrochemistry" Affilisated East West Press, New Delhi.
20. D. R. Crow, " The Principle of electrochemistry", Chapman Hall

21. C.Kittel, " Introduction to solid state Physics",Wiley
22. L.V.Azaroff, " Introduction to solids", McGraw Hill
23. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
24. N. B. Hanny, Treaties in Solid State Chemistry, 4th Edn,
25. N. B. Hanny, Solids,
26. Sulbha Kulkarni, Nanotechnology: Principles and Practices, Capital Publishing House, 2011.
27. T. Pradeep, Nano: The Essentials, Tata Mc-Graw Hill, 2012
28. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.
29. N. B. Hanny, "Solid State Chemistry"
30. C. N. R. Rao and Gopalakrishnan, "New Directions in Solid State Chemistry " Second Edition, Cambridge University Press.
31. Anthony R. West, "Solid State Chemistry and its Applications" Wiley India Edition.

Semester III

Practical-V (Code: 3P1)

Physical Chemistry Special

12 h /week Marks: 100

Thermodynamics:

1. Determination of partial molar volume of solute and solvent (ethanol-water, methanol-water, KCl-water mixture)

Solutions:

2. Study the variation of solubility of potassium hydrogen tartarate with ionic strength using a salt having a common ion and hence determine the mean ionic activity coefficients.
3. Determination of temp. dependence of the solubility of a compound in two solvents having similar intermolecular interactions(benzoic acid in water and DMSO – water mixture) and calculation of the partial molar heat of solution.

Phase equilibrium:

4. To study the effect of addition of an electrolyte such as NaCl, KCl,Na_2SO_4,K_2SO_4 etc. on the solubility of an organic acid(benzoic acid or salicylic acid).
5. To determine the heat of crystallization of $CuSO_4$,$5H_2O$
6. To determine the heat of reaction involving precipitation of a salt $BaSO_4$
7. To determine transition temperature of $CaCl_2$ by thermometric method and to determine transition temperature of $CaCl_2$, sodium bromide by solubility method

Kinetics:

8. To determine the activation energy of hydrolysis of an ester by acid.
9. Kinetics of reaction between sodium thiosulphate and KI. Determination of rate constant; study of influence of ionic strength
10. Kinetics of decomposition of H_2O_2 catalysed by iodide ion. Also determination of activation energy of reaction.

Conductometry:

11. Estimate the concentration of H_2SO_4, CH_3COOH, $CuSO_4.5H_2O$ in a given solution by carrying out conductometric titration against NaOH solution.
12. Determine the eq. conductance of strong electrolyte (KCl, NaCl, HCl, KNO_3) at several concentration and hence verify Onsager's equation.
13. Carry out the following precipitation titration conductometrically. a. 50 ml.0.02N $AgNO_3$ with 1N HCl; b.50 ml.0.02N $AgNO_3$ with 1N KCl; c. 50 ml 0.004 N $MgSO_4$ with 0.1 N Ba$(OH)_2$; d. 50 ml 0.002 N $BaCl_2$ with 1 N Li_2SO_4; e. 50 ml.0.02 N $BaCl_2$ with 1N K_2SO_4

Potentiometry:

14. To prepare calomel electrode and to determine the potential of calomel electrode by potentiometry.

15. To determine stability constant of Fe^{3+} with potassium dichromate in presence of dilute sulphuric acid by redox titration.
16. To determine solubility product of Silver chloride by potentiometric method.
17. Determination of redox potential of the couples(**Fe^{2+}/Fe^{3+}**,Co^{3+}/Co^{2+}**,Cr^{3+}/Cr^{2+}**,MnO_4^-/Mn2+(**any two**)** and equilibrium constant.
18. Study of complex formation by potentiometry e.g.Ag^+-$S_2O_3^{-2}$, Fe^{3+}-SCN^-,Ag^+-NH_3(any two) and calculation of stability constant.

Spectrophotometry:

19. To verify Beers law for solution of potassium permanganate and to find molar extinction coefficient.
20. To determine the indicator constant (**pK_{In}**) of methyl orange/red spectrophotometrically.

Polarography:

1. Determination of the half-wave potential of the cadmium ion in 1M potassium chloride solution.
2. Investigation of the influence of dissolved oxygen.
3. Determination of cadmium in solution.
4. Determination of lead and copper in steel.

List of Books

1. Vogel A : A Textbook Of Quantitative Inorganic Analysis, Longman
2. Das and Behra, Practical Physical Chemistry
3. Carl W. Garland, Joseph W. Nibler and David P. Shoemaker, Experiments in Physical Chemistry, Mc-Graw Hill, 8th Edition, 2009.
4. Farrington Daniels, Joseph Howard Mathews, John Warren Williams, Paul Bender, Robert A. Alberty, Experimental Physical Chemistry, Mc-Graw Hill, Fifth Edition, 1956.
5. John W. Shriver and Michael George, Experimental Physical Chemistry, Lab Manual and Data Analysis, The University of Alabama in Huntsville, Fall 2006
6. Day And Underwood :Quantitative Analysis
7. Merits And Thomas:Advanced Analytical Chemistry
8. Ewing, G. W. : Instrumental Methods of Chemical Analysis, Mcgraw-Hill
9. Drago, R.S:Physical Methoods In Inorganic Chemistry
10. Christain G.D:Analytical Chemistry
11. Khopkar S.M.:Basic Concept Of Analytical Chemistry
12. Koltath And Ligane:Polorography
13. Braun:Instrumental Methods Of Chemical Analysis
14. Willard, Merritt And Dean: Instrumental Methods Of Chemical Analysis ,Van Nostrand
15. Strouts,Crifi;Llan And Wisin: Analytiacl Chemistry
16. Skoog S.A. And West D. W.:Fundamental of Analytical Chemistry
17. Dilts R.V.: Analytiacl Chemistry
18. Jahgirdar D.V :Experiments In Chemistry
19. Chondhekar T.K: Systematic Experiments In Physical Chemistry, Rajbog S.W., Aniali Pubn.
20. Wlehov G. J: Standard Methods Of Chemicalanalysis 6th Ed

Semester III

ANALYTICAL CHEMISTRY SPECIALIZATION

Paper IX(Code: 3T1)

Special I-Analytical Chemistry

60h (4h/week) 15h/unit 80 Marks

Unit-I: Radioanalytical Chemistry-I 15h

Radioactivity-Radiation-Units-Curie, Becquerel, Gray, Rad, Sievert, RBE, REM, Half life, mixed half life, branching decay, different types of radiations and their interactions with matter, radioactive

equilibrium, Elementary principles of GM and proportional counters, Gamma Ray Spectrometer, Ionization chamber, HPGe detector, NaI(Tl) detector, calibration using standard sources, resolution, numericals.

Unit-II:Optical methods of analysis-III 15h

Atomic absorption spectroscopy: Principle. Atomic energy levels. Grotrian diagrams. Population of energy levels. Instrumentation. Sources: Hollow cathode lamp and electrodeless discharge lamp, factors affecting spectral width. Atomizers: Flame atomizers, graphite rod and graphite furnace. Cold vapour and hydride generation techniques. Factors affecting atomization efficiency, flame profile. Monochromators and detectors. Beam modulation. Detection limit and sensitivity. Interferences and their removal. Comparison of AAS and flame emission spectrometry. Applications of AAS.

Unit-III: Electrochemical methods of analysis-III 15h

Stripping Voltammetry: Principle and technique in anodic and cathodic stripping voltammetry, applications to metal ion analysis, limitations.

Adsorptive stripping voltammetry: Principle, technique, applications to metal ions and organic analysis. Advantages over anodic stripping voltammetry. Catalytic effects in voltammetry.

Working electrodes: Mercury electrodes, carbon electrodes, film electrodes.

Cyclic voltammetry: Principle and technique. Randles-Sevcik equation. Interpretation of voltammogram- reversible, irreversible and quasi-reversible systems. Applications of cyclic voltammetry in study of reaction mechanism and adsorption processes.

Electrochemical sensors (Chemically modified electrodes): Biosensors, catalytic sensors and gas sensors.Comparison of voltammetry with AAS and ICP-AES.

Unit-IV: Miscellaneous techniques-I 15h

Fluorometry and phosphorimetry: Principles of fluorescence and phosphorescence. Jablonski diagram. Concentration dependence of fluorescence intensity. Fluorescence quenching. Instrumentation. Applications.

Nephelometry and turbidimetry: Principle, instrumentation and applications.

*Photoacoustic spectroscopy:*Theory. Instrumentation. Advantages over absorption spectroscopy. Chemical and surface applications of PAS.

Electrogravimery: Theory of electrolysis. Electrode reactions. Decomposition potential. Overvoltage. Characteristics of deposits and completion of deposition. Instrumentation. Application in separation of metals.

Semester III

Paper X(Code: 3T2)

Special II-Analytical Chemistry

60h *(4h/week)* 15h/unit 80 Marks

Unit-I: Organoanalytical Chemistry 15h

Elemental analysis: Outline of macro, semi-micro, micro and ultra-micro analysis, semi-micro determination of carbon, hydrogen, halogen, sulphur, nitrogen, phosphorous, arsenic, boron and metals in organic compounds.

Functional group analysis: Semi-micro determination of the following functional groups in organic compounds- hydroxyl, amino, nitro, nitroso, azo, N-acetyl, O-acetyl, methyl, aldehydes, ketones, thio, disulphide, sulphonamide, unsaturation and active hydrogen.

KF reagent: Karl Fischer reagent and its use in analysis of water in organic compounds.

Unit-II: Analysis of ores and cement

15h

Ores: Composition and analysis of the followings ores- Bauxite, Pyrolusite, Dolomite, Chromite.
Portland cement: Composition, raw material, manufacturing processes, characteristics, analysis.

Unit III: 15h

Water pollution and analysis: Sources of water pollution, composition of potable water, importance of water analysis, sampling and sample preservation, physico-chemical analysis of water. Mineral analysis (temperature, pH, conductivity, turbidity, solids, alkalinity, chloride, fluoride, sulphates, hardness), Demand analysis (DO, BOD, COD, TOC), nutrients (nitrogen-total, nitrate, nitrite, phosphate) and heavy metals (As, Cd, Cr, Hg and Pb). A brief idea of coagulation and flocculation. Water treatment plants: Sand filters and other types of filters.

Unit-IV: Air pollution and analysis 15h

Air pollution and analysis-classification of air pollutants, sources of air pollution and methods of control, sampling of aerosols and gaseous pollutants and their effects, SO_2, NO_2, CO, CO_2, particulates-SPM, RSPM, High Volume Sampler, Fabric Filters, Cyclones (direct and Reverse), ESP, ozone layer, Green house effect, Heat Islands, Acid Rain.

List of books:

1. Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)
2. Substoichiometry in Radioanalytical Chemistry: J. Ruzicka and J Stary (Pergamon Press)
3. Introduction to Radiation Chemistry: J. W. T. Spinks and R. J. Woods
4. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
5. Instrumental Methods of Analysis: Willard, Meriit and Dean(Van Nostrand)
6. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
7. Vogel's Text Book of Quantitative Inorganic Analysis: Bassett, Denney, Jeffery and Mendham (ELBS)
8. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
9. Atomic Absorption Spectroscopy: Robinson (Marcol Dekker)
10. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
11. Analysis of Water: Rodier
12. Laboratory manual of water analysis: Moghe and Ramteke (NEERI)
13. Electroanalytical chemistry: Joseph Wang
14. Electroanalytical stripping methods: Brainina and Neyman (Wiley-Interscience)
15. Trace analysis: S. Lahiri (Narosa Publishing House)
16. Electroanalytical Chemistry: Bard (Marcel-Dekker)
17. Chemistry in Engineering and Technology- Vol I and II: J.C. Kuriacose and J. Rajaram (Tata-McGraw Hill)

Semester III

Practical-V (Code: 3P1)

Analytical Chemistry Special

12 h /week Marks: 100

pH-metry

1. Determination of percent Na_2CO_3 in soda ash by pH-metric titration.
2. Determination of isoelectric point of amino acid.
3. Determination of three dissociation constants of phosphoric acid.

Conductometry

1. Displacement titration of CH_3COONa with HCl.
2. Precipitation titration of $MgSO_4$ and $BaCl_2$.

3. Titration of mixture of CH_3COOH, H_2SO_4 and $CuSO_4$ with NaOH.

Potentiometry

1. Estimation of Cl^-, Br^- and I^- in a mixture.
2. Determination of percent purity of phenol by potentiometric titration with NaOH.
3. Estimation of acids in mixtures.

Coulometry

1. Estimation of nickel and cobalt by coulometric analysis at controlled potential.
2. Analysis of antimony (III) with I_3^- .

Polarography

1. Determination of $E_{1/2}$ of Cd^{2+} and Zn^{2+} at DME.
2. Estimation of Cd^{2+} and Zn^{2+} in respective solutions by calibration curve and standard addition methods.
3. Determination of composition /stability constant of complex.

Cyclic voltammetry

1. Study of cyclic voltammograms of $K_3[Fe(CN)_6]$.

Electrogravimetry

1. Estimation of nickel and copper individually as well as in mixture.

Polarimetry

1. Inversion of cane sugar in the presence of HCl.
2. Determination of percentage of two optically active substances (d-glucose and d-tartaric acid) in mixture.

Colorimetry**/**spectrophotometry

1. Simultaneous determination of chromium and manganese in given mixture.
2. Simultaneous determination of two dyes in a mixture.
3. Estimation of Mn in steel.
4. Estimation of Cu/Ni in alloys.
5. Estimation of iron in water sample using 1,10-phenanthroline.
6. Estimation of Fe(III) in given solution by photometric titration with EDTA (salicylic acid method).

Flame photometry

1. Estimation of Li, Na, K, Ca in rock/ soil / water samples.

Turbidimetry and nephelometry

1. To determine molecular weight of polymer.
2. Estimation of sulphate in water sample by turbidimetry.
3. Estimation of phosphate by nephelometry.

Radioanalytical techniques

1. GM-counter: Plateau, nuclear statistics, half thickness of aluminium absorbers, dead time.
2. Gamma ray spectrometer: Calibration using standard sources, determination of half life (Mn-56, I-128, In-116)
3. Experiments based on radiation chemistry: G-value-$G(NO_2^-)$.

Demonstrations

1. UV-spectrophotometry

Semester III

Paper XI **(**Code**:** 3T3**)**

Elective**-** Nuclear Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit**-I:** Radioactive decay 15h

Various modes of decay, natural radioactivity, successive radioactive decay and growth kinetics, radioactive equilibrium, half life, half life of mixed radioisotopes, decay schemes, its determination by experimental methods, statistical nature of nuclear radiation, treatment of nuclear data and calculation of standard deviation, probability

Unit-II: Nuclear structure 15h

mass-energy relationship, nuclear binding energy, semi-empirical mass formula, nuclear stability rules, nuclear properties, mass size, spin and parity, nature of nuclear forces, liquid drop model, shell model, its evidence and advantages, comparison of the two models, calculations based on above.Energetics of nuclear reaction, cross reaction, comparison with chemical reactions, various types of nuclear reactions, photonuclear, spallation and thermonuclear reaction

Unit-III: Interaction of radiations with matter,detectors 15h

Interaction with matter and detection of gamma rays with matter by photoelectric, Compton and pai production, interaction of beta particles, neutrons and heavy charged particles, various methods of detecting nuclear radiations, gas filled counters, ionization chamber, proportional and GM counters, scintillation detector and solid state detectors- Ge(Li), Si(Li) and HPGe.

Unit-IV: Nuclear fission and Fusion 15h

Probability, mass and charge distribution, release of energy and neutrons, spontaneous fission, nuclear reactors and their uses for power production, brief idea about thermal and fast breeder reactors, reprocessing of nuclear fuel, PUREX process, heavy water- manufacturing and use in reactors. accelerators, nuclear fusion. Production of isotopes by nuclear reactions, production of new elements, radioactive waste management and disposal

Semester III

Practical VI–Elective (Code: 3P3)

Nuclear Chemistry Practical

12 h per week Marks-100

1. Working of GM counter, plateau, statistics, geometry effects, dead time, energy of beta particle, back scattering
2. Working of gas flow proportional counter, plateau, statistics, geometry effects, dead time, energy of beta particle
3. Working with scintillation counter, gamma ray spectra, energy calibration and resolution, half life determination of single and composite nuclei.
4. Radiochemical separation of ^{234}Th from natural uranium salt and its half life determination
5. Experiment on Neutron Activation Analysis by non-destructive method
6. Dose measurement by Fricke and other chemical dosimeters
7. Radiolysis of potassium nitrate, methyl iodide, carbon tetrachloride-iodine systems
8. Szilard-Chalmers reactions with inorganic and organic systems, potassium permanganate and methyl iodide
9. Some trace experiments like partition coefficient, solubility product, isotopic exchange, isotope dilution analysis, radiochromatography, ion exchange.

List of books:

1. H. J. Arnikar - Essentials of Nuclear Chemistry (Willey Eastern Ltd)
2. G. Friendlander, J. W. Kennedy,E. S. Macias and J. M. Miller-Nuclear and Radiochemistry (Wiley Intersciences, New York)
3. G. R. Choppin and J. Rydberg- Nuclear Chemistry-Principles and Applications(Pergamon press, London)
4. B. G. Harvey-Introduction to Nuclear Physics and Chemistry(Prentice Hall of India)
A. N. Nesmeyanov - Radiochemistry- (Mir Publications)
5. M. N. Sastry-Introduction to Nuclear Science, Affiliated East-West Press, New Delhi
6. G. Hughes- Radiation Chemistry- Oxford University Press, London

7. V. Verschinskii and A. K. Pikeav-Introduction to Radiation Chemistry, Israel Publication, Jerusalem-Robinson (Marcol Dekker)
8. Farhat Aziz and M. A. J. Radgers-Radiation Chemistry-Principles and Applications, VCH Publishers FRC.
9. M. Hassinsky-Nuclear Chemistry and its application, Addison Wesley

Semester III

Paper XI (Code: 3T3)

Elective- Environmental Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit -I: Concept and scope of Environmental Chemistry 15 h

Biosphere, Lithosphere, Hydrosphere and Atmosphere, Ecological principles- aspects of ecology, classification,types of ecosystems. Biogeochemical cycles- carbon, nitrogen, phosphorous, oxygen, hydrogen, sulphur, iron, sodium, potassium, magnesium, cobalt, mercury, lead, zinc and cadmium.
Thermal pollution—sources, harmful effects and prevention of thermal pollution.
Noise pollution --- sources, effects and control of noise pollution.

Unit-II: Water 15 h

Origin, physico-chemical properties of water, sources of water, hydrological cycle, criteria ofwater quality, Water management- water shed management, rain water harvesting, waterpollution-sources, consequences and harmful effects of water pollution, strategies for waterpollution control.

Unit-III: Air 15 h

Major regions of the atmosphere, composition of the atmosphere, temperature inversionand air pollution episodes, photochemistry of the atmosphere, depletion of the stratosphericozone, green house effect, green house gases, remedial measures for reversion of green house effect, acid rain, photochemical smog, particulate matter.

Unit-IV: 15 h

Soil: Chemical and mineralogical composition of soil, classification of soil, types of soil- saline and alkaline, physical properties – texture, bulk density, permeability, chemical properties—Ion exchange capacity, soil pH and micro and macro nutrient availability. Soil management—Management of saline and alkaline soil, soil indicator plants,
Radioactive Pollution: Introduction to radiation chemistry, sources of radioactive pollution, effects of radioactivepollution, nuclear disasters in the two decades, protection from radiation, control of radiation.

Semester III

Practical VI–Elective (Code: 3P3)

Environmental Chemistry Practical

12h per week Marks-100

WATER ANALYSIS

1 Sampling of water-tap water, overhead storage tank water, pond water and lake water
2 Physico –chemical and organoleptic characteristics of the above water sample
3 Statistical evolution of the data obtained for optimization of result
4 Determination of total solids, total dissolved solids and total suspended solids and its significance
5 Determination and comparison of chlorine content in tap water, storage tank and swimming pool
6 Determination of acidity and alkalinity in water samples
7 Determination of total, permanent and temporary hardness of water sample
8 Determination of DO, COD, and BOD of water sample

9 Analysis of chemicals used in water and waste water treatment-alum, bleaching powder, activated carbon
10 Analysis iron and manganese in water sample by visual titrimetry
11 Analysis of copper and nickel in water sample by Spectrophotometry
12 Analysis of phenol in water sample by Spectrophotometry
13 Analysis of nitrite in water sample by Spectrophotometry
14 Analysis of chromium in water sample
15 Analysis of chloride in water sample
16 Analysis of sulphate in water sample
17 Determination of turbidity of a given water sample
18 Estimation of Na, K, by flame photometry in given water

AIR ANALYSIS

1 Determination of SOx and NOx and TSPM **(**total suspended particulate matter**)** and RSPM in ambient air

SOIL ANALYSIS

1 Analysis of different types of soil like pH, conductivity, alkalinity etc**.**
2 Determination of N,K, P of soil by flame photometry
3 Analysis of nutrients**-**nitrogen **(**total, ammonia, nitrite & nitrate **)**, phosphate total
4 Determination of macro &micro nutrients in soil

List of books

1. Water analysis : J. Rodier
2. A Text book of Inorganic Analysis : A.I.Vogel
3. Colorimetric Determination of metals : E.B.Sandell
4. Environmental Chemistry : Moore J W and Moore E A. Academic Press, New York, 1976.
5. Environment and Man Vol VII: The Chemical Environment Edited by J Lenihar and W Fleecher Vlackie Publication, 1977.
6. The Chemistry of Environment: R A Horne, Wiley Interscience Publication 1978.
7. Fundamentals of Air Pollution: A C Stern
8. Instrumental Methods of Analysis: Willard,Merrit and Dean
9. Analytical Chemistry: Meites and Thomas
10. Standard Methods for Examination of water and waste water: A E Greenberg, A D Eaton, APHA, AWWA,WEF
11. Chemistry for Environmental Engineering and Science: C N Sawyer, P L McCarty and G F Parkin
12. Laboratory Manual for the Examination of Water, waste water and soil: H H Rupa and H Krist, V C H Publication
13. Manual on Water and Waste water analysis: D S Ramteke and C A Moghe, NEERI
14. Environmental Chemistry: B K Sharma and H Kaur
15. Environmental Chemistry: A K De
16. Environmental Pollution- Management and control for sustainable Development: R K Khatoliya
17. Environmental Chemistry: A K Bhagi and G R Chatwal

Semester III

Paper XI **(**Code**:** 3T3**)**

Elective**-** Polymer Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Introduction to polymers 15h

Nomenclature and classification of polymers, Polymerization: condensation, addition, radical chain-ionic and co-ordination and co-polymerization and their mechanisms, Types of polymers- linear, branched, crosslinked, ladder, thermoplastic, thermosetting, fibres, elastomers, natural polymers, addition and condensation polymers.Stereoregular polymers- atactic, syndiotactic and isotactic.

Unit-II: Molar mass and its determination 15h

Molecular mass and molar distribution. Number average, mass average, viscosity, average molecular mass and relation between them. Molecular mass distribution. Determination of molecular mass- Osmometry (membrane and vapour phase), light scattering, gel permeation chromatography, sedimentation and ultracentrifuge, viscosity method and end-group analysis.

Unit III: Physical characteristics of polymers 15h

Morphology and order in crystalline polymers. Configuration of polymer chains, crystal structure of polymers. Morphology of crystalline polymers, strain-induced morphology, crystallization and melting. The glass transition temperature (Tg), relationship between T_g and T_T, Effect of molecular weight, dilments, chemical structure, chain topology, branching and cross linking. Methods of determination of glass transition and crystallinity of polymers.

Unit IV: Commercial polymers 15h

A) Organic polymers: Commercial polymers, synthesis and and application of polyethylene, Cellulose Acetate, PMMA, polyaimdes, polyesters, Urea resins and eposy resins.

B) Functional polymers: Fire retarding polymers and conducting polymers, biomedical polymers.

Semester III

Practical VI – Elective (Code: 3P3)

Polymer Chemistry Practical

12h per week Marks-100

1. Synthesis of polymers:
   a) Synthesis of Thiokol rubber (condensation)
   b) Urea-formaldehyde (condensation)
   c) Glyptal resin: glycerine phthalic acid (crosslinked Polymer Chemistry)
   d) Polyacryonitril (bulk polymerization)
   e) Polyacryonitril (emulsion polymerization)
   f) Polymethylomethacrylate (emulsion of suspension Polymer Chemistry)
   g) Nylon-66 (interfacial polycondensation)
   h) Coordination polymers
   i) Conducting polymer (electro- or peroxodisulphate oxidation)
2. Characterization of polymers:
   a) End-group analysis
   b) Viscosity and molecular mass
   c) Density of polymer by flotation methods
   d) IR spectra.
3. Purification and fractionation of polymer, polystyrene, Nylon 66, PMMA.
4. Magnetic and electrical properties of polymers, magnetic susceptibility and electrical conductivity of coordination and conducting polymers.
5. Thermal analysis and degradation of polymers:
   i. TGA: Isothermal and non-isothermal;
   ii. DTA: Glass transition temperature and melting point
6. Crystallinity of polymers by density measurement.
7. Swelling and solubility parameters of polymers.
8. Synthesis of Graft-Polymers and its characterization by density and IR spectra.
9. Dielectric behavior of polymers.
10. Kinetics of polymerization:
    a) Polycondensation
    b) Peroxide initiation polymerization.

List of books:

1. Textbook of polymer science: F.W. Billmayer Jr. Wiley.
2. Polymer science: V.R. Gowarikar, N. V. Viswanathan and J. Sreedhar, Wiley-Eastern.

3. Fractional monomers and polymers: K Takemoto, Y. Inaki, and R.M. Ottam Brite.
4. Contemporaty polymer chemistry: H.R. Alcock and F. W. Lambe, Prentice Hall.
5. Principles of polymer Chemistry: Flory, Cornell Univ. press.
6. Introduction to polymer chemistry: R. B. Seymour, McGraw Hill.
7. Principles of polymerization: Odian.
8. A first course in polymer chemistry: A. Strepikheyew, V. Derevistkay and G. Slonimasky, Mir Publishers, Moscow.
9. Laboratory preparation of macro chemistry: EMM effery, McGraw Hill Co.
10. A practical course in polymer chemistry: S.J. Punea , Pergamon Press.

Semester III

Paper XI Elective (Code: 3T3)

Medicinal Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

UNIT-I: 15 h

Drug Design:

Development of new drugs, factors affecting development of new drugs, sources of lead compounds, serendipity and drug development. Concept of QSAR, QSAR methods and parameters, procedure followed in drug design, structure activity relationship (SAR) method, Free and Wilson analysis, Hansch analysis, concept of prodrugs and softdrugs, SOFT DRUGS, isosterism, bioisosterism, drug receptors, theories of drug action, types of reversible enzyme inhibitors, some special inhibitors and design of inhibitors.

UNIT-II: 15 h

A] **Pharmacokinetics and pharmacodynamics:** Indroduction drugs absorption, distribution and disposition of drugs, excretion and elimination, Pharmacokinetics of elimination and Pharmacokinetics in drug development process.
Pharmacodynamics: Introduction, enzyme stimulation, enzyme inhibition, membrane active drugs, drugs metabolism, biotransformation and significance of drug metabolism

B] **Diuretics:** Introduction, mode of action, loop diuretics. Synthesis of Bumetanide, Frusemide, Ethacrynic acid, clorexolone Quinethazone.

C] **Analgesics and Antipyretics:** Introduction, mode of action, evaluation of analgetic agents.Synthesis of: Aspirin, salsalate, phenacetin, phenylbutazone, Indomethacin, Analgin.

UNIT-III: 15h

A] **Cardiovascular Drugs:** Introduction, cardiovascular diseases, Synthesis and uses of cardiovascular drugs; amyl nitrate, diltiazem, varapamil, methyldopa, atenolol, sorbitrate, quinidine, oxyprenolol

B] **Antineoplastic Agent:** Introduction, mechanism of tumor formation, treatment of cancer, types of cancer chemotherapy, role of alkylating agents and antimetabolites in treatment of cancer, carcinolytic antibiotics, mitotic inhibitors, harmones, natural products. Synthesis of melphalan , thiotepa, lomustine

UNIT-IV: 15 h

A] **Psychoactive drugs:** Introduction, neurotransmitters, structure of nerve cell, chemical transmitters, CNS depressants, sedative and hypnotics, Synthesis of Barbiturates, Phenobarbital, thiopental sodium, diazepam, lorazepam, bromazepam, ethosuximide, general anaesthetic: Antianxiety drugs, synthesis of oxazepam, alprazolam, puspirone, antipsychotic drugs and antidepressant drugs, MAO inhibitors, antimanic drugs, synthesis of thiopental sodium, ethiosuxmide, glutethimide, trimethadione, phenytoin.

B] Coagulant and Anticoagulants: Introduction, factors affecting coagulant and anti-coagulant. Mechanism of Blood coagulation and Anticoagulation. Structure of Vitamin K1, Vitamin K2 and heparin. Synthesis of Coumarins and indanediones.

Semester III

Practical VI–Elective (Code: 3P3)

Medicinal Chemistry Practical

12 h per week Marks-100

1. Volumetric estimation of Ibuprofen.
1. Estimation of aspirin by volumetric and instrumental methods.
2. Analysis of ascorbic acid in biological/tablet sample.
3. Determination of paracetamol by colorimetry.
4. Analysis of ampicillin trihydrate.
5. Determination of vitamin B12 in commercial sample by spectrophotometry.
6. Determination of phenobarbitone in given cough syrup.
7. Determination of tetracycline in given capsule.
8. Determination of iron, calcium and phosphorus from milk or drug sample.
9. To perform I.P. monograph of tablet.
10. Estimation of chloride in serum and Urine.
11. Separation and determination of sulpha drugs in tablets or ointments.

Preparation of Drugs: Synthesis, purification and identification of (8-10) of the following drugs.

1. Benzocaine from p-nitrobenzoic acid.
2. Dapsone from diphenyl sulphone.
3. Paracetamol from p-nitro phenol.
4. Uracil from sulphanil amide.
5. Diphenyl hydantion from benzoin.
6. Aluminium asprin from salicylic acid.
7. 4,6-diphenyl-thiazine from chalcone.
8. 6/8 nitro coumarin from resorcinol.
9. Copper aspirin from salicylic acid.
10. N-acetyl parabanic acid.
11. Nerolin from 2-naphthol
12. Phenothiazine from diphenylamine
13. Umbelliferon from resorcinol
14. Benzylidene from benzaldehyde and aniline
15. 1-phenyl-1,2-pentadine-3-one from benzaldehyde
16. 1,5 diphenyl-1,3-pentadiene-2-one from benzaldehyde
17. 1,3-diphenyl-prop-2-ene-1-one
18. 3-methy pyrazol-5-one from ethylacetoacetate
19. 6-methyl uracil
20. Sulphanilamide from acetanilide

List of books:

1. Text book of organic medicinal chemistry-Wilson,Geswold
2. Medicinal chemistry Vil I and II-Burger
3. A textbook of pharmaceitical chemistry-Jayshree Ghosh
4. Introduction to medicinal chemistry-A Gringuadge
5. Wilson andGisvold text book of organic medicinal and pharmaceutical chemistry-Ed.Robert F Dorge
6. An introduction to drug design-S S Pandey,and JR Demmock
7. Goodman and Gilmans pharmacological basis of therapeutics- Stragies for organic drug sythesis and design-D Lednicer

8. Textbook of Medicinal Chemistry- A. Kar
9. Medicinal Chemistry – D Sriram and P. Yogeeswari

Semester III

Paper XII (Code: 3T4)

Foundation Course - IApplied Analytical Chemistry– I

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Analysis of Pesticides and Fertilizers 15h

Pesticides: General introduction, analysis of pesticides in general with reference to DDT, Dieldrin, Malathion, Parathion, BHC by different analytical methods such as titrimetric, colorimetric, chromatography and electroanalytical methods.

Fertilizers: Sampling and sample preparation, determination of water, total nitrogen, urea, total phosphates, potassium, acid or base forming quality.

Unit-II: Forensic chemistry 15h

Introduction. Classification of poisons on the basis of physical states, mode of action and chemical properties with examples of each type. Methods of administration. Action of poisons in body. Factors affecting poisoning. Study of some common poisons used for suicide. Signs and symptoms of As, Pb, Hg and cyanide poisoning. Poisonous effects of kerosene and cooking gas.

Unit-III:Analysis of petroleum and petroleum products 15h

Introduction, determination of flash and fire point, Pensky Marten's apparatus, cloud and pour point, aniline point, drop point, viscosity and viscosity index, Redwood and Saybolt viscometer, API specific gravity, water and sulphur in petroleum products, carbon residue, corrosion stability, decomposition stability, emulsification, neutralization and saponification number.

Unit-IV: Analysis of alloys 15h

Definition of alloy. phase diagrams of Fe-C, Pb-Sn, Pb-Ag systems and their applications. Types of steel: hypoeutectic, hypereutectic steels, mild steel, and stainless steel. Uses of steel. Composition and uses of brass, bronze and soldering alloy. Analysis of iron, nickel, chromium and manganese in steel. Analysis of copper and zinc in brass, lead and tin in soldering alloy. Industrial applications of alloys.

OR

Semester III

Paper XII (Code: 3T4)

Core Subject Centric - I: Spectroscopy– I

60 h (4 h per week): 15 h per unit 80 Marks

Unit - I: Symmetry properties of molecules and group theory: 15h

Symmetry elements and symmetry operations. Properties of group. Point groups and Schoenflies symbols. Symmetry operations as a group. Matrix representations of groups. Multiplication table for C_{2v}, C_{3v} and C_{2h}. Reducible and irreducible representations. Similarity transformation. Classes of symmetry operations. Great Orthogonality Theorem. Derivation of character tables for H_2O and NH_3 using Great Orthogonality Theorem. Application of character tables in selection rules of IR, Raman and Electronic spectroscopy.

Unit - II: 15h

A] Mass spectrometry: Theory, ion production(EI, CI, FD, FAB), ion analysis, ion abundance, isotopic contribution, N-rule, types of fission processes, high resolution mass spectrometry, metastable peak, molecular ion peak, Mclaffferty rearrangement, mass spectral fragmentation of organic compounds alkanes, alkenes, alkynes, alcohols, amines, amides, acids, aldehydes, ketones, halides, Structure determination of organic molecules by mass spectrometry, problem based on mass spectral data

B] Mössbauer spectroscopy: Basic principle, experimental techniques, recoil emission and absorption, source, absorber, isomer shift, quadrupole interaction, magnetic hyperfine interaction,

applications in determining electronic structure, molecular structure, crystal symmetry, magnetic structure, surface studies, biological applications.

Unit **-** III**:** 15h

A**]** Microwave spectroscopy: Classification of molecules on the basis of M.I., rigid and non rigid rotor, effect of isotopic substitution on transition frequencies, stark effect, microwave spectrometer, application in deriving: molecular structure, dipole moment, atomic mass and nuclear quadrupole moment.

B**]** ESR spectroscopy: Introduction, principle of ESR, ESR spectrometer, hyperfine coupling, zero field splitting, factors affecting g values, Kramer's degeneracy, application of ESR spectra to study free radicals like hydrogen, methyl radical, 1,4-semibenzoquinone, naphthalene, transition metal complexes, biological systems.

Unit IV**:** 15h

A**]** Infrared spectroscopy: Diatomic molecules: 1) Molecules as harmonic oscillator, Morse potential energy function, vibrational spectrum, fundamental vibrational frequencies. Force constant, zero point energy, isotope effect. The Anharmonic oscillator, the interactions of rotations and vibrations. P,Q,R branches, vibration of polyatomic molecules, selection rules, normal modes of vibration, group frequencies, overtone and combination frequencies. Structure determination of organic molecules by IR spectroscopy, problem based on IR spectral data

B**]** Raman Spectroscopy: Rayleigh scattering. Raman Scattering, classical and quantum theories of Raman effect. Rotational Raman Spectra for linear and symmetric top molecules. Vibrational Raman Spectra, rotational fine structure. Selection rules, coherent antiStokes Raman spectroscopy, Structure determination from Raman and Infra-red spectroscopy.

List of books

1] Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morril, John Wally
2] Introduction to NMR spectroscopy-R. J. Abraham, J. Fisher and P Loftus Wiely
3] Application of Spectroscopy to Organic Compound-J. R. Dyer, Printice Hall
4] Organic Spectroscopy-William Kemp, ELBS with McMillan
5] Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi
6] Organic Spectroscopy-RT Morrison and RN Boyd
7] Practical NMR Spectroscopy-ML Martin, JJ Delpench, and DJ Martyin
8] Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming
9] Fundamentals of Molecular Spectroscopy-CN Banwell
10] Spectroscopy in Organic Chemistry-CNR Rao and JR Ferraro
11] Photoelectron Spectroscopy-Baber and Betteridge
12] Electron Spin Resonance Spectroscopy-J Wertz and JR Bolten
13] NMR –Basic Principle and Application-H Guntur
14] Interpretation of NMR spectra-Roy H Bible
15] Interpretation of IR spectra-NB Coulthop
16] Electron Spin Resonance Theory and Applications-W gordy
17] Mass Spectrometry Organic Chemical Applications, JH Banyon

Semester III

Seminar**-**III **(**Code**:** 3S1**)**

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 Credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

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M.Sc. Chemistry Semester IV
INORGANIC CHEMISTRY SPECIALIZATION
Paper XIII(Code: 4T1)
Special I-Inorganic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit-I 15h

A) Nanoparticals & Nanostructural materials :Introduction, methods of preparation, physical properties, and chemical properties. Molecular Precursor routes to inorganic solids:- Introduction, sol-gel chemistry of metal alkoxide, hybrid organic-inorganic compounds. Nanoporous Materials: Introduction, Zeolites & molecular sieves, determination of surface acidity, porous lamellar solids, composition-structure, preparation & applications.

B) Solid State Reaction: General principles, reaction rates, reaction mechanism, reaction of solids, factors influencing reactivity, photographic process.

Unit-II 15h

A) Coordination Polymers:Coordination polymers and their classification. Synthesis and applications of coordination polymers. Use of polymeric ligands in synthesis of coordination polymers. Organosilicon polymers. Synthesis and their uses.

B) Characterization of coordination polymers on the basis of:
i) Spectra (UV, Visible, IR and NMR)
ii) Magnetic and thermal (TGA,DTA and DSC) studies

Unit-III 15h

Catalysis: Basic principles, thermodynamic and kinetic aspects, industrial requirements, classification, theories of catalysis, homogeneous and heterogeneous catalysis .Introduction, types & characteristics of substrate-catalyst interactions, kinetics and energetic aspects of catalysis, selectivity, stereochemistry, orbital symmetry and reactivity. Catalytic reactions of coordination and Organometallic compounds including polymerization activation of small molecules, addition to multiple bonds, hydrogenation Zeigler-Natta polymerization of olefins, hydroformylations, oxidations, carbonylations and epoxidation.

Name organic reaction involving inorganic compounds: Suzuki Coupling, Heck Reaction, Negishi reaction and Sonogirhra reaction

Unit-IV 15h

A) Optical sensor for metal Ions: Chelates ligand (Multidentates, Ruthenium bipyridyls, calixarenes, Lanthanide ion); Macrocyclic ligands (Flexible Macrocycles, Azamacrocycles, Cryptands, porphyrins); Crown ether and Cryptands(Napthalene and Anthracene crowns, Cryptands, structural features)

B) Thin films and languir-Biodgett films: Preparation technique, evaporation/spultering, chemical processe MOCVD, solgel etc. Languir-Biodgett(LB) film, growth techniques, photolithography properties and applications of thin and LB films.

List of books:

1. Barsoum ,M.W.,Fundamentals of Ceramics,McGraw Hill ,New Delhi
2. Ashcroft ,N.W. and Mermin,N.D.,SolidStaePhysics,Saunders College
3. CallisterW.D.,Material Science and Engineering, An Introduction,Wiley
4. Keer,H.H,Principals of Solid State,Wiley Eastern
5. Anderson J.C.,LeverK.D.,Alexander J.M and Rawlings,R.D.,ELBS
6. GrayG.W.Ed.Thermotropic Liquid Crystals,John Wiley
7. Kelkar and Hatz Handbook of Liquid Crystals,ChemieVerlag.
8. Kalbunde K.I.,Nanoscale Materials in Chemistry,JohnWiley,NY.
9. Shull R.D.,McMichael R.D. and SwartzendrubL.J.,Studies of Magnetic Properties of Fine particles and their relevance to Mataerials Science, Elsevier Pub. Amsterdam

10. Optoelectronic Properties of Inorganic Compounds, D. Max Roundhill and John P. Fakler, Jr. Plenum Press, New York

Semester IV

Paper XIV(Code: 4T2)

Special II-Inorganic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit-I 15 h

A) Basics of Photochemistry: Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped flow techniques, Energy dissipation by radiative and no-radiative processes, absorption spectra Frank-Condon principles; photochemical stages-primary & secondary processes.

B) Properties of excited states: Photochemical kinetics,Calculation of rates of radiative processes.

C) Excited States of Metal Complexes: Electronically excited states of metal complexes, charge transfer spectra, charge transfer excitations, metods for obtaining charge transfer spectra.

Unit-II 15h

A] Photophysical and photochemical properties of Gold(I) complexes: Introduction, Binuclear and trinuclear complexes, Mixed metal Systems, Photochemical reactivity, Solid state studies, Mononuclear Gold(I) complexes, Mononuclear three coordinate Gold(I) complexess

B) Redox reactions by Excited Metal Complexes: Energy transfer under conditions of weak interaction & strong interaction – exciplex formation, conditions of excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2-bipyridine & 1,10-Phenanthroline complexes.), illustration of reducing and oxidizing character of ruthenium (II); role of spin-orbit coupling, lie time of these processes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants in to highenergy products, chemical energy in to light.

Unit-III 15h

Organotransition Metal Chemistry: Alkyls and Aryls of Transition Metals: Types, routes of synthesis, stability &decomposition pathways of alkyls & aryls of transition metals. Organocopper in Organic synthesis. Compounds of Transition Metal –Carbon Multiple bonds: Alkylidenes, alkylidynes, low valent carbenes & carbynes–synthesis, nature of bond, structural characteristics, nucleophilic & electrophilic reactions on ligands, role inorganic synthesis.

Unit-IV 15h

Transition Metal Pi Complexes-Carbon multiple bonds. Nature of bonding, structural characteristics & synthesis, properties of transition metal pi- Complexes with unsaturated organic molecules, alkenes alkynes, allyl, diene, dienyl, arene & trienyl complexes. Application of transition metal, organometallic intermediates in oraganic synthesis relating to nucleophilic & electrophilic attack on ligands, role in organic synthesis.

List of books:

1. ElschenbroichCh.andSalzer A.: Organometallics, VCH,Weinheim, NY.
2. BalzaniVandCavassitiV.:Photochemistry of Coordination compounds,AP,London
3. Purcell K.F.andKotzJ.C., An Introduction to Inorganic Chemistry,HoltSounder,Japan.
4. RohtagiK.K.andMukharjee,Fundamentals of Photochemistry,Wiley eastern
5. CalvertsJ.G.and Pits.J.N., Fundamental of Photochemistry, John Wiley
6. Wells, Inorganic Solid State Chemistry, Oxford University, Vth , Edition
7. Paulson,OrganometallicChemistry,Arnold
8. Rochow,OrganometallicChemistry,Reinhold
9. Zeiss,OrganometallicChemistry,Reinhold
10. Gilbert A.andBaggott,J,Essential of Molecular Photochemistry,BlackwellSci.Pub.
11. TurroN.J.and Benjamin W.A.,Molecular Photochemistry

12. CoxAandCamp,T.P.IntroductoryPhotochemistry,McGraw-Hill
13. KundallR.P.andGilbertA,Photochemistry, Thomson Nelson Coxon J and HaltonB.,Organic Photochemistry, Cambridge University Press.
14. Optoelectronic Properties of Inorganic Compounds, D. Max Roundhill and John P. Fakler, Jr. Plenum Press, New York

Semester IV

Practical-VII (Code: 4P1)

Inorganic Chemistry SpecialPractical

12 h /week Marks: 100

A Preparation and characterization of following complexes/organometallic compound including their structural elucidation by the available physical methods.(element analysis molecular weight determination, conductance and magnetic measurement and special studies)

1 Preparation of mercury tetrathiocyanotocobaltate(II)
2 Preparation of Iron (II) oxalate & potassium trioxalatoferrate (III) trihydrate
3 Preparation of cis & trans potassium dioxalatodiaquochromate (III)
4 Preparation of hexa-aminecobalt(III) chloride
5 Preparation of hexa-aminenickel(II) chloride
6 Preparation of tris (acetylacetonato) manganese (III)
7 Preparation of N-N bis (salicyldehyde) ethylene diaminonato nickel (II)
8 Preparation of trinitrotriaminocobalt(III)
9 Preparation of chloropentammine cobalt (III) chloride
10 Preparation of potassium trioxalatochromate (III)
11 To prepare copper (II) acetylacetonate complex
12 To prepare cis and trans bis (glycinato) Cu II monohydrate complex
13 To prepare dipyridineiodine (I) nitrate
14 Preparation of ammonium nickel(II) sulphate

B SOLID STATE

1 Preparation of oxides and mixed oxides(MnO_2 , NiO, Cu_2O,Fe_3O_4,$ZnFe_2O_4$,$ZnMn_2O_4$,$CuMnO_4$and $NiFe_2O$)
2 Preparation of silica and alumina by sol –gel technique
3 To study the electrical conductivity of ferrites, magnetite's, doped oxides and pure samples and determine band gap

C SEPARTION AND QUANTITATIVE ESTIMATION OF BINARY AND TERNARY MIXTURE BY THE USE OF FOLLOWING TECHNIQUES:

1 Paper and thin layer chromatography
2 Ion exchange
3 Solvent extraction

D INORGANIC PHOTOCHEMISTRY

1. Synthesis of potassium ferrioxalate and determination of intensity of radiation
2. Photo oxidation of oxalic acid by UO^{2+}sensitization
3. Photo decomposition of HI and determination of its quantum yield

List of books:

1. Practical Inorganic Chemistry - Pass
2. Practical Inorganic Chemistry - Marr & Rocket
3. Basic Concept Of Analytical Chemistry - Khopkar S. M.
4. Synthesis And Characterisation Of Inorganic Compounds – W. L. Jolly, Prentice Hall
5. Inorganic Experiments – J. Derck Woollins, Vch.
6. Practical Inorganic Chemistry – G. Marrand, B.W. Rockett, Van Nostrand
7. A Text Book Of Quantitative Inorganic Analysis – A.I. Vogel, Longoman.
8. Edta Titration – F. Laschka

9. Instrumental Methods Of Analysis – Willard, Merit And Dean (Cbs, Delhi)
10. Inorganic Synthesis – Jolly
11. Instrumental Methods Of Chemical Analysis – Yelri Lalikov
12. Fundamental Of Analytical Chemistry- Skoog D .A. And West D. M. Holt Rinehart And Winston Inc.
13. Experimental Inorganic Chemistry7 – W.G. Palmer, Cambridge
14. Solid Stst Chemistry – N.B. Hanney
15. Introduction To Thermal Analysis , Techniques And Applications – M. E. Brown, Springer
16. Preparation And Properties Of Solid State Materials – Wilcox, Vol I&Ii, Dekker
17. The Structure And Properties Of Materials – Vol Iv, John Wulff,Wiley Eastern

Semester IV

ORGANIC CHEMISTRY SPECIALIZATION

Paper XIII (Code: 4T1)

Special I-Organic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit I:

A] Carbanions in organic Chemistry 15 h

Ionization of carbon hydrogen bond and prototopy, Base and acid catalysed halogenation of ketones, keto-enol equilibria, structure and rate in enolisation, concerted and carbanion mechanism for tautomerism, geometry of carbanions, kinetic and thermodynamic control in the generation of enolates, LDA, hydrolysis of haloforms, use of malonic and acetoacetic esters, Aldol, Mannich, Cannizzaro, Darzens, Dieckmann, Claisen Baylis-Hillman reactions, Knoevenagel, benzoin condensation, Julia olefination, alkylation of enolates and stereochemistry thereof, Conjugate additions, enamines in organic synthesis

B] Organometallic reagents -I

Synthesis and applications of organo Li and Mg reagents, nucleophilic addition to aldehyde, ketones, ester, epoxide, CO_2, CS_2, isocyanates, ketenes, imines, amides, lactones, Stereochemistry of Grignard addition to carbonyl compounds, *o*-metallation of arenes using organolithium compounds.

Unit II: 15 h

A] Organometallic reagents-II:Organozinc reagents: Preparation and applications, Reformatsky reaction, Simon-Smith reaction.

Organocopper reagents: Preparation and applications in C-C bond forming reaction, mixed oragnocuprates, Gilman's reagent. Organo Hg and Cd reagents in organic synthesis.

B] Transition metals in organic synthesis: Transition metal complexes in organic synthesis-Introduction-oxidation states of transition metals, 16-18 rule, dissociation, association, insertion, oxidative addition, reductive elimination of transition metal

Organopalladium in organic synthesis-Heck reaction, carbonylation, Wacker oxidation, coupling reactions: Kumada Reaction, Stille coupling, Sonogashira, Negishi and Suzuki coupling reactions and their importance

Applications of $Co_2(CO)_8$, $Ni(CO)_4$, $Fe(CO)_5$ in organic synthesis. Wilkinson catalyst of Ruthenium and Rhodium – synthesis and uses its use in hydrogenation reactions-deallylation, C-C, C-O, C-N bond cleavages. Olefin metathesis by I^{st} and II^{nd} generation catalyst, reaction mechanism and application in the synthesis of homo and heterocyclic compounds

Unit III: 15 h

A] Advanced Stereochemistry: Conformation of sugars,monosaccharides, disaccharides, mutorotation, Recapitulation of Stereochemical concepts- enantiomers, diastereomers, homotopic and heterotopic ligands, Chemo-, regio-, diastereo- and enantio-controlled approaches; Chirality transfer, Stereoselective addition of nucleophiles to carbonyl group: Re-Si face concepts, Cram's rule, Felkin Anh rule, Houk model, Cram's chelate model. Asymmetric synthesis use of chiral auxiliaries, asymmetric hydrogenation, asymmetric epoxidation and asymmetric dihydroxylation,

B] Protection and Deprotection of functional groups: Protection and deprotection of functional groups like, hydroxyl, amino, carbonyl and carboxylic acids groups, Solid phase peptide synthesis.

Unit IV: Designing the synthesis based on retrosynthetic analysis 15 h

A) Disconnection Approach: An introduction to synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reactions, amine synthesis

B) One Group C-C Disconnections: Alcohols andcarbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis

C) Two Group C-C Disconnections: Diels-Alder reaction, 1,3-difunctionalised compounds, α,β-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds, Michael addition and Robinson annelation, Methods of ring synthesis, Linear and convergent synthesis

List of books

1] Principle of Organic Synthesis R. O. C. Norman and J. M. Coxon
2] Modern Synthetic Reaction. H. O. House and W. A. Benjamin
3] Organic Synthesis: The Disconnection Approach-S. Warren
4] Designing Organic Synthesis-S. Warren
5] Some Modern Methods of Organic Synthesis-W. Carruthers
6] Advance Organic Reaction. Mechanism and Structure-Jerry March
7] Advance Organic Chemistry Part-B-F. A. Caray and R. J. Sundberg Plenum Press
8] Organic Reaction and their Mechanism-P. S. Kalsi
9] Protective Groups in Organic Synthesis-T. W. Greene
10] The Chemistry of Organo Phosphorous-A. J. Kirbi and S. G. Warren
11] Organo Silicon Compound-C. Eabon
12] Organic Synthesis via Boranes-H. C. Brown
13] Organo Borane Chemistry-T. P. Onak
14] Organic Chemistry of Boron-W. Gerrard

Semester IV

Paper XIV(Code: 4T2)

Special II-Organic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit I: Enzyme chemistry 15h

A] Enzymes: Introduction, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Nomenclature and classification, Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Baker's yeast catalyzed reactions

B] Mechanism of Enzyme Action: Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A.

C] Co-Enzyme Chemistry: Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD^+, $NADP^+$, FMN, FAD, lipoic acid, biotin as CO_2 carrier. Mechanisms of reactions catalyzed by the above cofactors.

Unit II: Heterocycles 15h

A*]* Azoles**:** Structural and chemical properties; Synthesis of pyrazole, isothiazole and isoxazole; Synthesis of imidazoles, thiazoles and oxazoles; Nucleophilic and electrophilic substitutions; Ring cleavages, Carbonyldiimidazole as coupling agent

B*]* Benzofused heterocycles**:** Synthesis of indole, benzofuran and benzo-thiophene, quinoline and isoquinoline Nucleophilic, electrophilic and radical substitutions; Addition reactions; Indole rings in biology.

C*]* Diazines**:** Structural and chemical properties; Synthesis of pyridazines, pyrimidines, pyrazines; Nucleophilic and electrophilic substitutions.

D**]** Synthesis of following bioactive compounds**:** Vitamin B_6, Ondansetron, Serotonin, Indometacin, Cyanamid, fentiazac, trimethoprim, papaverine

Unit III**:** 15h

A*]* Nucleic Acids**:** Primary, secondary and tertiary structure of DNA; DNA replication and heredity; Structure and function of mRNA, tRNA and rRNA. Purines and pyrimidine bases of nucleic acids and their preparation.

B**]** Lipids**:** Fatty acids, essential fatty acids, structures and functions of triglycerols, glycerophospho lipids, spingolipids, lipoproteins, composition and function, role in atherosclerosis
Properties of lipid aggregates, micells, bilayers, liposomes and their biological functions, biological membranes, fluid mosaic model of membrane structure, Lipid metabolism, β-Oxidation of fatty acids

C**]** Vitamins**:** Structure determination, and synthesis of vitamin A, E and H.

Unit IV**:** 15h

A**]** Dyes**:** General Introduction, classification on the basis of structure and methos of application dying mechanism, methods of dying, such as direct dying, vat dying, dispersive dying, formation of dye in fibre, dying with reactive dyes, study of quinoline yellow, cyamine dye, ethyl red, methylene blue, Alizarin, cyamine-green, fluorescein, cosin, erythrosine, Rhodomines and Indigo.

B**]** Pharmaceutical chemistry**:**
History, medical terms in pharmaceutical chemistry, classification of drugs, antibacterial and antifungal drugs, specific clinical applications, Synthesis and applications of: Benzocaine, Methyl dopa, dilantin, ciprofloxacin, acyclovir, terfenadine, salbutamol

C**]** Polymer chemistry**:** Importance of polymers, Basic concepts: monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition, radical chain-ionic and co-ordination and co-polymerization and their mechanisms, Polymerization in homogeneous and heterogeneous systems. Ziegler-Natta polymerization with mechanism, Stereo regulated polymers, syndiotactic, isotactic and atactic polymers

List of books

1] Textbook of Polymer Science, F. W. Billmeyer Jr, Wiley
2] Polymer Science, V. R. Gowarikar, N. V. Viswanathan and J. Sreedhar, Wiley-Eastern
3] Functional Monomers and Polymers, K. Takemoto, Y. Inaki and R. M. Ottanbrite
4] Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-Verlag
5] Understanding Enzymes, Trevor Palmer, Prentice Hall
6] Enzyme Chemistry: Impact and Applications, Ed. Collin J. Suckling, Chapman and Hall
7] Enzyme Structure and Mechanism, A. Fersht, W. H. Freeman
8] Introduction to Medicinal Chemistry, A. Gringuage, Wiley-VCH
9] Wilson and Gisvold's Text Book of Organic Medical and Pharmaceutical Chemistry, Ed Robert F. Dorge
10] Burger's Medicinal Chemistry and Drug Discovery, Vol-1, Ed. M. E. Wolff, John Wiley
11] Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley
12] The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press

Semester IV
Practical-VII (Code: 4P1)
Organic Chemistry Special Practical

12 h /week Marks: 100

A] Quantitative Analysis based on classical and instrumental technique (any 9-10)

1] Estimation of nitrogen.
2] Estimation of halogen.
3] Estimation of sulphur.

Spectrophotometric/calorimetric and other instrumental methods of estimation

1] Estimation of streptomycin sulphate.
2] Estimation of vitamin B-12.
3] Estimation of amino acids.
4] Estimation of proteins.
5] Estimation of carbohydrates.
6] Estimation of Ascorbic acid.
7] Estimation of Aspirin.
8] Solvent extraction of oil from oil seeds and determination of saponification value, iodine value of the same oil.

B] Organic multi-step preparations (Two/Three steps): Minimum 10-12 preparations

[1] Aniline → Diaminoazobenzene → p-aminoazobenzene
[2] Benzoin → Benzyl → Dibenzyl
[3] Aniline → acetanilide →*p*-bromoacetanilide →*p*-bromoaniline
[4] Aniline → Acetanilide →*p*-nitroacetanilide →*p*-nitroaniline
[5] Benzaldehyde (thiamine hydrochloride) → benzoin → benzil → benzilic acid
[6] *p*-Nitrotoluene →*p*-nitrobenzoic acid→ PABA →*p*-iodobenzoic acid
[7] *p*-Cresol →*p*-cresylacetate → 2-hydroxy-5-methyl acetophenone → 2-hydroxy chalcone
[8] Benzaldehyde → benzilidene acetophenone → 4,5-dihydro-1,3,5-triphenyl-1*H*-pyrazole
[9] Aniline → phenylthiocarbamide → 2-aminobenzthiazole (Microwave in step I)
[10] Chlorobenzene → 2,4- Dinitrochlorobenzene → 2,4- Dinitrophenylhydrazine.
[11] Acetophenone → acetophenone phenyl hydrazone → 2-phenylindole
[12] Benzion → benzoin benzoate → 2,4,5-triphenyl oxazole
[13] Benzophenone → benzpinacol → benzopinacolone (Photochemical preparation)
[14] Benzophenone → Benzophenone oxime → Benzanilide → Benzoic acid + aniline
[15] Aniline → aniline hydrogen sulphate → sulphanilic acid → Orange II
[16] Aniline → N-arylglycine → indoxyl → indigo
[17] Phthalimide → Anthranilic acid → Phenyl glycine-o-carboxylic acid → Indigo
[18] Phalic anhydride → Phthalimide → Anthranilic acid → o-chlorobenzoic acid
[19] Phalic anhydride → Phthalimide → Anthranilic acid →Diphenic acid
[20] Ethyl acetoacetate → 3-methyl-pyrazol-5-one → 4,4-dibromo-3-methyl-pyrazol-5-one Butanoic acid
[21] Biosynthesis of ethanol from sucrose
[22] Enzyme catalyzed reactions

[C] SPECTRAL INTERPRETATION

Structure Elucidation of organic compounds on the basis of spectral data (UV, IR, ^{1}H and $^{13}CNMR$ and Mass) (Minimum 12 compounds are to be analysed during regular practicals).

Semester IV
PHYSICAL CHEMISTRY SPECIALIZATION

Paper XIII(Code: 4T1)
Special I-Physical Chemistry)

60h (4h/week) 15h/unit 80 Marks

UNIT-I CHEMICAL DYNAMICS - II 15h

A] Overview of Arrhenius rate law, Non-conventional equilibrium between reactants and activated complexes. Potential energy surfaces and reaction coordinate. Derivation of transition state theory based equation for rate constant of bimolecular reaction. Prediction of rate constant using partition function and comparison with that given by collision theory. Arrhenius equation and activated complex theory. Transmission coefficient, quantum mechanical tunneling,

B] Reactions in solution: Cage effect, diffusion controlled reactions, volume of activation its determination and correspondence with entropy of activation, Ionic reactions: Primary (Ionic strength) and Secondary salt effect and their nature.

UNIT II CORROSION AND CORROSION ANALYSIS 15h

A] Scope and economics of corrosion, causes (Change in Gibbs free energy), Electrochemical Series and Galvanic series, dry (atmospheric) and wet (electrochemical) corrosion, other types of corrosion- Pit, Soil, chemical and electrochemical, inter-granular, waterline, microbial corrosion, measurement of corrosion by different methods, factors affecting corrosion, passivity, galvanic series, protection against corrosion, design and material selection.

B] Thermodynamics of corrosion, corrosion measurements (Weight loss, OCP measurements, polarization methods), passivity and its breakdown, corrosion prevention (electrochemical inhibitor and coating methods).

UNIT – III: RADIATION CHEMISTRY 15h

A] Interaction of radiation with matter, radiation track spurs and □-rays. Linear energy transfer, Bathe's equation for linear energy transfer, Bresstrahlung effect, Passage of neutron through matter, Interaction of □-radiation with matter, photoelectric effect and Compton effect, pair production phenomena, units of measuring radiation absorption, Radiolysis of water, Radiolysis of some aqueous solutions. Effect of radiation on biological substances, genetic effects, Radiation effects on organic compounds and Polymers.

UNIT IV: ELECTRICAL AND THERMAL PROPERTIES OF SOLIDS 15h

A] Classical free electron theory, electrical conductivity, thermal conductivity, Wiedemann-Franz Law, Lorenz number, Electronic distribution in solids using Fermi Dirac Statistics, The Fermi Distribution function and effect of temperature, Quantum theory of free electrons, periodic potential, The Kronig-Penney Model, Brillouin Zones, Distinction between metals, insulators and intrinsic semiconductors based on above theory.

B] Thermal Properties: Specific heat of solids, Classical theory, Einstein's theory of heat capacities, Debye theory of heat capacities or Debye T-cubed law

Books Sugggested:

1. G.M.Panchenkov and V.P.Labadev, " Chemical Kinetics and catalysis", MIR Publishing
2. E.A. Moelwyn- Hughes, " Chemical Kinetics and Kinetics of Solutions", Academic
3. K.J.Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York
4. J.Raja Ram and J.C.Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan IndianLtd., New Delhi (1993)
5. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, Vol 1., Elsevier Publications, New York, 1969.
6. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, Vol 2., Elsevier Publications, New York, 1969.

7. S. Glasstone, K. J. Laidler and H. Eyring, The Theory of Rate Processes, Mc-Graw Hill, New York, 1941.
8. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
9. D. Mcquarie and J. Simon, Physical Chemistry – A Molecular Approach, University Press, 2000
10. G. M. Barrow, Physical Chemistry, Tata Mc-Graw Hill, V edition 2003.
11. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
12. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
13. C.Kittel, " Introduction to solid state Physics",Wiley
14. L.V.Azaroff, " Introduction to solids", McGraw Hill
15. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
16. N. B. Hanny, Treaties in Solid State Chemistry, 4th Edn,
17. N. B. Hanny, "Solid State Chemistry"
18. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
19. C.N.Rao. Nuclear Chemistry
20. B. G. Harvey, *Introduction to Nuclear Physics and Chemistry,* Prentice Hall, Inc. (1969).
21. H.J. Arnikar, *Essentials of Nuclear Chemistry*, 4th Edition (1995), Wiely-Eastern Ltd., New Delhi.
22. W. Loveland, D. Morrissey and G. Seaborg, Modern Nuclear Chemistry, Wiley-Interscience, 2006.
23. P. P. Milella, Fatigue and Corrosion in Metals, Springer, 2013.
24. Corrosion- Understanding the Basics, asminternational.org, 2000.
25. H. H. Uhlig, Corrosion and Corrsion Control – 3rd edn, John Wiley & sons, New York.
26. J. W. T. Spinks and R. J. Woods, An Introduction to Radiation Chemistry, John Wiley and sons., New Yoek, 1975.
27. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.

Semester IV

Paper XIV (Code: 4T2)

Special II-Physical Chemistry

60h *(4h/week)* 15h/unit 80 Marks

UNIT I: SOLID STATE AND THEIR MAGNETIC PROPERTIES 15h

A] Solid State Chemistry: Metals, Insulators and Semiconductors, Electronic structure of solids—band theory. Band structure of metals, Insulators and Semiconductors, Intrinsic and Extrinsic Semiconductors, p-n junction, energy band formation, forward bias and reversed bias p-n junction, their applications, Superconductors— types, Meissner effect, BCS theory, Low Temperature Superconductor (LTSC) and High Temperature Superconductor (HTSC), Conventional and organic Superconductors, their applications.

B] Magnetic Properties: Behaviour of substances in magnetic field, effect of temperature, Curie and Curie-weiss law, calculation of magnetic moments, magnetic materials, their structure and properties, Applications, structure/ property relations, numericals.

UNIT II: ELECTRICAL PROPERTIES OF MOLECULES 15h

Dipole moments of molecules, basic ideas of electrostatic interactions, polarizability, orientation polarization, Debye equations, limitation of the Debye theory, Clausius-Mossotti equation. electrostatic of dielectric medium, molecular basis of dielectric behavior, structural information from dipole moment measurements, use of individual bond dipole moments, application to disubstituted benzene derivatives, dipole moment and ionic character of a molecule, determination of dipole moment from dielectric measurements in pure liquids and in solutions. The energies due to dipole-dipole, dipole induced dipole and induced dipole-induced dipole interaction. Dispersion, dielectric loss and refractive index. Lennard-Jones potential.

Unit III: LIQUID STATE AND INTERFACES 15h

A] Theory of liquids: - Theory of liquids, partition function method or model approach, single cell models, communal energy and entropy, significant structure model.

B] Liquid gas and liquid interfaces: Surface tension, methods of determination of surface tension, surface tension across curved surfaces, vapor pressure of droplet (Kelvin equation), surface spreading, spreading coefficient, cohesion and adhesion energy, contact angle, constant angle hystereis, wetting and detergency.

Unit IV: IONIC LIQUIDS AND BATTERY TECHNOLOGY 15h

A] Supercooled and ionic liquids: Supercooled and ionic liquids, theories of transport properties, non Arrhenius behavior of transport properties, Cohen-Turnbull free volume model, configurational entropy model, Macedo- litovitz model, glass transition in supercooled liquids.

B] Battery Technology: basic concept, classification of batteries, primary, secondary and reserve batteries, Construction, working and application of Acid Storage batteries, Lithium - MnO_2 batteries, Nickel- Metal hydride batteries, Fuel Cells, Construction and working of $H_2O_2$and methanol-O_2 Cell.

List of books

1. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
2. D. Mcquarie and J. Simon, Physical Chemistry – A Molecular Approach, University Press, 2000
3. G. M. Barrow, Physical Chemistry, Tata Mc-Graw Hill, V edition 2003.
4. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
5. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
6. A. Kokorin, Ionic Liquids: Theory, Properties and New Approaches, Intech, Croatia, 2011.
7. Gholam-Abbas Nazri, Gianfranco Pistoia, Lithum Batteries-Science and Technology, Springer, 2003.
8. N. H. March and M. P. Tosi, Introduction to Liquid State Physics, World Scientific, London, 2002.
9. George Kackson, Liquid State Theory,
10. C.Kittel, " Introduction to solid state Physics",Wiley
11. L.V.Azaroff, " Introduction to solids", McGraw Hill
12. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
13. N. B. Hanny, Treaties in Solid State Chemistry, 4th Edn,
14. N. B. Hanny, Solids,
15. H. Y. Erbil, Surface Chemistry of Solid and Liquid Interfaces, Blackwell Publishing, 2013.
16. N. B. Hanny, "Solid State Chemistry"

Semester IV

Practical-VII (Code: 4P1)

Physical Chemistry Special Practical

12 h /week Marks: 100

Adsorption:

1. To verify Freundlich adsorption isotherm.
2. To verify Langmuir adsorption isotherm.
3. To verify Gibbs adsorption isotherm and to find surface excess concentration of solute.
4. Study of variation of surface tension of solution of n-propyl alcohol with concentration and hence determine the limiting cross section area of alcohol molecule.

Kinetics:

5. Clock reaction- activation energy of bromide-bromate reaction.
6. Temp dependence of persulfate-iodide reaction by iodine clock method and calculation of thermodynamic and Arrhenius activation parameters. Study of ionic strength effect on persulfate-iodide reaction.
7. Kinetics of B-Z reaction; Kinetics of modified B-Z reaction
8. Investigate the Autocatalytic reaction between potassium permanganate and oxalic acid.
9. Determination of pKa value of a weak acid by chemical kinetic method (formate-iodine reaction)

Potentiometry:

10. Transport number by potentiometry.

11. To determine degree of hydrolysis of aniline hydrochloride and hence to determine the hydrolysis constant of salt by potentiometry method.
12. To determine pK of weak acids, succinic acid, acetic acid, Malonic acids, (dibasic acids).
13. Complexation between Hg^{2+} and I^- conductometrically.

Conductometry:

14. To determine degree of hydrolysis of aniline hydrochloride and hence to determine the hydrolysis constant of salt by conductometric method.
15. To determine pK of weak acids, succinic acid, acetic acid, Malonic acids, (dibasic acids).
16. Complexation between Hg^{2+} and I^- conductometrically.
17. To determine solubility product of lead chromate.
18. Kinetic study of saponification ethyl acetate by conductometry.

Spectrophotometry:

19. To determine the stability constant of reaction between Ferric ion solution and SCN^- ion solution by Job's method.
20. To determine the stability constant between Fe^{3+} and SCN^- ion solution by Ostwald & Frank method.

Transport Number:

21. To determine transport number by Hittorff's method
22. To determine the transport number by moving boundary method

List of Books

1. Vogel A, 3rd Edition : A Textbook Of Quantitative Inorganic Analysis, Longman
2. Das and Behra, Practical Physical Chemistry
3. Carl W. Garland, Joseph W. Nibler and David P. Shoemaker, Experiments in Physical Chemistry, Mc-Graw Hill, 8th Edition, 2009.
4. Farrington Daniels, Joseph Howard Mathews, John Warren Williams, Paul Bender, Robert A. Alberty, Experimental Physical Chemistry, Mc-Graw Hill, Fifth Edition, 1956.
5. John W. Shriver and Michael George, Experimental Physical Chemistry, Lab Manual and Data Analysis, The University of Alabama in Huntsville, Fall 2006
6. Day And Underwood :Quantitative Analysis
7. Merits And Thomas:Advanced Analytical Chemistry
8. Ewing, G. W. : Instrumental Methods Of Chemical Analysis, Mcgraw-Hill
9. Drago, R.S:Physical Methoods In Inorganic Chemistry
10. Christain G.D:Analytical Chemistry
11. Khopkar S.M.:Basic Concept Of Analytical Chemistry
12. Koltath And Ligane:Polorography
13. Braun:Instrumental Methods Of Chemical Analysis
14. Willard, Merritt And Dean: Instrumental Methods Of Chemical Analysis ,Van Nostrand
15. Strouts,Crifi;Llan And Wisin: Analytiacl Chemistry
16. Skoog S.A. And West D. W.:Fundamental Of Analytical Chemistry
17. Dilts R.V.: Analytiacl Chemistry
18. Jahgirdar D.V :Experiments In Chemistry
19. Chondhekar T.K: Systematic Experiments In Physical Chemistry, Rajbog S.W., Aniali Pubn.
20. Wlehov G. J: Standard Methods Of Chemicalanalysis 6th Ed
21. Ramesh Rand Anbu M, Chemical Methods For Envirnmental Analysis : Watewr And Sedient , Macmillion India

Semester IV

ANALYTICAL CHEMISTRY SPECIALIZATION

Paper XIII(Code: 4T1)

Special I-Analytical Chemistry

60h (4h/week) 15h/unit 80 Marks

Unit-I: Radioanalytical Chemistry-II 15h

Preparation of some commonly used radioisotopes (^{22}Na, ^{60}Co, ^{131}I, ^{65}Zn, ^{32}P), Use of radioactive isotopes in analytical and physico-chemical problems, Industrial applications, Neutron sources, Neutron Activation Analysis, Isotope Dilution Analysis, Radiometric titrations (Principle, Instrumentation, applications, merits and demerits), Radiochromatography, Carbon dating, Numericals based on above.

Unit-II: Optical methods of analysis-IV 15h

Inductively coupled plasma-atomic emission spectroscopy: Principle, atomization and excitation. Plasma source and sample introduction. Instrumentation. Comparison of ICP-AES with AAS. Applications.

X-ray fluorescence spectroscopy: Principle. Instrumentation: wavelength and energy dispersive devices. Sources and detectors. Comparison between wavelength and energy dispersive techniques. Sample preparation for XRF. Matrix effects in XRF. Applications in qualitative and quantitative analysis.

*Particle induced X-ray emission (PIXE):*Basic principle, Instrumentation and applications.

*Electron microscopy:*Principle, instrumentation and applications of scanning electron microscopy (SEM) and transmission electron microscopy (TEM)

Unit-III:Electrochemical methods of analysis-III 15h

Ion selective electrodes: Theory of membrane potential. Types of ion-selective electrodes. Construction of solid state electrodes, liquid membrane electrodes, glass membrane electrodes and enzyme electrodes, Selectivity coefficients, Glass electrodes with special reference to H^+, Na^+ and K^+ ions. Applications of ISE in analysis of environmentally important anions like F^-, Cl^-, Br^-, I^-, NO_3^- and CN^-. Advantages of ISE.

Coulometry: Principle. Coulometry at constant potential and constant current. Instrumentation. Applications and advantages of coulometric titrations.

Electrochemical microscopy: Introduction to scanning probe microscopy (SPM), scanning tunneling microscopy (STM), atomic force microscopy (AFM) and scanning electrochemical microscopy (SECM).

Unit-IV: Thermal methods of analysis 15h

Introduction to different thermal methods, Thermogravimetry (TG and DTG), Static thermogravimetry, quasistatic thermogravimetry and dynamic thermogravimetry, Instrumentation-Balances, X-Y recorder, Stanton-Redcroft TG-750, Thermogram, Factors affecting thermogram, Applications of thermogravimetry, Differential Thermal Analysis (DTA)- Theories, DTA curves, Factors affecting DTA curve, Applications of DTA, simultaneous determination in thermal analysis, Differential Scanning Calorimetry (DSC)- Introduction, Instrumentation, DSC curves, factors affecting DSC curves, applications, Thermogravimetric titration-Theory, Instrumentation and applications.

Semester IV

Paper XIV(Code: 4T2)

Special II-Analytical Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit-I: Pharmaceutical and clinical analysis 15h

Requirements of a quality control laboratory for pharmaceutical units.

Structures, category, identification (qualitative) and assay (quantitative) of following drugs

1. Antibiotics: Amoxycillin, Azithromycin, Cefixime, Levofloxacin

2. Antihistamine: Cetirizine, Cinnarizine
3. Vitamins: Thymine hydrochloride (Vitamin-B_1) Riboflavin (Vitamin-B_2), Ascorbic acid (Vitamin-C)
4. Analgesics: Diclofenac, paracetamol, Aspirin.

Composition of blood, sample collection for blood and urine, clinical analysis, Immuno Assay-RIA, Setting up of RIA and applications, Fluorescence Immunoassay, Enzyme immunoassay, Blood gas analyzer, Trace elements in the body.

Unit-II: Soil analysis and coal analysis 15h

Soil analysis- Classification and composition, pH and conductivity, analysis of constitutents such as nitrogen, phosphorous, potassium and microconstitutents (Zn and Cu).

Coal analysis- Proximate analysis (moisture content, ash content, volatile matter, fixed carbon). Ultimate analysis (carbon, hydrogen, sulphur, nitrogen, oxygen content). Combustion of carbonaceous fuel- Flue gas. Calorific value and its units, Bomb calorimeter.

Unit-III: Corrosion and corrosion analysis 15h

Definition, draw backs and theories of corrosion-dry and wet corrosion, Different types of corrosion-Pit, Soil, chemical and electrochemical, intergrannular, waterline, microbial corrosion, measurement of corrosion by different methods, factors affecting corrosion, passivity, galvanic series, protection against corrosion, design and material selection.

Unit-IV: Automation in analytical chemistry 15h

Automation in the laboratory, Principle of automation, automated instruments, classification, continuous analyzer, automatic instruments, semiautomatic instruments GeMSAEC Analyzer, Flow Injection Analysis (FIA), Dispersion coefficient, Factors af fecting Peak Height, microprocessor based instruments, Numericals based on above.

Hyphenated techniques: Introduction to GC-MS, LC-MS, ICP-MS and MS-MS (Tandem) spectrometry.

Semester IV

Practical-VII (Code: 4P1)

Analytical Chemistry Special Practical

12 h /week Marks: 100

A. Organoanalytical chemistry

1. Estimation of sulphur, nitrogen, phosphorous,chlorine in organic compound.
2. Estimation of phenol.
3. Estimation of aniline.

B. Separation techniques

Ion exchange

1. Separation and estimation of zinc and magnesium/cadmium in a mixture on anion exchanger.
2. Separation and estimation of chloride and iodide in a mixture on anion exchanger.
3. Determination of total cation concentration in water.

Solvent extraction

1. Estimation of Copper using Na-DDC.
2. Estimation of Iron using 8-hydroxyquinoline.
3. Estimation of Nickel using DMG.
4. Estimation of Cobalt using 8-hydroxyquinoline.
5. Estimation of Nickel by synergistic extraction with 1,10-phenanthroline and dithizone.

Paper chromatography

1. Separation and estimation of copper and nickel in a mixture.
2. Separation and estimation of cobalt and nickel in a mixture.

Thin layer chromatography

1. Separation and estimation of bromophenol blue, congo red and phenol red in a mixture.

2. Separation and estimation of metal ions in mixture.

C. Water analysis

1. *Mineral analysis*: Ttemperature, pH, conductivity, turbidity, solids, alkalinity, chloride, fluoride, sulphate, hardness
2. *Demand analysis*: DO, COD
3. *Heavy metals*: Fe, Cd and Pb

D. Demonstrations

1. Gas chromatography
2. HPLC

List of books:

1. Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)
2. Substoichiometry in Radioanalytical Chemistry: J. Ruzicka and J Stary (Pergamon Press)
3. Thermal analysis: Blazek (translated by J. F. Tyson, Van Nostrand)
4. Instrumental Methods of Analysis: Willard, Meriit and Dean(Van Nostrand)
5. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
6. Vogel's Text Book of Quantitative inorganic Analysis: Bassett, Denney, Jeffery and Mendham (ELBS)
7. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
8. Atomic Absorption Spectroscopy: Robinson (Marcel Dekker)
9. Instrumental Methods of chemical Analysis: Braun (Tata McGraw-Hill)
10. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
11. Analysis of Water: Rodier
12. Ion selective electrods: Koryta (Cambridge University Press)
13. Instrumentation in analytical chemistry: Borman (American Chemical Society)
14. Industrial Chemistry: Arora and Singh (Anmol Publications)
15. Diffraction Methods: John Wormald (Clarendon Press)
16. Electroanalytical Chemistry: Bard (Dekker)
17. Analytical Chemistry by Open Learning (Wiley)
18. An Introduction to Electron Diffraction: Beeston (North Holand Publishing Co.)
19. Material Science and Engineering: V. Raghavan (Printice-Hall of India)
20. Practical Physical Chemistry: J. B. Yadav (Goel Publishing House)
21. Indian Pharmacoepia, Vol-I, II and III.

Semester IV

Paper XV (Code: 4T3)

Elective- Nuclear Chemistry

60 h (4 h per week): 15 h per unit — 80 Marks

Unit-I: Radiation Chemistry, Radiolysis — 15h

Measurement of dose. Dosimetric terms and units (Roentgen, REM, Rad, Gray, Sievert), inter conversions, calculation of absorbed dose-various types of dosimeters, chemical dosimeters (Fricke, Ceric sulphate and FBX), experimental methods, TLD badges, Radiolysis-definition, process, Radiolysis of water and aqueous solutions, hydrated electron,

Effect of radiation on biological substances, genetic effects, radiation effects on organic compounds (Halides-carboxylic acids), polymers, nitrates and solid thermoluminescence.

Unit-II: Hot Atom Chemistry and Radiochemistry — 15h

Recoil energy and calculations, Szilard Chalmers effects, Kinetics, primary and secondary retention-effect of various factors on retention and its uses, Mossbauer effect- principle, instrumentation and chemical applications,

Unit-III: Radioanalytical techniques — 15h

Neutron sources, Neutron activation analysis, principle, methodology and application for trace analysis, Isotope dilution analysis-principle and application, Isotopic exchange reaction, mechanism

and application in use of radioisotopes and tracers, radioactive dating based on carbon-14 and lead isotopes.

Unit-IV: Radiopharmaceuticals 15h

Radioimmunoassay (RIA), discovery, principle, set up of RIA, Principle of Immunoradiometric assay (IRMA), principle and set up, Radiopharmaceuticlas, classification of products, preparations, quality control aspects, ^{99}Mo-^{99m}Tc generator, Cylotron based products, PRT studies, Therapeutic applicatyions , Radiotherapy

Semester IV

Paper XV (Code: 4T3)

Elective- Environmental Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Water Pollution 15h

Pollutants- Types of pollutants, sources of water pollution, sampling, preservation and storageof water sample, physico –chemical, organoleptic and chemical analysis of water, electro-analytical,optical (UC-visible spectrophotometry, AAS, flame photometry, XRF, ICPAES), chromatographic (GC and HPLC) and neutron activationmethods of analysis of Co, Ni, Cu, Fe, Mn, Zn, Cd, Pb, Hg, As, Cl^- ,F^-, $SO4^{--}$,PO_4^-, NO_3^-. Historical development of detergents, chemistry of soaps and detergents.

Unit-II: Air Pollution 15h

Natural versus polluted air, air quality standards, air sampling, analysis and control of Particulates, Chemistry and analysis of SOx, NOx, CO, ozone, hydrocarbons, CFCs.Chemistry of gaseous, liquid and solid fuels- gasoline and additives, antiknock agents.Air pollution control—control of automobile emission and control measures in thermal power stations.

Unit-III: Soil Pollution 15h

Types and sources of soil pollution, classification of soil pollutants, impact of soil pollutionon air quality, Specifications for disposal of sewage and effluent on land for irrigation andground water recharge. Methodology of waste water disposal on land in India. Impact of usage of land for solid waste disposal both municipal solid waste and industrial solid wastes (fly ashfrom thermal power station, lime sludge from paper and pulp industry), cause of soil erosion,effects of soil erosion, conservation of soil, control of soil pollution.

Unit-IV: Solid waste pollution 15h

Sources, types and consequences, classification of wastes- domestic, industrial, municipal, hospital, nuclear and agricultural and their methods of disposal. Transfer and transport,Recycle, reuse, recovery, conversion of solid wastes -energy / manure.Analysis and monitoring of pesticides.

Impact of toxic chemicals on enzymes, Biochemical effects of As, Cd, Pband Hg, their metabolism, toxicity and treatment.

Semester IV

Paper XV (Code: 4T3)

Elective- Polymer Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: Polymerization 15h

Types of polymerization, addition-chain, free radical, ionic polymerization, step polymerization, electropolymerization, ring-opening polymerization.

Unit II: Techniques of polymerization 15h

Techniques of polymerization-suspension, emulsion and bulk polymerization, coordination, polymerization mechanism of Ziegler Natta polymerization, stereospecific polymerization, interfacial polycondensation, mechanism of polymerization.

Unit III: Characterization of polymers 15h

Electronic, IR and NMR spectral methods for characterization of polymers (Block and Graft)

Thermal methods-TGA, DTA, DSC, thermomechanical and X-ray diffraction study, Block and Graft copolymers, random, block, graft co-polymers, methods of copolymerization.

Unit IV: Specific polymers 15h

A) Biomedical polymers: Contact lens, dental polymers, artificial heart, kidney and skin.

B) Inorganic polymers: Synthesis and application of silicon, phosphorous and sulphur containing polymers.

C) Coordination polymers: Synthesis and applications of coordination polymers.

Semester IV

Paper XV (Code: 4T3)

Elective- Medicinal Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

UNIT-I: 15 h

A] Drug rules and drug acts, Overview of Intellectual property right, Indian and International framework for patent protection.

B] Statastical method: For sampling and interpretation of results, Statastic in quality control, T-Test, F-Test, Validation of analytical methods as defined proceeding USP Radio immune analysis, Investigational drugs.

C] Antidiabetic Agents- Type-I and Type-II diabetes, Insulin, thiazolidinediones, Synthesis of ciglitazone.

UNIT-II: 15 h

A] Anti-Viral agents: Inroduction, viral diseases, viral replication, and transformation of cells, investigation of antiviral agents,. Chemotherapy for HIV. Synhesis of: Idoexuidine, acyclovir ,amantadine and cytarabin.

B] Anti-malarial agents: Introduction, malarial parasite, and its life cycle, development of antimalarials, chemotherapy of malaria. Synthesis of: Chloroquin, primaquin, proguanil, and Quinacrine

C] Local Anti-infective drug: Introduction and general mode of action. Synthesis of sulphonamides, ciprofloxacin, norfloxacin, dapsone ,amino salicylic acid, isoniazid, ethionamide, ethambutal, econozole, griseofulvin.

UNIT-III: 15 h

A) Histamines and Antihistamic agents: Introduction, histamine H1-receptor antagonists. Inhibitors of histamine release. Synthesis of: alkyl amines, phenothiazines, piperzines derivatives.

B) Antibiotics: Introduction, β-lactam antibiotics, classification, SAR and chemical degradation of penicillin, cephalosporins-classification , tetracycline antibiotics-SAR,miscellaneous antibiotics. Synthesis of ampicillin, cephradine, methacycline,chloramphenicol

UNIT-IV: 15 h

A) Anthelminitics and antiamoebic drugs: Introduction to Helminthiasis, Anthelminitics, drugs used in cestode infection, drugs used in trematode infection, origin of antiamoebic drug, drugs used in nematode infection. Synthesis of: Clioquinol, Iodoquinol, Haloquinol, Dichlorphen, Niclosamide.

B) Anti-inflammatory drugs: Introduction, etiology of inflammatory diseases. The inflammatory response, biochemical response. Synthesis of: Phenyl butazone and its derivatives, pyrazolone derivatives, pyrole and indole acetic acid derivatives.

Semester IV

Paper XVI (Code; 4T4)

Foundation Course–IIApplied Analytical Chemistry-II

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Water treatment 15h

Hardness of water and types of hardness. Problems due to hardness. Removal of hardness by lime-soda process, Zeolite process and synthetic ion-exchange resins. Principle, instrumentation and comparison of these three processes. Numericals based on hardness removal. Desalination of sea-water.

Unit-II: Polymer chemistry and leather analysis 15h

Polymer chemistry: Definition, classification, co-polymers, conducting polymers, determination of acid value, saponification value, iodine value, molar mass by end group analysis- amide and hydroxyl, molecular weight by viscosity method, glass transition temperature of polymers, TGA and DTA studies of polymers.

Analysis of leather: Determination of moisture, acid, free sulphur, total ash, chromic oxide in leather, tensile strength and stretch of leather.

Unit-III: Metallurgy

Ores and minerals, General principles of extraction of metals from ores. Steps involved in metallurgical extraction. Purification and concentration of ores. Extraction of crude metal from concentrated ore-pyrometallurgy, hydrometallurgy and electrolytic processes. Refining of metal. Thermodynamic aspects of metallurgical processes and Ellingham diagram. Furnaces in metallurgy. Metallurgy of Cu, Ag, Au, Al and Fe.

Unit-II: Clinical analysis 15h

General composition of blood, Collection and storage of blood samples, Estimation of chloride, calcium, sodium, potassium and bicarbonate in blood sample. Qualitative tests for reducing sugar. Estimation of blood glucose, urea, uric acid, blood urea-nitrogen, total serum protein, serum albumin, serum creatinine, serum phosphate, serum bilirubin, serum cholesterol. Radioimmunoassay (RIA).

OR

Semester IV

Paper XVI (Code: 4T4)

Core Subject Centric –IISpectroscopy – II

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: 15 h

A] Ultraviolet and visible spectroscopy: Natural line width, line broadening, transition probability, Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels. General nature of band spectra. Beer- Lambert Law, limitations, Frank-Condon principle, various electronic transitions, effect of solvent and conjugation on electronic transitions, Fiesher Wooodward rules for dienes, aldehydes and ketones. Structure differentiation of organic molecules by UV Spectroscopy

B] Photoelectron spectroscopy: Basic principles, photoelectric effect, ionization process, Koopman theorem, PES and XPES, PES of simple molecules, ESCA, chemical information from ESCA, Auger electron spectroscopy.

Unit II: Nuclear magnetic Resonance Spectroscopy 15 h

Magnetic properties of nuclei, resonance condition, NMR instrumentation, chemical shift, spin spin interaction, shielding mechanism, factors affecting chemical shift, PMR spectra for different types of organic molecules, effect of deuteration, complex spin spin interaction(1^{st} order spectra), stereochemistry, variations of coupling constant with dihedral angle, electronegativity, Karplus equation etc., classification of molecules as AX, AX_2, AMX, A_2B_2, Shift reagents. NMR studies of ^{13}C, chemical shift in aliphatic, olefinic, alkyne, aromatic, heteroatomic and carbonyl compounds, ^{19}F, ^{31}P. Structure determination of organic molecules by NMR spectroscopy

Unit III: 15 h

A] Application of NMR spectroscopy: FT-NMR, advantages of FT-NMR, two dimensional NMR spectroscopy-COSY, HETCOR, NOSEY, DEPT, INEPT, APT, INADEQUATE techniques, Nuclear overhauser effect, use of NMR in medical diagnosis

B] Problems based on structure determination of organic molecules by using NMR (^{1}H and ^{13}C nuclei) data, Structure elucidation using combined techniques including UV, IR, NMR and mass spectrometry (based on data and copies of the spectra)

Unit IV**:** Diffraction techniques 15 h

X ray diffraction: Braggs condition, Miller indices, Laue method, Bragg method, Debye Scherrer method, identification of unit cells from systematic absences in diffraction pattern, structure of simple lattices and x-ray intensity, structure factor and its relation to intensity and electron density, absolute configuration of molecules.

Electron diffraction: scattering intensity vs scattering angle, Wierl equation, measurement techniques, elucidation of structure of simple gas phase molecules, low energy electron diffraction and structure of surfaces.

Neutron diffraction: Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques, elucidation of structure of magnetically ordered unit cell.

List of books

1] Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morril, John Wally
2] Introduction to NMR spectroscopy-R. J. Abraham, J. Fisher and P Loftus Wiely
3] Application of Spectroscopy to Organic Compound-J. R. Dyer, Printice Hall
4] Organic Spectroscopy-William Kemp, ELBS with McMillan
5] Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi
6] Practical NMR Spectroscopy-ML Martin, JJ Delpench, and DJ Martyin
7] Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming
8] Fundamentals of Molecular Spectroscopy-CN Banwell
9] Spectroscopy in Organic Chemistry-CNR Rao and JR Ferraro
10] Photoelectron Spectroscopy-Baber and Betteridge
11] Electron Spin Resonance Spectroscopy-J Wertz and JR Bolten
12] NMR –Basic Principle and Application-H Guntur
13] Interpretation of NMR spectra-Roy H Bible
14] Interpretation of IR spectra-NB Coulthop
15] Electron Spin Resonance Theory and Applications-W gordy
16] Mass Spectrometry Organic Chemical Applications, JH Banyon
17] Spectroscopy- H. Kaur

Semester IV

Practical VIII **(**Code**:** 4PROJ1**)**

Project

12 h/week 100 Marks

Project is a part of practical examination. Project should be carried out by the student under the supervision of Guide/Teacher. The examination shall be conducted by External and Internal Examiners. Students are supposed to present their work either on LCD Projector / OHP or blackboard.

The division of marks will be as follows**:**

For written Project Work	: 40 Marks	- Evaluated jointly by External and Internal Examiners
Presentation	: 20 Marks	- Evaluated jointly by External and Internal Examiners
For Viva-Voce	: 20 Marks	- Evaluated by External Examiner
Internal Assessment	: 20 Marks	- Evaluated by Internal Examiner

Note**:** One external examiner shall be appointed for evaluation of group of 6 students**.**

Semester IV

Seminar**-**IV **(**Code**:** 4S1**)**

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 Credit). Seminar should be delivered by the student under the guidance of concerned teacher on thetopic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

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SYLLABUS for M. Sc. Physics
Choice Based Credit System (Semester Pattern)
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
With effect from 2018-19

Candidates opting for this course are advised to go through the direction relating to the course "DIRECTION RELATING TO THE EXAMINATION LEADING TO THE DEGREE OF MASTER OF SCIENCE, SEMESTER PATTERN (CHOICE BASED CREDIT SYSTEM) AND DEGREE OF MASTER OF SCIENCE AND TECHNOLOGY (APPLIED GEOLOGY). SEMESTER PATTERN, (CHOICE BASED CREDIT SYSTEM) (FACULTY OF SCIENCE & TECHNOLOGY)" which is available on R. T. M. Nagpur University website.
The direction will provide details on admission criteria, rules for ATKT, scheme of examination, absorption scheme for CBS students into CBCS pattern, elective papers, foundation course papers, subject centric papers, coding pattern, pattern of question papers, practicals, distribution of marks, seminars, project work, internal assessment, calculation of SGPA and CGPA, etc.

Table of Contents

Revised Syllabus to be implemented from 2018-19
Choice Based Credit System(CBCS)

Subject Scheme of Revised Syllabus 2015-2016 Semester Pattern
Syllabus for Each theory paper is based on 60 clock hours of teaching.

M.Sc. Physics Semester I
1. (Core 1)Paper 1: Mathematical Physics
2. (Core 2) Paper 2: Complex Analysis and Numerical Methods
3. (Core 3) Paper 3: Electronics
4. (Core 4)Paper 4: Electrodynamics I

M.Sc. Physics Semester II
1. (Core 5) Paper 5: Quantum Mechanics-I
2. (Core 6) Paper 6: Statistical Physics
3. (Core 7) Paper 7: Classical Mechanics
4. (Core 8) Paper 8: Electrodynamics II

M.Sc. Physics Semester III
1. (Core 9) Paper 9: Quantum Mechanics-II
2. (Core 10) Paper 10: Solid State Physics and Spectroscopy
3. Any one of the Elective papers from the following list. Paper 11 (Core Elective 1)
E1.1 Materials Science I **E1.2. X-ray I**
E1.3Nanoscience and Nanotechnology I **E1.4. Atomic and Molecular Physics I**
E1.5Applied Electronics I

4. Foundation course 1
Paper 12 (Not for Physics Students) : Physics I (Classical Physics)

Subject Centric Core Course which can be taken in lieu of Foundation course 1.
S1.2 Nanoscience and Nanotechnology **S1.3 Quantum Computing**
S1.4 Digital Electronics and Microprocessor
M.Sc. Physics Semester IV
1. (Core 11) Paper 13: Nuclear and Particle Physics
2. (Core 12) Paper 14: Solid State Physics
3. One of the elective papers from list below Paper 15 (Core Elective 2)
E2.1 Materials Science II **E2.2 X-ray II**
E2.3 Nanoscience and Nanotechnology II **E2.4 Atomic and Molecular Physics II**
E2.5 Applied Electronics II

4. Foundation course 2
Paper 16 (Not for Physics students) : Physics II (Modern Physics)

Subject Centric Core Course which can be taken in lieu of Foundation course 2.
S2.2 Experimental Techniques in Physics S2.3 Communication Electronics
S2.4 Electroacoustics

Semester I Paper 1 (Core 1) 1T1 Mathematical Physics

Unit I

Curvilinear co-ordinate Systems, Physical ideas about gradient, divergence and Curl, Fourier Series : Definition, Dirichlet's condition, Convergence, Fourier Integral and Fourier transform, Convolution theorem, Parseval's identity, Applications to the solution of differential equations,

Unit II

Elementary ideas about tensors, Cartesian tensors, differential of Cartesian tensors, gradient, divergence and curl , Laplacian of Cartesian tensors. Non-Cartesian tensors.Tensor densities and capacities. Differentiation of Non-Cartesian tensors, Chrisoffel symbols. gradient, divergence and curl , Laplacian of Non-Cartesian tensors

Laplace transform of elementary functions – Inverse Laplace transforms – Methods of finding Inverse Laplace transforms – Heaviside expansion formula – Solutions of simple differential equations

Unit III

Linear vector spaces - linear independent bases, Dimensionality, inner product, matrices, linear transformation, Matrices- Inverse, Orthogonal and Unitary matrices, Cayley Hamilton theorem, eigen vectors and eigen value problem, Diagonalization, Complete orthonormal sets of function.

Unit-IV

Linear differential equations, Special Function- Laguerre, Hermite, Legendre polynomials, Special Bessel's function, Spherical harmonics, Generating Function and recursion relations, differential and integral form.

1.Matrices and Tensor in Physics: A.W.Joshi
2. Mathematical Physics: H.K.Dass
3. Vector analysis – Newell
4. Rajput B S, Mathematical Physics, PragatiPrakashan (Meerat) 1999

Semester I Paper 2 (Core 2) 1T2 Complex Analysis and Numerical Methods

Unit I

Definition of Complex Numbers, Equality of Complex Number, Complex Algebra, Conjugate Complex Numbers, Geometrical representation of Complex Number, Geometrical representations of the sum, difference, product and quotient of Complex Number, Cauchy-Rieman Conditions, Analytic functions, Multiply connected regions, Cauchy Theorem, Cauchy Integration formula, Derivatives, problems (Rajput – 283 – 314).

Unit II

Singularities- Poles, Branch Points, Calculus of Residues-Residues Theorem, Cauchy Principle value, Pole Expansion of Meromorphic Functions, Product expansion of entire Functions, problems (Rajput 326 – 384).

UNIT III

Methods for determination of zeros and linear and non-linear single variable algebraic and transcendental equations, (Bisection method, false position method, iteration method, Newton-Raphson method, secant method), Finite differences. Newton's formulae (no proofs)

Unit IV

Lagrange's interpolation, Divided differences. Numerical integration, trapezoid rule, simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule, Linear least squares.

Euler and RungeKutta methods for solving ordinary differential equations. (No proofs)

References:

1. Rajput B S, Mathematical Physics, PragatiPrakashan (Meerat) 1999
2. Introductory Methods of Numerical Analysis: S SSastry
3. Computer Oriented Numerical Methods: V Rajaraman
4. R. V. Churchill, Complex variables and Applications, 7th Edition McGraw Hill
5. Computer oriented Numerical Methods: R.S.Salaria
6. Mathematical Physics: H.K.Dass
7. Higher Engineering Mathematics : B. S. Grewal

Semester I Paper 3 (Core 3) 1T3 Electronics

Unit I

Electronics Semiconductor discrete devices (characteristic curves and physics of p-n junction), Schottky, Tunnel and MOS diodes, Bipolar junction transistor, junction field effect transistor (JFET),Metal-oxide-Semiconductor Field effect transistor (MOSFET), unijunction transistor(UJT) and sillicon controlled rectifier (SCR), Opto-electronic devices (Photo-diode, solar cell, LED, LCD and photo transistor), Diffusion of impurities insillicon, growth of oxide.

Unit II

Applications of semiconductor devices in linear and digital circuits- Zener regulated power supply, Transistor (bipolar, MOSFFT, JFET) as amplifier, coupling of amplifier stages (DC, RC and Transformer coupling), RC-coupled amplifier, dc and power amplifier Feedback in amplifiers and oscillators (phase shift, Hartley, Colpitts and crystal controlled) clipping and clamping circuits. Transistor as a switch OR, AND and NOT gates (TIL and CMOS gates).

Unit III

Digital integrated circuits- NAND and NOR gates building block, X-OR gate, simple combinational Circuits -Half and full address, Flip-Flops, Multivibrators (using transistor) and sweep geneator (using transistors, UJT and SCR). shift registers, counters, A/D and D/A coverters, semiconductor memories (ROM, RAM, and EPROM, basic, architecture of 8 bit microprocessor (INTEL 8085). Linear integrated circuits-Operational amplifier and its applications-Inverting and noninverting amplifier, adder, integrator, differentiator, waveform generator, comparator and Schmittrigger, Butterwoth active filter, phase shifter,

Unit IV

Communication Electronics-Basic principle of amplitude frequency and phase modulation. Simple circuits for amplitude modulation and demodulation, digital (PCM) modulation and demodulation. Fundamentals of optical communication, Microwave Oscillators (reflex, klystron, megnetron and Gunn diode), Cavity resonaters. Standing wave detector.

Textbooks:

1. A. Malvino and D. J. Bates: Electronic Principles (Mc Graw Hill Education, India)
2. Boylstad&Neshishkey, “Electronic devices & circuits” , PHI
3. Milliman, J. Halkias, “integrated elctronics”, Tata McGraw Hill
4. J. J. CatheySchaum’s Outlines “Electronic Devices & Circuits” Tata McGraw Hill.
5. J. D. Ryder,” Electronics Fundamentals and Applications”, John Wiley-Eastern Publications.
6. A. P. Malvino, D.P. Leach, “Digital Principles and Applications”, McGraw Hill Book Co., 4th Edition (1986).
7. Ramakant A. Gayakwad, “Op-amps and Linear Integrated Circuits” PHI
8. Anil Maini, Varsha Agrawal, “ Electronic Devices and acircuits” Wiley
9. George Kennedy, “ Electronic Communication Systems”, Tata McGraw Hill.
10. Dennis Roddy, John Coolen, “Electronic Communication Systems ”, Pearson.

Semester I Paper 4 (Core 4) 1T4 Electrodynamics I

Unit I

Electrostatics: Coloumb's law, Electric field, Charge distribution, Dirac delta function, Field lines, Gauss's law and applications, Differential form of Gauss's law, Electric potential, Poisson and Laplace's equations, Electrostatic potential energy.

Unit II

Electrostatics: Boundary value problems, Uniqueness theorems, Green's theorem, Method of images, Method of separation of variables (Cartesian Coordinates, Spherical and Cylindrical Coordinates), Multipole expansion.

Unit III

Magnetostatics: Biot-Savart law, Ampere's law, Differential form of Ampere's law, Vector potential, Magnetic field of a localized current distribution, magnetic moment, Magnetostatics boundary conditions, Magnetic Shielding.

Unit IV

Time varying fields: Faraday's law, Maxwell's displacement current, Maxwell's equations, Maxwell's equations in matter, Scalar and vector potentials, Gauge Transformation, Wave equations, Poynting's theorem, Conservation laws.

Text Books:

1.Introduction to Electrodynamics, David J. Griffith, Prentice Hall of India Private Limited.
2. Classical Electrodynamics, John D. Jackson, Wiley Eastern Limited.
3. Classical Electrodynamics, Tung Tsang, World Scientific Publishing Private Limited.

Semester I Practical 1P1 and 1P2

Practical 1 (core 1 and 2)

1. To find the largest or smallest of a given set of numbers.
2. Bubble sort.
3. To generate and print first hundred prime numbers.
4. Matrix multiplication.
5. To generate and print an odd ordered magic square.
6. Other exercises involving conditions, loop and array
7. Lagrange Interpolation.
8. Method of successive approximation
9. Bisection Method
10. Newton-Raphson Method.
11. Gaussian Elimination
12. Linear Least Squares Fit.
13. Simpson's rule integration.
14. Computation of special functions

Practical 2 (Core 3 and 4)

1. Design of a regulated power supply.
2. Characteristics and applications of silicon controlled rectifier.
3. Design of common emitter Power transistor amplifier.
4. Experiments on bias stability.
5. Negative feedback (Voltage series / shunt and current series / shunt).
6. Astable, Monostable and Bistablemultivibrator.
7. Experiment on FET and MOSFET characterization and application as an
8. amplifier.
9. Experiment on Uni-junction transistor and its application.
10. Digital – I: Basic, TTL, NAND and NOR.
11. Digital – II: Combinational logic.
12. Flip-Flops.
13. Study of modulation (FM, AM, etc.).
14. Operational Amplifier.
15. Differential Amplifier.
16. Microprocessor.
17. Verification of Biot-Savart law.
18. Verification of Faraday's Law

Semester II Paper 5 (Core 5) 2T1 Quantum Mechanics I

Unit- I

Time dependent and time-independent Schrodinger equation, continuity equation, wave packet, admissible wave functions, stationary states.

Formalism of wave mechanics, expectation values, quantum mechanical operators for position and momentum in the coordinate representation, Construction of quantum mechanical operators for other dynamical variables from those of position and momentum, Ehrenfest's theorem, momentum eigen functions in the coordinate representation, box normalization and Dirac delta function.

Coordinate and momentum representations, Schrodinger equation in momentum representation,

Unit-II

Brief revision of linear vector spaces, inner or scalar product, Schwarz inequality, state vectors, general formalism of operator mechanics vector, operator algebra, commutation relations, eigen values and eigen vectors, hermitian operators degeneracy, orthogonality eigenvectors of Hermitian operators, noncommutativity of two operators and uncertainty in the simultaneous measurements of the corresponding dynamical variables, the fundamental expansion postulate, representation of state vector, Dirac's bra-ket notations.

Matrix representation of operators, change of basis, unitary transformations,

quantum dynamics, Schrodinger, Heisenberg and interaction picture.

Unit-III

Solution of Schrodinger equation for simple problems, 1-D Square well, step and barrier potentials, 1-D harmonic oscillator, zero point energy. harmonic oscillator problem by operator method.

Angular momentum operator, commutation relations, expression for L^2 operator in spherical polar coordinates, Role of L^2 operators in central force problem, eigen value problem for L^2 , separation of Schrodinger equation in radial and angular parts, solution of radial equation for hydrogen atom, 3-d square well potential, parity of wave function, parity operator.

Unit-IV

Generalized angular momentum, raising and lowering operators, matrices for J^2, Jx, Jy, Jzoperators,Pauli spin matrices, Addition of angular momenta, Clebich-Gordon Co-efficient, spin angular momentum, spin momentum functions.

Text and Reference Books:

1. Quantum mechanics: E. Merzbacher
2. Quantum mechanics: L.I.Schiff
3. Quantum mechanics: Mathews and Venkatesan
4. Quantum mechanics :Ghatak and Loknathan
5. Quantum mechanics: B.Craseman and J.D.Powell
6. Modern quantum mechanics: J.J.Sakurai
7. Quantum Theory D. Bohm, (Asia Publishing House)
8. Quantum Mechanics: 500 problems with Solutions: Aruldhas (PHI)

Semester II Paper 6 (Core 6) 2T2 Statistical Physics

Unit I

Fundamentals of classical statistical mechanics, microstate and macrostate, distribution function, Liouville's theorem, Gibbs Paradox, ensembles (micro-canonical, canonical and grand-canonical), partition function, free energy and connection with thermodynamic quantities, energy and density fluctuations

Unit II

Fundamentals of quantum statistical mechanics, BE and FD Statistics, Symmetry of wave functions, Boltzmann limit of Bosons and Fermions, Ideal Bose system: Bose-Einstein condensation, Behaviour of ideal Bose gas below and above Bose temperature, Photons and liquid helium as bosons.

Unit III

Ideal Fermi system: Weak and strong degeneracy, Fermi function, Fermi energy, Behaviour of ideal Fermi gas at absolute zero and below Fermi temperature, Fermionic condensation, Free electrons in metals as fermions, Electronic specific heat,
Cluster expansion for classical gas, Virial equations of states.

Unit IV

Phase transition: Phase transition of first and second order, Landau theory of phase transition, Ising model, Order parameter, Critical exponents, Scaling hypothesis, Random walk, Brownian motion, Langevin theory, Correlation function and fluctuation-dissipation theorem, Fokker-Planck equation. Weiss theory of ferromagnetism.

Text and Reference Books:

1. Fundamentals of Statistical Physics: B. B. Laud
2. Statistical Mechanics: R. K. Pathria
3. Statistical Mechanics: S. K. Sinha
4. Statistical and Thermal Physics: F. Reif
5. Statistical Mechanics: K. Huang
6. Statistical Mechanics: Loknathan and Gambhir
7. Statistical mechanics: R. Kubo
8. Statistical Physics: Landau and Lifshitz

Semester II Paper 7 (Core 7) 2T3 Classical Mechanics

Unit-I

Survey of elementary principles of mechanics of a particle, Dynamical systems, Phase space dynamics, stability analysis, constraints & their classifications, D'Alemberts Principle, Variational Principle, Lagrange's equation, Hamilton's Principle

Unit-II

Conservation theorems and symmetry properties, Hamiltonian formalism, Hamiltons equations, Routh's procedure for cyclic coordinates, conservation laws
Canonical transformations, Poisson brackets and Poisson theorems, Hamilton-Jacobi Theory

Unit-III

Central force motion, reduction to one body problem, equations of motions and first integrals , classification of orbits for inverse square central forces. Two body collisions, Rutherford scattering in laboratory and centre-of-mass frames;

Unit-IV

Rigid body dynamics, Euler's angles, Euler's theorem, moment of inertia tensor, eigen values and principal axis transformation, non-inertial frames and Pseudo forces, Periodic motion,: small oscillations, normal modes.

Text and Reference books:

1. Classical Mechanics: H. Goldstein
2. Classical Mechanics: N.C.Rana and P.S.Joag
3. Classical Mechanics : J. C. Upadhyaya (Himalaya Publishing House)

Semester II Paper 8 (Core 8) 2T4 Electrodynamics II

Unit-I

Scalar waves : Plane waves, spherical waves, phase and group velocities and wave packets Vector waves : Electromagnetic plane waves, harmonic plane waves, elliptic linear and circular polarization, Stokes parameters (iii) Reflection and refraction of plane waves, Fresnel polarization on reflection and refraction, (iv) Propagation in dielectric films.

Unit-II

Symmetries of Maxwell equations : Lorentz transformations, Covariance of electrodynamics, Lorentz gauge condition, equation of continuity and Maxwell equations, electrodynamics field tensor and its transformation.

Unit-III

Motion of a charge in EM fields : Lorentz force, motion in uniform, static, electric and magnetic fields and combined static EM fields.

Electric dipole, electric quadrupole and magnetic dipole radiation, Radiation by a moving charge :Lienard-Wiechert potentials of a point charge, Larmor's formula, Angular distribution of radiation. Fields and radiation of a localized oscillating source, Bremstrahlung, Synchrotron radiation.

Unit-IV

Wave guides : fields on the surface and within a hollow metallic conductor,TE, TM, TEM modes in a rectangular and cylindrical wave guide, Resonant Cavities, Dielectric waveguides.

Reference Books

1.Introduction to Electrodynamics: David Griffiths (PHI)
2. Electrodyanamics J. D. Jackson
3. Introduction to Electrodynamics, A. Z. Capri and P. V. Panat (Narosa)
4. Classical theory of fields, Landau &Lifshitz
5. Electrodynamics, W. Panofsky and M. Phillips
6. Principles of Optics, M. Born & E. Wolf Pergamon Press
7. Electromagnetism and Classified Theory, A. D. Barut, Dover

Semester II Practical 2P1 and 2P2

Practical 3 (C5 and C6)

1. Study of B-H Curve
2. Determination of e/m of electron by normal Zeeman effect using Febry Perot Etalon.
3. Determination of Lande's factor of DPPH using ESR spectrometer
4. Determination of e/m by Thomson method.
5. Determination of e/m by Busch's helical beam method.
6. Study of paramagnetic to ferromagnetic phase transition.
7. Study of Paramagnetic salt by Guoy's balance
8. Differential scanning Calorimetry
9. Determination of Plank's constant.
10. Determination of Stephan's constant.
11. Simulation of Ising model.
12. Location of critical point in Ising model using Binder cumulant.
13. Simulation of random walk.
14. Simulation of mean field model of para-ferro transition.
15. Numerical solution of particle in a box.
16. Simulation of Maxwell's velocity distribution.

Practical 4 (core 7 and 8)

1.Study of Focault pendulum
2.Study of Bifilar pendulum
3.Fibre optics
4.Study of waveguide
5.Thickness of thin wire with lasers
6.Measurement of wavelength of He-ne laser light using ruler.
7.To study Faraday effect using He-Ne laser.
8.Simulation of simple pendulum
9.Simulation of compound pendulum
10. Simulation of planetary motion.

Semester III Paper 9 (Core 9) 3T1 Quantum Mechanics II

Unit- I

Time independent perturbation theory, First order perturbation theory applied to non-degenerate states, second order perturbation extension to degenerate state, Application of perturbation theory to the ground state energy, He atom (calculation given in Pauling and Wilson), Normal and anomalous Zeeman effect, First order Stark effect in the ground and first excited states of H atom and second order Stark effect of H atom, an-harmonic oscillator.

Unit II

Time dependent perturbation theory, transition rate, Fermi Golden rule, constant perturbation harmonic in time, radiative transitions, absorption and induced emission, atomic radiation, dipole approximation, Einstein's atomic radiation, Einstein's A and b coefficients and their calculations.

Approximation methods: W. K. B. method and its application to barrier penetration.

Variational principle and its application to simple cases like ground state of He atom and deuteron in Yukawa potential.

Unit III

System of identical particles, exchange and transposition operators, totally symmetric and antisymmetric wave function and their expressions for a system of non-interacting particles, statistics of systems of identical particles, Relation of statistics with spin, Ortho and para states of the helium atom and their perturbation by Coulomb repulsion.

Hamiltonian of a molecule, Born-Oppenheimer approximation, outline of Heitler-London theory of the hydrogen molecule.

Scattering theory, scattering cross-section in laboratory and centre of mass system, scattering by a central potential, Partial wave method, phase shifts and their importance, scattering by a square well potential and a perfectly rigid sphere, resonance scattering.

Unit IV

Relativistic wave equation, the Klein-Gordon equation and initial difficulties in interpreting its solutions, Dirac's relativistic equation, Dirac's matrices, explanation of the spin of the electron, equation for an electron in an electromagnetic field and explanation of the magnetic moment due to the electron spin, spin-orbit interaction, solution for hydrogen atom in Dirac's theory, negative energy states and their qualitative explanations.

Text and References Books:

1. E. Merzbacher, Quantum Mechanics (Wiley and Sons-Toppon)
2. J. L. Powell and B. Crasemann, Quantum mechanics (B I Publications)
3. L. I. Schiff, Quantum Mechanics (McGraw-Hill)
4. Quantum Mechanics: Aruldhas
5. Pauling and Wilson, Introduction to Quantum Mechanics
6. A.K. Ghatak and Lokanathan, Quantum Mechanics (Macmillan, India)
7. Quantum Mechanics: 500 problems with Solutions: Aruldhas (PHI)

Semester III Paper 10 (Core 10) 3T2 Solid State Physics and Sprectroscopy

Unit I: Order in Solids-Crystal classes and system, 2d and 3d lattices, Space groups, b Concept of point group, bonding of common crystal structure; reciprocal lattice, diffraction and structure factor, Miller and Bravais indices, Bonding, diffraction and structure factor in solids, short and long range order in liquids and solids, liquid crystals, quasicrystals and glasses

Unit II

Defects: Vacancies, Point defects, line defects and stacking faults, Burgers vector and Burger circuit, presence of dislocation, dislocation motion, perfect and imperfect dislocations, slip planes and slip directions, dislocation reactions

Dielectric Properties: -Polarization mechanisms, Clausius-Mossotti equation, piezo, pyro and ferroelectricity

Unit III

Atomic Structure and Atomic Spectra : Quantum states of an electron in an atom. Electron spin.Spectrum of helium and alkali atom. Some features of one-electron and two electron atoms, Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS & JJ couplings. Inner shell vacancy, X-rays and Auger transitions.chemical shift. Frank-Condon principle.

Unit IV

Molecular Structure and Molecular Spectra : Types of molecules, Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Morse potential energy curve, Molecules as vibrating rotator, Vibration spectrum of diatomic molecule, PQR branches. Elementary discussion of Raman, ESR and NMR spectroscopy, chemical shift

Reference Books: 1. Physics of Atoms and Molecules: Bransden and Joachain.
2. Introduction to Atomic Spectra: H.E. White.
3. Solid State Physics, Charles Kittel, John Willey & Sons
4. Molecular Spectra and Molecular Spectroscopy (Vol. 1), G. Herzberg
5. Introduction to Atomic Spectra: HG Kuhn
6. Fundamentals of molecular spectroscopy, C.B. Banwell
7. Introduction to molecular Spectroscopy , G. M. Barrow
8. Introduction to Solid State Physics: C. Kittle
9. Materials Science and Engineering: V. Raghavan
10. Solid State Physics: S. O. Pillai (New Age International 2006)
11. Ferroelectricity Jona and Shirane

Semester III Practical 3P1

Practical 5 (Core 9 and Core 10).

1.Determination of ionization potential of lithium
2.X-ray diffraction by TELEXOMETER.
3.Study of emission spectra of iron (Iron arc).
4.Determination of Dissociation Energy of Iodine Molecule by photography of the absorption band of Iodine in the visible region.
5.Study of Stark effect
6.Study of Molecular Spectra
7.Determination of Rydberg's constant
8.Determination of Plank's constant
9. Study of Crystals
10. Study of line spectra

Semester III Paper 11 (Core Elective E1.1) 3T3 Materials Science I

Unit- I

Equilibrium and kinetics: Stability and metastability, Basic thermodynamic functions, Statistical nature of entropy, Kinetics of thermally activated process.

Phase diagrams: The phase rule, free energy composition diagram, correlation between free energy and phase diagram, calculation of phase boundaries, thermodynamics of solutions, single component system (water), two component system containing two phases and three phases, Binary phase diagrams having intermediate phases, Binary phase diagrams with eutectic system. Lever principle, maximum, minimum, super lattice, miscibility gap, microstructure changes during cooling, application to zone refining.

Unit – II

Phase transformations: Time scale for phase changes, peritectic reaction, eutectoid and eutectic transformations, order disorder transformation, transformation diagrams, dendritic structure in alloys, transformation on heating and cooling, grain size effect on rate of transformation at constant temperature and on continuous cooling, grain size effect on rate of transformation, nucleation kinetics, growth kinetics, interface kinetics leading to the crystal growth.

Unit-III

Diffusion in solids: Fick's laws and their solutions, the Kirkendall effect, mechanism of diffusion, temperature dependence of diffusion co-efficient, self diffusion, interstitial diffusion, the Snoek effect in diffusion, diffusion in ionic crystals, diffusion path other than the crystal lattice, thermal vibrations and activation energy, diffusion of carbon in iron.

Solid State Ionics: Definition, classification and characteristic properties of solid electrolytes. Complex impedance spectroscopy, Arrhenius theory of ionic conductivity. Chemical sensors: Nernst equation, potentiometer and amperometric sensors for various gases, electrochemical redox-reaction, advantages of electrochemical sensors.

UNIT-IV

Solid state energy devices: Fundamental of Solar cells, Primary and secondary solid state cells, advantages of lithium batteries, ion intercalation compounds for secondary cell, open circuit voltage and short circuit current, intercalation compounds for secondary cell, open circuit voltage and short circuit current, Energy density, power density. Fuel cells –advantages and disadvantages, classification, efficiency- emf of fuel cells, hydrogen/oxygen fuel cell, criteria for the selection electrode and electrolyte, methanol fuel cell, solid oxide fuel cells, phosphoric acid fuel cells, molten carbonate fuel cell, proton exchange membrane fuel cell, biochemical fuel cell.

Text and Reference books:

1. Vanvellak: Materials Science.
2. V. Raghvan: Materials Science.
3. D. Kingery: Introduction to ceramics.
4. R. E. Reedhil: Physical metallurgy.
5. Martin Start Sharger: Introductory materials.
6. Sinnot: Solid state for engineers.
7. Kelly and Groves: Crystal and defects.
8. Kittel: Solid state physics, Vth edition.
9. M. A. Azaroff: Elements of crystallography
9. Introduction to solid state theory: Modelung.
10. Fuel Cells – A. Mcdougall, Macmillan 1976 Ch 3,5,7,8 and 11.

Semester III Paper 11 (Core Elective E1.2) 3T3 X-ray I

Unit I

Production of X-rays: Continuous and characteristic X-ray spectra. X-ray emission from thick and thin targets. Efficiency of X-ray production.Various types of demountable and sealed X-ray tubes.

Basics of high-tension circuits and vacuum systems used for the operation of X-ray tubes.

Synchrotron radiation: Production and properties of radiation from storage rings, Insertion devices.

Unit II

Absorption of X-rays: Physical process of X-ray absorption. Measurement of X-ray absorption coefficients.Units of dose and intensity.Radiography, Microradiography and their applications.

X–ray fluorescence: Fluorescence yield. Auger effect.X–ray fluorescence analysis and its applications.Techniques and applications of Photoelectron spectroscopy and Auger electron spectroscopy.

Unit III

X-ray spectroscopy: Experimental techniques of wavelength and energy dispersive x-ray spectroscopy.

Bragg and double crystal spectrographs.Focusing spectrographs.Dispersion and resolving power of spectrographs, Photographic and other methods of detection, resolving power of detectors.

X–ray emission and absorption spectra.Energy level diagram. Dipole and forbidden lines, Satellite lines and their origin, Regular and irregular doublets. Relative intensities of X-ray lines.

Unit IV

Chemical Effects in X-ray Spectra: Chemical effects in X-ray spectra. White line, Chemical Shifts of absorption edges, Fine structures (XANES and EXAFS) associated with the absorption edges and their applications.

Dispersion Theory: Dispersion theory applied to X-rays, Calculation of the dielectric constant, Significance of the complex dielectric constant, Refraction of X-rays, Methods for measurement of refractive index

Text and Reference Books:

1. A. H. Compton and S. K. Allison: X-rays in Theory and Experiment
2. J. A. Nielsen and D. Mc. Morrow: elements of Modern X-ray Physics.
3. M. A. Blokhin: X-ray Spectroscopy.
4. E. P. Bertin: Principles and Practice of X-ray Spectrometric Analysis.
5. C. Bonnelle and C. Mande: Advances in X-ray Spectroscopy.
6. D. C. Koningsberger and R. Prins: X-ray Absorption Principles, Applications, Techniques of EXAFS, SEXAFS and XANES.
7. C. Kunz: Synchrotron Radiation.

Semester III Paper 11 (Core Elective E1.3)3T3 Nanoscience and Nanotechnology I

Unit I:

Introduction to Nanoscience:

Free electron theory (qualitative idea) and its features, Idea of band structure, Density of states for zero, one, two and three dimensional materials, Quantum confinement, Quantum wells, wires, dots, Factors affecting to particle size, Structure property relation, Size dependence properties. Determination of particle size, Increase in width of XRD peaks of nano-particles, Shift in photoluminescence peaks, Variation on Raman spectra of nano-materials.

Unit II:

Synthesis of Nanomaterials:

Physical methods**:** High energy Ball Milling, Melt mixing, Physical vapour deposition, Ionised cluster beam deposition, Laser ablation, Laser pyrolysis, Sputter deposition, Electric arc deposition, Photolithography.

Chemical methods**:** Chemical vapour deposition, Synthesis of metal & semiconductor nanoparticles by colloidal route, Langmuir-Blodgett method, Microemulsions, Sol-gel method, Combustion method, Wet chemical method

Unit III:

Nanomaterials Characterizations:

X-ray diffraction, UV-VIS spectroscopy, Photoluminescence spectroscopy, Raman spectroscopy, Transmission Electron Microscopy, Scanning Electron Microscopy, Scanning Tunnelling Electron Microscopy, Atomic Force Microscopy, Vibration Sample Magnetometer, Spintronics

Unit IV:

Special Nanomaterials and Properties:

Carbon nanotubes, Porous silicon, Aerogels, Core shell structures. Self assembled nanomaterials. Metal and semiconductor nanoclusters

Mechanical, Thermal, Electrical, Optical, Magnetic, Structural properties of nanomaterials

Text and Reference books:

1. Nanotechnology: Principles &Practicals. Sulbha K. Kulkarni ,Capital Publishing Co.New Delhi.

2. Nanostructures & Nanomaterials Synthesis, Properties & Applications**.** Guozhong Cao, Imperials College Press London.

3.Nanomaterials: Synthesis, Properties & Applications**.** Edited by A.S. Edelstein &R.C.Commorata.Institute of Physics Publishing, Bristol & Philadelphia.

4. Introduction to Nanotechnology. C.P. Poole Jr. and F. J.Owens, Wiley Student ed.

5. Nano: The Essentials. T.Pradeep , McGraw Hill Education.

6. Handbook of Nanostructures: Materials and Nanotechnology. H. S. Nalwa Vol 1- 5, Academic Press, Bostan.

7. Hand Book of Nanotechnology, Bhushan

8. Nanoscience and Technology: Novel Structure and Phenomena. Ping and Sheng

Semester III Paper 11 (Core Elective E1.4) 3T3 Atomic and Molecular Physics I

Unit I

Quantum states of an electron in an atomic Electron spin, spectrum of hydrogen, Helium and alkali atoms, Relativistic corrections for energy levels of hydrogen; Basic principles of interaction of spin and applied magnetic field.

Concepts of NMR spectroscopy concepts of spin-spin and spin-lattice relaxation, chemical shift; spin-spin coupling between two and more nuclei; chemical analysis using NMR.

Mossbauer effect-Recoil less emission of gamma rays, chemical shieft, magnetic hyperfine interaction,

Unit II

electron spin resonance, experimental setup, hyperfine structure and isotopic shift,width of spectral lines, LS & JJ coupling, Zeeman, Paschen Back & Stark effect. Spontaneous and Stimulated emission, Einstein A & B Coefficients; LASERS, optical pumping, population inversion, rate equation, modes of resonators and coherence length, Role of resonant cavity, three and four level systems, Ammonia MASER, ruby, He-Ne, CO_2, dye and diode lasers, Lasers applications

Unit III

Rotational, vibrational and Raman spectra of diatomic molecules, Quantum theory, Molecular polarizability, Intensity alteration in Raman spectra of diatomic molecules, Experimental setup for Raman spectroscopy in the structure determination of simple molecules. polyatomic molecules, symmetric top asymmetric top molecules. Hunds rule.

Unit IV

Electronic spectra of diatomic molecules, Born Oppenheimer approximation, Vibrational Coarse structure of electronic bands, intensity of electronic bonds, Franck Condon principle, and selection rules,dissociation and pre dissociation, dissociation energy, rotational fine structure of electronic bands. General treatment of molecular orbitals, Hund's coupling cases.

Text Book and References:

1. Molecular Spectroscopy: - Jeane L. McHale.
2. Mossbauer spectroscopy –M. R. Bhide.
3. NMR and Chemistry – J. W. Akitt.
4. Structural Methods in inorganic chemistry, E.A V.Ebsworth, D. W. H.Rankin, S.Crdock.
5. Introduction to Atomic Spectra – H. E. White.
6. Fundamental of Molecular Spectroscopy – C. B. Banwell.
7. Spectroscopy Vol. I, II and III, Walker and Straghen.
8. Introduction to Molecular Spectroscopy – G. M. Barrow.
9. Spectra of diatomic molecules – Herzberg.
10. Molecular spectroscopy – Jeanne L. McHale.
11. Molecular spectroscopy – J. M. Brown.
12. Spectra of Atoms and Molecules – P. F. Bemath.
13. Modern Spectroscopy – J. M. Holkas.
14. Laser spectroscopy and instrumentation- Demtroder

Semester III Paper 11 (Core Elective E1.5) 3T3 Applied Electronics I

Unit – I

Operational Amplifiers, Block diagram of a typical operational amplifier, analysis, open loop configuration, inverting and non-inverting amplifiers, operational amplifier with negative feedback,voltage series feedback, effect of feedback on close loop gain, input resistance output resistance bandwidth and output offset voltage, voltage follower. Practical operational amplifier, input offset voltage, input bias current, input off set current, total output off set voltage, CMRR, frequency response, dc and ac amplifier, summing, scaling and averaging amplifier, instrumentation amplifier, integrator and differentiator.Application of Op-Amp as fixed and variable voltage regulator. Oscillators principles- Barkhausen criterion for oscillations, The phase shift oscillator, Weinbridge oscillator, LC tunable oscillator, multi-vibrators, mono-stable and astable, comparators, square wave and triangular wave generators

UNIT II

Communication electronics: Amplitude modulation , generation of AM waves, demodulation of AM waves, DS BSC modulation, generation of DSBSC waves, coherent detection DSBSC wave, SSB modulation, generation and detection of SSB waves, Vestigial sideband modulation, frequency division multiplexing (FDM).

Microwave communication: Advantage and disadvantage of microwave transmission, loss in free space propagation of microwaves, atmospheric effect on propagation, Fresnel zone problem, ground refection,fading sources, detector components, antennas used in microwave communication systems

Unit – III

Microprocessor: Introduction to microcomputers, Memory. Input-output devices, interfacing devices.8085 CPU, architecture, bus timing, de-multiplexing, the address bus, generating control signals,instruction set, addressing modes, illustrative programmes, assembly language programmes, looping, counting and indexing, counters and timing delay, stack and sub routings. read only memory (ROM) and applications. Random access memory (RAM) and applications,

Digital to analogue converters. Ladder and weighted register types, analog to digital converters, ,successive approximations and dual slop converters, application of DAC and ADC,

Unit – IV

Microwave devices: Klystrons, magnetrons, and travelling wave tubes, velocity modulation, basic principle of two cavity klystrons and reflex klystrons, principle of operation of magnetrons, Helix travelling wave tubes, wave modes, transferred electron devices, gunn effect, principle of operation,modes of operation, read diode, IMPATT diode, TRAPATT diode..

Text and Reference Books:

1. Electronic devices and circuit theory: RobortBoylested and L. Nashdsky (PHI, New Delhi).
2. OP-Amps and linear integrated circuits: Ramakanth A. Gayakwad (PHI 2nd Edn).
3. Digital principles and Applications: A. P. Malvino and D. P. Leach (Tata Ma-Graw Hill).
4. Microprocessor architecture, programming and Application with 8085/8086, Ramesh S. Gaonkar(Wiley-Estern).
5. Microelectronics: Jacob Millman (Mc-Graw Hill International).

6. Optoelectronics: Theory and Practices: Edited by Alien Chappal (Mc Graw Hill).
7. Microwaves: K. L. Gupta (Wiley Ester New Delhi).
8. Advanced electronics communication systems: Wayne Tomasi (Phi Edn).
9. Fundamentals of microprocessors and Micro-computers: B. Ram. (Dhanpat Rao and Sons.).

Semester III Paper 12 (Foundation course F1.1) 3T4 Physics I

(Classical Physics)

Unit 1

Kinetic Energy and Work, Work done by gravitational force, Work done by spring, Work done by general variable force, power.

Potential energy, path independence of conservative force, determining potential energy, conservation of mechanical energy, work done on system by force, conservation of energy.
(Ch. 7 and 8 of Ref. 1)

Unit 2

Rotation, nature of angular quantities, kinetic energy of rotation, Newton's second law for rotation, Work and rotational energy.
Rolling as translation and rotation, kinetic energy of rolling, forces of rolling, torque, angular momentum, Newton's second law in angular form. Angular momentum of system of particles, angular momentum of rigid body rotation about a fixed axis. Conservation of angular momentum
(Ch. 10 and 11 of Ref. 1)

Unit 3

Equilibrium, requirements of equilibrium. Centre of gravity, examples of static equilibrium, indeterminate structures.

Fluids, density and pressure, measuring pressure, Archimedes principle, Paskal's principle, ideal fluids in motion, equation of Continuity, Bernoulli's equation.
(Ch. 12 and 14 of Ref. 1)

Unit 4.

Avogadro's number, ideal gases, pressure temperature and rms speed, translated kinetic energy, molar specific hear, adiabatic expansion of ideal gas
Irreversible process and entropy, changes in entropy, second law of thermodynamics, examples of entropy in real world, efficiencies of real engines, statistical view of entropy.
(Ch. 19 and 20 of Ref. 1)

References:

1. Halliday, Resnick and Walker “Principles of Physics” International Students Version 9^{th} Ed.

Semester III Practical 3P2 for elective papers

Practical 6 (elective)

Materials Science

1. Crystal structure determination by powder diffraction.
2. Study of microstructures of metal alloys.
3. Dislocation in alkali halide crystals.
4. Crystal growth from slow cooling of the melt.
5. Thermal analysis of binary alloy.
6. Differential thermal analysis of $BaTiO_3$-$PbTiO_3$ solid solution.
7. To study electrochemical method of corrosion control.
8. Dielectric behaviour of $LiNbO_3$ and $BaTiO_3$ in crystals and ceramics.
9. Electrical conductivity of ionic solids.
10. To test hardness of a material by Brinell hardness tester.
11. Photo elasticity study.
12. Multiple beam interferromentric study of surfaces.
13. Thermal conductivity of bad conductor. 14. Thermal expansion coefficient of metals.
15. Study of transport property in solid electrolytes.
16. Verification Nernst law/Oxygen sensor.
17. Determination of Thermoelectricity Power.

X-Rays

1. Study of Crystal Models.
2. X-ray Diffraction Photograph of a Metal Foil by transmission (Hull Method).
3. X-ray Diffraction Photograph of a Metal Foil by Back Reflection.
4. Powder Photograph by Debye Scherrer Method, Computer Analysis.
5. Laue Photograph and Gnomonic Projection.
6. Rotation oscillation Photograph.
7. Diffraction of X-rays by Liquids.
8. Bragg's Spectrometer: Uhler and Cooksey's method. 55
9. Bent Crystal (Cauchois) Transmission Type Spectrograph: Study of K and L Absorption Edges.
10. Bent Crystal (Cauchois) Transmission Type Spectrograph: Study of K and L emission Spectra.
11. Measurement of Intensities of Emission Lines, Computer Analysis.
12. Study of Satellite Lines. 13. Analysis of XANES Spectrum, Computer Analysis.
14. Analysis of EXAFS Spectrum, Computer Analysis.
15. Determination of Planck's constant by X-rays.
16. X-ray Fluorescence Spectrum Analysis.
17. Absorption Coefficient for X-rays by G. M. / Scintillation Counter.
18. Characteristics of G. M. tube.
19. Compton Effect.
20. Operation of a Demountable X-ray Tube.

Nanoscience and Nanotechnology

1. Synthesis of metal oxide nanoparticles by wet chemical method.
2. Deposition of thin films by spray pyrolysis technique.
3. Synthesis of inorganic nanomaterials by combustion method.

4. Synthesis of nanomaterials by sol-gel method.
5. Synthesis of conducting polymer nanofibres by chemical oxidation method.
6. Study of optical absorption of nanoparticles.
7. Determination of particle size of nanomaterials from x-ray diffraction.
8. Study of photoluminescence of well known luminescent nanoparticles.
9. Deposition of thin films by spin coating method.
10. Thermoluminescence study of nanomaterials.
11. Deposition of thin films by dip coating technique.
12. Study of particle size effect on luminescence.
13. Electrical characterization of nanostructured materials.
14. Synthesis of metal oxide nanoparticles by hydro-thermal method.
15. Deposition of thin film in vacuum.
16. Electrical resistivity of nanomaterials using four probe method
17. Photoluminescence study of prepared red/blue/green luminescent nanomaterials.
18. Characterization of nanomaterials using SEM/TEM.
19. Computer modelling methods for studying materials on a wide variety of length and time scales.

Atomic and Molecular Physics

1. Study of line spectra on photographed plates/films and calculation of plate factor.
2. Verification of Hartman's dispersion formula.
3. Study of sharp and diffuse series of potassium atom and calculation of spin orbit interaction constant.
4. Determination of metallic element in a given inorganic salt.
5. To record the spectrum of CN violet bands and to perform vibrational analysis.
6. To record the visible bands of ALO and to perform vibrational analysis.
7. To photograph and analyse the reddish glow discharge in air under moderate pressure.
8. To photograph the analyse the whitish glow discharge in air under reduced pressure.
9. To perform vibrational analysis of a band system of N2.
10. To perform vibrational analysis of band system of C2
11. To photograph and analyse the line spectrum of Calcium atom.
12. To record/analyse the fluorescence spectrum of a sample.
13. To record/analyse the Raman spectrum of a sample.
14. Study of Hyperfine structure of the green line of mercury.
15. To photograph the (O, O) band of CuH and to perform rotational analysis.
16. Flashing & quenching in Neon Gas.
17. E/m of electron.
18. Experiments on Prism/Grating Spectrometer.
19. Wavelength of laser light.
20. Faraday effect with laser.
21. Michelson interferometer.
22. Analysis of ESR Spectra of transition metals.
23. Analysis of H-atom spectra in minerals.
24. Measurements of dielectric constant of polymer sheet at low frequency.
25. E.S.R. of DPPH.
26. To measure the dielectric constant and polarisation of unknown liquid.
27. To measure the dielectric constant of unknown wood at microwave frequency
28. To measure the ultrasonic velocity in unknown liquid.

29. He-Ne Layer
30. To study polarisation of sodium light
31. To study polarisation of light using Babinet compensator

Semester III (Subject Centric Core Course S1.2) 3T4 Nanoscience and Nanotechnology

Unit I: Introduction to Nanoscience

Introduction to quantum physics, electron as waves, wave mechanics, Schrödinger equation and particle in a box, Free electron theory (qualitative idea) and its features, Idea of band structure, Density of states for zero, one, two and three dimensional materials, Quantum confinement, Quantum wells, wires, dots, Factors affecting to particle size, Size dependence properties. Determination of particle size, Increase in width of XRD peaks of nano-particles, Shift in photoluminescence peaks, Variation on Raman spectra of nanomaterials.

Unit II: Nanomaterials Synthesis

Physical methods**:** High energy ball milling, Physical vapour deposition, Ionised cluster beam deposition, Laser ablation, Laser pyrolysis, Sputter deposition, Electric arc deposition, Photolithography.

Chemical methods**:** Chemical vapour deposition, Synthesis of metal & semiconductor nanoparticles by colloidal route, Langmuir-Blodgett method, Microemulsions, Sol-gel method, Chemical bath deposition, Wet chemical method.

Unit III: Nanomaterials Characterizations

X-ray diffraction, UV-VIS spectroscopy, Photoluminescence spectroscopy, Raman spectroscopy, Transmission Electron Microscopy, Scanning Electron Microscopy, Scanning Tunnelling Microscopy, Atomic Force Microscopy, Vibration Sample Magnetometer.

Unit IV: Special Nanomaterials and Properties:

Special Nanomaterials: Carbon nanotubes, Porous silicon, Aerogels, Core shell structures. Self assembled nanomaterials.

Properties of nanomaterials: Mechanical, Thermal, Electrical, Optical, Magnetic, Structural.

Text and Reference books:

a. Nanotechnology: Principles & Practicals. Sulbha K. Kulkarni ,Capital Publishing Co.New Delhi.
b. Nanostructures & Nanomaterials Synthesis, Properties & Applications**.** Guozhong Cao, Imperials College Press London.
c. Nanomaterials: Synthesis, Properties & Applications**.** Edited by A.S. Edelstein & R.C.Commorata. Institute of Physics Publishing, Bristol & Philadelphia.
d. Introduction to Nanotechnology. C.P. Poole Jr. and F. J.Owens, Wiley Student Edition.
e. Nano: The Essentials. T.Pradeep , McGraw Hill Education.
f. Handbook of Nanostructures: Materials and Nanotechnology. H. S. Nalwa Vol 1-5, Academic Press, Bostan..
g. Nanoscience and Technology: Novel Structure and Phenomena. Ping and Sheng
h. Hand Book of Nanotechnology, Bhushan

(This course cannot be offered to students opting for elective Nanoscience and Nanotechnology E1.3 and E2.3)

Semester III (Subject Centric Core Course S1.3) 3T4 Quantum Computing

Unit 1 Introducing quantum mechanics:
Quantum kinematics, quantum dynamics, quantum measurements.Single qubit, multiqubits, gates. Density operators, pure and mixed states, quantum operations, environmental effect, decoherence. Quantum no-cloning, quantum teleportation.

Unit 2 Introduction to quantum algorithms.
Deutsch-Jozsa algorithm, Grover's quantum search algorithm, Simon's algorithm. Shor's quantum factorization algorithm.

Unit 3 Quantum Cryptography:

Cryptography, classical cryptography, introduction to quantum cryptography. BB84, B92 protocols. Introduction to security proofs for these protocols.

Unit 4 Quantum Entanglement:

Quantum correlations, Bell's inequalities, EPR paradox.

Theory of quantum entanglement. Entanglement of pure bipartite states.

Entanglement of mixed states. Peres partial transpose criterion. NPT and PPT states, bound entanglement, entanglement witnesses

Textbook

Nielsen, Michael A., and Isaac L. Chuang. *Quantum Computation and Quantum Information.* Cambridge, UK: Cambridge University Press, September 2000. ISBN: 9780521635035.

N. David Mermin “Quantum Computer Science: An introduction” Cambridge University Press (2007).

Semester III (Subject Centric Core Course S1.4) 3T4 Digital Electronics and Microprocessor

Unit–I:

Logic gates: Characteristics of TTL, ECL, CMOS circuits with reference to fan in / out noise, speed, power dissipation with suitable examples. Simplifying logic circuits: Algebric method SOP (minterm) and POS (maxterma) forms. Karnaugh mapping Fundamental products, pairs, gaurds, octats, Don□t□s care conditions.

Complementary Karnaugh map. Diagonal adjacencies. NAND-NAND and NOT-NOR networks. Applications of K maps to half adder, full adder. Arithmetic circuits: Number representation. Binary point, negative numbers, sign and magnitude. 1s and 2 s complement adder, parallel binary adder, BCD addition, parallel BCD adder, binary multiplication and division

Unit – II

Multiplexers, demultiplexers : IC 74150 multiplexer and IC 74154 demultiplexer.

Tristate buffers, their use in bus organization. Key board encoders, BCD, octal, Hex and scanned matrix keyboard.

A/D and D/A converters: Weighted resistor and R-2R ladder D/A converters. A/D converter –parallel comparator and Application. ADC 0808, 08116/08117, DAC 0800, look up table, measurement of electrical and physical quantities.

Unit -III:

Memories Allied Devices: Design consideration of Bipolar RAM, MOS memory and dynamic RAM, ROM, EXROM and CCD. Read/Write operation. Expanding memory sizewordsize and word capacity. FIFO and LIFO. Study of 7489 RAM and 745370 RAM and other chip. Magnetic bubble memories. Floppy disks-track and sector organization, data format Winchester disk (hard disk).

Unit – IV:

Microprocessor Architecture: Introduction to architecture, pin configuration etc. of 8086, The parts of up. CPU, memory requirements, numerical data,representation of characters, microprocessor instructions, program storage, instruction execution fetch and execute cycles, addressing modes including simple memory paging, direct scratch and pad addressing. The instruction set including memory reference, immediate conditional jump-shift, change control, stack and program counter, subroutines, flow charts, masking, simple programs.

I/O Systems: Program interrupts including multiple interrupt priorities. Interfacing memory mapping, memory mapped and I/P mapped I/O. Use of decoders, I/O posts. ic 8212.

, IC 8155 and IC8255 (with block diagram of internal circuits) Typical programs using these ICS.

Text and Reference Books

1. Design of Digital Systems : P. C. Pitman (Galgotia Pub).
2. Digital Computer Electronics :A. P. Malvino (TMH).35
3. Digital Fundamentals: T. L. Floyd (Universal Book Stall).
4. Theory and Problems of Digital Principles : R. L. Tokheim (TMH).
5. Modern Digital Electronics : R. P. Jain (TMH).
6. Introduction to UP : A. K. Mathur (PHL).
7. Up and Small Digital Computer Systems for Scientist and Engineers L G. A. Korn, (McGraw Hill).
8. An Introduction to Micro-computer: Adam Osborne(Galgotia).
9. Introduction top 4 bit and 8 bit UP : Adam Osborne

(This course cannot be offered to students opting for elective Applied Electronics E1.5 and E2.5)

Semester IV Paper 13 (Core 11) 4T1 Nuclear and Particle Physics

UNIT 1 ;

Basic nuclear properties; size, radii, shape, and charge distribution, spin, parity, mass, binding energy, semi-empirical mass formula, liquid drop model, nuclear stability, laws of radioactive decay. Nature of nuclear force, elements of deuteron problem, n-n scattering, charge independence and charge symmetry of nuclear forces.Electric and magnetic moments of nuclei.Evidence for nuclear shell structure, single particle shell model-its validity and limitations.

UNIT 2 :

Elementary properties of alpha-, beta-, and gamma-, decay of nuclei, their classification, characteristics and selection rules. Elementary theories of alpha-, beta-, and gamma-, decay. Nuclear reactions- conservation laws, mechanism, and cross section. Nuclear reaction mechanism, compound nucleus, direct reactions. Fission and fusion reactions, nuclear energy, elements of nuclear power.

UNIT 3 :

Interaction of charged particles and electromagnetic radiation with matter. Principles of nuclear radiation detectors: G-M counter, proportional counter, Na(Tl) scintillation detector, semiconductor detectors. Elementary principles of particle accelerators: linear accelerators, Van de Graaf, cyclotron, betatron, synchrocyclotron, ion beam accelerators.

UNIT 4 :

Classification of elementary particles, strong, weak and electromagnetic interaction.Gellmann-Nishijima formula Properties of hadrons, baryons, mesons, leptons, and quarks- their quantum numbers, charge, mass, spin, parity, iso-spin, strangeness etc. Symmetry and conservation laws.Elements of quark model and standard model.Higgs boson.

Text-books recommended:

1) Introductory Nuclear Physics,: Kenneth S Krane, Wiley, New York ,1988.
2) Nuclear and Particle Physics: Brian Martin.
3) Atomic and Nuclear Physics: S.N. Ghoshal.
4) Introduction to Particle Physics : D. Griffiths.
5) Introduction to Nuclear Physics: F. A. Enge, Addison Wesley (1975)
6) Introductory Nuclear Physics: Burcham

Semester IV Paper 14 (Core 12) 4T2 Solid State Physics

Unit I: Band Theory: Bloch theorem, the Kronig- Penney model, construction of Brillouin zones, extended and reduced zone schemes, effective mass of an electron, tight binding approximation. Fermi surface.

Magnetic Properties:

Quantum theory of paramagnetism, magnetism of iron group and rare earth ions,.exchange interactions. Pauli paramagnetic susceptibility

Unit II

Lattice Dynamics: Energy of atomic motions, adiabatic principle, harmonic approximation, cyclic boundary condition.Lattice vibrations of linear monoatomic and diatomic chains.Dispersion relations, acoustic and optical phonons.

Theories of lattice specific heat, Dulong and Petit'slaw, Einstein and Debye models, T^3 law, Born procedure, anharmonicity and thermal expansion.

Unit III: Free Electron Theory: Electrons moving in one and three dimensional potential wells, quantum state and degeneracy, density of states, electrical and thermal conductivity of metals, relaxation time and mean free path, the electrical resistivity of metals, thermonic emission. Seebeck effect, thermoelectric power.

Semiconductors: Free carrier concentration in semiconductors, Fermi level and carrier concentration in semiconductors, effect of temperature on mobility, electrical conductivity of semiconductors, Hall effect in conductors and semiconductors.

Unit IV

Superconductivity, Type I and II super conductors, Meissner effect, isotope effect, London equation, coherence length, elements of B. C. S. theory, tunnelling DC and AC Josephson effect, Ginzberg-Landau Theory macroscopic quantum interference. Josephson junction.high temperature superconductor (elementary).

Text and Reference books:

1. C. Kittle: Introduction to Solid State Physics (2nd and 4th Edition).
2. A. J. Dekker : Solid State Physics.
3. Kubo and Nagamiya : Solid State Physics.
4. Feynman Lectures: Vol. III.
5. Board and Huano : Dynamical Theory of Crystal Lattice.
6. N. W. Ashcroft and D. Mermin: Solid State Physics.

Semester IV Practical 4P1 for core papers

Practicals based on core 11 and core 12

1. Measurement of resistivity of a semiconductor by four probe method at two different temperatures and determination of band gap energy.
2. Measurement of Hall coefficient of given semiconductor: identification of type of semiconductor and estimation of charge carrier concentration.
3. Determination of Hall life of 'In".
4. Determination of range of Beta-rays from Ra and Cs.
5. G-M counter
6. Magnetoresistance by Hall effect
7. Determination of Dielectric constant
8. Random decay of nuclear disintegration using dice (or simulation)

In all 7 practicals, instructor can introduce new and relevant experiments which are not in the list.

Semester IV Paper 15 (Core Elective E2.1) 4T3 Materials Science II

Unit –I

Mechanical response of Materials : Elasticity, model of elastic response, inelasticity, viscoelasticity, stress-strain curves, concept of various mechanical properties such as hardness, yield strength, toughness, ductility, yield toughness, ductility, brittleness, stiffness, young modulus, shear modulus, shear strength, Frenkel model, Peierls-Nabarro relation, Plastic deformation,

Corrosion and degradation of materials – electrochemical considerations – passivity forms of corrosion – corrosion inhibition.

Spintronics and Photonics: Spin glass, magnetic bubbles, domain walls, magnetic multilayers, magnenites, GMR and CMR, DMS materials. Photonic band gap materials.

Unit – II

Concept of Synthesis: Concept of equilibrium and nonequilibrium processing and their importance in materials science.

Synthesis of materials: Physical method – Bottom up: cluster beam evaporation, Ion beam deposition, Gas evaporation, Chemical method – Hydrothermal, combustion, bath deposition with capping techniques and top down: Ball milling. Solvated metal atom dispersion – thermal decomposition – reduction methods – colloidal and micellar approach.

Unit-III

Processing of materials: Metallic and non metallic, Ceramics and other materials. Only basic elements of powder technologies, compaction, sintering calcination, vitrification reactions, with different example, phenomenon of particle coalescence, porosity.Quenching : concept, glass formation

structural characterization:

Diffraction techniques: interpretation of x-ray powder diffraction patterns, Identification & quantitative estimation of unknown samples by X-ray powder diffraction technique Electron and neutron diffraction.

Unit –IV

Structural determination by fluorescent analysis. Theory and method of particle size analysis. Integral breadth method, Warren-Averbach's Fourier method, profile fitting method.

Microscopic techniques –TEM, SEM & STEM.AFM, EDX and XPS.

Text and Reference Books:

1. Basic Solid State Chemistry, 2nd Edition, Anthony R. West, John Wiley & Sons, 1996.
2. New Directions in Solid State Chemistry, C. N. R. Rao and J. Gopalkrishnan, Cambridge University Press, Cambridge, 1986.
3. Chemical approaches to the synthesis of inorganic materials, C. N. R. Rao Wiley Eastern Ltd.1994.

4. Materials Science and Engineering – An Introduction, W. D. Callister Jr. John Wiley & Sons,1991.
5. Materials Science, J. C. Anderson, K. D. Leaver, R. D. Rawlings and J. M. Alexander, 4th Edition, Chapman & Hall (1994).
6. Nanostructured Materials and Nanotechnology, Hari Singh Nalwa, Academic Press (1998).

Semester IV Paper 15 (Core Elective E2.2) 4T3 X-ray II

Unit I

Space lattice and unit cell of a crystal, Choice of a unit cell, Crystal systems, Bravais lattices, Crystal faces and internal arrangement, Miller indices, Law of rational indices, Indices of a direction. Point groups, Space groups.

Perspective projections: Gnomonic projection, Stereographic projection, Orthographic projection.

Reciprocal lattice concept: Graphical construction, Relation to interplanar spacing, Interpretation of Bragg's law.

Unit II

Scattering of X-rays: Thomson scattering, Compton scattering, Wave mechanical treatment of scattering, Scattering by a pair of electrons, Theory of scattering by a helium atom, Scattering by many electrons, Experiments on scattering by monatomic and polyatomic gases, liquids and amorphous solids.

Unit III

Physical Basis of X-ray Crystallography: Atomic and crystal structure factors, Structure factor calculations, The integrated intensity of reflection. Different factors affecting the intensity of diffraction lines in a powder pattern.Dynamical theory X-ray diffraction.

The Fourier Transform, electron density projections in crystals, Application to X-ray diffraction.

Unit IV

Experimental Methods of Structure Analysis: Laue method, Debye-Scherrer method, rotation Oscillation method, Weisenberg camera, The sources of systematic errors and methods of attaining precision.

Principles of energy dispersive and time analysis diffractometry.

Methods of detecting and recording diffraction patterns.

Structures of metals and alloys. Phase transformations, Order-disorder phenomenon. Super lattice lines.Determination of grain size.

Other Diffraction Techniques: Electron and neutron diffraction tsechniques and their applications. Comparison with X-ray diffraction.

Text and Reference Books:

1. A. H. Compton and S. K. Allison: X-rays in Theory and Experiment.
2. N. F.M. Henry, H. Lipson and W. A. Wooster: The interpretation of X-ray Diffraction Photographs.
3. K. Lonsdale: Crystals and X-rays.
4. B. D. Cullity: elements of X-ray Diffraction.
5. M. M. Woollfson: X-ray Crystallography.
6. M. J. Buerger: X-ray Crystallography.
7. Bacon: Neutron Physics.

Semester IV Paper 15 (Core Elective E2.3) 4T3 NanoScience and Nanotechnology II

Unit – I:

Nanophotonics:

Fundamentals of photonics and photonic devices, Lasers, CFLs, LEDs, OLEDs, Wall paper lighting, Display devices, X-ray imaging nanophosphers, Photo therapy lamps and its applications, Nanomaterials for radiation, Dosimetery special for thermoluminescence. Optical stimulated luminescence, Luminescence solar concentration.

Unit – II:

Nanomagnetics:

Basics of Ferromagnetism, effect of bulk nanostructuring of magnetic properties, dynamics of nanomagnets, nanopore containment, giant and colossal magnetoresistance, applications in data storage, ferrofluids, Superparamagnetism, effect of grain size, magneto-transport, Magneto-electronics, magneto-optics, spintronics.

Unit – III:

Nanoelectronics:

Top down and bottom up approach, CMOS Scaling, Nanoscale MOSFETs, Limits to Scaling, System Integration, Interconnects;

NanoDevices: Nanowire Field Effect Transistors, FINFETs, Vertical MOSFETs, Other Nanowire Applications, Tunneling Devices, Single Electron Transistors, Carbon nanotube transistors, Memory Devices,

Unit – IV:

Nanocomposites:

Classification of nanocomposites, Metallic, ceramic and polymer nanocomposites, Tribology of polymeric nanocomposites, Nano ceramic for ultra high temperature MEMS, Optimizing nanofiller performance in polymers, Preparation techniques, Graphene/Fullerene/Carbon nanotube (CNT) polymer nanocomposites, One dimensional conducting polymer nanocomposites and their applications

Text and reference books:

1. H.S.Nalwa; Hand book of Nanostructure materials and nanotechnology; (Vol.1-5), Acad. Press, Boston, 2000
2. C.P.Poole Jr., F.J.Owens; Introduction to Nanotechnology, John Wiley and sons, 2003
3. C. Furetta; Hand book of thermoluminescence; World Scientific Publ.
4. S.W.S. McKEEVER; Thermoluminescence in solids; Cambridge Univ. Press.
5. Alex Ryer; Light measurement hand book; Int. light Publ.
6. M.J.Weber; Inorganic Phosphors; The CRC Press.
7. T.J.Deming; Nanotechnology; Springer Verrlag, Berlin, 1999
8. W.D.Kalister Jr., Materials Science and Engineering, 6th Eds, WSE Wiley, 2003
9. Gusev; Nanocrystalline Materials
10. C. Delerue, M.Lannoo; Nanostructures theory and Modelling
11. Fausto, Fiorillo ; Measurement and Characterization of Magnetic materials
12. Bhushan; Hand Book of Nanotechnology
13. Janos H., Fendler; Nanoparticles and Nanostructured Films
14. T.Pradip; Nano: The Essentials

15. Liu; Hand Book of Advanced Magnetic Materials (4 Vol.)
16. Lakhtakia; Nanometer Structure
17. Banwong, Anurag Mittal; Nano CMOS Circuit and Physical Design
18. G.W.Hanson: Fundamental of Nanoelectronics
19. Edward L. Wolf (2nd Ed.), *Nanophysics & Nanotechnology: An Introduction to Modern Concepts in Nanoscience*, WILEY-VCH, 2006
20. S. Sakka; Sol-gel science and technology processing, characterization and applications; Kluwer Acad. Publ.
21. Goser et al, "*Nanoelectronics&Nanosystems: From Transistor to Molecular & Quantum Devices"*
22. SupriyoDatta, "*From Atom to Transistor*"
23. John H. Davies, *The Physics of Low Dimensional Semiconductors: An Introduction"*, Cambridge University Press, 1998.
24. Hari Singh Nalwa, "*Encyclopedia of Nanotechnology*"
25. A. A. Balandin and K. L. Wang, "*Handbook of Semiconductor Nanostructures &Nanodevices*"
26. Cao Guozhong, "*Nanostructures &Nanomaterials - Synthesis, Properties & Applications*

Semester IV Paper 15 (Core Elective E2.4) 4T3 Atomic and Molecular Physics II

Unit I

Time dependence in quantum mechanics, Time dependent perturbation theory, rate expression for emission, perturbation theory, calculation of polarizability.Quantum mechanical expression for emission rate.

time correlation function and spectral Fourier transform pair, properties of time correlation functions and spectral time shape,

Fluctuation dissipation theorem rotational correlation function and pure rotational spectra, Re-orientational spectroscopy of liquids.

Unit II

Saturation spectroscopy, Burning and detection of holes in Doppler broadened two level systems, Experimental methods of saturation spectroscopy in laser, Ramsey fringes, Saturation techniques for condensed matter application,

Laser optogalvanicspectroscopy.Two photon absorption spectroscopy, Selection rules, Expression for TPA cross section –photo acoustic spectroscopy, PAS in gaseous medium, Roseneweig and Greshow theory, Thermally thin, thick samples, Typical experimental set up, Application in Spectroscopy,

Unit III

Stimulated Raman scattering, Quantum mechanical treatment, Raman Oscillation Parametric instabilities, Electromagnetic theory of SRS.Vibronic interaction, Herzberg Teller theory, Fluorescence spectroscopy, Kasha's rule, Quantum yield, Non-radioactive transitions, Jablonski diagram, Time resolved fluorescence and determination of excited state lifetime.Light detectors, Single photon counting technique, Phase sensitive detectors.

Unit IV

Matrix isolation spectroscopy, Fourier transforms spectroscopy, Laser cooling. Molecular symmetry and group theory, Matrix representation of symmetry elementsof a point group, Reducible and irreducible representations, and character tables specially for C_{2v} and C_3 point group molecules, Normal coordinates normal modes, Application of group theory to molecular vibrations.

Text Book and References:

1. Molecular Quantum Mechanics: P. W. Alkins and R. S., Fridman.
2. Quantum electron – A. Yariv.
3. Introduction to non-linear laser spectroscopy – M. D. Levenson.
4. Photoacoustics and its applications, Roseneweig.
5. J. M. Hollas, High resolution spectroscopy.
6. Cotton, Chemical Applications of Group Theory.
7. Herzberg, Molecular spectra and molecular structure II and III.
8. Demtroder, Laser spectroscopy and instrumentation.
9. King, Molecular spectroscopy.
10. Lakowicz, Principles of fluorescence spectroscopy.
11. Molecular Quantum Mechanics: P. W. Alkins and R. S., Fridman.

Semester IV Paper 15 (Core Elective E2.5) 4T3 Applied Electronics II

Unit – I:

An Overview of Electronic Communication system ; block diagram of an digital electronic Communication system, Pulse modulation systems, sampling theorem, lowpass and band-pass signals,PAM channel bandwidth for a PAM signal, Natural sampling, flat top sampling, signal recovery throughholding, quantization of signals, quantization, differential PCM delta modulation, adoptive delta modulation CVSD. Digital modulation techniques: BPSK, DPSK, QPSK, PSK, QASK, BFSK, FSK, MSK. Mathematical representation of noise, sources of noise, frequency domain representation of noise, Noise in Pulse Code and Delta modulation system, PCM transmission, calculation of quantization of noise, out pit signal power effect of thermal noise, outr signal to noise ratio in PCM, DM, quantization noise in DM, out put signal power, DM oput-put, signal to quantization noise ratio, effect of thermal noise in delta modulation, output signal to noise ratio in DM.

Unit – II

Computer communication systems: Types of networks, design features of communication network,examples, TYMNET, ARPANET, ISDN, LAN.Mobile radio and satellite - time division multiplex access (TDMA) frequency division multiplex access(FDMA) ALOHA, Slotted ALOHA, Carrier sense multiple access (CSMA) Poisson distribution protocols.

Unit – III

Microprocessor and Micro-computers: Microprocessor and architecture, Pin out and pin functions of 8086/8088 Internal microprocessor architecture, bus buffering and latching ,Bus timings, ready and wait states, minimum mode versus and maximum mode. Real and protected mode of memory addressing, memory paging, addressing modes, data addressing modes, programme memory addressing mode, stack memory addressing modes, instruction sets, data movement instruction, arithmetic and logic instruction, programme control instruction, clock generator (8284A),

Unit –IV

Memory and I/O Interface : Memory devices, ROM,RAM.,DRAM, SRAM, Address decoding , 3 to 8 line decoder 74LS138, 8086, and 80386(16 bits) Memory interface, , Introduction to I/O interface , Interfacing using 8255, Introduction to PIT 8254, Basic Communication device(UART) pin diagram and functioning of 16550 Interrupts: Basic interrupt processing, Hardware interrupt, expanding the interrupt structure, 8259A PIC.

Text and Reference books.

1. Principles of communication systems :Taub and Schilling (ii Edn THM ,1994)
2. Principles of communication systems: Taub and Schilling GoutamSaha Third Edition
3. Communication systems : Simon Haykin (iii Edn John Wiley & Sons)
4. The intel microprocessors 8086/80188,80386,80486, Pentium and Pentium processor architecture, programming and interfacing : Barry B. Brey (PHI iv Edn, 1999)
5. Microprocessor and interfacing ,programming and hardware : Douglas V. Hall (ii Edn, Mc GrawHill International edn. 1992)
6. The 80x86 IBMPC compatible computer: Muhammad Ali Maxidi and J .G. Mazidi (ii Edn.Prentice –Hall International.)

Semester IV Paper 16 (Foundation course F2.1) 4T4 Physics II

(Modern Physics)

Unit 1
Relativity: Postulates,, Measuring an event,, Relativity of simultaneity, Relativity of time, Relativity of length, Lorentz transformations, consequences of Lorentz equations, relativity of velocities, doppler effect, how momentum changes.

(Ch. 37 of Ref. 1)

Unit II

Photon, quantum of light, photoelectric effect, photons have momentum, light as a probability wave, electrons and matter waves, Schrodinger's equation, Heisenberg's uncertainty principle.

Sring waves and matter waves, energies of trapped electron, wave functions of trapped electrons, electron traps in various dimensions, Bohr Model, Schrodinger equation and Hydrogen atom

(Ch. 38 and 39 of Ref. 1)

Unit III
Nuclear Physics and Nuclear Energy: Discovering nucleus, nuclear properties, radioactive decay, alpha decay, beta decay, radioactive dating, nuclear model.
Nuclera fission: Basic process, Model for fission, nuclear reactor, natural nuclear reactor, thermonuclear fusion: the basic process, thermonuclear fusion in sun and other stars, controlled thermonuclear fusion.
(Ch. 42 and 43 of Ref. 1)

Unit IV
Particle physics, leptons, hadrons, conservation law, quark model, messenger partiles, expanding univers, background radiation, dark matter, big bang

(Ch. 44 of Ref. 1)

References:
1. Halliday, Resnick and Walker "Principles of Physics" International Students Version 9th Ed.

Semester IV (Subject Centric Core Course S 2.2) 4T4 Experimental Techniques in Physics

Unit 1: Radiation Sources, Detectors and Sensors

Different types of radiations (X-rays, UV-VIS, IR, microwaves and nuclear) and their sources
Detectors: gamma-rays, X-rays, UV-VIS, IR, microwaves and nuclear detectors
Sensors: Sensor's characteristics, Classification of sensors, Operation principles of sensors such as electric, dielectric, acoustic, thermal, optical, mechanical, pressure, IR, UV, gas and humidity with examples

Unit 2:Structural Characterization and Thermal Analysis

X-ray Diffraction – Production of X-rays, Types (continuous and characteristics), Bragg's diffraction condition, principle, instrumenation (with filters) and working, Techniques used for XRD – Laue's method, Rotating crystal method, Powder (Debye-Scherrer) method, Derivation of Scherrer formula for size determination Neutron Diffraction: Principle, Instrumentation and Working
Thermal analysis: Principle, Instrumentation and Working: Thermo-gravimetric (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC); Graphical analysis affecting various factors. Numericals

Unit 3: Morphological and Magnetic Characterization

Optical Microscopy: Principle, Instrumentation and Working of optical microscope.
Electron Microscopy: Principle, Instrumentation and Working of Scanning Electron Microscope (SEM), Field Emission Scanning Electron Microscope (FESEM) – Advantages over SEM, Transmission Electron Microscope (TEM), Selected Area Electron Diffraction (SAED)
Probe Microscopy: Principle, Instrumentation and Working of Scanning Tunneling Microscope (STM) and Atomic Force Microscope (AFM)
Magnetic Characterization: Principle, Instrumentation and Working of Vibrating Sample Magnetometer (VSM), Analysis of Hysteresis loop, SQUID Technique:
Principle, Instrumentation and Working. Numericals

Unit 4 : Spectroscopic Analysis

Spectroscopic characterization (principle, instrumentation and working): Infra-Red (IR), Fourier Transform Infra-Red (FTIR), Ultraviolet-Visible (UV-VIS), Diffused Reflectance Spectroscopy (DRS), X-ray Absorption (XPS), Electron Spin Resonance (ESR), Nuclear Magnetic Resonance (NMR). Numericals.

Reference Books:

1. Nuclear Radiation Detectors, S.S. Kapoor, V. S. Ramamurthy, (Wiley-Eastern Limited, Bombay)
2. Instrumentation: Devices and Systems, C.S. Rangan, G.R. Sarma and V.S.V. Mani, Tata Mc Graw Hill Publishing Co. Ltd.
3. Instrumental Methods of Chemical Analysis, G. Chatwal and S. Anand, Himalaya Publishing House
4. Instrumental Methods of Analysis by H.H. Willard , L.L. Merritt, J.A. Dean, CBS Publishers
5. Characterization of Materials, John B. Wachtman & Zwi. H. Kalman, Pub. Butterworth Heinemann (1992)
6. Elements of X-ray diffraction, Bernard Dennis Cullity, Stuart R. Stock, (Printice Hall, 2001 - Science – 664

Semester IV (Subject Centric Core Course S 2.3) 4T4 Communication electronics

UNIT I

Modulation AM and FM (Transmission and reception): Modulation, AM generation, Power consideration, Balanced modulator, SSB transmission, AM detection, AGC, Radio receiver characteristics, signal to noise ratio, FM analysis, noise considerations, generation, direct method and reactance tube method, FM transmitter, AFC, FM Propagation, phase discriminator.

UNIT II

(Propagation of radio waves) Ground wave, sky wave and space wave propagation. Ionosphere (Eccles- Larmer theory, magneto ionic theory).

UNIT III

(Antenna and TV) Antenna, HF antenna, Yagi antenna, loop antenna, Satellite communication, parabolic reflector, dish antenna, Fundamentals of image transmission, vestigial transmission, TV camera tubes, image orthicon, vidicon, TV transmitter, TV receiver and picture tubes.

UNIT IV

(Transmission Lines) Voltage and current relations on transmission line, propagation constant, characteristic impedance, impedance matching, quarter wave T/L as impedance transformer, attenuation along coaxial cable, cables of low attenuation, propagation of radio waves between two parallel lines, wave guide modes, TE10 mode and cut off wavelength, cavity resonator, light propagation in cylindrical wave guide, step index and graded index fibers, attenuation and dispersion in fibers.

Books Recommended:

1. George Kennedy & Davis: Electronics Communication Systems

2. Millar & Beasley: Modern Electronics Communication

3. R.R Gulani: Monochrome and colour television (Wiley Eastern Limited)

4. Taub and Schilling: Principle of Communication Systems (TMH)

5. Simon Gaykuti: Communication Systems (John Wiley & Sons Inc. 1994)

(This course cannot be offered to students opting for elective Applied Electronics E1.5 and E2.5)

Semester IV (Subject Centric Core Course S 2.4) 4T4 ElectroAcoustics

Unit – I:

Fundamentals of ultrasonic, Acoustics interaction with liquids, Velocity in fluids, Absorption due to heat conduction and viscosity, single relaxation, internal degrees of freedom, Relaxation in binary mixtures, Normal and associated liquid essential difference in low and high amplitude ultrasonic wave propagation of low amplitude waves, ultrasonic generators piezoelectric effect. Propagation in Solids Attenuation due to electron phonon interaction; Phonon-Phonon interaction, Measurement Techniques, optical method, interference method, Pulse method, Sign-around method. Applications of ultra-sound in industrial and medical fields.

Unit - II

Architectural Acoustics, Classical ray theory. Decay of sound in live and in dead rooms, Measurement of reverberation time. Effect of absorption on reverberation, Sound absorption coefficient, absorbing materials and their uses. Fundamentals of musical scales. Physics of musical instruments. Public address system and music sound system for auditoria. Instruments used for acoustical tests. Underwater acoustics, Velocity of Sound in Sea-water, sound transmission loss in sea-water. Refraction Phenomena, Masking by noise and by reverberation, Passive detection hydrophone systems.

Unit – III

Loud Speakers, idealized direct radiator, Typical cone Speaker, Effect of voice coil parameters, Horn Loudspeakers, pressure response, Woofer, midrange and tweeter, Crossover net works, Fletcher Munsion Curves, Baffles; Infinite type, vented type and acoustic suspension type, Microphones, Moving coil type, Carbon microphones, condenser microphones, Cardiod type, Polar response, Rating of microphone responses. Reciprocity theorem and calibration. RIAA equalization Preamplifiers, Tone control circuits, Equalization amplifiers, Noise filters, Dolby Noise Reduction, High Fidelity Stereo amplifiers, Recording and reproduction of sound.

Unit – IV

Noise Decibels and levels, dB Scales in acoustics, Reference Quantity for acoustic Power, intensity and pressure, Determination of overall levels from band levels, Basic sound measuring system using sound level meter. Octave band analyzer. Acoustic Calibrator, Definition of Speech interference levels (SIL), Noise criteria for various spaces. Nomogram relating SPL in octave bands to loudness in Tones, Computation of LL and SIL. .

Text and Reference books:

1. Fundamentals of Acoustics: Kinsler and Fry, (Wiley Eastern).
2. Acoustics: Leo L. Beranek (John Wiley and Sons.).
3. Noise Reduction: L. L. Beranek.
4. Fundamentals of Ultrasonic: J. Blitz.
5. Ultrasonic Absorption: A. B. Bhatia.
6. Acoustical Test and Measurements: Don Davis.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY
NAGPUR

M. Sc. Botany Syllabus

Semester pattern with Choice Base Credits System

2017 -18 and Onwards

APPENDIX – 1
Scheme of teaching under choice based credit system for M. Sc. Program in Botany.

S. No.	Semester	Course Code / Paper	Title of the Paper	Course / Paper	Teaching Scheme		
					Theory (Hours)	Practical (Hours)	Number of Credits
1	One	1T1	Microbiology, Algae and Fungi	I	04	04	04
2	One	1T2	Bryophytes & Pteridophytes	II	04	04	04
3	One	1T3	Paleobotany and Gymnosperms	III	04	04	04
4	One	1T4	Cytology and Genetics	IV	04	04	04
5	One	1P1	Algae, fungi, Bryophytes	Pract. I	-	-	04
6	One	1P2	Pteridophytes, Gymnosperms, Paleobotany, Cytology & Genetics	Pract. II	-	-	04
7	One	1S1 Seminar					01
8	Two	2T1	Plant Physiology and Biochemistry	I	04	04	04
9	Two	2T2	Plant Development and Reproduction	II	04	04	04
10	Two	2T3	Cell and Molecular Biology-I	III	04	04	04
11	Two	2T4	Angiosperms-I and Ethnobotany	IV	04	04	04
12	Two	2P1	Plant Physiology, Plant Biochem., Plant Development & Reproduction	Pract. I	-	-	04
13	Two	2P2	Cell and Molecular Biology I, Angiosperms I	Pract. II	-	-	04
14	Two	2S1 Seminar					01
15	Three	3T1	Plant Ecology and Conservation Biology	I	04	04	04
16	Three	3T2	Angiosperms-II	II	04	04	04
17	Three	3T3	Elective -I	III	04	08	04
18	Two	3T4	Foundation I	IV	04	-	04

19	Three	3P1	Plant Ecology and Conservation Biology and Angiosperms II	Pract. I	-	-	04
20	Three	3P2	Elective	Pract. II	-	-	04
21	Three	3S1 Seminar					01
22	Four	4T1	Cell and Molecular Biology-II	I	04	04	04
23	Four	4T2	Plant Biotechnology and Plant Breeding	II	04	04	04
24	Four	4T3	Elective II	III	04	-	04
25	Four	4T4	Foundation II	IV	04	-	04
26	Four	4P1	Cell and Molecular Biology-II, Plant Biotechnology and Plant Breeding	Pract. I	-	-	04
27	Four	4P2	Project	Pract. II	-	08	04
28	Four	4S1 Seminar					01

1. In each semester student will have to give seminar on any topic relevant to the syllabus encompassing the recent trends and development in that field. The topic of the seminar will be decided at the beginning of each semester in consultation with supervising teachers. The students have to deliver the seminar, which will be followed by discussion. The seminar will be open to all the teachers of the department invitees and students.

2. The students will have to carry out the research based project work in lieu of practical in the fourth semester in the department or depending on the availability of placement; he/she will be attached to any of the national/ regional/ private research institute / organization for the duration of the fourth semester. The student will be randomly allotted the priority number for the selection of the supervisor in the third semester. The student in consultation with supervisor will finalize the topic of the project work at the third semester.

3. These course can be taught by person having post graduate qualification in relevant / equivalent subjects/ or having teaching / research experience in that particular area.

APPENDIX – 2

Scheme of the examination under choice based credit system for M. Sc. Program in Botany

S. No.	Semester	Course Code / Paper	Title of the Paper	Duration of Paper / hrs		Maximum Marks	Total Credits
				Theory	Practical		
1	One	1T1	Microbiology, Algae and Fungi	03		80 + 20	04
2	One	1T2	Bryophytes & Pteridophytes	03		80 + 20	04
3	One	1T3	Paleobotany and Gymnosperms	03		80 + 20	04
4	One	1T4	Cytology and Genetics	03		80 + 20	04
5	One	1P1	Algae, fungi, Bryophytes		06	100	04
6	One	1P2	Pteridophytes, Gymnosperms, Paleobotany, Cytology & Genetics		06	100	04
7	One	1S1	Seminar		01	25	01
8	Two	2T1	Plant Physiology and Biochemistry	03		80 + 20	04
9	Two	2T2	Plant Development and Reproduction	03		80 + 20	04
10	Two	2T3	Cell and Molecular Biology-I	03		80 + 20	04
11	Two	2T4	Angiosperms-I and Ethnobotany	03		80 + 20	04
12	Two	2P1	Plant Physiology, Plant Biochem., Plant Development & Reproduction		06	100	04
13	Two	2P2	Cell and Molecular Biology I, Angiosperms I		06	100	04
14	Two	2S1	Seminar		01	25	01
15	Three	3T1	Plant Ecology and Conservation Biology	03		80 + 20	04
16	Three	3T2	Angiosperms-II	03		80 + 20	04
17	Three	3T3	Elective -I	03		80 + 20	04
18	Two	3T4	Foundation I	03		80 + 20	04
19	Three	3P1	Plant Ecology and		06	100	04

			Conservation Biology and Angiosperms II				
20	Three	3P2	Elective		06	100	04
21	Three	3S1	Seminar		01	25	01
22	Four	4T1	Cell and Molecular Biology-II	I	03	80 + 20	04
23	Four	4T2	Plant Biotechnology and Plant Breeding	II	03	80 + 20	04
24	Four	4T3	Elective II	III	03	80 + 20	04
25	Four	4T4	Foundation II	IV	03	80 + 20	04
26	Four	4P1	Cell and Molecular Biology-II, Plant Biotechnology and Plant Breeding	Pract. I		100	04
27	Four	4P2	Project			100	04
28	Four	4S1	Seminar		01	25	01

1. In each semester student will have to give seminar on any topic relevant to the syllabus encompassing the recent trends and development in that field. The topic of the seminar will be decided at the beginning of each semester in consultation with supervising teachers. The students have to deliver the seminar which will be followed by discussion. The seminar will be open to all the teachers of the department, invitees and students.

2. The students will have to carry out the research based project work in lieu of practical in the fourth semester in the department or depending on the availability of placement; he/she will be attached to any of the national/ regional/ private research institute / organization for the duration of the fourth semester. The student will be randomly allotted the priority number for the selection of the supervisor in the third semester. The student in consultation with supervisor will finalize the topic of the project work at the third semester.

3. The regular full time teacher of the department / contributory teacher approved by university / scientist of government / private research laboratory appointed by university as a contributory teacher and having M. Phil. or Ph. D. degree can supervise the project work of the student.

Subject Wise Core Elective Papers:

M. Sc. Subject	Core elective paper to be opted in Semester III	Core elective paper to be opted in Semester IV
Botany	Molecular Biology and Plant Biotechnology - I	Molecular Biology and Plant Biotechnology - II
	Reproductive Biology of Angiosperms - I	Reproductive Biology of Angiosperms - II
	Advanced Phycology and Hydrobiology - I	Advanced Phycology and Hydrobiology - II
	Mycology and Plant Pathology - I	Mycology and Plant Pathology - II
	Plant Physiology - I	Plant Physiology - II
	Paleobotany - I	Paleobotany - II
	Palynology - I	Palynology - II

Foundation Course: (Candidate can opt for any one foundation course paper in the Semester III and IV; however, student shall opt for this paper from any other subject other than his /her main subject for post-graduation.

List of foundation courses is available in the Appendix - A of Direction No. 13 of 2017

SEMESTER I

PRACTICAL (1P1)

Time : 6 Hours Full marks : 100

Q. 1	To identify the given Cyanobacterial material A.	10
Q.2	To identify two algal forms B, C, from the given mixture.	10
Q.3	To identify the given fungal culture D	10
Q. 4	To identify the given plant pathogen in the given material E.	10
Q. 5	To prepare a temporary microprepration of the given Bryophytic Material F and identify it	10
Q. 6	Comment on the given spot G (Cyanobacteria/Bacteria), H (Algae), I (Fungi), J (Bryophyte)	10
Q.7	Viva-voce	20
Q. 8	Practical Recordand tour report	20

SEMESTER I

PRACTICAL (1P2)

Time : 6 Hours Full marks : 100

Q. 1	To prepare a double stained microprepration of the given Pteridophytic materialA and identify it.	10
Q.2	To prepare a double stained microprepration of the given gymnospermic material B and identify it.	10
Q.3	Comment on the given fossil specimen C	10
Q. 4	One experiment from Cytology and Genetics D	10
Q. 5	Comment on the given spot E (Pteridophyte), F (Gymnosperm), G (Fossils), H (Cytology/Genetics)	20
Q.6	Viva-voce	20
Q. 7	Practical Recordand tour report	20

SEMESTER II

PRACTICAL (2P1)

Time : 6 Hours Full marks : 100

Q. 1	To perform the given physiological experiment A and report the findings	10
Q.2	To quantify the given metabolite in the given sample B	5
Q.3	To study the cytohistological zonation in SAM of given material C	10
Q. 4	Toperform the given exercise based on plant development D	10
Q. 5	Write a note on given stage of micro-or megasporogenesis E	10
Q. 6	Spotting: F (Physiology), G (Plant development), H (Reproduction)	15
Q. 7	Viva-voce	20
Q. 8	Practical Record	20

SEMESTER II

PRACTICAL (2P2)

Time : 6 Hours Full marks : 100

Q. 1	One experiment from paper VII A	15
Q.2	One experiment from paper VII B	10
Q.3	One experiment from paper VIII C	15
Q. 4	One experiment from paper VIII D	10
Q. 5	Spotting	10
Q. 6	Viva-voce	20
Q. 7	Practical Record and field diary	20

SEMESTER III

PRACTICAL (3P1)

Time : 6 Hours Full marks : 100

Q. 1	To perform the given ecological exercise A	15
Q.2	To solve the given statistical problem B	15
Q.3	To describe the given plant in technical language with floral formula and floral diagram C	10
Q. 4	To prepare the generic/family key D	5
Q. 5	To identify species of the given plant using Flora	5
Q. 7	Spotting	10
Q. 8	Viva-voce	20
Q. 9	Practical Record	20

SEMESTER III

PRACTICAL 3P2 (ELECTIVE)

ADVANCED PHYCOLOGY & HYDROBIOLOGY

Time: 6 Hours Full Marks: 100

1. Isolation and identification of Two Procaryotes (Bacteria & Cyanobacteria) (A) 10
2. Isolation and identification of Two Eucaryotes (B) 10
3. To demonstrate Any One of the following Experiments: (C) 10

a. Separation of algal pigments.

b. Extraction and separation of amino acids of fats or carbohydrates

c. Count the density of phytoplanktons.

4. Analysis of water samples for Any One of the following : (D) 10

a. Dissolved Oxygen, pH & Temperature
b. Free Carbon dioxide pH and Temperature
c. Total alkalinity
d. Total Hardness
e. Calcium Hardness
f. BOD & COD
g. Chloride
h. Ammonical Nitrogen

5. Analysis of soil for Any One of the following : (E) 10

a. Chloride, d. Calcium

b. Phosphate, e. Magnesium

c. Nitrogen

6. Identify the spots giving reasons F,G 10

7. Viva-Voce 20

8. Practical Record and Field Report 20

PRACTICAL 3P2 (ELECTIVE)

REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

Time: 6 Hours Full Marks: 100

1. Dissect and mount the endothecium/endosperm from the given materials. 10

2. Dissect and mount given stage of embryo from the material. 10

3. In vitro pollen germination percentage and pollen tube growth. Record the data under given conditions. 10

4. Study the Morphology of pollen grain. 10

5. A) Localize the Biochemical compounds in a given plant material. 5

B) Draw the camera lucida figure of a embryological stage focused under the microscope. 5

6. Identification and comment on the given spots.(2 Spots) 10

7. Practical record & field Report. 20

8. Viva-voce 20

PRACTICAL 3P2 (ELECTIVE)

APPLIED MYCOLOGY AND PLANT PATHOLOGY

Time: 6 Hours Full Marks: 100

1. Identify giving salient characters of fungi from the given culture. (A) 10

2. Identification of given diseased material, their symptoms and characters.(B) 10

3. Effects of different concentrations of sugar solutions on the conidial germination and

presentation of data on graph paper.	10
4. Drawing of camera lucida diagram of the given fungus/microorganism.	10
5. Demonstration of pure culture techniques /transfer techniques.	10
6. Spotting (two spots)	10
7. Practical record, Herbarium and field report	20
8. Viva-voce	20

PRACTICAL 3P2 (ELECTIVE)

MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

Time: 6 Hours Full Marks: 100

1. One Major Experiment from Group A	15
2. One Minor Experiment from Group A	10
3. One Major Experiment from Group B	15
4. One Minor Experiment from Group B	10
5. Identification and comments on given two spots	10
6. Practical record	20
7. Viva-voce	20

PRACTICAL 3P2 (ELECTIVE)

PLANT PHYSIOLOGY

Time: 6 Hours Full Marks: 100

1. One Major Experiment from Special paper- I A	15
2. One Minor Experiment from Special paper- IB	10
3. One Major Experiment from Special paper- II C	15
4. One Minor Experiment from Special paper- IID	10
5. Identification and comments on given two spots (E, F)	10
6. Practical record and Project/field report.	20
7. Viva-voce	20

PRACTICAL 3P2 (ELECTIVE)

PALYNOLOGY

Time: 6 Hours Full Marks: 100

1. Pollen preparation by standard method/s - Section 'A'.	15
2. Any ONE experiment from Section B.	15
3. Any ONE experiment from Section C.	15
4. Any ONE experiment from Section A/B/C (Minor) (Other than asked in Question 1 - 3)	5
5. Spotting	10
6. Practical Record, Permanent slides & field record	20
7. Viva-voce	20

PRACTICAL 3P2 (ELECTIVE)

PALAEOBOTANY

Time: 6 Hours Full Marks: 100

1. Preparation of ground section slide of a given fossil specimen	10
2. Preparation of slide by maceration technique	10
3. Preparation of a peel section of given fossil specimen. Draw a well Labelled Diagram and comment	10
4. Write monograph on the given specimen	10
5. Comment on Given Fossil wood	10
6. Comment on the spots	10
7. Practical record and Field Report	20
8. Viva-Voce	20

SEMESTER IV

PRACTICAL (4P1)

Time : 6 Hours | Full marks : 100

Q. 1	One experiment from Paper XIII A	15
Q.2	One experiment from Paper XIII B	10
Q.3	One experiment from Paper XIV C	15
Q. 4	One experiment from Paper XIV D	10
Q. 5	Spotting from Elective Paper II	10
Q. 6	Viva-voce	20
Q. 7	Practical record	20

M. Sc. Botany Syllabus

Semester I

1T1- Core : Microbiology, Algae and Fungi

Botany 1T1- Core : Microbiology, Algae and Fungi

Objectives:

Understanding & Application the structure, reproduction eco. imp. of bacteria, viruses and archaebacteria

Understanding & Application classification, life cycles, eco. imp. Of various groups of algae and fungi

Understanding & Application symptoms, histopathology, etiology and identification of plant diseases and measurements

Outcomes: After completion of the course, the student will be able to

Identify the structure, life cycles, economic importances etc of bacteria, virus, arhaebacteria, algae, fungi and apply this knowledge

Based on symptoms, identify plant diseases and apply knowledge for control of diseases

Perform various microbial culture techniques and apply for development of various cultures.

Module I: Prokaryotes and viruses

General Microbiology: History- Contributions made by Leeuwenhoek, Pasteur, Robert Hook, Jenner, Waksman, Iwanowsky. Koch's Postulates.

Bacteria: Structure, morphology, reproduction.

Viruses: General account; Morphology and ultrastructure of TMV, Bacteriophage; Introduction to viroids, prions and interferon.

Archaebacteria and bacteria: General account; ultrastructure, nutrition and reproduction, biology and economic importance; Cyanobacteria:*Microcystis, Lyngbya*, *Nostoc*, *Scytonema*, *Gloeotrichia* and *Stigonema*.

Module II: Phycology

Criteria for classification of algae: Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Pheophyta and Rhodophyta; pigments, reserved food, flagella.

Algae in diversified habitats (terrestrial, freshwater, marine), thallus organization; cell ultrastructure; reproduction (vegetative, asexual, sexual); algal blooms, algalbiofertilizers; algae as a food, feed and uses in industry.

Module III: Mycology

General account: Classification of Fungi (recent trends and criteria used in classification); Physiology of Fungi (with reference to biotrophs, hemibiotrophs, symbionts); Fungal Cytology; Heterothallism, heterokaryosis, parasexual cycle.

Comparative study, classification and evolutionary trends in the following: Myxomycota: Protist characters and general account with special reference to *Physarium* and *Plasmodiophora*

Eumycota: i. Oomycetes: *Saprolegnia, Synchytrium, Phytophthora, Peronospora,*

ii. Zygomycetes: *Mucor, Rhizophus, Syncephalastrum, Cunninghamella*

Module IV: Mycology and plant pathology

Mycology contd….: Comparative study, classification and evolutionary trends in the following: iii. Ascomycetes: *Saccharomyces, Phyllactinia, Chaetomium, Xylaria*

iv. Basidiomycetes: *Melampsora, Puccinia, Ravenelia, Ustilago, Polyporus*.

v. Deuteromycetes: *Helminthosporium, Fusarium, Colletotrichum.*

Plant Pathology: Symptomology, histopathology, etiology and identification of diseases with reference to following fungal, bacterial and viral diseases (Paddy blast, wheat rust, bunt of wheat, smut of jowar, black arm of cotton, red rot of sugarcane, citrus canker, gummosis, leaf curl of papaya, potato blight.)

Practicals

Classification and type study of the following classes:

Prochlorophyta: *Prochloron,* Chlorophyta:*Pandorina, Eudorina, Stigeoclonium, Ulva, Chlorella,* Scenedesmus, Caulerpa, Valonia, Acetabularia; Phaeophyta:*Spacelaria, Padina,Turbinaria*; Rhodophyta: *Nemalion, Gelidium, Gracilaria, Corallina, Polysiphonia*; Euglenophyta:*Euglena, Phacus*; Bacillariophyta:*Cyclotella, Synedra, Cymbella, Navicula, Gomphonema.*

Morphological Studies of Fungi (any 15 of the following)

Stemonities, Perenospora, Phytopthora, Albugo, Mucor, Rhizopus, Yeast, Aspergillus, Penicillium, Chaetomium, Taphrina, Peziza, Erisyphe, Phyllactenia, Uncinula, Melamosora, Uromyces, Drechslera,Ravenallia, Ustilago, Polyporus, Morchella, Cyathus, Alternaria, Helminthosporium, Curvularia, Colletotrichum, Phoma, Plasmodiophora, Cercospora, Fusarium, Claviceps.

Symptomology of some diseased plants (any 7 of the following).

White rust of Crucifers, Downy mildew, powdery mildew, Rusts, Smuts, Ergot, Groundnut leaf spot (Tikka disease), False smut of paddy, red rot of Sugarcane, Wilt disease, Citrus canker, Angular leaf spot of cotton, Potato blight, Leaf mosaic of bhindi/ papaya, Leaf curl of tomato/Potato/Papaya, Little leaf of brinjal.

Identification of Fungal cultures (Any 5)

Rhizopus, Mucor, Aspergillus, Penicillum, Drechslera, Curvularia. Phoma, Colletotrichum, Alternaria, Helminthosporium.

Field study: For collection and studying fungal flora

Suggested Readings:

1. Kumar HD (1988) Introductory Phycology. Affiliated East-West Press Ltd. New Delhi
2. Morris I (1986) Introduction to the Algae. Cambridge University Press, UK
3. Round FE 1986 The Biology of Algae. Cambridge University Press, UK
4. Mandahar CL 1978 Introduction to Plant Viruses. Chand & Co. Ltd., New Delhi
5. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
6. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.
7. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.
8. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.
9. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York
10. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
11. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.
12. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.
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24. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.
25.Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.
26. On line Journals available on UGC -VSAT

Semester I

1T2- Core: Bryophytes & Pteridophytes

Objectives:

- **Understanding general characters, ecology, fossil history, classification, various types of bryophytes, pteridophytes.**
- **Learn evolutionary trends of various orders of Bryophytes, Pteridophytes and their different organs**

Outcomes:
After successful completion of the course the students will be able to

- **Learn various types of bryophytes, Pteridophytes characters for identification in lab and nature.**
- **Understand various types of fossils in bryophytes and Pteridophytes**
- **Understand evolutionary trends in bryophytes and pteridophytes**

Module I: Bryophytes

General characters, distribution, classification, ecology of Bryophytes, fossil history of bryophytes, cytology of bryophytes, regeneration in bryophytes, evolution of sporophyte-Retrogressive and Progressive theory.

Module II: Bryophytes contd…..

General account of-Hepaticopsida: Sphaerocarpels, Takakiales; Anthocerotopsida: Anthocerotales; Bryopsida: Sphagnales, Polytrichales.

Module III: Pteridophytes

General characters, distribution, classification, evolution of stele, heterospory and seed habit, apospory and apogamy; Important contributions of Indian Pteridologists, General account of Ryniopsida, Psilopsida, Lycopsida [protolepidodendrales, Lycopodiales, Selaginales, Isoetales].

Module IV: Pteridophytes contd…

General account and evolutionary trends of Sphenopsida [Hyeniales, Equisetales], Filicopsida [Ophioglossales, Filicales, Salvinales, Marsileales], Tracheophyta [Progymnospermosida].

Practicals

Bryophytes:

Study of morphological and reproductive characters of representative members mentioned in the syllabus using cleared whole mount preparations, dissections and sections. Preparation of permanent slides is necessary.

Study of bryophytes in their natural habitats.

Botanical excursion outside the state is compulsory to study the bryophytes in their natural conditions.

Pteridophytes:

Study of fossil forms (specimens and permanent micropreparations).

Study of living forms: Morphological, anatomical and reproductive characters of the forms mentioned in the syllabus. Anatomical characters to be studied either by taking free hand sections (t.s./l.s.) and by observing the permanent micropreparations. Preparations of permanent slides are essential.

Study of pteridophytes in their natural habitats.

Botanical excursion outside the state is compulsory to study the pteridophytes in their natural conditions.

Suggested Readings

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2. Arnold C.A. (1947) An introduction to Paleobotany (McGraw Hill, New York)

3. Banks H.P. (1968) The early history of Land plants. In evolution and environment, ed. E.T. Drake. New Haven: Yale Univ. Press, pp, 73-107.

4. Banks H.P. (1970) Evolution and plants of past. (Belmont, California, Wadsworth).

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8. Campbell, D. H. (1961). The evolution of the Land Plants (central Book Depot, Allahabad)

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12. Delevoryas T. (1962) Morphology and Evolution of fossil plants (Holt, Rinehart and Winston, New York).

13. Eames A.J (1936) Morphology of vascular plants, lower groups (McGraw Hill, New York).

14. Foster A.S.and E.M Gifford Jr. (1959) Comparative morphology of vascular plants Freeman, San Fransisco.

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21. Mehra, P.N. and O. N. Handoo (1953). Morphology of Anthoceros erectus and A. himalayensis and the phylogeny of the anthocerotales. Bot. Gaz.114:371-382.

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28. Rashid A. (1982) (4th edn) An introduction to pteridophyta (Vikas Publ House Pvt Ltd.)

29.Schuster R. (1966). The Hepaticae and Anthocerotae of North America.East of the Hundredth meridian, Newyork (Colombia University Press).

30. Scott D.H. (1908) Studies in fossil botany. London, Black Part 2.

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32. Sharma O.P (1996) Textbook of pteridophyta (Mac Millan India Ltd, New Delhi)

33. Smith A. J. E. (1986). Bryophyte phylogeny fact or Fiction? Journal of Bryology, 14,83 89.

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36. Sporne K.R. (1962) The morphology of pteridophyta (Hutchinson Univ. Library, London)

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Semester I

1T3- Core: Paleobotany and Gymnosperms

Objectives:

- **Understand fossils formation, history, preservation, geological time scale, reconstruction and nomenclature of various types of fossils**
- **Learn the origin of gymnosperms, classification, evolution, eco. imp. of gymnosperms**

Outcomes:

After successful completion of the course the students will be able to

- **Identification, nomenclature, reconstruction of fossils and their significance in time scale**
- **Identification of various gymnosperms, evolution of gymnosperms and their relationships**

Module I: Paleobotany

Introduction; Plant fossils- Preservation, preparation, age determination, geological time scale; Fossil record- systematics, reconstruction and nomenclature; Applied aspects of paleobotany.

Module II: Gymnosperms

General account; distribution (living, Fossil); origin; systems of classification; economic importance.

Comparative morphology and evolutionary tendencies of:

1.Pteridospermales- Lyginoptridaceae (*Calymotheca hoeninghausii, Hetarngium, Spherostoma*); Medullosaceae (*Medullosa, Trignocarpus*).

2. Cycadales- Cycadaceae; Fossil history (*Baenia, Nilssonia, Androstrobus*)

3. Cycadeoidales- Williamsoniaceae, Cycadoeoidaceae

Module III:**Gymnosperms contd…**

General account and relationships of- Cordaitales, Caytoniales, Glossopteridales, Pentoxylales, Gnetales

Module IV: **Gymnosperms contd…**

Ginkgoales (*Ginkgo, Baiera, Trichopitys*); Coniferales (General characters, Embryogeny and phylogeny, evolution of ovuliferous scales, phylogeny); Taxales (*Taxus*, taxonomic position of taxales with respect to coniferales)

Laboratory exercise

Comparative Study of vegetative and reproductive parts of: *Cycas, Zamia, Cedrus,Abies, Pinus, Cupressus, Cryptomeria, Taxodium, Podocarpus, Agathis, Thuja, Gnetum,Ephedra, Juniperus,Cephalotaxus, Taxus*. Permanent micropreparatious to be submitted by the students.

Ginkgo: Morphology to be studied from Museum specimens & anatomy from permanent slides only.

Study of important fossil gymnosperms from material and permanent slides.

Visit to palaeobotanical Institutes, localities and collection of specimens.

Field visits to ecologically different localities to study living gymnosperms.

Suggested Reading

1. Stewart, W.N. and Rothwell G.W. (1993), Palaeobotany and the Evolution of Plants, Cambridge University Press.

2. Foster A.S. & Gifford F.M. (1967): Comparative morphology of vascular plants, FreemanPublishers, San Fransisco.

3. Eames, A.J.(1974): Morphology of Vascular Plants-lower groups, Tata Mc-Graw Hill publishing Co., New Delhi.

4. Arnold, C.A. (1947): Introduction to Palaeobotany, Mc-Graw Hill Book Co. Inc., New York and London.

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7. Biswas, C & Johri, B.N. (2004), The Gymnosperms, Narosa Publishing House, New Delhi.

8. Coulter J.M. & Chamberlain C.J.(1978): Morphology of Gymnosperms, Central Book Depot, Allahabad.

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15. Bierhorst D.W. (1971): Morphology of vascular plants McMillan, New York.

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17. Spicer, R.A. & Thomas, B.A. (1986) Systematic and taxonomic approaches in Palaeobotany. Systematic Association Special Volume.

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19. On line Journals available on UGC -VSAT

Semester I

1T4- Core: Cytology and Genetics

Objectives:

- **Understand the laws of inheritance, various modifications, types of chromosomal inheritance patterns**
- **Understand multiple alleles and multiple gene inheritance, cytopplasmic inheritance**
- **Learn structural and numerical changes in chromosomes, mutations and inheritance patterns in various biological organisms and in their populations**

Outcomes:
After successful completion of the course the students will be able to

- **Know various types of inheritances in biological organisms and analyse inheritance patterns**
- **Understanding population genetics and equilibrium affecting various factors**
- **Understand the molecular mechanism of mutations and its role in crops improvement**

Module I

Mendel's laws of inheritance; Deviations from Mendel's findings: incomplete dominance, co-dominance,penetrance, expressivity, multiple alleles and isoalleles (example Corn, Drosophila and *Nicotiana*), gene interactions (non-epistatic and epistatic), Linkage; Chromosome theory of inheritance; Modifiers, suppressors and pleiotrpic genes; multigene families (globin and immunoglobin genes); sex determination in plants, *Drosophila, C. elegans*.

Module II

Cytoplasmic inheritance and maternal effect

Chromatin organization: Chromosome structure and packaging of DNA, molecular organization of centromere and telomere, rRNA genes, euchromatin and heterochromatin; Karyotype analysis and evolution, banding patterns; C-value paradox, Cot curve and its significance; specialized types of chromosomes: polytene, lampbrush, B-chromosome, sex chromosome; molecular basis of chromosome pairing.

Module III

Structural and numerical (heteroploidy) changes in chromosomes; origin, breeding behaviour of duplications, deficiency, inversion and translocation heterozygotes; effect of aneuploidy on plants; transmission of trisomics and monosomics and their use in chromosome mapping; complex translocation heterozygotes, translocation tester sets; Robertsonian translocation.

Population genetics: Hardy-Weinberg equilibrium; Factors affecting Hardy-Weinberg equilibrium; Quantitative trait loci (Kernel colour in wheat, corolla length in *Nicotiana longifera*).

Module IV

Mutations: Spontaneous and induced; physical and chemical mutagens- classification, mode of action; molecular basis of gene mutations; transposable genetic elements; site directed mutagenesis- definition, applications and PCR based oligonucleotide mutagenesis; role of mutations in crop improvement; induction of polyploidy

Epigenetics: Introduction; histone code; base modification; paramutations in maize; Callipygh sheep; Epigenetics and Lamarckism; Epigenome and epigenomics (Introduction).

Practicals

1. To study cell division (mitosis and meiosis) in the given material.
2. To study the effect of mutagen treatment on germination and seedling height.
3. To study effect of mutagen on the rate of cell division.
4. To study effect of mutagen on genetic material by scoring the chromosomal aberrations.
5. To study the translocation heterozygote in *Rheo discolor* or any other suitable material.
6. To study polytene chromosomes in *Chironomas* larvae.
7. To solve the given problems on interaction of genes (atleast five).
8. To study the karyotype of given organism.
9. To study the chiasma frequency in the given material.
10. To solve the given problem on population genetics (atleast three).

Suggested Reading

Gupta P K 2007 Genetics: Classical to Modern. Rastogi Publications, Meerut.

Hexter W and Yost Jr. H T 1977 The Science of Genetics. Prentice Hall of India Pvt. Ltd.,

New Delhi.

Hartl D L and Jones E W 1998 Genetics: Principles and Analysis (4thed.). Jones and Barflett Publishers, USA.

Khush G S 1973 Cytogentics of Aneuploids.Academic press, New York.

Snustad D P and Simmons M J 2000 Principles of Genetics (2nded.) John Wiley and Son Inc., USA.

Semester II

2T1- Core: Plant Physiology and Biochemistry

Objectives:

- **Understanding photosynthesis and respiration in plants.**
- **Understanding mechanistic underpinnings of the plant hormones and sensory photobiology.**
- **Understanding Enzymology.**
- **Understanding the solute transport system and metabolism.**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the aspects of plant respiration and photosynthesis.**
- **Understand the aspects of metabolism of different components**
- **Perform and check the enzymatic activities of different components.**

Module-I

The Scope of plant physiology

Photosynthesis: Evolution of photosynthetic apparatus, pigments, Light, light harvesting complex, Mechanism of electron transport, Photo protective mechanism, CO2 fixation, C3, C4 and CAM pathway, Photorespiration, the chemiosmatic-coupling hypothesis and ATP Synthesis, , ATP Synthesis in chloroplast

Respiration:- introduction, ,Glycolysis, Citric acid cycle, oxidative pentose phosphate pathway, Plant mitochondrial electron transport and ATP synthesis (oxidative phosphorylation) alternate oxidase.

Module-II

Plant hormones:- biosynthesis, storage , breakdown and transport of hormones, physiological effect and mechanism of action of hormones auxins, gibberellins and cytokinine

Sensory photobiology:- structure, function and mechanism of phytochromes, cryptochromes and phototropins, stomatal movement. Photoperiodism and biological clock

Module-III

Enzymes: Nomenclature and classification of Enzymes enzyme kinetics, Michaelis –Menten equation, mode and mechanism of Enzyme action (Regulation of Enzyme activity), Activators & Inhibitors of enzymes, properties of Enzymes, factors affecting Enzyme activity, isozymes.

Solute transport and photo-assimilate translocation:-uptake transport and translocation of water, ion, solutes and macromolecules from soil through cell, across membranes, through xylem and phloem , transpiration, mechanism of loading and unloading of photo -assimilates

Module –IV

Carbohydrate Metabolism: Composition, structure and function of carbohydrates, synthesis of starch and

Sucrose, catabolism (degradation) of starch and sucrose

Lipid Metabolism: Composition, structure and function of lipids, fatty acid biosynthesis, membrane Storage lipids.

Protein metabolism: Composition, structure (Ramchandra plot. secondary, tertiary and quaternary structure)and function of Proteins

Metabolism of amino acids: Composition, structure and function of amino acids, amino acid biosynthesis in Plants.

Nitrogen metabolism: Nitrate and ammonium assimilation

Secondary metabolites: Biosynthesis of terpenes, phenols. Nitrogenous compounds and their roles

Suggested laboratory exercises

1. To study the effect of time and enzyme concentration on the rate of reaction of enzyme (e.g. phosphatase, nitrate reductase).

2. To study the effect of substrate concentration on activity of enzyme and determination of its Km value.

3. Demonstration of the substrate inducibility of the enzyme nitrate reductase.

4. Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.

5. To determine the total carbohydrate content in the given sample

6. Estimation of Pectic Substances-gravitic method .

7. To prove Berr-Lambert.s law using a suitable solution.

8. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum ofchlorophyll and carotenoids.

9. To determine the chlorophyll a/ cholorophyll b ratio in C3 and C4 plants.

10. Isolation of intact chloroplasts and estimation of choloroplast proteins by spot protein assay.

11. Preparation of standard curve of protein (BSA) and estimation of protein content in extractsof plant material by Lowry's or Bradford's method.

12. Preparation of Leaf Protein Concentrates from green vegetables.

13. Determination of reducing sugars by Nelson – Somogyi Method.

Suggested reading (for laboratory exercises)

1 Bajracharya, D. 1999. Experiments in Plant Physiology: A Laboratory Manual. Narosa Publishing House, New Delhi.

2 Cooper, T.G. 1977. Tools in Biochemistry.John Wiley, New York, USA.

3Copeland, R.A. 1996. Enzymes: A Practical Introduction to Structure, Mechanism andData Analysis. VCH Publishers, New York.

4Dennison C. 1999.A guide to Protein Isolation. Kluwer Academic Publishers, Dordrecht,The Netherland.

5Devi, P. 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios, Jodhpur, India.

6 Dryer, R. L. and Lata, G. F. 1989.Experimental Biochemistry. Oxford UniversityPress, New York.

7Hames, B.D.(Ed.).1998. Gel Electrophoresis of Proteins: A Practical Approach, 8th edition. PAS, Oxford University Press, Oxford, UK.

8Harborne, T.C. 1981. Phytochemical Methods: A Guide to Modern Techniques of Plants Analysis. Chapman& Hall, London.

9Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory Manual.Springer-Verlag, Berlin.

10Ninfa, A. J. and Ballou, D. P. 1998. Fundamental Laboratory Approaches forBiochemistry and Biotechnology. Fitzgerald Science Press, Inc., Maryland, USA.

11 Plummer, D.F. 1988. An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

12Scott, R.P.W. 1995. Techniques and Practice of Chromatography.Marcel Dekker, Inc., New York.

13Wilson, K. and Goulding, K.H.(Eds), 1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London,UK.

14Wilson, K. and Walker, J. 1994. Practical Biochemistry: Principles and Techniques, 4th edition. Cambridge University Press, Cambridge, UK.

15 Sadasivam and Manikum: Biochemical Methos , New Age International (p) Limited Publishers 4835/24, Ansari Road, Daryaganj, New Delhi-110002

Suggested readings (for theory)

1 Buchanan, B. B., Gruissem, W. and Jones, R.L. 1989.Biochemistry and Molecular Biology of plants.American Society of Plant Physiologists, Maryland, USA.

2Dennis, D.T., Turpin, D. H., Lefebvrc, D.D. and Layzell, D.B. (eds).1997. Plant Metabolism (2nd Ed.)Longman, Essex, England.

3 Gaiston, A.W.1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.

4 Hooykass P.J.J., Hall, M. A. and Libbenga, K.R.(eds).1999. Biochemistry and Molecular Biology of plant Horm. Elsevier, Amsterdam, The Netherlands.

5 Hopkins, W.G. 1995. Introduction to Plant Physiology.John Wiley & Sons, Inc., New York, USA.

6 Jones R, Ougham H, Thomas H and Waaland S 2013 The Molecular life of plants. Wiley-Blackwell Publ., USA

6 Lodish, H., Berk, A., Zipursky S.L., Matsudaira, P., Baltimore, D and Darnell, J. 2000.Molecular Cell Biology (4thed). W. H. Freeman and Company. New York ,USA.

7 Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2nded). Springer-Verlag, New York, USA.

8 Nobel, P.S.1999. Physicochemical and Environmental Plant Physiology (2nd ed). Academic Press, Diego, USA.

9 Salisbury, F.B. and Ross, C.W.1992: Plant Physiology (4thed). Wadsworth Publishing Co., California, USA.

10 Singhal G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee.1999: Concepts in Photobiol Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.

11 Taiz, L. and Zeiger, E. 1998: Plant Physiology. Sinaucr Associates, Inc., Publishers, Massachus, USA.

12 Thomas,B. and Vince-Prue,D.1997: Photoperiodism in Plants (2nd ed). Academic Press, San Diego, USA.

13 Westhoff, P.1998: Molecular Plant Development: From gene to plant. Oxford University Press, Oxford, UK.

14 Dey, P. M. And Harborne, J. B. 2000: Plant Biochemistry ,Harcourt Asia PTE Ltd. A Harcourt Publishers International Company, 583 Orchard Road 09-01 Forum Singapore

15 Ranjan, purohit, Prasad 2003: Plant Hormones Action and Application, Agrobios(India), agro house, behind Nasrani cinema Chopasani Road, Jodhpur -34

Semester -II

2T2- Core: Plant Development and Reproduction

Objectives:

- **Understanding the basic growth kinetics and growth patterns in plants**
- **Understanding the plant growth regulators with respect to plant growth and metabolism**
- **Understanding dormancy, senescence and their influences on plant growth and reproduction.**

Outcomes:
After successful completion of the course the students will be able to

- **Know the basic growth kinetics and role of phytohormones in plant development**
- **Know the molecular mechanism of growth and differentiation of root, leaf flowers and seeds**
- **Learn to use biomolecules for flower formation, seed setting, senescence effects.**

Module I: Plant development

Plant growth kinetics and patterns of growth.

Seedling growth: Tropisms; Photomorphogenesis of seedling; hormonal control of seedling growth.

Shoot Development: Organization of shoot apical meristem (SAM); cytological and molecular analysis of SAM; regulation of cell fate in meristem; tissue differentiation in the shoot.

Phytohormones: Classification, chemical nature and their role in plant development.

Module II:Plant development contd…..

Leaf growth and differentiation: Determination; phyllotaxy; control of leaf form; differentiation of epidermis (with special reference to stomata & trichomes) and mesophyll.

Root Development: Organization of root apical meristem (RAM); vascular tissue differentiation; lateral root hairs; root microbe interactions.

Flower Development: Physiology of flowering, florigen concept and photoperiodism, Genetics of floral organ differentiation; homeotic mutants in *Arabidopsis* and *Antirrhinum*.

Pollination mechanisms and vectors.

Module III: Reproduction

Male Gametophyte: Structure of anther, microsporogenesis, tapetum; pollen development and gene expression; male sterility; sperm dimorphism; pollen germination; pollen tube growth and guidance.

Female Gametophyte: Ovule types; megasporogenesis; organization of embryo sac; structure of embryo sac cells.

Pollen-pistil interaction, self-incompatibility and fertilization; Structure of the pistil; pollen-stigma interactions, double fertilization; *in vitro* fertilization.

Module IV:Reproduction contd…..

Seed Development and fruit growth: Endosperm development; embryogenesis; ultrastructure and nuclear cytology; storage proteins of endosperm and embryo; polyembryony; apomixes; embryo.

Fruit development and growth

Latent life: Dormancy; Importance and types of dormancy; seed dormancy; overcoming seed dormancy; bud dormancy.

Senescence and Programmed Cell Death (PCD): Basic concepts; types of cell death, PCD in life cycle of plants; metabolic changes associated with senescence and its regulations; influence of hormones and environmental factors on senescence.

Suggested readings

1) Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.

2) Fageri, K. and Van der Pol, L. 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.

3) Fahn, A. 1982. Plant Anatomy, (3rd edition). Pergamon Press, Oxford.

4) Fosket, D.E. 1994. Plant Growth and Development.A molecular Approach. Academic Press, San Diego.

5) Howell, S.H. 1998, Molecular Genetics of Plant Development. Cambridge University Press, Cambridge.

6) Leins, P., Tucker, S.C. and Endress, P.K. 1988. Aspects of Floral Development. J. Cramer, Germany.

7) Lyndon, R.F., 1990. Plant Development.The Cellular Basis. Unnin Hyman, London.

8) Murphy, T.M. and Thompson, W.F. 1988. Molecular PlantDevelopment. Prentice Hall, New Jersey.

9) Proctor, M. and Yeo, P. 1973. The Pollination of Flowers.William Collins Sons, London.

10) Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.

11) Raghavan, V. 1999. Developmental Biology of Flowering Plants.Springer -Verlag, New York.

12) Raven, P.H., Evert, R.F. and Eichhorn, S.E. 1992. Biology of Plants (5th Edition).worth, New York.

13) Steeves, T.A. and Sussex, I.M. 1989. Patterns in Plant Development (2nd edition). Cambridge University Press, Cambridge.

14) Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London.

15) Waisel, Y., Eshel, A. and Kafkaki, U. (eds) 1996. Plant Roots: The Hidden Hall (2nd edition.) Marcel Dekker, New York.

16) Shivanna, K.R. and Sawhney, V.K. (eds) 1997. Pollen Biotechnology for Crop Production and Improvement, Cambridge University Press, Cambridge.

17) Shivana, K.R. and Rangaswamy, N.S. 1992. Pollen Biology: A Laboratory Manual. Springer-Verlag, Berlin.

18) Shivana, K.R. and Johri, B.M. 1985. The Angiosperm Pollen: Structure and Function. Wiley Eastern Ltd., New York.

19) The Plant Cell. Special issue on Reproductive Biology of Plants, Vol. 5(10) 1993.The American Society of Plant Physiologists, Rockville, Maryland, USA.

20) On line Journals available on UGC -VSAT

Suggested Laboratory / Field Exercises (Any 12)

1. Tissue systems, meristem, vascular and cork cambium.

2. Internal structure of root, stem and leaf (dicot and monocot), advanced secondary growth in dicot stem and root.

3. Anomalies in primary and secondary structure of stem.

4. Study of living shoot apices by dissections using aquatic plants such as *Ceratophyllum* and *Hydrilla*.

5. Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double-stained permanent slides of a suitable plant such as *Coleus, Kalanchoe*, Tobacco.

6. Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.

7. Study of alternate and distichous, alternate and superposed, opposite and superposed; opposite and decussate leaf arrangement.

8. Examination of rosette plants (*Launaea, Mollugo, Raphanus, Hyoscyamus* etc.) and induction of bolting under natural conditions as well as by GA treatment.

9. Microscopic examination of vertical sections of leaves such as *Cleome, Nerium*, Maize and Wheat to understand the internal structure of leaf tissues and trichomes, glands etc. Also study the C3 and C4 leaf anatomy of plant.

10. Study of epidermal peels of leaves such as *Coccinia, Gaillardia, Tradescantia, Thunbergia*, etc. to study the development and finalstructure of stomata and prepare stomatal index. Demonstration ofthe effect of ABA on stomatal closure.

11. Study of whole roots in monocots and dicots. Examination of L.S. of root from permanent preparation to understand the organization of root apical meriste m and its derivatives. (use maize, aerial roots of banyan, *Pistia, Jussieua* etc.).

12. Origin of lateral roots.

13. Study of leguminous roots with different types of nodules.

14. Study of microsporogenesis and gametogenesis in sections of anthers.

15. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (Maize, Grasses, *Crotolaria, Tradescantia, Brassica, Petunia, Solanum melongena*, etc.)

13. Tests for pollen viability using stains and in vitro germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface culture.

14. Estimating percentage and average pollen tube length *in vitro*.

15. Role of transcription and translation inhibitors on pollen germination and pollen tube growth.

16. Pollen-pistil interaction, self-incompatibility, *in vitro* pollination.

17. Study of ovules in cleared preparations; study of monosporic, bisporic and tetrasporic types of embryo sac development through examination of permanent stained serial sections.

18. Field study of several types of flower with different pollination mechanisms (wind pollination, thrips pollination, bee/butterfly pollination, bird pollination).

19. Emasculation, bagging and hand pollination to study pollen germination, seed set and fruit development using self compatible and obligate outcrossing systems.

20. Study of cleistogamous flowers and their adaptations.

21. Study of nuclear and cellular endosperm through dissections and staining.

22. Isolation of zygotic globular, heart-shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun (*Syzygium cumini*) etc. by dissections.

23. Study of seed dormancy and methods to break dormancy.

Semester II

2T3 - Core: Cell and Molecular Biology-I

Objectives:

- **Understanding the structures and functions of the cell wall, plasma membrane and plasmodesmata**
- **Understanding the structures and functions of cell organelles, cytoskeleton, nuclear envelope, and structure of DNA**
- **Understanding various types of stresses and defense mechanisms in plants and apply this knowledge.**

Outcomes:

After successful completion of the course the students will be able to

- **Know the cell wall & cellular organization of the eukaryotic and prokaryotic cells**
- **Learn the cell cytoskeleton and its role**
- **Learn and apply techniques of stress related problems in plants**

Module I:

Cell wall: Structure; function; biogenesis and growth.

Plasma membrane: Membrane architecture (fluid mosaic model); sites for ATPases; membrane transport-ion carriers, channels, pumps and aquaporins; receptors.

Plasmodesmata: Structure, role in movement of molecules and macromolecules; comparison with gap junction.

Module II:

Cellular organelles: Ultra-structure and function of golgi complex, lysosomes, peroxisomes, endoplasmic reticulum, mitochondria, chloroplast and plant vacuoles.

Cell shape and motility: The cytoskeleton; organization and role of microfilaments, intermediate filaments and microtubules; motor movements, implications in cell division, flagellar & other movements.

Module III:

Nucleus: Ultrastructure, nuclear pores, nucleolus, DNA structure A, B and Z forms, replication in prokaryotic and eukaryotic cells, DNA replication proteins, damage and repair.

Module IV:

Stress biology: Definition and classification of stress.

Biotic stress: Plant defence mechanism (passive and active); HR and SAR; modulation of plant metabolism in response to biotic stress: early and late response; production of ROS, induction of enzymes; PR proteins; R-genes.

Abiotic stress: Effect of water, temperature, salt and light stress on plants; developmental and physiological mechanisms protecting plants against environmental extremes.

Suggested readings

Atherly, A.G., Griton, J.R. and Mc Donald, J. F. 1999.The Science of Genetics.Saunders College Pub. Fort Worth, USA

Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 Biochemistry and Molecular Biology of Plants. American Soc. Of Plant Physiologists, Maryland, USA.

Bush, H. Rothblum, L. 1982. Vol. X. The Cell Nucleus RDNA part A. Academic Press.

Dc, D. N. 2000 Plant cell vacuoles: An introduction. CSIRO Publication, Collingwood, Australia.

De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8Ed. B. I. Waverly Pvt. Ltd., New Delhi.

Jones R, Ougham H, Thomas H and Waaland S 2013 The Molecular life of plants. Wiley-Blackwell Publ., USA

Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.

Kleinsmith, L.J. and Kish, V.M. 1995 Principles of Cell and Molecular Biology (2nd Edi.)Harper Collins Coll. Publisher, New York, USA.

Krishnamurthy, K.V. 2000 Methods in Cell wall Cyto-chemistry. CRC Press, Boca Raton, Florida

Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Dar nell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA

Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA

Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Taiz, L. and Zeiger, E. 1998: Plant Physiology. Sinaucr Associates, Inc., Publishers, Massachus, USA

Practicals

1. To study salivary gland chromosomes of Chironomas and Drosophila.
2. To isolate mitochondria and determine the activity of its marker enzyme SDH.
3. To isolate bacterial and plant DNA and quantify them by spectrophotometric method.
4. To demonstrate the semi-permeability of the plasma membrane.
5. To study the activity of Na/K ATPase.
6. To demonstrate different components of cytoskeleton in the suitable material.

7. To perform flagellar staining.

8. Isolation of DNA and preparation of Cot-curve.

9. Demonstration of vital structure and functions of cell

10. To study the activity of PAL in the seedlings challenged with elicitors.

11. To study the induction of antioxidant enzymes in the seedlings challenged with elicitors.

12. To study the effect of water stress on the seedling growth and its chlorophyll content.

13. To study the effect of temperature stress on the seedling growth and its chlorophyll content.

14. To study the effect of salt stress on the seedling growth and its chlorophyll content.

Suggested readings (for laboratory exercises)

Fukui, K. and Nakayama, S. 1996. Plant Chromosomes: Laboratory Methods. CRS Press, Boca Raton, Florida.

Glick, B. R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology and Biotechnology.CRC Press, Boca Raton, Florida USA.

Goswami, H. K. 1986. Practical cytology – Applied Genetics and Biostatistics Himalaya Pub. House, Bombay.

Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology: Structure and Function. Jones and Barlett Publishers, Boston, Massachusetts.

Hall, J.L. and Moore, A.L. 1983.Isolation of Membranes and Organelles from Plant Cells Academic Press, London, U.K.

Harris,N. and Oparka, K.J. 1994. Plant Cell Biology: A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.

Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering. Har Academic Publishers, Australia.

Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press, Oxford.Techniques, 2nd edition. PAS, IRL Press at Oxford University Press, Oxford.

References: Online journals available on UGC V-SAT programme.

Review Journals:

Annual Review of Plant Physiology and Molecular Biology

Biochemistry and Cell Biology

Cell Death and Differentiation

Cell Motility and the Cytoskeleton

Cellular Physiology and Biochemistry

Current Advances in Plant Sciences

European Journal of Cell Biology Journal of Cell Science

Nature Reviews: Molecular and Cell Biology

Protoplasma-An International Journal of Cell Biology

Trends in Cell Biology

Trends in Plant Sciences

Semester II

2T4 –Core :Angiosperms-I and Ethnobotany

Objectives:

- **Understanding the morphology of flowers of dicot and monocots for proper identification of angiosperm plants**
- **Understanding plant taxonomy and modern trends in taxonomy and conservation methods of ethnobotanical plants**

Outcomes:

After successful completion of the course the students will be able to

- **Learn basic structure of flowers for identification and distinguish them**
- **Apply taxonomic tools in taxonomic classification, modern and numerical taxonomy and phylogeny**

Module I:

Angiosperm Morphology, structural units and floral symmetry, dicot and monocot flower; structure, diversity origin and evolution of stamen, carpels; placentation types and evolution.

Floral adaptation to different pollinators

Module II:

Angiosperm Taxonomy: Scope, aims, principles of taxonomy, historical development of plant taxonomy, relative merits and demerits of major systems of classifications. Taxonomic structure: taxonomic hierarchy, concept of taxa, concept of species, concept of genus and family; Taxonomic character: HETEROBATHMY, ANALYTIC versus synthetic character, qualitative versus quantitative characters.

Module III:

Taxonomic evidence: Morphology, anatomy, embryology, palynology, cytology, phytochemistry, genome analysis.

Taxonomic tools: herbarium, floras, monographs, botanical gardens, biochemical and molecular techniques, computers and GIS.

Module IV:

Biosystematics: The population concept phenotypic plasticity, biosystematic categories, methods of biosystematics studies. Numerical taxonomy: principles, aims and objectives, cladistics in taxonomy, polarity of characters, homology, homoplasy, monophyly, polyphily.

Plant nomenclature: Salient features of ICBN

Ethnobotany:Definition; scope and significance; Sacred groves and their role in conservation.

Practicals

1. To study the floral symmetry in various taxa.

2. To study and work out the differences in dicot and monocot flower.

3. To study the variation in stamens and carpels.

4. To study placentation types in various taxa.

5. To study the floral adaptations for pollination.

6. To study anatomical features of various taxa.

7. To study embryological features of various taxa.

8. To study palynological features of various taxa.

9. To study cytological features of various taxa.

10. To prepare a cladogram on the basis of various morphological features of the species belonging to a genus.

Suggested Readings

Devis, P.H. and Heywood, V. H. 1973.Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.

Grant, V. 1971.Plant Speciation, Columbia University press, London.

Grant W. F. 1984. Plant Biosystematics.Academic press, London.

Harisson, H.J. 1971. New concept in flowering plant Taxonomy. Hickman educational books Ltd. London.

Hislop-Harisson, J. 1967.Plant Taxonomy.English Language Book Sco.And Edward Arnold Pub.Ltd, UK.

Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.

Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co. New York.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw -Hill Book Co., New York.

Nordentam, B., El Gazaly, G. and kassas, M. 2000.Plant systematic for 21st century.Portland press.Ltd, London.

Radford, A. E. 1986. Fundamentals of plant systematic.Harper and Raw publication, USA.

Solbrig, O.T. 1970. Principles and methods of plant Sytematics. The Macmillan Co. Publication Co. Inc., USA.

Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.

Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.

Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edvard Arnold Ltd, London.

Joncs, A. D.; Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., New

Semester III

3T1 - Core : Plant Ecology and Conservation Biology

Objectives:

- **Understanding the concept of community, ecological succession trends and climax.**
- **Understanding the structures and functions of ecosystem**
- **Understanding and applying various methods of plant conservation; importace and maintenance of National parks, sanctuaries, Biospheres, botanical gardens etc.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn structure and function of ecosystems and their succession and climax formation**
- **Learn and apply the knowledge of conservation methods.**

Learn and apply techniques of Botanical gardens etc.

Module I:

Vegetation organization: Concepts of community and continuum, analysis of communities (analytical ad synthetic characters): interspecific associations, concept of ecological niche.

Vegetation development: Temporal changes (cyclic and non-cyclic); mechanism of ecological succession (relay floristics and initial floristic composition; facilitation, tolerance and inhibition models).

Community function- Dynamics and succession, laboratory model, trends in succession, climax concept, General introduction to autecology.

Module II:

Ecosystem organization: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); litter fall and decomposition (mechanism, substrate quality and climatic factors); global biogeochemical cycles of C, N, P and S. Nutrient budget in forest and aquatic ecosystem.

Module III:

Ecosystem stability: Concept (resistance and resilence); Ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion; environmental impact assessment; ecosystem restoration.

Ecological management: Concepts; sustainable development; sustainability indicators.

Module IV:

IUCN- General account, categories, Commissions, role in conservation; Red Data Book

Protected areas- Sanctuaries, National parks, Biosphere reserves.

Wetlands and Mangroves

Coral Reefs- Types, importance, artificial reefs, conservation measures

Botanical gardens, Seed Banks; *In-vitro* repositories; Cryobanks,

Practicals

Based on Biostatistics

1. Calculate mean, variance, standard deviation and coefficient of variation for comparing two means related to given ecological data.
2. Calculate mean, variance, and to use t-test for comparing two means related to given ecological data.
3. To find out association between important grassland species from the given data using chi-square test.
4. To find out relationship between two ecological variables using correlation analysis.
5. To perform the one-way ANOVA from the given data.

Based on Ecology

1. A trip to the grass land/ forest/ water body to get acquainted with their plant species.
2. Distribution pattern of different plant species determined by Quadrate/Transect/ Point centered Quarter methods.
3. To determine minimum size and number of quadrats required to study grassland.
4. Qualitative parameters of distribution of plant species, Frequency, Density, Basal cover, dominance, Abundance and IVI.
5. To determine diversity indices (Shanon-Weiner, species richness, B-diversity) from given data.
6. To estimate DO content in the eutrophic and oligotrophic water samples by azide modification of Winklers method.
7. To determine gross and net phytoplankton productivity by light and dark bottle method.
8. To estimate chlorophyll content in SO_2 fumigated and unfumigated leaves.
9. Analysis of soils of two different areas i.e. Cropland and forest/ grassland for certain nutrients, CO3, NO3, Base deffiency.
10. To study ecological adaptations of the given plants

Suggested readings

1. Ambasht R.S. 1968. Freshwater ecosystem-Manual of Ecology 123-137 (See Misra KC et al 1968)

2. Ambasht R.S. 1966 Conservation Ecology, Abs Proc School on Plant Ecol (Full paper in press Oxford and IBH Calcutta).

3. Ambasht R.S. 1995 A text book of plant ecology Student and co. Varanasi-5

4. Anderson JM Ecology for environmental sciences: biosphere ecosystems and man

5. Billings WB 1964 Plants and the ecosystem Macmillan & co, London.

6. Clements FE 1916 Plant succession, An analysis of the development of vegetation. Carnegie Institute of Washington.

7. Cragg JB 1968 The theory and practice of conservation, IUCN Publ, New Series No. 12, 25-35.

8. Dash MC 1993 Fundamentals of Ecology WB Saunders and co. Philadelphia USA.

9. Deangelis DL Energy flow, nutrient cycling and ecosystem resilience. Ecology 56, 23843.

10. Dwivedi Rama Shankar 1968. The decomposer system manual of ecology See Misra KC et al 1970)

11. Frankel OH, Soule ME, 1981, Conservation and Evolution, Cambridge Univ Press.

12. Grace J 1983, Plant atmosphere relationships. Champman & Hall.

13. Greig Smith P 1983, Quantitative plant ecology, Univ California Press, California.

14. Hutchings MJ (ed) 1988, Plant population biology, Blackwell.

15. Hutchinson GE 1978, An introduction to population ecology. Yale Univ. Press.

16. Kochhar PL 1986 Plant Ecology Ratan prakashan, Mandi, Agra.

17. Krebs GJ 1972 Ecology Harper and Row Publ, New York.

18. Kumar HD 1994 Modern concepts of ecology. Vikas publishing house pvt ltd, New Delhi.

19. May RM (ed) 1981 Theoretical Ecology, Blackwell.

20. Odum EP 1963 Ecology Holt Reinhart and Winston Inc.

21. Odum EP 1983 Basic Ecology, Saunders Publ Philadelphia.

22. Reynolds CS 1984 The ecology of phytoplankton, Cambridge Univ Press

23. Silverton JW 1982 Introduction to plant population ecology, Longman.

24. Southwick CH 1983 (ed) Global Ecology Sinauer.

25. Whittaker RH 1975 Communities and Ecosystems (2nded) MacMillan, New York.

Semester III

3T2 - Core : Angiosperms-II

Objectives:

- **Understanding the morphology and descriptions of various dicot and monocots groups for proper identification of angiosperm plants**
- **Understanding plant biodiversity concept, role**

Outcomes:

After successful completion of the course the students will be able to

- **Learn and apply knowledge basic structure of flowers for identification and distinguish them family-wise.**
- **Training in usage of floras for identification of species, field trips for preparation of field notes and compilation of plant data.**

Module I

General account, distinguished characters, floral variation and evolution, affinities of:- Magnolidae, Hamamelidae, Dilleniidae, Rosidae, Asteridae, circumscription as per Cronquist,1968

Module II

Alismatidae, commelinidae, Aracidae, Lilidae; Interesting features and systematic position of Cucurbitaceae, Cactaceae, Asteraceae, Amentiferae, Lemnaceae, Palmae, Orchidaceae.

Module III

Probable ancestors of angiosperms, primitive living angiosperms, speciation and extinction, IUCN categories of threat, distribution and global pattern of biodiversity.

Module IV

Biological diversity concept and levels, role of biodiversity in ecosystem functions and stability, Endemism, hotspots and hottest hotspots, invasions and introductions, local plant diversities and its socioeconomic importance.

Practicals

1. Description of specimens from representative, locally available families.

2. Description of a species based on various specimens to study intra specific variation: collective exercise.

3. Description of various species of a genus, location of key characters and preparation keys at generic level.

4. Location of key characters and use of keys at family level.

5. Field trips within and around the campus; compilation of field notes and preparation herbarium sheets of such plants, wild or cultivated as are abundant.

6. Training in using floras herbaria for identification of specimens described in the class.

7. Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.

8. Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparation of dendrograms.

Suggested readings

Devis, P.H. and Heywood, V. H. 1973.Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.

Grant, V. 1971.Plant Speciation, Columbia University press, London.

Grant W. F. 1984. Plant Biosystematics.Academic press, London.

Harisson, H.J. 1971. New concept in flowering plant Taxonomy. Hickman educational books Ltd. London.

Hislop-Harisson, J. 1967.Plant Taxonomy.English Language Book Sco.And Edward Arnold Pub.Ltd, UK.

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Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co. New York.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw -Hill Book Co., New York.

Nordentam, B., El Gazaly, G. and kassas, M. 2000.Plant systematic for 2ft century.Portlant press.Ltd, London.

Radford, A. E. 1986. Fundamentals of plant systematic.Harper and Raw publication, USA.

Solbrig, O.T. 1970. Principles and methods of plant Sytematics. The Macmillan Co. Publication Co. Inc., USA.

Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.

Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.

Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edvard Arnold Ltd, London.

Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., New Delhi.

Semester III

3T3- Core Elective I:(Molecular Biology and Plant Biotechnology- I)

Objectives:

- **Understanding the structures, replication and damage and repair mechanisms of the DNA, transcription, translation.**
- **Knowledge on recombinant DNA technology & its tools**
- **Practical knowledge and analysis skills in usage of various bioinformatic tools.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn the structure, replication of DNA etc.**
- **Learn the transcription, translation etc.**
- **Learn and apply bioinformatic tools for analysis of bioinformation data.**

Module I

a. DNA replication: DNA replication in prokaryotic organism– Initiation, elongation, and termination, DNA replication in eukaryotes – origin, replication form, replication proteins, Comparative account of DNA replication in prokaryotes and eukaryotes, DNA replication proteins

b. DNA damage and repair:Types of DNA damage, factors for DNA damage, Repair system: Single base change, direct repair, mismatch repair, SOS response.

Gene expression and regulation: Transcriptional, translational and post-translational regulation

Module II

a. Tools of rDNA technology: DNA manipulation enzymes- Nucleases, polymerases, ligases, kinases and phosphatases; methods of gene isolation.

b. Molecular probing: Recombinant DNA libraries (gDNA and cDNA, oligonucleotide probes); nucleic acid hybridization (southern, northern, dot-blot and slot-blot); antibodies as probe for proteins (immunoblotting or western blotting, immunoprecipitation, southwestern screening).

Module III

a. Splicing of foreign DNA into cloning vector: Vectors for prokaryotes; ligation.

b. Introduction of foreign DNA into host cell: Transformation; transfection; transgenesis

c. Isolation of genes or protein products from clones: Expression vectors-Characteristics; vectors producing fusion proteins

d. Polymerase chain reaction: The basic techniques and its modifications; applications of PCR in molecular biology

Module IV

a. Sequence alignment and phylogenetic trees: Pairwise (dot-matrix method, dynamic programming method, Word or k-tuple method) and multiple alignment, Local and global alignment, significance of alignment, phylogeny and phylogenetic trees.

b. Genomics: Definition; Structural, functional and comparative genomics.

c. Proteomics: Description of protein structure; classification of proteins on the basis of structure and sequence similarity; prediction of a protein structure.

Suggested readings

Alberts, Bruce; Johnson Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter, Peter, C. 2002 Molecular Biology of the Cell, Garland Science, New York and London.

Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.

Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics

Bergman, N.H 2007 Comparative Genomics. Humana Press Inc., Part of Springer Science+ Business Media

Brown, T. A. 1999. Genomes, John Wiley &Sons(Asia) Pvt. Ltd., Singapore

De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.

Glover, D.M. and. Hames, D.B 1995 DNA Cloning : A practical approach, R.L. Press, Oxford.

Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques.Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.

Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics.Birkhauser Verlag, Basel, Switzerland.

Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.

Lehninger. Principles of biochemistry-Nelson, Cox, 4th Edn., W.H.Freeman and Co.,2005.

Lewin, B. 2000 Gene VII Oxford Univ. press, New York.

Lewin, B. 2010 Gene X Oxford Univ. press, New York.

Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA

Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi

Old and Primrose , 1994, Principles of gene manipulation. Blackwell Scientific Publ.

Raymond Schuler and Zielinski, E. 2005, Methods in plants Molecular biology.Acad. Press.

Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA

Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.

Shaw, C.H. 2006, Plant Molecular Biology: A practical approach. Panima Pub. Corp.

Stryer, Berg, Biochemistry-6th Edition, W. H. Freeman and Co.,2007.

Voet, D.; Voet, J.; Biochemistry – 3rd Edn. John Wiley and sonsInc., 2004.

Wilson Keith and Walker John 2005 Principles and techniques of biochemistry and molecular biology, 6th Ed. Cambridge University Press, New York.

Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Practicals

Group A

1. To detect the damage caused by mutagens to the DNA.
2. To detect molecular polymorphism in different species using a suitable technique.
3. To demonstrate the presence of a particular polypeptide by Western blotting.
4. To design PCR primers to isolate the given gene for cloning it in the given vector.
5. To amplify and sequence the nrDNA by PCR
6. To find the sequences of a given protein in the protein database
7. To work out the sequence from given autoradiogram and to identify it from GeneBank by BLAST method.
8. Todownload the DNA sequences from databases and generate pairwise and multiple sequence alignment.
9. Todownload the protein sequences from databases and generate pairwise and multiple sequence alignment.
10. To generate phylogenetic tree using given sequences.
11. To predict a protein from given sequence by using online tools from NCBI.

Group B

12. To demonstrate *Agrobacterium tumefaciens* mediated gene transfer in a suitable plant.
13. To perform ELISA testing of Bt gene in cotton.
14. To raise the suspension culture using a callus and plot the growth curve.
15. To induce the secondary metabolite synthesis in suspension culture.
16. To isolate the secondary metabolites from suitable plant material by gel filtration method.
17. To purifythe plant metabolite/ protein by column chromatography.

18. To demonstrate the use of molecular markers to detect polymorphism in different varieties of plants/strains of microbes.
19. To isolate and develop the protein profile of different plant species by SDS-PAGE.
20. To demonstrate bacterial transformation and selection of transformed cells.
21. To perform DNA ligation and analysis of ligated DNA on agarose gel.
22. To study of expression of inducible genes at biochemical level.
23. To demonstrate Organogenesis using appropriate explants.
24. To demonstrate somatic embryogenesis using appropriate explants and prepare artificial seeds.
25. To demonstrate preparation of artificial seeds.
26. To demonstrate the anther culture.
27. To study the effect of heavy metals on the growth of plants.
28. To screen the hyperaccumulator plants for a given heavy metal.

Suggested readings (for laboratory exercises)

Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinfor matics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.

Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics. McEntyre, J.; Ostell, J., editors Bethesda (MD) The NCBI Handbook: National Library of Medicine (US), NCBI; 2002-2005

Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.

Tools & updated literature available atwww.ncbi.com

References: Online journals available on UGC V-SAT programme.

Semester III

3T3- Core Elective I: (Reproductive Biology of Angiosperms - I)

Objectives:

- **Understanding of need of reproductive system as experimental material.**
- **Understanding of structure of male and female reproductive parts and thei developmentin Angiosperms.**
- **Understanding & Application of knowledge of male sterility .**
- **Understanding of pollen mechanism, pollen-pistil interaction and incompatability.**

Outcomes: After completion of the course, the student will be able to

- **Learning the structure, and developmental variation in the sexual organs in Angiosperms.**
- **Analysis of causes for male sterility.**
- **Understanding and application of knowledge of reproduction for human welfare**

Module I

General: Need for reproductive system as experimental material, Interdisciplinary approaches: genetic and molecular perspective,

Anther: Structure, anther wall; endothecium, middle layer, tapetum-Structure, typesstructure-function relationship, role of tapetum, microsporogenesis-sporogenous cells cytoplasmic reorganization during sporogenesis (Ultrastructural changes), molecular biology of meiosis, DNA and RNA synthesis, Protein synthesis, meiosis specific genes. Pollen tetrad development, pollen wall proteins, adaptive significance of pollen wall.

Module II

Male gametophyte development: formation of vegetative and generative cells, differential behaviour of sperms, gene expression during pollen development.

Pollen: Physiological and biochemical aspects, pollen storage, viability, causes for loss of viability. Pollen abortion and male sterility: structural, developmental and functional aspects of male sterility environmental factors, role of mitochondrial genome in male sterility, gametocides.

Module III

Pistil: Carpel determination, ovule and its structural details.

Megasporogenesis: Meiosis, functional megaspores, organization of female gametophyte structure of the embryo sac, egg, synergid-ultrastructure, role central cell, antipodal cell, haustoria, cytoskeleton of the embryo sac, enzymatic isolation of embryo sac, types of embryo sac, nutrition of embryo sac.

Module IV

Pollination: pollination mechanism, biotic and abiotic pollination, floral attractants and rewards,

Pollen-pistil interaction: The stigma-Types and structure, stigmatic exudates, style-transmitting tissue, canal cell, post pollination events (stigma receptivity, pollen adhesion, pollen hydration, pollen germination and pollen tube growth, biochemistry of pollen germination, RNA and protein metabolism during pollen tube, calcium gradient in the pollen tube (Chemotropism) pollen allelopathy.

Incompatibility: General concept, self incompatibility (Intraspecific type) heteromorphic, homomorphic types, mechanism of self compatibility, importance of self compatibility, methods of overcoming self incompatibility, Parasexual hybridization,

Suggested readings

1. Asker S. 1979, Progress in apomixis research. Hereditas 91, 231-240.

2. Barnier, G. 1986, The flowering process as an example of plastic development. Soc. Expt.. Biol. 40: 257-286.

3. Barth, F.G. 1991, insects and flowers, Princeton Univ. Press. Princeton.

4. Battaglia, E. 1963. Apomixis In recent advances in the embryology of angiosperms (ed P. Maheshwari), pp-264, Intt. Soc. Plant Morphologists, Univ. Delhi.

5. Bhandari N. N. 1984, The microsporangium in embryology of angiosperms (ed B.M. Johri) Springer-Verlag, Berlin, pp. 53-121.

6. Bhandari N.N., M. Bhargava and P. Chitralekha 1986, Cellularization of free nuclear endosperm of Pappaver somniferum L. Phytomorphology, 36, 357-366.

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10. Cartson P.S., Smith N.H., Dearing R.D. (1972) Parasexual interspecific plant hybridization. Proc. Nat. Acad. Sci. USA, 69, 2292-2294.

11. Cartson P.S. (1973) The use of protoplasts of genetic research. Proc. Nat. Acad. Sci. USA, 70, 598-602.

12. Chitralekha P. and N.N. Bhandari 1991, Post fertilization development of antipodal cells in Ranunculus scferatus. Phytomorphology 41, 200-212.

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14. Cocking E.C. 1960, A method for the isolation of plant protoplasts and vacuoles. Nature (London) 187-927-929.

15. Cocking E.C. 1970, Virus uptake, cell wall regeneration and virus multiplication in isolated plant protoplasts. Int. Rev. Cytol 28-89-124.

Practicals

1) Study from the permanent preparations.

a) Development and structures of anther pollen.

b) Structure of ovule, types, megasporogenesis, embryo sac types.

c) Development of endosperm, types.

d) Structure and development of embryo-types

e) Pericarp and seed coat structure from sections and macerations.

f) Sketching of ovular structure, embryo sac, anther wall, embryo with the help of camera lucida.

2) Techniques, Familiarity with phase contrast, polarizing, fluroscence and electron microscopy, wholemounts, fissection and macerations, permanent double stained microtome sections, photo microscopy.

3) Preparation of dissected wholemounts of endothecium, tapetum, endosperm and embryo, squash preparations of tapetum, microspore mother cells, dyads, tetrads pollinia and massulae. Study of mitosis and meiosis and identification of various stages.

4) Study of different pollen using acetolysed and non acetolysed pollen, preparation of permanent slides for morphological study. (polarity, symmetry, shape, size, aperture, sporoderm stratification: minimum 15 slides to prepare).

5) Interpretation of electron micrographs (SEM, TEM) of pollen.

6) Short term exercises on pollen production, viability and their percentage of germination. Rate of growth of germ tube to be studied in a given period.

7) Viability of seed through germination, biochemical and excised embryo methods.

8) Cytology of pollen inhibition in self and interspecific incompatibility, application of some technique to overcome incompatibility.

9) Experiments on intra-ovarian pollination.

10) Experiments on plant tissue culture. Technique-washing.Sterilization, preparation of media, storage of media, inoculation, callus initiation, proliferation.

11) Responses of calli to stress condition viz. temp, (low, high), moisture, salinity.

12) Induction of androgenesis through anther culture.

13) Physiology of embryo development, using electropheratic and histochemical methods embryo culture.

14) Somatic embryogenesis

15) Protoplast culture.

Semester III

3T3 - Core Elective I :(Mycology and Plant Pathology - I)

Objectives:

- **Understanding structure, reproduction of bacteria, viruses, fungi and mycorrhiza.**
- **Understanding & Application of knowledge human diseases caused by various fungi**
- **Understanding fungal metabolite production and its uses.**

Outcomes: After completion of the course, the student will be able to

- **Learning the structure, life cycles, economic importances etc of bacteria, virus, fungi and apply this knowledge in identification of organisms.**
- **Analysis of diseases based on symptoms, and apply knowledge for identification of disease**
- **Understanding and application of knowledge of fungal metabolites, their uses for human welfare**

Module I:General Microbiology

Bacteria- Morphology, size, shape, structure, Characters of Eubacteria, Actinomycetes, Archaebacteria, Bacterial nutrition, reproduction.

Viruses- General Characteristics, structure, classification (LHI System), replication (lytic cycle & lysogeny)

Rikettsia- General Characters.

Fungal diversity in different ecosystems, effect of environment on fungal growth and behaviour.

Module II: Mycorrhiza

1. Kinds of mycorrhizae. Ectotrophic and endotrophic mycocrhizae, their morphology and anatomy.V A-mycorrhiza.Mycorrhiza in plant growth promotion, mycorrhiza in plant disease control.

2. Rhizoshere and phyllosphere -General concept and importance.

3. Medical Mycology-Dermatophytic fungi -Knowledge of common dermatophytes and human diseases caused by them viz. *Tinea pedis, Tinea capitis, Tinea barbae. Tinea, corporis* and *Tinea manuum*; Aspergillosis, fungi allergic to human beings.

Module III: Production of Metabolites by Fungi

A) Industrial Fungal Metabolites:

i) Antibiotics -Penicillin, Cephalosporin, Griseofulvin, Industrial production of Penicillin

ii) Enzymes -. Amylase, proteases, Lipases, Pectinases, Cellular and xylanases.

iii) Organic acids -Critic acid, Gluconic acid, lactic acid, kojic acid, Itaconic acid.

B) Non Industrial Fungal Metaboilites:

i) Phytoalexins, ii) Mycotoxins

Module IV: Fungi as welfare to human beings

i) Fungi in food processing: soybean products, cheese, fermented milk, other fermented foods.

ii) Fungal metabolites – General account of production and application: Primary metabolites (vitamins, proteins), Secondary metabolites (antibiotics, pigments, alkaloids)

iv) Fungi as food -edible mushrooms, methods oftheir cultivation

v) Concept of biodeterioration and Biodegradation

a) Biodeterioration of non-cellulosic materials (leather, plastics, hydrocarbons, pesticides)

b) Biodeterioration of cellulosic materials.

c) Role of microorganisms in Biodegradation of organic wastes. Factors affecting the process of Biodegradation.

Suggested readings

1. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.

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6. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.

7. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.

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13. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.

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18. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.

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20. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.

21. Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.

22. Sunder Rajan, S. (2001) Tools and Techniques of Microbiology, Anmol Publ.New Delhi.

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24. Vaidya, J.G. (1995) Biology of the fungi, Satyajeet Prakashan, Pune.

25. Walker, J.G. (1952) Diseases of Vegetables Crops. McGraw Hill, New York.

26. Walker, J.C. (1968) Plant Pathology, McGraw Hill, New York.

27. Eggins, H.O.W. and Allsop (1975) The Filamentous Fungi Vol. I Industrial Mycology (Biodetoriation and Biodegradation by Fungi) Eds. J.E. Smith and D.R. Berry Edward Arnold, London.

28. Emmons, C. W., C. H. Bin ford, J.P. Utz and Know Chung (1977) Medical Mycology, Lea and Febigo, Philadelphia.

29. Holliday, P. Fungus disease of tropical plants (1980), Cambridge University Press, Cambridge.

On line Journals available on UGC -VSAT

Practicals

1. Principles & working of tools, equipments and other requirements in the Mycology & Plant Pathology laboratory.

2. Micrometry and measurement of organisms.

3. Sterilization Processes viz. moist heat, dry heat, chemical and radiation.

4. Drawing of Camera Lucida diagrams and knowledge of computer based photomicrography and image processing

5. Preparation of different cultural media for cultivation of Fungi and Bacteria.

6. Monitoring and analysis of Aeromycoflora.

7. Isolation & identification of Phyllosphere mycoflora.

8. Demonstrate antifungal activities of different antibiotics and leaf, flower and root extract.

9. Study of toxicity of fungi in relation to seed germination, and seedling abnormality.

10. Cultivation of Mushrooms.

11. Demonstration on biodegradation of organic waste.

12. Isolation of Soil fungi by soil plate (War cup) and serial dilution (Walksman) method.

13. Isolation and identification of Rizosphere mycoflora.

14. Isolation of external and internal seed borne mycoflora by blotter and Agar Plate method. Cereals, pulses, oil seeds, fruit seeds.

15. Demonstration of Koch's Postulate.

16. Calculation of spore count using haemocytometer.

17. Qualitative estimation of enzymes – cellulases, amylases.

18. Estimation of sugars, proteins and aminoacids in fungal mycelium and culture filtrate.

19. Study of mycorrhiza (VAM)

20. Monographic study of locally available plant diseases caused by fungi (atleast 10).

21. Study of locally available crop plant diseases caused by Bacteria (Five)

22. Study of locally available plant diseases caused by viruses & Phytoplasma (Five)

23. Demonstration of morphological & physiological changes in disease plants.

24. Preparation and presentation of herbarium of pathological specimens available in the region (Atleast 15)

25. Field visit to different localities Visit to Agriculture University, Plant Pathological research centers

Semester III

3T3 - Core Elective I:(Palynology - I)

Objectives:

- **Know the history, palynological centres in India**
- **Understanding the structure of pollen & pistil and their importance.**
- **Understanding pollination, floral adaptations to diff. Pollinators, applications of pollen biology.**
- **Knowledge on different types of honeys, uses of honey in medicine, cosmetics etc.**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the diff. aspects of pollen, pistil and pollination**

Applying knowledge with reference to agriculture, horticulture, medicine

Module I

General aspects of Palynology: -Historical background, Definition, basic concepts, scope,inter-relationship with other branches of Botany, Applications, Indian work on Palynology,Palynological centres in India.

Microsporogenesis : Stamen initiation, anther differentiation- anther initiation, anther wall,Tapetum, structure and functions, its role in pollen development, Functions of callose wall,pollen/microspore and wall development, production and deposition of sporopollenin.

Pistil : Structure and function of stigma and style, stigma receptivity and its importance.

Module II

Pollination Biology -Origin of pollination biology/anthecology, Spore and pollen dispersal inlower plants and gymnosperms, Pollination in angiosperms- types of pollination, floral adaptation to different pollinators(mode, style) flowers pollinated biotically (Hymenoptera, Diptera, Coleoptera, Lepidoptera,birds, bats) and abiotically (wind, water), pollination-plant interactions, special devices associated with pollinator attraction - pollen, nectar,Elaiophores, resin glands, osmophores, floral scent and perfume flowers.

Palaeopalynology: - Palynomorphs, their preservation in diverse lithic types, techniquesinvolved in the recovery and concentration of spores and pollen from clays, shales, coals andlignites. Maceration techniques, Application of Palynology in relation to oil and coal exploration. Role of spores and pollen in stratigraphy, index spores.

Module III

Phylogeny of Pollen and spores, Systematic palynology-monocotyledoneae anddicotyledoneae, evolutionary trends among pollen grains based on palynotaxonomical works, Palynology of spores / pollen- Algae, Fungi, Bryophytes, Pteridophytes and pollen types ofGymnosperms.

Pollen morphology of Angiosperms.: Introduction- Pollen units, polarity, symmetry, Shape, size, Apertures size, shape of thepollen grain, sporoderm stratification, Apertures-NPC System of classification, Apertural types, Exine ornamentation, LO analysis, evolutionary trends in exine structure, trends of evolution in apertural pattern, Techniques for the preparation of pollen slides, Light and scanning election microscopic studies of pollen, significance of SEM and TEM studies.

Module IV

Melittopalynology- Pollen analysis of honey-methods, qualitative and quantitative, social organization of honey bees, foraging behavior, geographical and floral origin of honey, its chemical analysis, adulteration of honeys, physical characteristics of honey, deterioration of honey, heavy metal contamination in honey, honey as environmental monitors, unifloral and multifloral honey, Applied Palynology with special reference to Agriculture and Horticulture - Bees as pollinators, role of apiaries in crop production. Use of honey in medicine, cosmetics, confectionary and other applications, Pollen loads, analysis, Bee pollen, chemical composition, utility, and its role in curing various human ailments.

Siggested Readings

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2. Agashe S. N. – Paleobotany (1997) – Plants of the past their evolution paleoenvironment and applications inexploration of Fossil.
3. Agashe S. N. – Palynology and its Applications – Oxford and IBH Publishing Co.Pvt. Ltd. New Delhi.
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5. Alexander, M.P. (1987). A method for staining pollen tubes in pistil. Stain Technol 62, 107-112.
6. Alexander, M.P., Ganeshan S. (1990).An improved cellophane method for *in vitro*germination of recalcitrant pollen. *Stain Technol* 64:225-227. Archaeology, *Rev.Palaeobot. Palynol* 21:171-185,
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15. Chowdhary, J.B. and T.M. Varghese. 1968. Pollen sterility in crop plants- A review *Palyn. Bull.*IV (2).
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18. Cronquist, A. 1968. The evolution and classification of flowering plants, Nelson, London
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21. Dumas C, Knox R.B. (1983). Callose and determination of pistil viability and incompatibility. Theor Appl. Genet 67: 1 -10.
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24. Erdtman, G, (1956) "Lo-analysis" and "Welcker's rule". Sven Bot. Tidskr. 50:1-7.
25. Erdtman, G. 1945. Pollen Morphology and Plant Taxonomy IV Labiatae,Verbenaceae, Avicenniaceae. Svensk Botanisk Tidskrift. 39(3),
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List of practicals:

Section A. Basic aspects / Pollen Morphology

1. To study structure of stamen
2. Study of permanent slides of microsporogenesis
3. Field study on different pollination mechanism
4. To study structure of pistil
5. Preparation of glycerin jelly
6. Preparation of pollen- Acetolysis technique
7. Preparation of pollen – Wodehouse technique.
8. Study of pollen types using acetolysed and non-acetolysed pollen. Pollen
9. morphology polarity, symmetry, shape, size, sporoderm stratification aperture NPC(To study the pollen types from at least 30 different species, Angiosperms preparation of permanent slides.)
10. Preparation and palynological description in technical language (at least 10 speciesof Angiosperms).

11. Interpretation of selected electron micrographs (SEM, TEM) of pollen.

12. Preparation, description and identification of spores of Algae, Fungi, Bryophytes,Pteridophytes and pollen types of Gymnosperms.

Section B. Aeropalynology/Melittopalynology/Palaeopalynology (Atleast two expts.)

13. Use of pollen traps to study local air-spora.

14. Analysis of aerospora slides.

15. Preparation of reference slides by different techniques, culture method (culture of fungi/Algae)

16. Preparation of slides honey samples

17. Analysis of honey samples for qualitative and quantitative study of pollen contents.

18. Estimation of pollen load from bee hive or bees/ pollinator

19. Analysis of coal samples for microfossils with special reference to pollen and spores.

20. Preparation of allergenic extract of pollen.

Section C Pollen Physiology/ecology/biochemistry/ecology. (Atleast three expts)

21. To study pollen production of the given flowers.

22. To study pollen viability of the given flowers.

23. To study percentage of pollen germination & rate of pollen tube growth.

24. To study different techniques of pollen storage

25. Effect of temperature and relative humidity on viability of stored pollen

26. Effect on Boron and Calcium on pollen germination and tube growth.

27. Semi-vivo technique to study pollen germination and pollen tube growth.

28. Multiple staining for localizing pollen tubes in the pistil

29. To study pollen germination and pollen tube growth in the pistil by employing aniline-blue fluorescence method

30. Cytochemical localization of esterase on stigma surfaces

31. Cytochemical analysis of pollen and pollen tube for various metabolites like proteins, amino acids, carbohydrates, starch, ascorbic acid, DNA, RNA, lipids,lignin, pectin, cellulose, etc (at least five metabolites)

32. Study of pollen contents by paper chromatography/TLC.

33. Colorimetric estimation of proteins/carbohydrates of pollen grains

34. To separate pollen proteins by SDS-PAGE electrophoresis

35. Enzyme bioassay in pollen grains.

Semester III

3T3 - Core Elective I:(Plant Physiology - I)

Objectives:

- **Understanding Plant growth and Development.**
- **Understanding the function of different growth regulators.**
- **Understanding seed physiology**
- **Understanding stress physiology**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the aspects of plant growth and development**

Understand the aspects of seed physiology and stress physiology

Module:-I

Plant Growth and Development: - Growth, Differentiation and development. Control of growth and development, genetic control of development, hormonalControl of development. Pattern of growth and development, Plant growth Kinetics- Growth through time, Plant organs- How they grow? Morphogenesis.

Nitrogen: Importance of nitrogen for growth and development,nitrogen cycle, biological nitrogen fixation, symbiotic nitrogen fixation in legumes

Module-II

Growth Regulators (Plant Hormones): -Biosynthesis, Storage, breakdown and transport, physiological effects and movement of action., ABA, ethylene And nontraditional growth hormones, Jasmonate, Brassinosteriods, oligosachharins, polyamines, salisalate, nitric oxide, commercial application of plant growth regulators,

A brief idea about role of plant growth retardants: - a) CCC b) maleic hydrazide c) Trizoles d) TIBA

Module-III

Seed physiology:-

Structure of monocot and dicot seed

Latent life -Seed dormancy: Importance and types of dormancy, overcoming seeddormancy, bud dormancy. Factors responsible for dormancy, mechanism of dormancy, methods of breaking the seed dormancy.

Germination of seed: types of germination, chemical Changes duringgermination, mobilization of reserve Food during germination, hormonalControl seed Germination

Post Harvest Physiology: Ripening of fruit and its regulation, metabolismof leafy vegetables during storage.

Seed development: Biochemical changes during development of seeds.

Module-IV

Stress physiology: Response of plants to biotic(pathogen and insect) and abioticStress (water, temperature and salt)

a) Biotic Stress: - mechanism of resistance to biotic stress (HR, SAR) and tolerance to abiotic stress

b) Abiotic Stress:-

Water stress: - causes of water stress, drought effect On physiological processesin plants,various mechanism of drought resistance in plants.

Flooding stress: - nature of water logging stress. Effect of flooding onphysiological processes in plants. Mechanism of water logging tolerance

Salt stress :- definition of saline soil, physiological responses ofplants to salinitystress, halophytes and glycophytes mechanism of salinity tolerance in higherplants, genetic engineering for salt tolerance.

Thermal stresses: - Effect of high and low temperatures on plant metabolism,mechanism of high and low temperatures tolerance, cold hardening, role of HSP.

Oxidative stress: - Generation of reactive oxygen species, effect ofROS onmetabolism, ROX detoxification mechanisms in plants.

Suggested Readings (For theory):

Asana, R.D. and Sarin M.N. (1968): Crop Physiology in India IARI Publ.

Abdelhamid Elaissari, (2008). Colloidal Nanoparticles in Biotechnology, John Wiley

Apps *et al*., (1992).Biochemistry, ELBS.

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Bewley. J.D. and Black, M. 1994. Seeds: Physiology of Development andGermination, Plenum Press. New York.

Charles PP and Frank JO, (2006).Introduction to Nanotechnology, Wiley India Ed.

Cherry , J. H. 1989. Environmental stresses in plants .biochemical and physiological

mechanisms.

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Fageria, N. K. 1992. Maximizing crop yield.

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Gupta, U. S. (1972): Crop Physiology.

Gupta, I. S. (1986): Physiological aspects of dryland farming.

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Gaiston, A.W.1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.

Hans-Walter Heldt (2004) Plant Biochemistry . Elsevier Academic Press, 200 Wheeler Road, Burlington, MA 01803, USA, 525 B Street, Suite 1900, San Diego, California 92101-4495,USA

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Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York,USA.

Hale, M.C. and Orcutt, D.M. (1987): The Physiology of Plants Under Stress. ICARhandbook of Fertilizers.

Jain J.L. *et al.*,(2008). Fundamentals of Biochemistry, Chand ,New Delhi

Kozlowski, T. T. (1984): Flooding and Plant Growth. 11. Levitt, J. (1969, 1980): Responses of Plants to Environmental Stress.

Lodish, H., Berk, A., Zipursky S.L., Matsudaira, P., Baltimore, D and Darnell, J. 2000. Molecular Cell Biology (4thed). W. H. Freeman and Company. New York ,USA.

Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2nded). Springer- Verlag, New York, USA.

Mansfield, C.A. (1976): Effect of air pollutant on plants.

Marschner, H. W. (1986): Mineral nutrition of Higher Plants.

McLaren, J.S. (1985): Chemical manipulation of crop growth and Development.

Mehrotra, R.S. (1980): Plant Pathology.

Mahadevan ,A and Sridhar R.(1986) Methods in Physiological plant Pathology, Sivakami Publications, Madras

Nobel, P.S.1999. Physicochemical and Environmental Plant Physiology (2nd ed). Academic Press, Diego, USA.

Nelson D.L, Cox M.M.(2005). Lehninger Principle of Biochemistry, W.H. freeman and Company, New York

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Pessarkli, M. (2005): Handbook of Photosynthesis.

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Paleg, L.G. and Aspinal, D.(1982): The Physiology and Biochemistry of Drought resistant in Plants.

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Steeves, T.A. and Sussex, I.M., 1989.Patterns in Plant Development (2nd edition).

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Satyanaryana U, Chakrapaani U, (2006). Biochemistry, Books and Allied (P)Ltd.

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Sinha S.K., Sane P.V., Bhargava S.C. and Agarwal P.K. (1990): Proceeding ofInternational Congress of Plant Physiology Vol. I & II.

Salisbury, F.B. and Ross, C.W.1992: Plant Physiology (4thed). Wadsworth Publishing Co.,California, USA.

Singhal G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee.1999: Cocepts in PhotobiolPhotosynthesis and Photomorphogenesis. Narosa Publishing House, NewDelhi.

Turner, N. C. and Cramer, P.J.(1980): Adaptation of plants to water and high temperature stress.

Taiz, L. and Zeiger, E. 1998: Plant Physiology. Sinaucr Associates, Inc., Publishers,Massachus, USA.

Thomas,B. and Vince-Prue,D.1997: Photoperiodism in Plants (2nd ed).Academic Press, San Diego, USA.

Upeke, L. K. (1982): Tropical tree crops.

Westhoff, P.1998: Molecular Plant Development: From gene to plant. Oxford University Press, Oxford, UK.

Zuley G.L., (1998). Biochemistry, Wm.C .Brown Publishers USA.

Journals

- Annual reviews of Plant Physiology and Molecular Biology.
- Indian Journal of Plant Physiology.
- Journal of Experimental Botany.

Suggested Laboratory Exercises

1. Estimation of phenols from given plant material.
2. Estimation of proline from plant tissues under different environmental and physiologicalconditions.
3. Study the effects of red and infrared radiation on seed germination as affected.
4. Determination of gibberellic acid by half seed (cereal) method.
5. Demonstration of effects of auxin on abscission.
6. Demonstration of effects of cytokinin on senescence.
7. Demonstration of effects of abscission acid on stomatal regulation.
8. Preparation of cytoplasmic and chloroplastic LPC.
9. Estimation of Vitamin 'C' from suitable plant material.
10. Estimation of alkaloids from medicinal plants.
11. Study of changes in starch / protein content during seed development.
12. Study of lipid accumulation during development of oil seeds.
13. Study of effect of PEG induced water stress on seed germination.
14. Study the effect of ZnSO4 (800ppm) solution on (paddy) seed germination
15. study the physical and chemical methods for breaking the seed dormancy .

Suggested Readings (for laboratory exercises):

Bajracharya, D. 1999. Experiments in Plant Physiology: A Laboratory Manual. Narosa Publishing House, New Delhi.

Cooper, T.G. 1977. Tools in Biochemistry.John Wiley, New York, USA.

Copeland, R.A. 1996. Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis. VCH Publishers, New York.

Dennison C. 1999. A guide to Protein Isolation. Kluwer Academic Publishers, Dordrecht, The Netherland.

Devi, P. 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics.Agrobios, Jodhpur, India.

Dryer, R. L. and Lata, G. F. 1989.Experimental Biochemistry. Oxford University Press, New York.

Hames, B.D.(Ed.).1998. Gel Electrophoresis of Proteins: A Practical Approach, 8th edition. PAS, Oxford University Press, Oxford, UK.

Harborne, T.C. 1981. Phytochemical Methods: A Guide to Modern Techniques of Plants Analysis. Chapman& Hall, London.

Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory Manual. Springer-Verlag, Berlin.

Ninfa, A. J. and Ballou, D. P. 1998. Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Fitzgerald Science Press, Inc., Maryland, USA.

Plummer, D.F. 1988.An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

Scott, R.P.W. 1995. Techniques and Practice of Chromatography.Marcel Dekker, Inc., New York.

Wilson, K. and Goulding, K.H.(Eds), 1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London,UK.

Wilson, K. and Walker, J. 1994. Practical Biochemistry: Principles and Techniques, 4th edition. Cambridge University Press, Cambridge, UK.

Sadasivam and Manikum: Biochemical Methos , New Age International (p) Limited Publishers 4835/24, Ansari Road, Daryaganj, New Delhi- 110002

Semester III

3T4 - Foundation Course I: General Botany

(Student shall opt for this paper from any other subject other than his/her main subject for post graduation)

Objectives:

- **Understanding the morphology and histology of plant, taxonomy of plants**
- **Understanding concept of biodiversity and ecotourism, vision on ecotourism.**
- **Knowledge on local plant resources etc.**
- **Understanding on ecosystems, food chain and biodegradation of waste, pollution**

Outcomes:

After successful completion of the course the students will be able to

- **Learn different aspects of morphology, history, taxonomy biodiversity, biodegradation, pollution and ecotourism.**
- **Learn to apply knowledge of ecotourism development.**

Module I: Morphology and Taxonomy

Morphology of- Root, stem, leaf, flower and fruit.

Histology- Cell types and tissue systems in plant, specialized cells

Taxonomy- Classification system of Bentham & Hooker; General characters of- Fabaceae, Solanaceae, Verbanaceae, Liliaceae, Poaceae, Plant identification techniques.

Module II: Biodiversity & Ecotourism

Concept of biodiversity; Types (Species, genetic, ecosystem diversity); present status in India; Values of biodiversity; Mega-biodiversity centres; CBD- General account.

Aesthetic beauty of wild beautiful plants and their value in nature for Ecotourism point of view in various forests.

Module III: Plant resource utilization

Botany and uses of plants as a source of- fire wood, timber, Non-Wood forest products, cereals, pulses, oilseeds, spices, condiments, narcotics, beverages, fodder, forage, medicine and essential oil (any three of each type).

Module IV: Ecology & Biodegradation of waste

Introduction, concept of ecosystem, types of ecosystems, food chain and food web.

Pollution: Sources, consequences control of soil, air and water pollution. Carbon credit.

Various methods of bio-degradation of waste materials.

Suggested readings

Dash MC 1993.Fundamentals of Ecology. WB Saunders can Co., Philadelphia.

Devis, P.H. and Heywood, V. H. 1973.Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.

Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.

Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw -Hill Book Co., New York.

Khalid H and Nawaz K 2014.Introductory plant taxonomy. Kalyani Publ., New Delhi.

Kochhar PL 1986. Plant Ecology. Ratan Prakashan, Agra.

Kochhar SL 1998. Economic Botany in tropics 2e. Macmillan India Ltd., New Delhi.

Kumar HD 1994. Modern concepts of ecology. Vikas Publi. House Pvt. Ltd., New Delhi.

Sharma OP 1996 Hill's Economic Botany. TMH Publ. Co. Ltd., New Delhi.

Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.

Semester III

3T4 – Core : Aesthetic Botany

Objectives:

- **Knowledge on floristic regions of the world and India, endemism, hotspots etc.**
- **Understanding the scope, components of the garden and features of the garden**
- **Knowledge on scope of floriculture, methods of propagation and its importance in designs**
- **Understanding the scope of landscape, elements of landscape, importance of polyhouses, designing of lawns and cactus garden.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn phytogeographical regions of India, world, scope of gardening, landscaping.**
- **Learn designing of lawns and cactus, ornamental gardens.**

Module I – Phytogeography

Climate and Vegetation of the world

Floristic regions of the world. Phytogeographical regions of India; Endemism; Concept of hotspots, hot spots of the world. Forest types of India

Module II – Gardening

Garden Design: Scope and objectives of gardening; Style of gardens (Formal, Informal); Types of gardens (English, Mughal and Japanese)

Components of garden; Planning of outdoor gardens- Small, Residential, Larger Home Garden, Roof Garden, Terrace Garden, Industrial garden, Housing complex, Indoor gardening

Garden Features and Ornamentation: Water, Garden pool, Stream, Waterfall, Fountain, Rocks, Roads, Walks, Pavements and Steps, Walls fences and Gates, Hedges, Edges, Arches, Statues, Towers.

Module III– Floriculture

Nursery production and management: Scope, Site, Soil, Environment, Layout, Manure, Fertilizers, Maintenance, Garden tools, Culture and Garden calendar, Types, Nursery beds, Pest & Disease management.

Propagation of ornamental plants by seeds, bulbs, layering, cuttings, grafting, budding & tissue culture.

Plant disorders including nutrition, pests and diseases, and chimaeras

Ornamental ferns and their propagation; herbaceous perennials, Annuals & Biennials: Important Genera and Species, their importance in garden designs.

Module IV – Landscaping

Landscape Design: Definition, objectives and scope, Landscape elements of construction and designing of Residential, Commercial, Bungalow, Public area, Hotel, Educational Institute and religious places Palms and Cycas: Characteristics, propagation, culture, pest and disease, importance and uses, genera and species of palms and Cycads. Bamboo and conifers: Genera, species and varieties

Lawns & Grasses: Planting methods, maintenance, pest management

Ornamental succulents, Cacti

Polyhouse technology: Scope and objectives of floriculture.

References

Randhawa GS and Mukhopadhyay A. 2004.Floriculture in India.Allied Publishers Pvt. Limited.

Swarup Vishnu. 2003. Garden Flowers. National Book Trust

Hartmann HT, Kester DE, Davies FT and Geneve RL. 2002. Plant Propagation – Principles and Practices. Prentice Hall India Ltd.

Royal Horticultural Society's Encyclopedia of Gardening.

Semester IV

4T1 - Core : Cell and Molecular Biology-II

Objectives:

- **Knowledge on structure and functions of ribosomes, mechanism of transcription and translation in pro- and eukaryotes.**
- **Understanding the gene structure and regulation of gene expression**
- **Knowledge on genome organization and recombination mechanisms**
- **Understanding the mechanism of cell cycle, apoptosis, techniques in cell biology**

Outcomes:

After successful completion of the course the students will be able to

- **Learn structure and functions of ribosomes, mechanism of transcription and translation.**
- **Learn gene structure and regulation of gene expression**
- **Learn mechanism of cell cycle, apoptosis, application of cell biology techniques.**

Module I:

Ribosomes: Structure and function

Transcription: Transcription in prokaryotic and eukaryotic cells, plant promoters, transcription factors, types of RNA and their function, RNA splicing, mRNA transport

Translation:In prokaryotic and eukaryotic cells, structural levels of proteins, post-translational modification; structure and role of rRNA and tRNA.

Module II:

Protein sorting: Protein glycosylation; vesicles involved in protein transport; protein targeting to plastids, mitochondria, peroxisomes, nucleus, vacuoles; modification during transport.

Gene structure: Chemical nature of gene; Fine structure of gene: Classical and modern concept of gene, Cis-trans test; fine structure analysis in eukaryotes; introns and their significance, RNA splicing

Regulation of gene expression:Prokaryotes- Positive and negative control, inducible and repressible operons, lac operon, trp operon, attenutation, riboswitch; Eukaryotes- Regulation at DNA, transcription, translation and post translational level, Epigenetic regulation

Module III:

Genome organization in prokaryotes and eukaryotic organelles: Phage genome, genetic recombination in phage and mapping phage genes; mapping of bacterial genes through transformation, conjugation and transduction; genome of mitochondria and chloroplast.

Genetic recombination and genetic mapping: Recombination; independent assortment and crossing over; molecular mechanism of recombination; role of RecA and RecBCD enzymes; homologous, non-homologous and site-specific recombination; chromosome mapping- linkage

group, genetic markers, types of maps, construction of molecular maps, correlation of genetic and physical maps; Somatic cell genetics -an alternative approach to gene mapping.

Module IV:

Cell cycle and apoptosis: Control mechanismsof bacterial and eukaryotic cell cycle, check point control, presence of regulators of cell cycle, G1 – S progression, G2 – M progression, role of cyclins and cyclin dependent kinases; retinoblastoma and E2F proteins; cytokinesis and cell plate formation; Apoptosis and its pathway.

Signal transduction:Overview, receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascades, diversity in protein kinases and phosphatases, specific signaling mechanisms e.g. two-component sensor-regulator system in bacteria and plants, sucrose sensing mechanism

Techniques in cell biology: Electrophoresis, immunotechniques(Western blotting and ELISA), FISH, GISH, confocal microscopy

Suggested readings

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999.

Molecular Biology of Cell, Garland Publishing, Inc., New York.

Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 Biochemistry and Molecular Biology of Plants. American Soc. Of Plant Physiologists, Maryland, USA.

De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.

Jones R, Ougham H, Thomas H, Waaland S 2013 The Molecular life of plants. Wiley-Blackwell, USA

Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.

Khush, G.s. 1973 Cytogenetics of Aneuploids, Academic Press, New York, London Kleinsmith, L.J. and Kish, V.M. 1995 Principles of Cell and Molecular Biology (2 nd Edi.) Harper Collins Coll. Publisher, New York, USA.

Lewin, B. 2000 Gene VII Oxford Univ. press, New York.

Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi.W.H. Freeman and Co., New York, USA.

Malacinski, G. M. and Freifelder, D. 1998 Essentials of Molecular Biology (3rd Edi.)Jones and Bartiet Pub. Inc., London.

Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA

Sunstad, D. P. and Simmons, M. J. 2000 Principles of Genetics (2nd Edi.) John Wiley & Sons Inc., USA.

Tamarin, R. H. 2001 Principles of Genetics 7th Edi.The McGraw-Hill Companies.

Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.

References: Online journals available on UGC V-SAT programme

Practicals

1. Isolation of nuclei and identification of histones by SDS-PAGE.
2. Isolation of chloroplast and demonstration of two subunits of RUBISCO by SDS-PAGE
3. To perform the restriction digestion of the DNA and analyse the digest over agarose gel.
4. To study *in vitro* transcription.
5. To study *in vitro* translation.
6. To study conjugation in bacterial cells.
7. To detect the presence of specific antigen by ELISA
8. Isolation of RNA and quantification by spectrophotometric method.
9. To map the genes on the basis of given cross-over data.
10. Separation of amino acids by paper electrophoresis, TLC method.
11. Separation of carbohydrates by paper electrophoresis, TLC method.

Semester IV

4T2 - Core: Plant Biotechnology and Plant Breeding

Objectives:

- **Understanding the principles and techniques of gene cloning, types of vectors**
- **Knowledge on recombinant DNA technology & its tools, microbial genetic manipulations.**
- **Understanding the basic concepts of tissue culture and knowledge on transgenics.**
- **Practical knowledge and analysis skills in usage of various bioinformatic tools.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn gene cloning, recombinant DNA technology etc.**
- **Learn ttissue culture methods.**
- **Learn and apply bioinformatic tools for analysis of bioinformation data.**

Module I

a. Recombinant DNA technology: Gene cloning- Principles and technique; vectors- types (cloning & expression; plasmid & viral) and their properties; construction of DNA libraries (gDNA and cDNA); splicing of insert into the vector; screening of DNA libraries and introduction of the recombinant DNA into the host cells.

b. Genetic engineering of plants: Aims, strategies for development of transgenics (with suitable examples); Agrobacterium-the natural genetic engineer; T-DNA and transposon mediated gene tagging.

Module II

a. Microbial genetic manipulation: Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.

b. Genomics and proteomics: Molecular markers for introgression of useful traits; high throughput sequencing; functional genomics; Protein profiling and its significance.

c. DNA synthesis; DNA sequencing; basic polymerase chain reaction and applications of PCR; DNA fingerprinting

Module III

Plant tissue culture: Basic concepts; Principles and scope; tissue culture media; callus induction and cell suspension; aspects of morphogenesis; haploid and triploid production; production of somatic embryos; applications of plant tissue culture; protoplast isolation and culture; production of cybrids

Transgenic production: Methods to introduce gene in plants; selection of transformed plants/explants; salient achievements in crop biotechnology.

Module IV

Bioinformatics: Introduction, History, Definition and applications of bioinformatics; Database: Sequences (nucleotide and amino acid); nomenclature- IUPAC symbols, nomenclature of DNA & protein sequences, directionality of sequences, types of sequences used in bioinformatics; Definitions, types and classification of databases- Primary Databases, Secondary databases, Literature database and Taxonomy database.

Plant breeding: Methods of breeding sexually (self and cross pollinated) and vegetatively propagated crops; heterosis and inbreeding depression and their genetic basis; use of male sterility in hybrid production.

Suggested readings

Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics, John-Wiley and Sons Publications, New York.

Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.

Brown, T. A. 1999. Genomes, John Wiley &Sons(Asia) Pvt. Ltd., Singapore.

Callow, J. A., Ford-Lloyed, B. V. and Newbury, H. J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.

Chrispeeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture.Jones & Barlett Publishers, Boston, USA.

Dubey, R. C. 2014 Advanced Biotechnology. S. Chand & Co. Pvt. Ltd., New Delhi.

Glazer, A. N. and Nikaido, H. 1995.Microbial Biotechnology. W. H. Freeman & Company, New York, USA.

Gustafson, R. J. 2000. Genomes.Kluwer Academic Plenum Publishers, New York, USA.

Henry, R. J. 1997. Practical Applications of Plant Molecular Biology.Chapman & Hall, London, UK.

Jain, S. M., Sopory, S. K. and Veilleux, R.E. 1996. In vitro Haploid Production in Higher Plants, Vols. 1-5, Fundamental Aspects and Methods. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics.Birkhauser Verlag, Basel, Switzerland.

Kartha, K. K. 1985. Cryopreservation of Plant Cells and Organs.CRC Press, Boca Raton, Florida USA.

Kingsman, S. M. Genetic Engineering : An Introduction to Gene Analysis and Exploitation in Eukaryotes, Blackwell Scientific Publications, Oxford, 1998

Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi

Old, R. W. and Primrose, S. B. 1989.Principles of Genome Analysis.Blackwell Scientific Publications. Oxford, UK.

Primrose, S. B.1995. Principles of Genome Analysis.Blackwell Scientific Ltd., Oxford, UK.

Raghavan, V. 1997.Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.

Practicals

1. To study the growth characteristics of *E. coli* using plating and turbidimetric methods.

2. To isolate the plasmid from *E. coli* and quantify it with suitable method.

3. To perform restriction digestion of the given plasmid DNA and to estimate of the size of various DNA fragments.

4. To Clone the given DNA fragment in a plasmid vector.

5. To prepare competent cells from the given bacterial culture.

6. To transform the competent bacterial cells with the given vector and perform blue-whit selection.

7. To prepare the media for plant tissue culture.

8. To surface sterilize the given seeds/explant for tissue cultural manipulation.

9. To isolate protoplast and determine its viability.

10. To fuse the protoplast for production somatic hybrid.

11. To workout the DNA sequence from the given autoradiogram and identify the gene using online tools.

12. To search literature database of different organisms.

13. To search the genes in the Genebank.

14. To use the various tools to retrieve information available from NCBI

15. To locate gene(s) on chromosomes for a given disease/disorder.

Suggested Readings(for laboratory exrcises)

Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.

Glover, D. M. and Hames, B. D.(Eds) 1995. DNA Cloning 1: A Practical Approach: Core Techniques, 2nd edition PAS, IRL Press at Oxford University Press, Oxford.

Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques.Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.

Maniatis et al. Molecular cloning Vol.I, II and III.Cold-Spring Harbor Lab Press.

Shaw, C. H. (Ed.) 1988, Plant Molecular Biology : A Practical Approach. IRl Press, Oxford.

References: Online journals available on UGC V-SAT programme.

Semester IV

4T3 -Core Elective II:(Molecular Biology and Plant Biotechnology - II)

Objectives:

- **Understanding the methods of gene transfer.**
- **Know the applications of transformation, transgenics, molecular farming.**
- **Knowledge on some methods of tissue culture.**
- **Practical knowledge and analysis skills in usage of various DNA fingerprinting techniques.**
- **Knowledge on pollution cleaner Biotechnology.**

After successful completion of the course the students will be able to

- **Learn gene transfer methods, transgenics, molecular farming etc.**
- **Learn tissue culture methods.**
- **Learn and apply DNA finger printing techniques for analysis of molecular markers.**

Module I:

Transgenic plants: Cloning vectors for higher plants; Methods for gene transfer, *Agrobacterium tumefaciens*mediated gene transfer-Basis of tumour formation, features of Ti and Ri plasmids, mechanisms of DNA transfer, role of virulence genes;Direct DNA transfer- particle bombardment, electroporation, microinjection, macroinjection, liposomes, electrophoretic; pollen tube method; pollen transformation; PEG method; transformation of monocots; transgene stability and gene silencing; chloroplast transformation.

Module II:

a. Applications of transformation: Herbicide resistance; insect resistance; Bt genes, disease resistance; Nutritional quality; biopesticides and biofertilizers; hazards and safety regulations for transgenic plants.

b. Transgenics and molecular farming: Production of secondary metabolites; industrial enzymes; biodegradable plastics (PHB and any other); edible vaccines; antibody production and other important drugs.

Module III:

Plant tissue culture: History, Culture types- Callus culture, organ culture, suspension culture for production of secondary metabolites, protoplast culture, fusion and somatic hybrids, Somatic embryogenesis, production of haploid plants, somaclonal variations, organogenesis (direct and indirect).

Module IV:

a. DNA fingerprinting and marker assisted breeding:RFLP maps; linkage analysis; RAPD markers; STS; SSR (microsatellites); ISSR; SCAR (sequence characterized amplified regions); SSCP (single strand conformational polymorphism); AFLP; QTL: map based cloning; molecular marker assisted selection

b. Cleaner Biotechnology: Pollution control through genetically modified organisms; types of pollutants, bioremediation and phytoremediation; Production of bioethanol, biodiesel and biohydrogen.

Suggested readings

Alberts, Bruce; Johnson, Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter, Bhojwani SS and Rajdhan MK 1996 Plant tissue culture: Theory and Practice. Elsevier Sci. Publ., New York

Peter 2002 Molecular Biology of the Cell, New York and London: Garland Science.

Callow, J. A., Ford-Lloyed, B. V. and Newbury, H. J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.

Charlwood, B. Y. and Rhodes, M.V. 1999 Secondary products from plant tissue culture, Clarendon Press. Oxford.

Chrispeeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture.Jones & Barlett Publishers, Boston, USA.

Collins HA and Edwards S 1998 Plant cell culture. BIOS Sci. Publ., Oxford UK

Dicosmo F and Misawa, M. 1996 Plant Cell culture: Secondary metabolism towards industrial application, CRC press, Boca Raton, NewYork.

Glazer, A. N. and Nikaido, H. 1995.Microbial Biotechnology. W. H. Freeman & Company, New York, USA.

Gustafson, R. J. 2000. Genomes.Kluwer Academic Plenum Publishers, New York, USA.

Henry, R. J. 1997. Practical Applications of Plant Molecular Biology.Chapman & Hall, London, UK.

Jain SM, Sopory SK and Veilleux RE 1996 In vitro haploid production in higher plants. Vols. 1-5. Kluwer Acad. Publ., The Netherlands

Kurz, W.G.W 1989 Primary and Secondary metabolism of plant and Cell cultures, Springer Verlag, Berlin.

Old, R. W. and Primrose, S. B. 1989.Principles of Genome Analysis.Blackwell Scientific Publications. Oxford, UK.

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Raghavan, V. 1997.Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.

Shantharam, S. and Montgomery, J. F. 1999.Biotechnology, Biosafety, and Biodiversity. Oxford & IBH Publication Co., Pvt., Ltd., New Delhi.

Semester IV

4T3 - Core Elective II:(Reproductive Biology of Angiosperms - II)

Objectives:

- **Understanding of mechanism of fertilization. Formation of endosperm, nutritive part of the seeds.**
- **Understanding of development of embryo, variation in types of embryo formation,**
- **Understanding of use of biotechnology in solving plants reproductive problems and metabolite production and its uses.**

Outcomes: After completion of the course, the student will be able to

- **Learning of problems in fertilization and fruit froduction.**
- **Analysis of type of reproduction, production of seedless fruits and role of insects in the fruit formation/pollination**
- **Understanding and application of knowledge of role of biotechnology in the reproduction and their uses for human welfare.**

Module I:

Fertilization: Cellular nature of sperm, the sperm cytoskeleton, the male germ unit, isolation and characterization of sperm, growth of the pollen tube through the style, passage of sperm into the embryo sac, fussion of nuclei, double fertilization, triple fussion, unusual features. In-vitro approaches to the study of fertilization-Intra-ovarian pollination, test tube fertilization, in-vitro fertilization, placental pollination, Gynogenesis.

Endosperm: types of endosperms, ruminate endosperm, cytological status. endosperm haustoria, chemical composition of endosperm, food reserve in endosperm, role of endosperm in embryo development, endosperm mutants.

Module II:

Embryogenesis: Zygote and its ultra-structure, Johanssen's system of embryo development, symmetry and polarity, rest period in zygote embryonic formulae, embryonomic law. Suspensor-Ultra structure of suspensor cells, cytology of suspensor cell, physiology and biochemistry of suspensor; Nutrition of embryo-nutrient supply of the zygote, embryo-endosperm relation.

Polyembryony: Defination, causes, classification, induction of polyembryony, practical importance of polyembryony.

Module III:

Apomixis: Defination, causes, classification, -Diplospory, Apospory, pseudogamy, autogamous development of endosperm, causes of apomixes, significance.

Parthenocarpy:Defination, causes, practical importance

Mellitopalynology: Pollen analysis of honey, Role of apiary in crop production.

Biotechnology: Concept and scope of biotechnology; Cell structure, cellular totipotency

a) Anther and pollen culture,

b) Ovule and nucellus culture

c) Endosperm culture and its practical applications

Module IV:

d) Embryo culture: Techniques, nutritional aspects of embryo culture morphological and physiological considerations, culture of mature embryo and proembryo.

e) Somatic embryogenesis: historical background, embryogenesis from callus, direct embryogenesis-recurrent embryogenesis; cytology of somatic embryogenesis, nutritional factors, hormonal factors.

f) Protoplast culture and somatic hybridization-isolation of protoplast, culture methods, fussion of protoplast, selection of fussion products, consequences of fussion, production of Cybrids and hybrids.

g) Biotransformation and production of useful compounds through cell culture, factor affecting yield, biotransformation, bioreactors, perspective.

Semester IV

4T3 - Core Elective II:(Mycology and Plant Pathology -II)

Objectives:

- **Know the history, milestones in phytopathology of India**
- **Knowledge on host-parasite relationship, defence mechanism in host.**
- **Practical knowledge on disease control measures in various crops**
- **Knowledge on bacterial, viral, mycorhizal and nematode diseases, symptoms and their importance.**

After successful completion of the course the students will be able to

- **Knowledge on the history, milestones in phytopathology of India**
- **Learn host-parasite relationships, various diseases and control methods.**

Module I:

History:Milestones in phytopathology with particular reference to India. Major epidemics and their social impacts. Historical developments of chemicals, cultural and biological protectionmeasures.

Altered metabolism of plants under biotic and abiotic stresses.

Koch's Postulates

Epidemiology and forcasting of plant diseases

Indian Institutes and their research activities in Mycology and Plant Pathology

Module II: Principles of Plant pathology

i. Principles of plant pathology-Importance, nature, classification and general symptoms of plant diseases.

ii. Pathogenecity of microorganisms and pathogenesis.

iii. Host parasite relationship and Interaction; Signal transduction.

iv. Defence mechanism in host plants against pathogens -morphological or structural defence mechanism;Biochemical defence mechanisms - role of phenolic compounds, enzymes and toxins,

v. Principles and methods of plant disease control -cultural methods, chemical methods, Biological control,transgenic approach for plant disease control, integrated pest management (IPM), Biopesticides.

Module III:

A Detailed study of the Diseases of the following crops caused by fungal pathogens with effective control measures.

Diseases of Cereals: Seedling blight of cereals, Smut of wheat, Foot rot of wheat, Covered smut of Barley, False smut of rice, Downey mildew of jowar, Green ear disease of Bajra, Ergot of Bajra, Downey mildew of maize.

Diseases of Vegetable crops with special reference to the important diseases of thefollowing: Chilli, Brinjal, Tomato, Onion, Bhindi.

General knowledge of post harvest diseases of fruits and vegetables and their control.

Diseases of Oil Seed Crops viz. *Linum*, *Seasamum*, Groundnut, Mustard and Sunflower

Diseases of Fruit Trees-With special reference to important diseases of the following Citrus, Apple, Mango, Banana and Grapes.

Module-IV:

Bacterial diseases of plants - Bacterial blight of rice, Tundu disease of wheat, Angular leaf spot of cotton, stalk rot of maize, Fire blight of Apple, Bacterial soft rot of fruits and Vegetables.

Viral Diseases of Plant: Bunchy top of Banana, Leaf curl of Papaya, Yellow vein mosaic of Bhindi. Mosaic of Cucurbits, Viral diseases of Tobacco, Potato and Tomato.

Mycoplasma/Phytoplama (PPLO) Diseases of Plants: Citrus greening, Rice yellow dwarf: Little leaf of Brinjal, Sandal Spike.

Nematode Diseases of Plants: General knowledge of plant parasitic nematodes and important nematode diseases viz.Root knot of Vegetables, Ear cockle of wheat. .

Suggested readings

1. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.

2. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.

3. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.

4. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.

5. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York

6. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.

7. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.

8. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.

9. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.

10. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S.Chand & Co. Ltd.

11. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology -S.Chand & Co. Ltd.

12. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.

13. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.

14. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.

15. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermidiate Press.

16. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.

17. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.

18. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.

19. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.

20. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.

21. Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & diso rders of fruits & vegetables Vol.I & II Wolfe Scientific, London.

22. Sunder Rajan, S. (2001) Tools and Techniques of Microbiology, Anmol Publ.New Delhi.

23. Thind, T.S. (1998) Diseases of field crops and their management, National Agricultural Technology, Information Centre, Ludhiana.

24. Vaidya, J.G. (1995) Biology of the fungi, Satyajeet Prakashan, Pune.

25. Walker, J.G. (1952) Diseases of Vegetables Crops. McGraw Hill, New York.

26. Walker, J.C. (1968) Plant Pathology, McGraw Hill, New York.

27. Eggins, H.O.W. and Allsop (1975) The Filamentous Fungi Vol. I Industrial Mycology (Biodetoriation and Biodegradation by Fungi) Eds. J.E. Smith and D.R. Berry Edward Arnold, London.

28. Emmons, C. W., C. H. Bin ford, J.P. Utz and Know Chung (1977) Medical Mycology, Lea and Febigo, Philadelphia.

29. Holliday, P. Fungus disease of tropical plants (1980), Cambridge University Press, Cambridge.

On line Journals available on UGC -VSAT

Semester IV

4T3 - Core Elective II:(Palynology - II)

Objectives:

- **Knowledge on pollen physiology and biochemistry**
- **Understanding the pollen biotechnology, genetics and forensic palynology.**
- **Knowledge on aerobiology history and various methods applied for collection and data analysis.**
- **Knowledge on pollen allergy, causes, symptoms, prevention and cure.**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the diff. aspects of pollen physiology, biochemistry, genetics, biotechnology and forensic palynology.**
- **Applying knowledge on pollen allergies, identification of allergents, cure etc.**

Module I: Pollen physiology and biochemistry-

Pollen production, Pollenviability, tests for pollen viability, Pollen germination of pollen in *vivo* and in *vitro*, germination requirements, Role of boron and calcium in pollen germination, Factors affecting pollen germination. Chemical composition of pollen wall and pollen contents (amino acids, proteins, carbohydrates, lipids, vitamins, pectin, DNA, RNA, ascorbic acid, flavones, pigments etc.). Fine structure inside the tube, pollen culture movements of nuclei-and formation of calloseplug, promotion and inhibition of pollen tube, elongation, pollen enzymes and isozymes.

Module II: Pollen biotechnology and genetics, forensic palynology

Pollen storage-Factors affecting viability in storage, freeze-drying of pollen, storage of pollen in organic solvents, causes of decreased viability in storage and pollen germination.

Pollen-pistil interaction- significance, self incompatibility (regulation of fertilization) Pollen biotechnology & crop production- Anther / pollen culture, production of haploids

Genetics of pollen: Genetic segregation of pollen, pollen sterility- genic and cytoplasmic male sterility, factors involved in male sterility. Male sterility through recombinant DNAtechnology.

Forensic palynology- Introduction, methodology, role in criminology, examples

Module III:

Aerobiology-Introduction, Historical background, applications of Aeropalynology, Aeromycology,Aerophycology. Importance in medical field, importance of aero mycological

studies in various types of crop infection by spores, disease forecasting, aerobiological work in India and abroad.

Intramural and extramural studies, different devices to collect spores, pollen grains such askite, balloons, trap air strips and slides, volumetric samplers, culturing techniques, analysis ofdata and their processing, seasonal changes of air-spora, Indoor environments, Outdoor airspora, characteristics, identification

Module IV:

Airborne allergens- Introduction, allergens and their types, Impact of airborne materials onhuman system, Lung as particulate sampler, Source, causes, symptoms of Pollen allergy, fungal spore allergy, dust mite allergy, algal allergy other allergies, pollinosis, nasobroncheal allergy, Prevention and cure, Human immunoglobulins- types, and significance in diagnosis of allergy, diagnosing allergic diseases, Testing and treatment standardization, pollen calendar and daily census of airborne pollen, Correlation between aerobiological, clinical and meteorological data.

Recommended reading

1. Afzelius, B.M. 1956 Electron-microscope investigation into exine stratification GranaPalynologica (N.S.) 1:2,

2. Agashe S. N. – Paleobotany (1997) – Plants of the past their evolution paleoenvironment and applications inexploration of Fossil.

3. Agashe S. N. – Palynology and its Applications – Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

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6. Alexander, M.P., Ganeshan S. (1990).An improved cellophane method for in vitro germination of recalcitrant pollen. Stain Technol 64:225-227. Archaeology, Rev. Palaeobot. Palynol 21:171-185,

7. Baker, H.G. 1954. Aperture membranes in Studies of Pollen Morphology and Taxonomy. Newphytologist, 54(3),

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9. Banerjee, U.C.1967.U!trastructure of the tapetal membranes in grasses. Grana paIynologia: 7,2-3,

10. Bhattacharya K., Majumdar M. and Gupta Bhattacharya S. (2006). A text book of Palynology.New Central Book Agency(P) Ltd.,Kolkata

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14. Caulton Eric, Agashe S. N. -Pollen and Spores applications with special emphasis on Aerobiology and Allergy15.

Chowdhary, J.B. and T.M. Varghese. 1968. Pollen sterility in crop plants-A review Palyn. Bull.IV (2).

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24. Erdtman, G, (1956) "Lo-analysis" and "Welcker's rule". Sven Bot. Tidskr. 50:1-7.

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Semester IV

4T3 - Core Elective II:(Plant Physiology - II)

Objectives:

- **Understanding the role of secondary metabolites in plants.**
- **Understanding various industrial applicable concepts and nanobiotechnology**
- **Understanding neuro and electro physiology**
- **Understanding the signal transduction in plant cells.**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the importance of secondary metabolites and their medicinal importance**
- **Understand the applicability of learnt concepts at industrial level.**
- **Understand the pathways and proteins involved for different signaling response at cellular level.**

Module-I

Secondary metabolites :-Introductionand classification, Secondary metabolitesand ecological functions in plants , secondary metabolites defend plants against herbivoresand pathogens

a. Alkaloids:- alkaloid biosynthesis, Biotechnological application of alkaloidsBiosynthesis, plant defense against pathogens

b. Terpenoids:- terpenoids and herbivory, steroids and sterols, polyterpens,prenyltrasferase and terpene synthase reactions, modifications of terpeniod skeletons toward transgenic production

c. Phenolic compounds:- medicinal properties of phenolic compounds, types- simple phenolics, coumarins, lignin, flavonoids, tannins

d. Glycosides:-saponins, cardiac glycosides, cyanogenics glycoside,glucosinolates

Module-II

Leaf protein: - Green crop fractionation (GCF), Leaf Protein Concentrate (LPC), Chloroplastic LPC, Cytoplasmic LPC, Deproteinised Leaf Juice (DPJ), Uses of DPJ.Importance of leaf protein

Industrial fermentation:-importance of fermentation, type of fermentation, alcoholic fermentation, enzyme production , antibiotic production

Biodiesel production:- introduction and historical account of biodiesel,methods of preparation biodiesel from vegetable oil, biochemical properties of biodiesel Importance of biodiesel.

Module-III

Plant Neuro/electro physiology:- introduction and historical account of plantelectrophysiology, Factor affecting electrical potential, electrodes and methods usedfor Measuring the Electrical potential energy of plants and fruits

S**ignal Perception and Transduction**:-Introduction, overview of signal transduction pathway, receptors, specific examples of plant receptors, signal transduction in Prokaryotes, signal transduction in eukaryotes, G-proteins and phospholipids signaling, cyclic nucleotides, secondary messengers (Calcium, calcium-calmodulin complexes, Protein kinases particular pathways of signal transduction Associated with plant growth regulators

Module-IV

Vitamins:- water and fat- soluble vitamins, biochemical function of thiamine, riboflavin, nicotinic acid, pantothenic acid, pyridoxin, biotin, folic acid, vitamin B12, ascorbic acid, vitamin A and vitamin D

Antioxidants:-what are antioxidants, types of antioxidants, role of antioxidants in medicine and in disease control, cure and prevention, antioxidant rich foods

Nanobiotechnology:-Application of nano-biotechnology in medicine and food, synthetic and natural bionanomaterials. Implications of nanoscience and nanotechnology on society.

Issues- biosensors and their applications, biological nanostructures.Applications of bionanoscience to materials research.

4T4 - Foundation Course II: Applied Botany
(Student shall opt for this paper from any other subject other than his/her main subject for post graduation)

Objectives:

- **Know the concept and types of entreneurship, types of start-ups**
- **Understanding the production of various plant products**
- **Understanding green herbal and cultural techniques**
- **Knowledge on different types of garden, floriculture, silviculture developments, post-harvent techniques.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn the production of plant bio-products**
- **Applying knowledge with reference to green herbal techniques, culture technique and cultivation of garden, silviculture,post-harvesting techniques etc.**

Module I: Entrepreneurship in Botany

Concept, definition, structure and theories of entrepreneurship; Types of start-ups; Types of entrepreneurship, Entrepreneurship of NTFP (collection/Production, value addition, marketing strategies), Biodiesel/bio-ethanol plant production, *Trichoderma* production for control of soil borne fungi, honey production., Plant enzyme production

Module II: Green herbal techniques

Phytochemistry: Classification of secondary metabolites accumulated by the plants; extraction of phytochemicals

Plant based products: Techniques for extraction/preparation of various dyes, cosmetics, perfumes (essential oils), sweeteners (*Stewia* etc.), herbal medicine, nutraceuticals.

Fibre production: Coir, Jute, banana, cotton, silk cotton etc.

Cultivation of common medicinal herbs: *Aloe vera, Curcuma longa, Zingier officinalis, Withania somnifera, Chlorophytum borivilianum.*

Module III: Gardening, silviculture and Post harvesting techniques

Gardening: History, types of gardens, landscape gardening, major gardens of the world.

Floriculture: General introduction, nursery management, methods of propagation (Bonsai, cutting, grafting, budding) poly house and green house, commercial floriculture.

Silviculture: Introduction, Agro-forestry, avenue trees, ornamental shrubs and trees cultivation.

Kitchen gardening: Spinach, tomato, brinjal, coriander, drumstick, lady's finger, chilly, curry leaf, methi and other spices etc.

Post harvest techniques: Vegetables, fruits, ornamentals, neutraceuticals,

Module IV: Culture techniques

Sterilization techniques for various types of cultures

Technique of- Mushroom culture, *Spirulina* cultivation, compost, vermi-composting, bio-fertilizer production, hydroponics, plant tissue culture, techniques to increase shelf-life of ornamental plants.

Suggested readings

Burch JG 1086. Entrepreneurship.Wiley, USA.

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Holt DH 1998. Entrepreneurship- New venture creation.Prentice-Hall of India, New Delhi.

Kas J. 1989. Entrepreneurship: Creativity and Organization. Prentice Hall Englewood Cliffs, New Jersey.

Kochhar SL 1998. Economic Botany in tropics 2e. Macmillan India Ltd., New Delhi.

Nandan H 2011.Fundamentals of Entrepreneurship 2e. PHI Learning Pvt. Ltd., New Delhi.

Randhwa GS and Mukhopadhyay A 1986.Floriculture in India.Allied Publ., New Delhi.

Sabnis SD and Daniel M 1990.A phytochemical approach to economic botany. Kalyani Publ., New Delhi.

Sagwal SS 2010.A textbook of silviculture. Kalyani Publ., New Delhi.

Sharma OP 1996 Hill's Economic Botany. TMH Publ. Co. Ltd., New Delhi.

Singh B. 2012. Horticulture at glance. Kalyani Publ., New Delhi.

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Swaminathan MS and Kochhar SL 2003.Groves of Beauty and Plenty- An atlas of major flowering trees in India. Macmillan India Ltd. New Delhi.

Subject wise Core Elective Papers

M. Sc. Subject	Core elective paper to be opted in sem III (Sem V in case of M. Sc. (Tech) Applied Geology)	Core elective paper to be opted in sem IV (Sem VI in case of M. Sc. (Tech) Applied Geology)
M. Sc. (Computer Science)	Neural Network	Design and Analysis of Algorithm
	Multimedia Technologies	Embedded System
	ASP.NET	Pattern Recognition

Foundation Course: (Candidate can opt for any one foundation course paper as shown below in the semester III and IV (Semester V & VI in case of M. Sc. (Tech) Applied Geology). However, Student shall opt for this paper from any other subject other than his / her main subject for postgraduarion. If the candidate decides to opt for foundation course papers then he/she shall not be eligible to opt for Core (Subject Centric) papers in their respective subjects). List of foundation courses available:

M. Sc. Subject	Foundation Course I in semester III (Sem V in case of M. Sc. (Tech) Applied Geology)	Foundation Course II in Semester IV (Sem VI in case of M. Sc. (Tech) Applied Geology)
M. Sc. (Computer Science)	Operating system concepts	Advances in information technology
	Principles of Management	Banking Operations And Services
	E-Business	Information Security And Cyber Law

Core (Discipline Centric): (Candidate can opt for this paper as shown below in the semester III and IV (Semester V & VI in case of M. Sc. (Tech) Applied Geology) in their main subject of post graduation only. If the candidate decides to opt for Core (Subject Centric) papers in their main subject of post graduation then he/she shall not be eligible to opt for Foundation Course papers neither in their own subject nor in any other subject). List of Core (Subject Centric) course available in the respective subject:

M. Sc. Subject	Core (Discipline Centric) I in semester III (Sem V in case of M. Sc. (Tech) Applied Geology)	Core (Discipline Centric) II in Semester IV (Sem VI in case of M. Sc. (Tech) Applied Geology)
M. Sc. (Computer Science)	Mobile Computing	Parallel Computing
	Digital & Cyber Forensics	Mobile & Cyber Forensics

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc.Computer Science

Semester I for M.Sc. Computer Science												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract	
Core 1	Paper 1 **Discrete Mathematical Structure**	4	-	4	4	3	80	20	100	40		
Core 2	Paper 2 **Programming in Java**	4	-	4	4	3	80	20	100	40		
Core 3	Paper 3 **Digital Electronics and Microprocessor**	4	-	4	4	3	80	20	100	40		
Core 4	Paper 4 **Advanced DBMS and Administration**	4	-	4	4	3	80	20	100	40		
Pract. Core 1 & 2	Practical 1 **based on theory paper-1 and 2**	-	8	8	4	3-8*	100 **	-	100		40	
Pract. Core 3 & 4	Practical 2 **based on theory paper-3 and 4**	-	8	8	4	3-8*	100 **	-	100		40	
Seminar 1	Seminar 1	2	-	2	1			25	25	10		
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**	

Semester II for M.Sc. Computer Science											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Core 5	Paper 5 **Windows Programming using VC++**	4	-	4	4	3	80	20	100	40	
Core 6	Paper 6 **Theory of Computation and Compiler Construction**	4	-	4	4	3	80	20	100	40	
Core 7	Paper 7 **Computer Architecture and Organization**	4	-	4	4	3	80	20	100	40	
Core 8	Paper 8 **Computer Graphics**	4	-	4	4	3	80	20	100	40	
Pract. Core 5 & 6	Practical 3 **based on theory paper-5 and 6**	-	8	8	4	3-8*	100 **	-	100		40
Pract. Core 7 & 8	Practical 4 **based on theory paper-7 and 8**	-	8	8	4	3-8*	100 **	-	100		40
Seminar 2	Seminar 2	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

Semester III for M.Sc. Computer Science											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Core 9	Paper 9 **Data Communication and Networks**	4	-	4	4	3	80	20	100	40	
Core 10	Paper 10 **Software Engineering**	4	-	4	4	3	80	20	100	40	
Core Elective 1	Paper 11 **CE1-1 Neural Network** **CE1-2 Multimedia Technologies** **CE1-3 ASP.NET**	4	-	4	4	3	80	20	100	40	
Foundation Course 1/ Core(Subject Centric)1	Paper 12 **FC1-1 Operating System Concepts** **FC1-2 Principles of Management** **FC1-3 E-Business** **CDC1-1 Mobile Computing** **CDC1-2 Digital & Cyber Forensics**	4	-	4	4	3	80	20	100	40	
Pract. Core 9 & 10	Practical 5 **based on theory paper-9 and 10**	-	8	8	4	3-8*	100 **	-	100		40
Pract. Core Elective 1	Practical 6 **based on paper 11**	-	8	8	4	3-8*	100 **	-	100		40
Seminar 3	Seminar 3	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

Semester IV for M.Sc. Computer Science

Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Core 11	Paper 13 **Data Mining**	4	-	4	4	3	80	20	100	40	
Core 12	Paper 14 **Artificial Intelligence & Expert System**	4	-	4	4	3	80	20	100	40	
Core Elective 2	Paper 15 **CE2-1 Design and Analysis of Algorithm CE2-2Embedded System CE2-3 Pattern Recognition**	4	-	4	4	3	80	20	100	40	
Foundation Course 2/ Core(Subject Centric)2	Paper 16 **FC2-1 Advances in Information Technology FC2-2 Banking Operations And Services FC2- 3 Information Security And Cyber Law CDC2-1 Parallel Computing CDC2-2 Mobile & Cyber Forensics**	4	-	4	4	3	80	20	100	40	
Pract.	Practical 7	-	8	8	4	3-8*	100	-	100		40

Core 11, 12 & Elective 2	**based on theory paper-13,14,15.**						**				
Project	Project		8	8	4		100 **	-	100		40
Seminar 4	Seminar 4	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

Note: Th = Theory; Pr = Practical/lab, * = If required, for two days.

** = The Practical and Project shall be evaluated by both External and Internal Examiner in the respective Department / Center / Affiliated College as per guidelines appended with this direction.

M.Sc. (Computer Science)

Semester I

Paper 1 : Discrete Mathematical Structure

Hours/Week : 4
Credits : 4

Unit-1 :
Fundamental –Sets and Subsets, operations on sets, sequence, Division in the integer, Matrices, Mathematics Structures. Logic-Proposition and Logical Operation Conditional Statements, Methods of Proof, Mathematical Induction,
MathematicsLogic- Statements and Notation, Connectives ,Normal Forms ,The Theory of Interface for the statement Calculus ,Inference Theory of the Predicate Calculus,

Unit-2 :
Counting-Permutation, Combination, The pigeonhole Principle, Recurrence Relations. Relationaland Digraphs- Product sets and Partitions, Relations and Digraphs, Paths in Relations and Digraphs Properties of Relations, Equivalence Relations, Computer Representation of Relations and Digraph, Manipulation of Relations, Transitive Closure and Warshall's Algorithms. Functions-Definition and Introduction, Function for Computer Science, Permutation Functions, Growth of Functions.

Unit-3 :
Graph Theory : Basic Concept of Graph Theory, Euler Paths and Circuits, Hamiltonian Paths and Circuits. Otherrelations and Structure- Partially Ordered Sets, Lattices Finite Boolean-Algebra, Functions of Boolean Algebra's, Boolean function as Boolean Polynomials. Tree-Introduction Unidireted Tree, Minimal Spanning Trees.

Unit-4 :
Semigroups and Groups**:** Binary Operations Revisited,Semigroups, Products and Quotations of Groups. Introduction to computability –Languages Finite –State Machines, Semigroup, Machines and Language.

Books :

1. Discrete Mathematical Structures By Bernard Kolmanc,Busby& Sharon Ross [PHI]
2. Discrete Mathematical Structures with Application to computer science By J.P.Tremblay&R.Manohar [Tata McGraw –Hill]
3. Combinational Mathematics By.C.J.Liu

Reference Books:

1.Discrete Mathematics with Graph Theory By Goodaire[PHI]
2. Discrete Mathematics by J.K.Sharma(McMillan)
3. Discrete Mathematics and its Applications By Kenneth Rosen (TMH)
4. Discrete Mathematics By Seymour Lipschutz, Marc Lipson (TMH)
5. Discrete Mathematics :RajendraAkerkar, Pearson

Paper 2: Programming in Java

Hours/Week : 4
Credits : 4

Unit-1 :
Java and Internet, Features of java: security, portability, multithreading, etc, Bytecode, Datatypes, variables and Arrays, Operators, Classes : declaring objects, methods, constructor, overloading constructor, garbage collection, finalize() method, static variable and method, final variable, command line argument. Inheritance: super keyword, final with inheritance. Packages and Interfaces.
Exception handling : Overview, types, Uncaught exception, try -catch block, multiple catch, nested try, throw, throws, finally, bulit-in and user- defined exception.
Multithreading : Life Cycle, Thread class and Runnable Interface, isAlive(), join(),Priorites, Synchronization : sleep() , run(). Interthreadcommunication : wait(), notify(), notifyAll(), deadlock. String Handling.

Unit-2:
Wrapper classes, Applet: Applet Class, Architecture, Life Cycle, Display methods, HTML APPLET Tag, Passing parameter to Applet
AWT : working with Windows, Controls, Layout Manager, Menus. Swings.Event handling.

Unit-3:
JDBC : Architecture, JDBC-ODBC bridge driver, SQL Package, ResultSet and its methods.
Networking : Socket, Reserve socket, Internet Addressing, InetAddress, TCP/IP client socket, TCP/IP server socket, URL, URL Connection, Datagram.
RMI : Introduction, Architecture, Remote Interface, java.rmi. server package, class naming, creating Rmi server and client ,transmitting files using rmi, client side callback, RMISECURITYMANAGER class, RMI Exception, Stub and Skeleton.

Unit-4:
Servlet : Life Cycle, Tomcat, javax. servlet package, reading servlet parameter, javax.servlet.http package, handling http request and response with HTTPGET and HTTPPOST, cookies,session tracking.
JSP : Introduction, Types of JSP tags, Application using JSP and Servlet.
JavaBeans : Advantages of Beans, BDK, JAR files, Introspection, Developing Beans using BDK.

Books:
1. Complete Reference by Herbert Schildt (TMH)
2. Programming with Java By C Muthu (McGraw Hill)
3. Black Book on java.

Paper 3 :Digital Electronics and Microprocessor

Hours/Week : 4
Credits : 4

Unit-1 :

Number System and Data Representation

Number System : Binary, Octal, Decimal and Hexadecimal number system and their inter conversion. Binary Codes : BCD, Excess3 , Parity, Gray, ASCII, EBCDIC codes and their advantages and disadvantages. Data Representation : Positive , negative ,maximum and minimum number representation (related to 8 bit number), real number representation, underflow, overflow , range and accuracy. Binary Arithmetic : Binary addition, decimal subtraction using 9's and 10's compliment, binary subtraction using 1's and 2's compliment, multiplication and division. Logic gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR , NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gates .

Unit-2 :

Boolean Algebra: Laws and Identities of Boolean algebra, DeMorgan's Theorem , use of Boolean Algebra for simplification of logic expression, K-Map for 2,3,4 variables, simplification of SOP and POS logic expression using K-Map.

Combinational circuits: Half adder, Full Adder, Parallel adder, Half subtractor, Full Subtractor, 4-bit binary adder subtractor, Multiplexer, Demultiplexer, Decoder, Encoder, Parity detector.

Unit 3 :

Sequential Circuits : Flip-Flops : Construction and working of RSFF, JKRSFF, DFF, TFF, JKFF, and JKMSFF . Counters : Construction and working of asynchronous, synchronous, up-down counter, shift registers and their types, Ring counter, Jonhson counter with their time diagram.

Unit-4 :

Architecture of 8086 and Assembly Language Programming

Block diagram of 8086, Pin diagram of 8086, Addressing modes, Instruction set: Data transfer, Arithmetic, Logical, String manipulations, Control Transfer, Unconditional branch, Conditional branch, Flag, Processor control. Assembler directives and operators, simple assembly programs.

Books:

1.Digital Electronics by Gothman(PHI)
2.Digital and analogue technique by Navaneeth, Kale and Gokhale
3.Fundamental of Micropocessor by B Ram
4.Microcomputers Systems: The 8086/8088 family by Liu. Gibson
5. Modern Digital Electronics By Jain (TMH)

Paper 4 :Advanced DBMS and Administration

Hours/Week : 4
Credits : 4

Unit-1 :

Relational Database design: Functional dependencies, and Normalization Normal forms based on primary keys (1 NF, 2 NF, 3 NF, BCNF, 4 NF, 5 NF) Loss less joins and dependency preserving decomposition Query Processing: Query Processing Stages, Query Interpretation, Equivalence of Expressions, Query Resource Utilization, Query Execution Statistics, Query Execution Plan, Estimation of Query Processing Cost, Table Scan, Sample Index Access, Fill Factor, Multiple Index Access, Methods for Joining Tables (Nested Loop, Merge Join, Hybrid Join, Multiple Join) Structure of a Query Optimizer

Unit-2 :

Transaction Processing & Concurrency Control: Concept and definition of transaction, ACID properties, serializibility, Prioritization, states of transaction, Types of failure, desirable properties of transaction schedules and recoverability, serial usability of schedules, levels of transaction consistency, deadlocks, long duration transactions, transaction performance, transaction processing as implemented in contemporary database, management system. Concurrency Control, locking techniques, techniques based on time-stamp ordering, multiple granularity. Crash Recovery**:** failure classification, recovery concepts, database backup, recovery concepts based on deferred update and on immediate update. Shadow paging, check points, on-line backup during database updates, crash recovery techniques.

Client/Server database: Evolution of client concept, Client/Server environment, characterization of Client/Server computing. Functions of clients server , application partitioning, the two-layer and three-layer architectures, communication between clients and servers.

Unit-3 :

Oracle Database Architectureand Administration: Oracle database architecture, Design, Creation, Migration and Management of Oracle Databases and related database schemes, Data Dictionary views and standard package Maintaining the control, Redo Loa files, Managing Tablespaces and Data Files, Storage structure and relationships, Managing rollback segment, Managing tables, Indexes, Managing data Integrity, Managing password security and resources, Managing users, Privileges, roles.

Oracle Backup and Recovery Strategies: Backup and recovery considerations, Oracle recovery structure and processes, Oracle backup and recovery configuration, Physical backup, Complete recovery of an Oracle database, Incomplete recovery of an Oracle database with Archiving, Oracle Export / Import utilities, Oracle standby database.

Unit-4 :

Oracle Tuning and Troubleshooting:Oracle performance tuning methodology,'Oracle alert and trace files, Tuning the shared pool, Buffer Cache, Redo Log buffer, Database configuration and I/O issues, Using Oracl Blocks efficiently, Optimizing sort operations, Rollback segment tuning, Monitoring and detecting lock contention, SQL issues and tuning considerations for different application. Integrity, Security: Need for Database Integrity, Integrity Constraints, Non-Procedural and Procedural Integrity Constraints Specifications in SQL, Introduction to Database Security issues, Authorization and use.

Books :

1. Fundamental of Database Systems by R. Elmasri; S. Navate; Benjamin Cummings;
2. Introduction to database systems by C. J .Date
3. Database system concept byKorth
4. DBA Handbook oracle press by Loney

Reference Books:

1. Principles of Database Management by James Martin
2. Relational database design for Micro computers Application by Prentice Hall (Jackson)
3. Database Management Systems by Bipin Desai

M.Sc. (Computer Science)

Semester II

Paper 5 :Windows Programming using VC++

Hours/Week : 4
Credits : 4

Unit-1 :

Windows, Visual C++, Application Frameworks Fundamentals and MFC Libraries View Class.
Introduction, MFC, ATL and WFC, Windows Programming Model, Components, Application Framework, MFC Library, Event Handling, Mapping Modes and Scrolling Views, Graphic Device Interface, Colors and Fonts, Modal Dialog and Windows Common Control, Modeless Dialog and Windows Common Dialog, ActiveX Controls and Internet Explorer Common Controls, Win32 Memory Management, Bitmaps, Message Processing and Multithreaded Programming.

Unit-2 :

Document View Architecture : Menus, Keyboard Accelerators, Rich Edit Control and Property Sheets, Tool bar and Status Bars, Reusable Frame Window Base Class, Separating the Documents from its View, Reading and Writing Documents- SDI applications, MDI applications, Printing and Print Preview, Splitter Windows and Multiple Views, Context-Sensitive Help, DLL's, MFC Programs without Documents or View Classes

Unit-3 :

Active X: COM, Automation and OLE : Component Object Model, Automation, Uniform Data Transfer- Clipboard Transfer and OLE, Drag and Drop, Structured Storage, OLE Embedded Components and Containers, Introducing the Active Template Library, ATL and ActiveX Controls.

Unit-4 :

Database Management: Database Management with Microsoft ODBC, Database Management with Microsoft Data Access Objects, OLE DB Templates.
Programming for the Internet: TCP/IP, Winsock, WinInet, Programming the Microsoft Internet Information Server, ActiveX document Servers and the Internet, Introducing the Dynamic HTML, Visual C++ for Windows CE.

Books :

1. Programming Microsoft Visual C++ by D. J. Kruglilski, G Shepherd and Scot Wingo Publication : Microsoft Press Fifth Edition.

Reference Books:

1. Visual C++ 6 From The Ground Up: Mueller: TMH Publication
2. VC++ 6 The Complete Reference: Pappas, TMH Publication

Paper 6:Theory of Computation and Compiler Construction

Hours/Week : 4
Credits : 4

Unit-1 :

Finite Automation and Regular Expression : Finite State systems, Basic Definitions, Non - deterministic finite Automata, Finite Automata with moves, Regular Expressions, Two way finite automata, Finite automata with output, Application on Finite Automata.

Properties of Regular Sets : The pumping lemma for Regular Sets, Close properties of Regular sets, Decision Algorithms for Regular Sets.

Context Free Grammars : Motivation and Introduction, Context Free Grammar, Derivation Tree, Simplification of context Free Grammars, Chomsky Normal form, Greibach normal form, The existence of inherently ambiguous context free languages.

Properties of Context free languages : The pumping lemma for CFL's , Closure properties of CFL's, Decision Algorithm for CFL's

Unit-2 :

Push Down Automata : Informal description, Definitions, Push – Down Automata & Context free languages.

Turing Machine : Introduction, The Turing Machine Model, Computable languages and functions , Techniques Turing Machine construction, Modification of Turing Machines, Churchs Hypothesis, Turing Machine as enumerators, Restricted Turing Machine equivalent to the basic model. Undecidability : Problems, properties of recursive and recursively enumerable problem, Turing Machine and undecidable problem, Rice theorem, Tool for proving CFL undecidable, Greibach's Theorem.

The Chomsky : Regular Grammars, Unrestricted Grammars, Context – Sensitive languages, Relation between classes of languages.

Unit-3 :

Introduction to Compilers :

Compilers and translators, need, the structure of a compiler, Lexical Analysis, Syntax analysis, Intermediate code Generation, Optimization, Code Generation, Book keeping, Error Handling, Compiler writing tools. Basic parsing Techniques: Parsers, Shift-reduce parsing, Operator precedence parsing, Top-down parsing, predictive parsers, automatic construction of efficient parsers : LR parsers the canonical collection of LF (O) items, constructing SLR parsing tables, constructing LALR parsing tables, Ambiguous grammar.

Unit-4 :

Syntax directed translation : syntax directed translation schemes, implementation, intermediate code,postfix notation, parse tree and syntax trees, tree- address code, quadruple, triple, translation of

Symbol Table: Data Structure, Representation of Scope Information,

Code Optimization: The principal source optimization, Loop optimization, The DAG Representation of basic blocks, Value number and algebraic laws, Global data-flow analysis.

Code Generation : Object Programmers Problems in code generation, A machine model, a simple code generator, Register Allocation and assignment, Code Generation from DAG's Peephole Optimization.

Books :

1. Introduction to Automata Theory, Languages and Computation: John E. Hoperott& Jeffery D. Ullman.
2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.
3. Theory of Computer Science : E. V. Krishmamoorty.
4. Theory of computer Science : K. L. P. Mishra.

Reference Books:

1. D. I. A. cohen : Introduction to Computer Theory (JW)
2. H. R. Lewis & C. H. Papadimitrion : Elements of Theory Of Computation (PHI)
3. J. Caroll and D. Long : Theory of Finite Automata (PHI)
4. M. Davis &Weyukur : Computability, Complexity & Languages.
5. M. Machtey& P. R. Young : An introduction to Genral Theory of Algorithm (Elsevier).
6. Zvihohavi : Switching and Finite Automata Theory (TMH).

Paper 7:Computer Architecture and Organization

Hours/Week : 4
Credits : 4

Unit-1 :
Principle of computer design : Software, hardware interaction, layers in computer architecture, central processing and machine language instruction, addressing modes, instruction types, instruction set selection, instruction and execution cycle.

Unit-2 :
Control Unit : Data path and control path design, microprogramming v/s hardwired control, pipelining in CPU design, RISC v/s CISC, superscalar processors.

Unit-3 :
Memory subsystem : Storage technologies, memory array organization, memory hierarchy, interleaving , cache memory and virtual memory including architectural aids to implement these.

Unit-4 :
Input/ Output Processing : Bus Interface, Data transfer techniques, I/O interrupts and channels,. Performance evaluation :SPECmarks , Transaction Processing Benchmarks.

Books :
1. Computer Architecture and Organization by Tenenbaum
2. Computer Architecture and Organization by J. P. Hayes.
3. Parallel Processing by Hwang
4. Computer Organization by Hamacher, Vranesic, Zaky (TMH)

Paper 8 : Computer Graphics

Hours/Week : 4
Credits : 4

Unit-1 :
Introduction of computer Graphics and its applications, Overview of Graphics systems, Video display devices, Raster scan display, Raster scan systems, video controller, Raster scan display processor, Random scan display, random scan systems, color CRT monitor, Flat panel display, Interactive input devices, Logical classification of input devices, Keyboard, mouse, Trackball and spaceball, Joysticks, Image scanner, Light pens, Graphics software, Coordinates representations, Graphics functions.

Unit-2 :
Line drawing algorithms, DDA, Bresenham's, Circle generating, Mid-point circle algorithm, Ellipse generating, Polygon , Scan-line polygon fill, Boundary fill.

Unit-3 :
Basic transformation's, Translation, Rotation, Scaling, Matrix representation's & homogeneous co-ordinates, Composite transformation's, Reflection, Two dimensional viewing, Two dimensional clipping, Line, Polygon, Curve, Text. 3D-transformation, Projection, Viewing, Clipping.
Spline representation, Cubic spline, Bezier curve, Bezier surfaces, Beta spline, B-spline surfaces, B-spline curve, Hidden surfaces, Hidden lines, Z-buffer.

Unit-4 :
Fractal's geometryFractal generation procedure, Classification of Fractal, Fractal dimension, Fractal construction methods. Color models, XYZ, RGB, YIQ, CMY & HSV, Shading algorithms, Shading model, Illumination model, Gouraud shading, Phong shading**.**

Books :

1. Computer Graphics by M. Pauline Baker, Donald Hearn, 2nd Edition PHI.
2. Mathematical Element for Computer Graphics By. David F. Roger., J. Alan Adams, 2nd Edition, Tata McGHill.

Reference Books:
1. Principles of Interactive Computer Graphics By. William. M. Newmann. 2ndEdition Mc. Graw Hill.
2. Procedural Element for Computer Graphics By. David F. Roger. Mc. Graw Hill.
3. Computer Graphics By A.P. Godse, 2ndEditioTPPublication,
4. Computer Graphics By V.K. Pachghare, 2ndEdition, Laxmi Publication
5. Computer Graphics ByApurva Desai (PHI)

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Semester III

Paper 9 :Data Communication and Network

Hours/Week : 4
Credits : 4

Unit-1 :

Introduction: Network structure and architectures and services OSI reference model.

The Physical Layer: theoretical basis for data communication, transmission media. Analog Transmission, Digital Transmission, Transmission and Switching, ISDN.

The Data Link Layer: Design issues, Error detection and correction, Elementary data link protocols, sliding window protocol, protocols performance, protocols specification and verification. Examples of the Data link layer.

Network Layer: Design issues, routing algorithms, Congestion control algorithms, Internet working, Examples of the network layer.

Unit-2 :

The Transport Layer: Design issues, Connection Management.

The session layer: Design issues and remote procedure call.

The Presentation Layer: Design issues, data compression techniques, cryptography.

The Application Layer: Design issues, file transfer, access and management, virtual terminals.

Unit-3 :

Network Security Fundamentals: Introduction, security Vulnerabilities and Threats, Classification of Security Services.Cryptography: Encryption principles, Conventional Encryption DES, IDEA, Algorithms, CBC, Location of Encryption Devices key Distribution.

Unit-4 :

Message Digests and Checksums, Message Authentication, Message Digests, Hash Functions and SHA, CRCs. Public key Systems: RSA Diffie-Heliman, DSS, Key Management.

Intruders: Intrusion Techniques, Intrusion Detection, Authentication, Password- Based Authentication, Address- Based Authentication, Certificates, Authentication Services, Email Security, Firewalls, Design Principles, Packet Filtering, Access Control, Trusted Systems, Monitoring and Management.

Books :

1. Computer Networks – Andrew S Tanenbum (PHI)
2. Network Security and Essentials: Application and standers
3. Willam Stalling – Pearson Education.
4. Cryptography and network security
5. Willam Stalling – Pearson Education.

Reference Books:

1. Internet Security: Timspeed, Juanita Ellis, Digital Press Publication
2. Internet Security: Jan L. Harington, Morgan Kaufmann Publication
3. Firewall Network System: John R. Vacca, Scott R. Ellis, Digital Press
4. Network Algoritm, George Varghese, Morgan Kaufmann Publication
5. TCP/IP Addressing: Buck Graham, Morgan Kaufmann Publication
6. Data Communication and Networking: Behrouz A. Forouzan, TMH.

Paper 10 :Software Engineering

Hours/Week : 4
Credits : 4

Unit-1 :

Introduction to Software Engineering :The evolving role of software, Changing Nature of Software, Software myths.

A Generic view of process :Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

Process models :The waterfall model, Incremental process models, Evolutionary process models, The Unified process. Software Requirements **:**Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

Unit-2 :

Requirements engineering process :Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. System models :Context Models, Behavioral models, Data models, Object models, structured methods. Modeling with UML .

Design Engineering :Design process and Design quality, Design concepts, the design model.

Creating an architectural design :Software architecture, Data design, Architectural styles and patterns, Architectural Design.

Unit-3 :

Object-Oriented Design :Objects and object classes, An Object-Oriented design process, Design evolution. Performing User interface design :Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

Testing Strategies :A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging. Product metrics **:**Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.

Unit-4 :

Metrics for Process and Products **:**Software Measurement, Metrics for software quality.

Risk management **:**Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

Quality Management :Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.

Books :

1.Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition.McGrawHill International Edition.

2. Software Engineering- Sommerville, 7th edition, Pearson education.

Reference Books:

1. Software Engineering- K.K. Agarwal&Yogesh Singh, New Age International Publishers

2. Software Engineering an Engineering approach- James F. Peters, WitoldPedrycz, John Wiely.

3. Systems Analysis and Design- ShelyCashmanRosenblatt,Thomson Publications.

4. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill.

Paper 11:CE1-1(Core Elective 1)
Neural Network

Hours/Week : 4
Credits : 4

Unit-1 :

Introduction: Feedforward Neural Networks: Artificial Neurons, Neural Networks and Architectures: Neuron Abstraction, Neuron Signal Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feed forward and Feedback, Salient Properties and Application Domains of Neural Network Geometry of Binary Threshold Neurons and Their Network: Patterns Recognition and Data Classification, Convex Sets, Convex Hulls and Linear Separability, Space of Boolean Functions, Binary Neurons are pattern Dichotomizes, Non-linearly separable Problems, Capacity of a simple Threshold Logic Neuron, Revisiting the XOR Problem, Multilayer Networks.

Unit-2 :

Supervised Learning I: Perceptrons and LMS: Learning and Memory, From Synapses to Behaviour: The Case of Aplysia, Learning Algorithms, Error Correction and Gradient Descent Rules, The Learning Objective for TLNs, Pattern space and Weight Space, Perceptron Learning Algorithm, Perceptron Convergence Theorem, Perceptron learning and Non-separable Sets, Handling Linearly Non-Separable sets, α-Least Mean Square Learning, MSE Error Surface and its Geometry, Steepest Descent Search with Exact Gradient Information, μ-LMS: Approximate Gradient Descent, Application of LMS to Noise Cancellation

Unit-3 :

Supervised Learning II: Backpropagation and Beyond: Multilayered Network Architectures, Backpropagation Learning Algorithm, Structure Growing Algorithms, Fast Relatives of Backpropagation, Universal Function Approximation and Neural Networks, Applications of Feedforward Neural Networks, Reinforcement Learning

Unit-4 :

Neural Networks: A Statistical Pattern Recognition Perspective: Introduction, Bayes Theorem, Classification Decisions With Bayes Theorem, Probabilistic Interpretation Of A Neuron Discriminant Function, Interpreting Neuron Signals As Probabilities, Multilayered Networks, Error Functions And Posterior Probabilities, Error Functions For Classification Problems

Generalization: Support Vector Machines and Radial Basis Function Networks: Learning from Examples and Generalization, Statistical Learning Theory Briefer, Support Vector Machines, Radial Basis Function Networks, Regularization Theory Route to RRBFNs, Generalized Radial Basis Function Network, Learning In RRBFNs, Image Classification Application, Other Models for Valid Generalization

Books :

1. Neural Network-A Classroom Approach, Satish Kumar, Tata McGraw Hill
2. Introduction to neural networks using MATLAB 6.0 by Sivanandam, S Sumathi, S N Deepa, Tata Mcgraw Hill

Reference Books:

1. Neural networks A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd edition 2004
2. Artificial neural networks -B.Yegnanarayana, Prentice Hall of India P Ltd 2005.
3. Neural networks in Computer intelligence, Li Min Fu, TMH 2003.
4. Neural networks James A Freeman David M S kapura, Pearson education 2004.

Paper 11: CE1-2 (Core Elective 1)
Multimedia Technologies

Hours/Week : 4
Credits : 4

Unit-1 :
Fundamental concepts in Text and Image: Multimedia and hypermedia, world wide web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video. Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

Unit-2 :
Action Script I :ActionScript Features, Object-Oriented ActionScript, Datatypes and Type Checking, Classes, Authoring an ActionScript Class Action Script II :Inheritance, Authoring an ActionScript 2.0 Subclass, Interfaces, Packages, Exceptions.

Unit-3 :
Application Development **:**An OOP Application Frame work, Using Components with ActionScriptMovieClip Subclasses.
Multimedia data compression:Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression, Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, EmbeddedZerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).

Unit-4 :
Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.
Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications : Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand(MOD).

Books :

1. Fudamentals of Multimedia by Ze-Nian Li and Mark S. Drew PHI/Pearson Education.
2. Essentials ActionScript 2.0, Colin Moock, SPD O,REILLY.

Reference Books:

1. Digital Multimedia, Nigel chapman and jenny chapman, Wiley-Dreamtech
2. Macromedia Flash MX Professional 2004 Unleashed, Pearson.
3. Multimedia and communications Technology, Steve Heath, Elsevier(Focal Press).
4. Multimedia Applications, Steinmetz, Nahrstedt, Springer.
5. Multimedia Basics by Weixel Thomson.
6. Multimedia Technology and Applications, David Hilman ,Galgotia.

Paper 11: CE1-3 (Core Elective1)
ASP.Net

Hours/Week : 4
Credits : 4

Unit-1 :

ASP.NET programming model:Introduction, event driven programming over http, http protocol, structure of ASP.NET page, ASP.NET component model, ASP.NET Provider model, Anatomy of ASP.Net Page: Invoking page, Page class, Page Life cycle.

ASP.NET Core Server controls:Generalities of Server Controls, Properties, events and methods of Control class, HTML controls:Generalities of HTML controls, HTML Containers, HTML input controls.

Unit-2 :

Web controls:Generalities of Web Control, core web control, misc web control, Validation controls: Generalities of validation controls, Gallery of controls, Programming with Web forms; HtmlFrom Class, Multiple forms, cross page postings, Page errors, Page Personalization.

Ritch Page Composition:Working with master page, working with themes, working with wizards,ADO.NET data Providers, Connecting to data sources:connection strings, connection pooling, Executing commands:ADO Data Readers, Data Adapters, working with transactions, procedures etc. Data container objects: Data sets, Data tables, Data Relations, Data binding models:expressions and components.

Unit-3 :

Creating bindable grid of data:DataGrid Control, GridView control, Managing list of records: ListView control and Managing views of records: DetailView Control, FromView Control, Initialization of Application: HttpApplicationClass, Application module, methods and events of HttpApplication Class, The global.asax file, HttpContext Class, Server Object, HttpResponse Object, HttpRequest Object.

Unit-4 :

ASP.NET state management: Application state, Session State: working with session state,
customizing session state, view state of page. ASP.NET caching: Caching Application data, the Cache Class, ASP.NET Security: Using Form authentication, membership and role management API, Security related controls, AJAX Enabled web services: Web services as application specific services, remote call via web services,

Books :

1. Programming with Microsoft ASP.NET 3.5 by Dino Esposito, Microsoft Press
2. Programming with Microsoft ASP.NET 4.0 by Microsoft Press
3. The Complete Reference ASP.NET by MacDonald(TMH)

Paper 12:FC1-1 (Foundation1)

Operating System Concepts

Hours/Week : 4
Credits : 4

Unit I - Introduction
OS As An Extended Machine, OS As An Resource Manager, History Of OS & Its Generation, Mainframe OS, Server OS, Multiprocessor OS, Personal Computer OS, Real Time OS, Embedded OS, Smart Card OS, Processor, Memory, I/O Devices, Buses, Processes, Deadlocks, Memory Management, I/O, Files, Security, The Shell, System Calls, OS Structure.

Unit II - Processes& Threads
Process Model, Process Creation, Process Termination, Process Hierarchies, Process State Implementation Of Processes, Thread Model, Thread Model, Thread Usage, Implementing Threads In User Space & Kernel, Hybrid Implementation, Scheduler Activations, Pop-Up Threads, Interprocess Communication, Scheduling.

Unit III - File System Concepts in OS.
File Name, File Structure, File Types, File Access, File Attributes, File Operations Memory Mapped Files, Single Level Directory System, Two Level Directory System, Hierarchical Directory System, Path Name, Directory Operations, File System Layout, Implementing Files, Implementing Directories, Shared Files, CD-Rom File System, Ms-Dos File System, Windows File System, Unix File System.

Unit IV
Introduction to Disk Operating System (DOS) - File types, Directory Structure, Booting - Warm and Cold Booting, Types of DOS commands (Internal and External), Directory commands, Commands related to file management, General commands, batch commands, wild card characters & its use.
Introduction to windows Operating System Advantages of windows operating system, GUI, use of help features, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows, new features in windows XP/Vista versions.
Introduction to UNIX Operating System
History of UNIX File System: Pdp-11 UNIX, Portable UNIX, Berkeley Unix, Standard Unix, Linux. Overview Of Unix, Processes In Unix Memory Management In Unix, I/O In Unix, Security In Unix.

Books:
1. Modern Operating System By Andrew Tannenbaum, PHI Publication.
2. UNIX the Complete Book a Guide for the professional By Jason Manger, Galgotia Publication
3. Red Hat Linux 7 By Brain Proffitt, PHI Publication.
4. Dos/Unix & Windows: I.T. Today (Encyclopedia) By S. Jaiswal
5. Operating System Concept: Sillberschatz Galvin
6. MSDOS; Manual

Paper 12: FC1-2 (Foundation1)

PRINCIPLES OF MANAGEMENT

Hours/Week : 4
Credits : 4

Unit I: Introduction - Nature, function, definition and importance of management, Definition, nature, purpose and scope of management, Functions of a manager, an overview of planning, organizing, staffing leading and controlling. Is management a science or art? Development of Management Thought - Scientific management; Contribution of Taylor, Fayol, Mary Follet, Elton Mayo; Hawthorne experiments, Contingency approach, Indian heritage in production and consumption. Management and administration, Management as a profession, Professionalism of management in India, Management ethics and management culture, Skills required of manager, Classification of skills, Methods of skills development

Unit II: Management Planning - Concept of planning, objectives, Nature, Types of plan, Stages involved in planning, Characteristics of a good plan, Importance, Limitations of planning, Making planning effective, Strategic planning in Indian Industry, MBO. Decision Making - Concept, characteristics of decisions, Types of decisions, Steps Involved in decision making, Importance of decision making, Methods of decision making, Committee Decision Making.

Unit III: Organisation - Concepts, Principle of organization, Importance, Features of good organization structure, Types of Organisation structure. Authority, Responsibilities and Accountability, Delegation of Authority Barriers to effective delegation, Span of control.Coordination & Direction Concept - Importance and need for coordination, Principles of coordination, Methods of achieving effective coordination; Meaning of direction, Importance and Principles of direction, Characteristics of good directives.

Unit IV: Control - Concept, planning-control relationship, process of control -setting objectives, establishing standards, measuring performance, correcting deviations. Brief review of Traditional Techniques & Modern Techniques of Control; Human response to control; Dimensions or Types of Control - (a) Feed forward control (b) Concurrent Control (Real Time Information & Control), (c) Feedback Control v) Techniques of Control.

Books:

1. Essentials of Management, Harold Koontz & Heinz, Weihrich, 5th Tata McGraw Hill
2. Management Stoner, Freeman, Gilbert Jr. ,6th ,Prentice Hall
3. Management (A Global Perspective), Heinz Weihrich&Harnold Koontz, 10th Tata McGraw Hill
4. A Dictionary of Business 3ed. By Elizabeth Martin – Oxford
5. Fundamentals of Management, Robins ,3rd Pearson Education Asia
6. Management, 6e, Stoner, Pearson Education Asia

Paper 12: FC1-3 (Foundation1)

E-BUSINESS

Hours/Week : 4
Credits : 4

UNIT- I: Introduction-Definition of E-commerce, Unique Features of E-commerce Technology: Ubiquity, Global Reach, Universal Standards, Richness, Interactivity, Information Density, Personalization/Customization, Social Technology: User Content Generation and Social Networking, Web 2.0, Play My version; Growth of the Internet and the Web, Origins and Growth of E-commerce, Insight on Technology: Spider Webs, Bow Ties, Scale-Free Networks and Deep Web Technology and E-commerce in Perspective

E-Business Technologies-The Internet: Key Technology Concepts: Packet Switching, Transmission Control Protocol/Internet Protocol (TCP/IP), IP Addresses, Domain Names, DNS, and URLs, Client/Server Computing The Internet Today: The Internet Backbone, Internet Exchange Points, Campus Area Networks (CANs), Internet Service Providers, Intranets and Extranets, Who Govern the Internet? Building an E-commerce Website: Planning: The Systems Development Life Cycle, Systems Analysis/Planning: Identify Business Objectives, System Functionality and Information Requirements. , System Design: Hardware and Software Platforms, Building Your-Own versus Outsourcing, Host your Own versus Outsourcing,

UNIT – II: E-Business Models- Eight Key Elements of a Business Model: Value Proposition, Revenue Model, Market Opportunity, Competitive Environment, Competitive Advantage, Market Strategy, Major Business to-Consumer (B2C) Business Models: Portal, E-tailer, Insight on Technology: Search, ads and Apps: The future for Google, (and Microsoft), Content Provider, Transaction Broker, Market Creator, Service Provider, Community Provider, Major Business-to-business (B2B) Business Model: E-distributor, EProcurement, Exchanges, Insight on Business: Onvia Evolves, Industry Consortia, Private Industrial Networks, Business Models in Emerging E-commerce Areas: Consumer-toconsumer (C2C) Business Models, Peer-to-peer (P2P) Business Models, M-commerce Business Models , E-Commerce Enablers: The Gold Rush Models, Insight on Society: Is Privacy Possible in a Wireless World?, How the Internet and the Web Change Business: Strategy, Structure, and Process, Industry structure , Industry Value Chains, Firm Value Chains, Firm Value Webs, Business Strategy.

UNIT- III: Back Office Automatics For E-Business - Basics of Enterprise Resource Planning, ERP Decision, Enterprise Architecture Planning, ERP Implementation, ERP Architecture and Toolkit Evolution, Implementation Supply Chain Management And EFulfillment: The Basics of Supply Chain Management, Internet-Enabled SCM, E-Supply Chain Fusion, Management Issues in e-supply Chain Fusion, The continuing Evolution of eSupply Chains, A Roadmap for Managers, Demystifying E-Procurement: Buy-Side, SellSide, Net Markets And Trading Exchanges: Evolution of e-Procurement Models, Evolution of Procurement Processes, e- Procurement Infrastructure Integrating Ordering, Fulfillment, and payment, E-Procurement, Analysis and Administration Applications, Marketplace Enables, A Roadmap for e-Procurement Managers.

UNIT-IV: Moving To E-Business - Spotting E-Business Trends, Trends Driving E-Business, Customer-Oriented Trends, E- Service Trends, Organizational Trends, Employee Megatrends, Enterprise

Technology, Trends, General Technology Trends, What These 20 Trends Have In Common, Digitizing The Business: E-Business Patterns, E-Business Patterns: The Structural Foundation, The E-Channel Pattern, The Click-And-Brick Pattern, The EPortal Pattern, The E- Market Maker Pattern, The Pure-E ―Digital Products‖ Pattern, Thinking E-Business Design: More Than Technology, The Race To Create Novel E-Business Designs, Step: 1: Self – Diagnosis, Step: 2: Reverse The Value Chain, Step: 3: Choose A Focus, Step 4: Execute Flawlessly, Lessons From E-Business Design.

Ethical, Social And Political Issues -Understanding Ethical, Social, and Political Issues in E-commerce, A Model for organizing the issues, Basic Ethical Concepts: Responsibility, Accountability, and Liability, Analyzing Ethical Dilemmas, Candidate Ethical Principles, Privacy and Information Rights, Information Collected at Ecommerce Sites, Profiling and Behaviourial Targeting, The Internet and Government Invasions of Privacy:, Ecommerce Surveillance, Legal Protections, Informed Consent, Intellectual Property Rights, Types of Intellectual Property Protection, Copyright: The Problem of Perfect Copies and Encryption, Patents: Business Methods and Processes, Trademarks: Online Infringement and Dilution, Challenge: Balancing the Protection of Property with other values.

Books:

1. E-Business & E-Commerece for Managers,Deitel,Pearson Education
2. Michael Allen's E-Learning Library: Creating Successful E-Learning: A Rapid System For Getting It Right First Time, Every Time (Michael Allen's E-Library) by Michael W. Allen
3. E-Business AmanagementPerspective,Reynolds, Oxford Higher Education
4. Harvard Business Review on Corporate Governance (Harvard Business Review Paperback Series) by Walter J. Salmon, Jay William Lorsch, Gordon Donaldson, and John Pound
5. E-Commerce: Business, Technology, Society (3rd Edition) by Kenneth Laudon and Carol Traver
6. Knowledge Management by Carl Frappaolo

Paper 12: CDC1-1 (Core Subject Centric1)

Mobile Computing

Hours/Week : 4
Credits : 4

Unit-1 :

Mobile Communications: An Overview:Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination, Mobility Management, Security Mobile Devices and Systems:Mobile Phones, Digital Music Players, Handheld Pocket Computers, Handheld Devices: Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems GSM and Similar Architectures:GSM-Services and System, Architecture, Radio Interfaces, Protocols, Localization, Calling Handover, Security, New Data Services, General Packet Radio Service, High-speed Circuit Switched Data, DECT

Unit-2 :

Wireless Medium Access Control and CDMA based Communication: Medium Access Control, Introduction to CDMA-based Systems, Spread Spectrum in CDMA Systems, Coding Methods in CDMA, IS-95 cdma One System, IMT- 20 0 0, i - m o d e , O F D M , Mobile IP Network Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunnelling and Encapsulation Route Optimization, Dynamic Host Configuration Protocol, Mobile Transport Layer, Conventional TCP/IP Transport, Layer Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP-layer Transmission for Mobile Networks, TCP Over 2.5G/3G Mobile Networks

Unit-3 :

Databases:Database Hoarding Techniques, Data Caching, Client-Server Computing and Adaptation, Transactional Models, Query Processing, Data Recovery Process, Issues relating to Quality of Service, Data Dissemination and Broadcasting Systems**:** Communication Asymmetry, Classification of Data-Delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing Techniques, Digital Audio Broadcasting, Digital Video Broadcasting, Data Synchronization in Mobile Computing Systems**:** Synchronization, Synchronization Software for Mobile Devices, Synchronization Protocols, SyncML Synchronization Language for Mobile Computing, Sync4J (Funambol), Synchronized Multimedia ,Markup Language (SMIL)

Unit-4 :

Mobile Devices Server and Management:Mobile Agent, Application Server, Gateways, Portals, Service Discovery, Device Management, Mobile File Systems, Security, Mobile Adhoc and Sensor Networks: Introduction to Mobile Ad-hoc Network, MANET, Wireless Sensor Networks, Applications Wireless LAN, Mobile Internet Connectivity, and Personal Area Network:Wireless LAN (WiFi) Architecture and Protocol Layers, WAP 1.1 and WAP 2.0, Architectures, XHTML-MP (Extensible Hypertext Markup Language Mobile Profile), Bluetooth-enabled Devices Network, Layers in Bluetooth Protocol, Security in Bluetooth Protocol, IrDA, ZigBeeMobile Application Languages XML, Java, J2ME, and Java Card:Introduction, XML, JAVA, Java 2 Micro Edition (J2ME), JavaCard, Mobile Operating Systems :Operating System PalmOS, Windows CE, Symbian OS, Linux for Mobile Devices 530

Books :

1. Mobile Computing, Raj Kamal, Oxford University Press

Reference Books:

1. Mobile Communications Jochen Schiller, Addison-Wesley.
2. Handbook of Wireless Networks and Mobile Computing, Stojmenovic and Cacute, Wiley,
3. Mobile Computing Principles: Designing and Developing Mobile
4. Applications with UML and XML, Reza Behravanfar, Cambridge University Press,

Paper 12: CDC1-2 (Core Subject Centric1)

DIGITAL & CYBER FORENSICS

Hours/Week : 4
Credits : 4

Unit I: Recent amendments in IT Act, internet & web technologies, web hosting and development, attributes in cyberspace and legal framework of cyberspace, hacking, virus, obscenity, pornography, programme manipulation, Copyright, Patent, software piracy, intellectual property rights, trademark, domain disputes, and computer security, etc., Encryption and Decryption methods. Search and seizures of evidence.Investigation of cyber crimes and tools for analysis.

Unit II: Information security: Domains, Common Attacks, Impact of Security Breaches. Protecting Critical Systems (Information Risk Management, Risk Analysis etc) Information Security in Depth Physical security (Data security Systems and network security) Program Security: Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats File protection mechanism, Authentication: Authentication basics, Password, Challenge response, Biometrics. Network Security: Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure e-mail, Networks and cryptography, Example protocols: PEM, SSL, IPsec. Principles of network forensics, Attack Traceback and attributes, Critical Needs Analysis. IDS: Network based Intrusion Detection and Prevention Systems, Host based Intrusion Previnsion System. Cloud Computing-Its Forensic and Security Aspects.

Unit III: Cyber Crime Investigations: Where Evidence Resides on Windows systems, Conducting a Windows investigation, File Auditing and Theft of information, Handling the Departing Employee, Steps in a Unix Investigation, Reviewing Pertinent Logs, Performing Keywords Searches, Reviewing Relevant Files, Identifying Unauthorized User Accounts or Groups, Identifying Rogue Processes, Checking for Unauthorized Access Points, Analyzing Trust Relationships, Detecting Trojan Loadable Kernel Models. Finding Network based Evidence, Generating Session data with TCP Trace, Reassembling sessions using TCP flow and Ethereal.

Unit IV: Open source tools for digital forensics and Registry Forensic- Open source, Open source examination platform, preparing the examination system, using LINUX and Windows as host, Study of Sleuth Kit: Installing Sleuth Kit, Sleuth Kit tools (Volume layer tools, File system Layer tools, Data unit Layer tools, Metadata Layer Tools) Registry Analysis, Understanding Windows Registry and Registry Structure.

Books:

1. C. P. Pfleeger, and S. L. Pfleeger, "Security in Computing", Pearson Education.
2. Computer Forensic Investigating Data and Image Files, EC Council Press
3. Robert Jones, Internet Forensics Using Digital Evidence to Solve Computer Crimes, O'Reilly Media Publication
4. Forouzan Data Communication and Networking McGraw Hill
5. Stallings, "Cryptography And Network Security: Principles and practice"
6. Kevin Mandia, Chris Prosise and Matt Pepe, Incident response and computer forensics, McGraw Hill Publication
7. Cory Altheide, Harlan Carvey, Digital Forensics with Open source Tools, Syngress Publication
8. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003
9. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRC

Press LLC, 2004.
10. Stuart McClure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGrawHill, 2003
11. Matt Bishop, “ Computer Security Art and Science”, Pearson/PHI, 2002.`
12. Advances in digital forensic VI by kampui chow, sujeetshenoi
13. Malware forensic by Cameron malin
14. Windows registry forensic by Harlan carvey,
15. Digital forensic for network internet and cloud computing clint garrison
16. Indian Patents Law and Procedure, D. P. Mittal, 2002, New Delhi, Allied Services (P) Ltd. 1999
17. Patent Act,1970.
18. Copyright Act, 1957.
19. Trade Mark Act,1999.
20. Information Technology Act,2000.
21. Linux kernel development , paperback
22. Beginning linux, paperback 77. Linux command line and shell script , paperback

M.Sc.(Computer Science)

Semester IV

Paper 13: Data Mining

Hours/Week : 4
Credits : 4

Unit-1 :

Introduction to Data Mining: Why Mine Data? Commercial Viewpoint, Scientific Viewpoint Motivation, Definitions, Origins of Data Mining, Data Mining Tasks, Classification, Clustering, Association Rule Discovery, Sequential Pattern Discovery, Regression, Challenges of Data Mining, Data Mining-Data: What is Data? Attribute Values, Measurement of Length, Types and Properties of Attributes, Discrete and Continuous Attributes, Types of data sets, Data Quality, Data Preprocessing, Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Attribute Transformation, Density.

Unit-2 :

Data Mining: Exploring Data: Data Exploration Techniques, Summary Statistics, Frequency and Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Visualization, Representation, Arrangement, Selection, Visualization Techniques: Histograms, , Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Other Visualization Techniques, OLAP : OLAP Operations, Data Mining Classification: Bask Concepts, Decision Trees, and Model Evaluation: Classification: Definition, Classification Techniques, Tree Induction, Measures of Node Impurity, Practical Issues of Classification, ROC curve, Confidence Interval for Accuracy, Comparing Performance of Two Models, Comparing Performance of Two Algorithms.

Unit-3 :

Data Mining Classification: Alternative Techniques: Rule-Based Classifier, Rule Ordering Schemes, Building Classification Rules, Instance-Based Classifiers, Nearest Neighbor Classifiers, Bayes Classifier, Naive Bayes Classifier, Artificial Neural Networks (ANN), Support Vector Machines. Data Mining Association Analysis: Basic Concepts and Algorithms: Association Rule Mining, Frequent Itemset Generation, Association Rule Discovery : Hash tree, Factors Affecting Complexity, Maximal Frequent Horible Closed Itemset, Alternative Methods for Frequent Itemset Generation, FPgrowth Algorithm, Tree Projection, Rule Generation, Pattern Evaluation, Statistical Independence, Properties of A Good Measure, Support-based Pruning, Subjective Interestingness Measure.

Unit-4 :

Data Mining Cluster Analysis: Basic Concepts and Algorithms: Applications of Cluster Analysis, Types of Clusters, Clustering Algorithms: 'K-means and its variants, Hierarchical clustering, Density based clustering. Graph-Based Clustering, Limitations of Current Merging Schemes, Characteristics of Spatial Data Sets, Shared Near Neighbor Approach, ROCK (RObust Clustering using linKs), Jarvis Patrick Clustering, SNN Clustering Algorithm, Data Mining Anomaly Detection: Anomaly jOutlier Detection, Importance, Anomaly Detection Schemes, Density-based: LOF approach

Books :

1. Introduction to Data Mining by Tan, Steinbach, Kumar.
2. Data Mining: Concepts and Techniques by Jiawei Han, MichelineKamber, Morgan Kaufmann

Reference Books:

1. Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten and Eibe Frank, Morgan Kaufmann, 2nd Edition (2005).
2. Principles of Data Mining: David Hand, HeikkiMannila&Padhraic Smyth, PHP Publication.

Paper 14 :Artificial Intelligence & Expert System

Hours/Week : 4
Credits : 4

Unit-1 :

AI problems, AI Techniques, Tic-tac-toe, Question Answering, Problem as a state space search, A water jug problem, production system, Control strategies, Heuristic Search, Problem Characteristics, Production system characteristics, Design of search programs

AI Search techniques :- Depth-first, Breadth-first search, Generate-and-test, Hill climbing, Best-first search, Constraint satisfaction, Mean-ends-analysis, A* Algorithm, AO* algorithm.

Unit-2 :

Knowledge Representation:- Representations and mappings, Knowledge Representations, Issues in Knowledge Representation, Predicate Logic:- Representing Instance and Isa Relationships, Computable Functions and predicates, Resolution, Natural Deduction, Logc programming, Forward versus Backward Reasoning, Matching, Control knowledge, Expert System.

Unit-3 :

Games playing :Minimax search procedure , adding alpha-beta cutoffs, additional refinements,

Planning :- Component of a planning system, Goal task planning, Nonlinear planning, Hierarchical Planning.

Unit-4 :

Understanding, Understanding as Constraint satisfaction, Natural Language Processing, Syntactic Processing, Unification grammars, Semantic Analysis, Introduction to pattern recognition, Parallel and Distributed AI, Psychological Modeling, Distributed Reasoning Systems,

Books :

1. Artificial Intelligence by Elaine Rich, Mcgrawhill Inc.
2. Artificial Intelligence and Expert Systems – Jankiraman, Sarukes (M)

Reference Books:

1. Expert System : Theory and Practice- Ermine (PHI)
2. Lisp Programming – RajeoSangal – (TMH)
3. Rule based Expert System – M.Sasikumar (Narosa)
4. Artificial intelligence – Russell-Pearson- Ist Text book.
5. Principles of AI- Nils Nilson
6. A.I. by R.J.Winston - Pearson
7. ES : Theory and Practice- Ermine – PHI.
8. Int. ti Expert System – Jackson – Pearson.

Paper 15: CE2-1 (Core Elective 2)

Design and Analysis of Algorithm

Hours/Week : 4
Credits : 4

Unit-1 :
Elementary Algorithmics: Introduction- Problems and Instances- The Efficiency of algorithms- Average and worst case Analysis. Asymptotic Notation: A notation for the order of – Other asymptotic notation- Conditional asymptotic notation- Asymptotic notation with several parameters- Operations on asymptotic notation.
Analysis of Algorithms: Introduction- Analyzing control structures- Average case analysis- Amortized Analysis- Solving recurrences.

Unit-2 :
Greedy Algorithms: Making change- General Characteristics of Greedy algorithms- Minimum spanning trees and shortest paths- Knapsack Problems- Scheduling.
Divide and Conquer: Introduction- Multiplying large numbers- The general template- binary search-sorting- Finding the median- Matrix multiplication- Introduction to cryptography.

Unit-3 :
Dynamic Programming: The Principle of Optimality- making change the knapsack problem- shortest paths- Chained matrix multiplication- approaches using recursion- Memory functions.

Unit-4 :
Back tracking & Brach Bound: Traversing trees- Depth first search of directed and ndirected graph- Breadth first search- Back tracking- Branch and bound- The minimax principle, Introduction to NP-Completeness; Classes P and NP- Polynomial reductions- NP- Complete Problems NP- Hard problems- Non- Deterministic algorithms.

Books :

1. Fundamentals of Algorithms - Gilles Brassard & Paul Brately. Prentice-Hall (India)Ltd.

Reference Books:

1. Fundamentals of Computer Algorithms by Ellis Horowitz &SartajSahani. Galgotia Publication.
2. Computer Algorithms: Introduction to Design & Analysis. Sara Baase& Alien Van Gelder. Addison Wesley Publishing Company.

Paper 15: CE2-2 (Core Elective 2)
Embedded System

Hours/Week : 4
Credits : 4

Unit-1 :

Introduction to Embedded Systems:Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded System-on-chip (Soc) and Use of VLSI Circuit Design Technology, Complex Systems Design and Processors, Design Process in Embedded System, Formalization of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills Required for an Embedded System Designer 8051 and Advanced Processor Architectures, Memory Organization and Realworld Interfacing:

8051 architecture, Real World Interfacing, Introduction to Advanced Architectures, Processor and Memory Organization,Instruction-Level Parallelism, Performance Metrics,Memory-Types, Memory-Maps and Addresses, Processor Selection, Memory Selection, Devices and Communication Buses for Devices Network:Types and Examples, Serial Communication

Devices, Parallel Device Ports, Sophisticated Interfacing Features in Device Ports, Wireless Devices, Timer and Counting Devices, Watchdog Timer, Real Time Clock, Networked Embedded Systems, Serial Bus Communication Protocols, Parallel Bus Device Protocols-Parallel Communication Network Using ISA, PCI, PCI-X and Advanced Buses, Internet Enabled Systems-Network Protocols, Wireless and Mobile System Protocols

Unit-2 :

Device Drivers and Interrupts Service Mechanism:Programmed-I/O Busy-wait Approach without Interrupt Service Mechanism, ISR Concept, Interrupt Sources, Interrupt Servicing (Handling) Mechanism, Multiple Interrupts, Context and the Periods for Context Switching, Interrupt Latency and Deadline, Classification of Processors Interrupt Service Mechanism from Context-Saving Angle, Direct Memory Access, Device Driver Programming,

Programming Concepts and Embedded Programming in C, C++ and Java: Software Programming in Assembly Language (ALP) and in High-Level Language 'C' 235 , C Program Elements: Header and Source Files and Preprocessor Directives, Program Elements:

Macros and Functions, Program Elements: Data Types, Data Structures, Modifiers, Statements, Loops and Pointers, Object-Oriented Programming, Embedded Programming in C++, Embedded Programming in Java,

Program Modeling Concepts:Program Models, DFG Models, State Machine Programming

Models for Event-controlled Program Flow, Modeling of Multiprocessor Systems, UML Modelling

Unit-3 :

Interprocess Communication and Synchronization of Processes, Threads and Tasks:Multiple Processes in an Application, Multiple Threads in an Application, Tasks, Task States, Task and Data, Clearcut Distinction between Functions, ISRS and Tasks by their Characteristics, Concept of Semaphores, Shared Data, Interprocess Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions,

Real Time Operating Systems: OS Services, Process Management, Timer Functions, Event Functions,

Memory Management, Device, File and 10 Subsystems Management, Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls, Real-time Operating Systems, Basic Design Using an RTOS, Rtos Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics, OS Security Issues,

Unit-4 :

Real time Operating System ProgrammingI:

MicrodOS-II and VxWorks, Basic Functions and Types of RTOSES, RTOS mCOS-II, RTOS VxWorks,

Realtime Operating System ProgrammingII:

Windows CE, OSEK and Real-time Linux Functions,Windows CE, OSEK, Linux 2.6.x and RTLinux,

Design Examples and Case Studies of Program Modeling and Programming with RTOS **I:**Case Study of Embedded System Design and Coding for an Automatic, Chocolate Vending Machine (ACYM) Using Mucos RTOS, Case Study of Digital Camera Hardware and Sofware Architecture, Case Study of Coding for Sending Application Layer Byte Streams on a TCPIIP Network Using RTOS Vxworks

Design Examples and Case Studies of Program Modeling and Programming with RTOS 2:

Case Study of Communication Between Orchestra Robots, Embedded Systems in Automobile, Case Study of an Embedded System for an Adaptive Cruise Control (ACC) System in a Car, Case Study of an Embedded System for a Smart Card, Case Study of a Mobile Phone Software for Key Inputs,

Embedded Software Development Process and Tools:Introduction to Embedded Software Development Process and Tools, Host and Target Machines, Linking and Locating Software, Getting Embedded Software into the Target System, Issues in Hardware-Software Design and Co-design,

Testing, Simulation and Debugging Techniques and Tools:Testing on Host Machine: Simulators, Laboratory Tools

Books :

1. Embedded Systems: Architecture, Programming and Design, Raj Kamal, McGraw Hill

Reference Books:

1. Embedded System Design" Frank Vahid&TonyGivargis; John Wiley &sons, Inc.
2. Real – Time Systems and software"Alan C. Shaw ; John Wiley &Sons Inc
3. Fundamentals of embedded Software", Daniel W. Lewis, Pearson
4. Real time Systems", J. W. S. Liu, Pearson
5. Embedded Realtime System Programming", S. V. Iyer and P. Gupta, TMH
6. An Embedded System Primer" David E. Simon; Addison-Wesley Pub
7. Embedded System Design" Steve Heath; Butterworth-Heinemann Pub.
8. Embedded System Computer Architecture" Graham Wilson, Butterworth-Heinemann
9. Introduction to Embedded Systems by Shibu K V (TMH)

Paper 15: CE2-3 (Core Elective 2)
Pattern Recognition

Hours/Week : 4
Credits : 4

Unit-1 :
Introduction to Pattern Recognition, Bayesian decision theory: Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, discrete features

Unit-2 :
Maximum Likelihood and Bayesian Estimation: Parameter estimation methods, MaximumLikelihood estimation, Bayesian estimation, Bayesian Parameter Estimation, Gaussian Case, General Theory, Problem of Dimensionality, Accuracy, Dimension, and Training Sample Size, ComputationalComplexity and Overfitting, Component Analysis and Discriminants, Principal Component Analysis (PCA), Expectation Maximization (EM), Hidden Markov models for sequential pattern classification, First-Order Markov Models, First-Order Hidden Markov Models, Hidden Markov Model Computation, Evaluation, Decoding and Learning.

Unit-3 :
Non-parametric: Density estimation, Parzen-window method, Probabilistic Neural Networks (PNNs),K-earestNeighbour, Estimation and rules, Nearest Neighbour and Fuzzy Classification. Linear Discriminant function based classifiers: Perceptron, Linear Programming Algorithm, Support Vector Machines (SVM)

Unit-4 :
Multilayer Neural Network: Feed Forward Classification, Back Propagation Algorithm, Error Surface Stochastic Data: Stochastic search, Boltzmann Learning, Evolutionary method and Genetic Programming.Non-metric methods for pattern classification: Decision trees, Classification and Regression Trees (CART) and other tree methods, String recognition and Rule Based method. Unsupervised learning and clustering : Mixture Densities and Identifiability, Maximum Likelihood estimation, Application Normal Mixture, Unsupervised Bayesian Learning, Data Description and Clustering, Hierarchical Clustering, Graph theory method, Problem of validity, Component analysis

Books :

1. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification 2nd Edition", John Wiley, 2007 2. 2. Christopher M. Bishop, "Neural Network for Pattern Recognition", Oxford Ohio Press.

Reference Books:

1. E. Gose, R. Johansonbargh, "Pattern Recognition and Image Analysis", PHI
2. EthenAlpaydin, "Introduction to Machine Learning", PHI
3. SatishKumar, "Neural Network- A Classroom Approach", McGraw Hill.
4. Dr. Rao&Rao,Neural Network & Fuzzy Logic
5. S. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press,
6. C.M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006
7. RajjanShinghal : Pattern Reognition (TMH)

Paper 16: FC2-1 (Foundation 2)
Advances in Information Technology

Hours/Week : 4
Credits : 4

Unit I:
Software and programming languages. Introduction, The Software: Software types, Systems Software, Application Software, Types of Programming Languages. Characteristics of good programming language, Development of programming languages-machine language, assembly language, high level language. Introduction to Microsoft Office, working with MS Word, MS Excel, MS Power point, Data Base, Data Base Management System

Unit II:
Computer communication, need for networks, forms of data communication – analog, digital; data transmission modes, data transmission media (Twisted pair, co-axial, Fibre Optic, Microwave, Satellite communication), Bandwidth, Protocols, modems, Multiplexing, Types of network-, LAN, WAN, MAN, Network topology, types of topologies, advantages & limitations .

Unit III:
Concept of E-Commerce and Internet. Brief history and development of internet, WWW, Internet architecture – servers, browsers, URL; service providers – shell account, TCP/IP internet services and Internet applications , Intranet, Extranet, Virus, Types of Viruses, Anti-Virus, Firewall and Anti-Spy ware Utilities, Open Source Software.

Unit IV:
Current Trends in Wireless communication: Mobile Internet, GPS, 3G, 4G, Wi-Fi, Bluetooth, Wireless Application Protocol,
Electronic Commerce, Types of E-Commerce and their utilities, M-Commerce.
Advanced Trends in IT - Mobile Computing, Cloud Technology, Bioinformatics, Virtual Reality, Neural Network, Grid Computing, Intelligent Software Agent, , Virtual LAN Technology, Distributed Computing, OLAP, Data Mining, BPO & KPO, Artificial Intelligence & Expert System, ERP, E-Banking.

Books:
1) Dr. Madhulika Jain, Shashank&Satish Jain ,"Information technology Concepts", BPB Publication, New Delhi, ISBN-- 8176562769
2) Information Technology - Dr. SushilaMadan (Taxmann's)
3) Computer Fundamentals By P. K. Sinha
4) Business On The Net An Introduction To The Whats And Hows Of Ecommerce By K. N. Agarwala& Others (Macmilan)
5) Verma,"Computer, Internet & Multimedia – Dictionary", Universities Press

Paper 16: FC2-2 (Foundation 2)

BANKING OPERATIONS AND SERVICES

Hours/Week : 4
Credits : 4

Unit I: Overview - Definition-utility of banks – banks and economic development -types of banks with their individual functions –Role of RBI – Monetary management –business in the globalized era, Rights of a banker, Clayton's case, Banker's Obligation to honourcheques, Secrecy of customers' accounts. Customers' Accounts -.Introduction for opening new accounts, opening of savings, current and fixed deposit accounts Minor's accounts, Club accounts, Partnership accounts, Joint stock company's account. Attorney's account, Joint accounts, Insolvency of the customer

Unit II: Payment and Collection of Cheques - Form of Cheque, Date, Amount, Insufficiency of funds, customer's signature, Countermanding payment of cheque, Crossing, Not Negotiable Crossing, Endorsements and Effect of Material Alterations. Liability for conversion, Protection to the collecting Banker, Duties of Collecting Banker.

Unit III: Bills of Exchange - Definition, Parties, Accommodation Bill, Calculation of Date of Maturity, Dishonour of Bills, Noting and Protesting, Drawee in Case of Need. Bank Drafts - salient features Advances - Advances against various securities, Life Policy, Fixed Deposit Receipt, Goods, Shares, Advances against Guarantees, Advances to Small-scale industries, Registration of Charge under Companies Act, 1956. Accounts Receivable financing Advances for priority sectors—Hypothecation, Documentation.

Unit IV: Investment Banking services: Fee based and Fund based services: Credit Cards, Debit Cards, , Venture Capital, Factoring, Forfeiting and Bill Discounting. Leasing and Hire Purchase, Housing Finance, Other investment banking a services including distribution of Insurance and Mutual fund products, PMS – Process and monitoring. Merchant Banking Services - Merchant Banking: An Introduction, Issue Management, Corporate Restructuring and Mergers and Project Financing.Securitization.Credit Rating.

Books:

1. Management of Banking and Financial Services,Padmalatha Suresh & Justin Paul, Pearson Education
2. Basics of Banking IIBF, Mumbai Taxmann Publications – paper I
3. Banking Law & Practices by H.C. Agarwal, Siwan Publications. –paper I
4. Indian Financial System & Commercial Banking by Shri B. Raviramchandran, Dr. Dwivedi et al, IIBF, Mumbai Paper I
5. An introduction to documentary Credit – RupNarayan Bose, Macmilan India Ltd. New Delhi –paper I
6. Financial Institutions, Markets & money by David S. Kidwell & others, John Willy & Sons
7. The Indian Financial System,3rdEdition,BharatiV.Pathak, Pearson Education

Paper 16: FC2-3 (Foundation 2)

INFORMATION SECURITY AND CYBER LAW

Hours/Week : 4
Credits : 4

Unit-I : - Information Security : Overview, need for information security, objectives of Information security. - Global information systems and their evolution, basics of information systems, role of the Internet and the World Wide Web - Understanding about the threats to information systems security Building blocks of InfoSec, How Organizations manage security of their information systems Information security risk analysis fundamentals - Importance of physical security and biometrics controls for protecting information systems assets - Security considerations for the mobile work force - Network security perspectives, networking and digital communications (overview only), security of wireless networks.

Unit-II : - Cryptographic techniques and Encryption, Intrusion Detection Systems and Firewalls, security of virtual private networks - Security issues in application development with emphasis on integration of enterprise applications, database security, operating security and security of electronic mailing systems - Security models and frameworks and standards through introduction to the ISO 27001, SSE-CMM (systems security engineering – capability maturity model), COBIT (Control Objectives for Information and related technologies) and the SarbanesOxley Act (SOX) and SAS 70 (statement on auditing standards) - Privacy Fundamentals, business practices‘ impact on data privacy, technological impact on data privacy, privacy issues in web services and applications based on web services - Information security best practices – staffing, audits, disaster recovery planning and business continuity planning and asset management - Ethical issues and intellectual property concerns for information security professionals – copy right, data protection etc.

Unit-III : - Introduction of IT Act 2000, main features of IT Act 2000, Digital Signature - Access Control : Operating system Access Controls, Group and Roles, Access Control lists, Unix Operating System Security, Windows NT, Capabilities, Added Features in Windows 2000, Granularity, Sandboxing and Proof-carrying code, Hardware protection, Other technical Attacks. - Cryptography &PKI : Symmetric Cryptography, Asymmetric Cryptography, Keys, Hash Functions, Digital Signatures. - Distributed Systems - Concurrency, Fault Tolerance and Fault Recovery, Naming.

Unit-IV - Multilevel and Multilateral Security : Multilevel Security, Multilateral Security - Electronic Banking –Banking and Bookkeeping. - Monitoring Systems –Introduction, Alarms, Prepayment Masters. - Biometrics : Physiological biometric techniques, behavioral biometric techniques, - New biometric techniques, biometric systems. - Incident Response : Incident Response, Prerequistes to planning an IRT. - Network attack and Defence : Most Common Attacks, Scripts Kiddies and Packaged Defence. - Management Issues :Organisational Issues, - Protecting E-commerce Systems – Introduction - Hacking – Introduction

Books :

1. Information Systems Security Management - Nina S. Godbole (Wiley India Pvt. Ltd.)
2. Security Engineering - Ross Anderson

3. Information Security Management Handbook -Harold Tpton&Micki Krause (Auerbach Publications)
4. Network Security Essentials: Applications and Standards - W. Stallings (Pearson Education)
5. eSecurity and You - SandeepOberoi (Tata McGraw-Hill)
6. Cyber Laws – Singh Yatindra
7. Cyber Crime – Bansal S K
8. Cyber law , E-commerce & M-Commerce – AhmandTabrez
9. Handbook of Cyber and E-commerce laws – Bakshi P M &Suri R K
10. Management Fundamentals and Information Systems Dr. SushilaMadan (Taxmann‘s)

Paper 16: CDC2-1 (Core Subject Centric 2)

Parallel Computing

Hours/Week : 4
Credits : 4

Unit-1 :

Introduction to Parallel Computing:Motivating Parallelism, Scope, Applications, Parallel Programming Platforms:Implicit Parallelism: Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques

Unit-2 :

Principles of Parallel Algorithm Design: Preliminaries ,Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, Basic Communication operations:One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift , Improving the Speed of Some Communication Operations

Unit-3 :

Analytical Modeling of Parallel Programs: Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics, Programming Using the Message Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations , MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators,

Unit-4 :

Programming Shared Address Space Platforms: Thread Basics, Why Threads? The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, OpenMP: a Standard for Directive Based Parallel Programming, Dense Matrix Algorithms: Matrix- Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort, Other Sorting Algorithms,
Graph Algorithms: Minimum spanning tree Prims Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms, Dynamic Programming: Overview of Dynamic Programming, Serial Monadic DP Formulations, Monadic DP Formulations, The Longest-Common- Subsequence Problem, Serial Polyadic DP Formulations, Floyd's All-Pairs Shortest-Paths Algorithm, NonserialPolyadic DP Formulations, The Optimal Matrix-Parenthesization Problem, Fast Fourier Transform: The Serial Algorithm, The Binary-Exchange Algorithm, The Transpose Algorithm

Books :

1. Introduction to Parallel Computing, AnanthGrama, Pearson Education

Reference Books:

1. Fundamental of Paralle Processing, Harry F. Jordan, Gita Alaghband, Pearson Education
2. Parallel Programming, Michael Allen, Barry Wilkinson, Pearson Education

Paper 16: CDC2-2 (Core Subject Centric 2)

MOBILE & CYBER FORENSICS

Hours/Week : 4
Credits : 4

Unit I: Mobile Forensic: History, Professional Applications, Types of evidence, Internal memory, External memory, Service provider logs, Forensic process, Seizure, Acquisition, examination and analysis, Data acquisition types, Manual acquisition, Logical acquisition, File system acquisition Physical acquisition tools, Commercial Forensic Tools, Open Source Tools, Forensic desoldering, Chip re-balling, JTAG, Command Line Tools, System commands AT commands dd Non-Forensic Commercial Tools, Flasher tools, controversies.

Unit II: Live Forensic : live response, volatile memory analysis, volatility, PTFinder, the impact on investigated system, memory image analysis, recovering cached and internet artifacts , internet browsing artifacts, volatile data acquisition, volatile forensic method, runtime disk explorer, logical acquisition, memory dump analyzer, crash dump analyzer, cryptanalysis, MAC times, metadata issues, analyzing file time stamps.

Unit III: Image Forensic: Detecting traces of re-sampling, more images are spliced together, detect high quality and consistent image forgeries, detect geometric transformations such as scaling, rotation or skewing re-sampling and interpolation. Detecting near–duplicated image regions, common type of digital image forgery, copy–move forgery, Noise inconsistencies analysis to conceal traces of tampering altered image regions. Application of cyclostationarity analysis to image forensics, (cyslostationary signals) exhibit periodicity in their statistics. Find the traces of geometric transformation shows promising results. Double JPEG compression, CFA analysis, quantization tables analysis, etc.

Unit IV: Network & Anti-Computer Forensics: Ethernet analysis, Network interface card analysis, wireless forensic , attackers footprints , firewall logs, IDS/IPS, web proxies, traffic captures, DHCP log examination, sniffing traffic , analyzing proxy cache, tools like tcpdumps, Snort, ngrep, tcpxtract, and wireshark. Email tracker pro, analyzing index.dat, input debugging, controlled flooding, ICMP traceback, packet marking techniques, honeypots and honeynets, source path isolation engine (SPIE). Anti-Computer Forensic: Definition, Sub-categories, Purpose and goals, Data hiding, Encryption, Steganography, Other forms of data hiding, Artifact wiping, Disk cleaning utilities, File wiping utilities, Disk degaussing / destruction techniques, Trail obfuscation, Attacks against computer forensics Physical, Effectiveness of anti-forensics

Books:

1. Wireless security model randall Nichols
2. Mobile application security by himanshudwivedi
3. Wireless crime and forensic investigation by Gregory kipper
4. Digital image forensic by husrevtaha, nasirmemon
5. Computer forensic investigating data and image files by Ec-council
6. Network forensic tracking hackers by sherri Davidoff
7. Mastering windows network forensic by stevenanson
8. Anti computer forensic by Grednumitor
9. Computer forensic Nathan Clarke
10. Gregory Kipper. Investigator's Guide to Steganography, Auerbach Publications.
11. Wireshark 101 essential skills for network analysis by laura chapel

12. Internet safety by leonotenboom
13. Guide to secure intranet and extranet server by Verisign
14. Intrusion detection with Snort by byrafeequrrehman
15. Improving web application security by Microsoft press
16. Open source security tools by tony howlett
17. Web application security by bryan Sullivan
18. Data recovery e-book V 1.5

Subject wise Core ElectivePapers

M. Sc. Subject	Core elective paper to be opted in sem III (Sem V in case of M. Sc. (Tech) Applied Geology)	Core elective paper to be opted in sem IV (Sem VI in case of M. Sc. (Tech) Applied Geology)
M. Sc. (Computer Science)	Neural Network	Design and Analysis of Algorithm
	Multimedia Technologies	Embedded System
	ASP.NET	Pattern Recognition

Foundation Course: (Candidate can opt for any one foundation course paper as shown below in the semester III and IV (Semester V & VI in case of M. Sc. (Tech) Applied Geology). However, Student shall opt for this paper from any other subject other than his / her main subject for postgraduarion. If the candidate decides to opt for foundation course papers then he/she shall not be eligible to opt for Core (Discipline Centric) papers in their respective subjects). List of foundation courses available:

M. Sc. Subject	Foundation Course I in semester III (Sem V in case of M. Sc. (Tech) Applied Geology)	Foundation Course II in Semester IV (Sem VI in case of M. Sc. (Tech) Applied Geology)
M. Sc. (Computer Science)	Operating system concepts	Advances in information technology
	Principles of Management	Banking Operations And Services
	E-Business	Information Security And Cyber Law

Core (Discipline Centric): (Candidate can opt for this paper as shown below in the semester III and IV (Semester V & VI in case of M. Sc. (Tech) Applied Geology) in their main subject of post graduation only. If the candidate decides to opt for Core (Discipline Centric) papers in their main subject of post graduation then he/she shall not be eligible to opt for Foundation Course papers neither in their own subject nor in any other subject). List of Core (Discipline Centric) course available in the respective subject:

M. Sc. Subject	Core (Discipline Centric) I in semester III (Sem V in case of M. Sc. (Tech) Applied Geology)	Core (Discipline Centric) II in Semester IV (Sem VI in case of M. Sc. (Tech) Applied Geology)
M. Sc. (Computer Science)	Mobile Computing	Parallel Computing
	Digital & Cyber Forensics	Mobile & Cyber Forensics

SYLLABUS FOR

M.Sc. CHOICE BASED CREDIT

SYSTEM (CBCS) SEMESTER PATTERN

IN

MICROBIOLOGY

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR (M.S.), INDIA

2018-2019 Onwards

Candidates opting for this course are advised to go through the direction relating to the course "DIRECTION RELATING TO THE EXAMINATION LEADING TO THE DEGREE OF MASTER OF SCIENCE, SEMESTER PATTERN (CHOICE BASED CREDIT SYSTEM) AND DEGREE OF MASTER OF SCIENCE AND TECHNOLOGY (APPLIED GEOLOGY). SEMESTER PATTERN, (CHOICE BASED CREDIT SYSTEM) (FACULTY OF SCIENCE & TECHNOLOGY)" which is available on R. T. M. Nagpur University website.
The direction will provide details on admission criteria, rules for ATKT, scheme of examination, absorption scheme for CBS students into CBCS pattern, elective papers, foundation course papers, subject centric papers, coding pattern, pattern of question papers, practicals, distribution of marks, seminars, project work, internal assessment, calculation of SGPA and CGPA, etc.

SYLLABUS for M. Sc. MICROBIOLOGY
Choice Based Credit System (CBCS) (Semester Pattern)
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Microbiology.

M. Sc. Microbiology Semester I												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract	
1T1	**PAPER-I** MICROBIAL METABOLISM (MM)	4	-	4	4	3	80	20	100	40		
1T2	**PAPER-II** ENZYMOLOGY AND TECHNIQUES (ET)	4	-	4	4	3	80	20	100	40		
1T3	**PAPER-III** ADVANCE TECHNIQUES IN MICROBIOLOGY (ATM)	4	-	4	4	3	80	20	100	40		
1T4	**PAPER-IV** MEMBRANE STRUCTURE AND SIGNAL TRANSDUCTION (MSST)	4	-	4	4	3	80	20	100	40		
1P1	PRACTICAL-I	-	8	8	4	3-8	100	-	100		40	
1P2	PRACTICAL-II	-	8	8	4	3-8	100	-	100		40	
1S1	SEMINAR	2	-	2	1			25	25	10		
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**	

M. Sc. Microbiology Semester II											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
2T1	**PAPER-I** MICROBIAL METHODS FOR ENVIRONMENT MANAGEMENT (MMEM)	4	-	4	4	3	80	20	100	40	
2T2	**PAPER-II** MICROBIAL METABOLITES (MMT)	4	-	4	4	3	80	20	100	40	
2T3	**PAPER-III** MEDICAL MICROBIOLOGY AND PARASITOLOGY (MMP)	4	-	4	4	3	80	20	100	40	
2T4	**PAPER-IV** IMMUNOLOGY AND IMMUNODIAGNOSTICS (IID)	4	-	4	4	3	80	20	100	40	
2P1	PRACTICAL-III	-	8	8	4	3-8	100	-	100		40
2P2	PRACTICAL-IV	-	8	8	4	3-8	100	-	100		40
2S1	SEMINAR	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

M. Sc. Microbiology Semester III											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
3T1	**PAPER-I** MOLECULAR BIOLOGY AND GENETICS (MBG)	4	-	4	4	3	80	20	100	40	
3T2	**PAPER-II** RECOMBINANT DNA TECHNOLOGY AND NANOBIOTECHNOLOGY (RDTN)	4	-	4	4	3	80	20	100	40	
3T3	**PAPER-III** MICROBIAL DIVERSITY, EVOLUTION AND ECOLOGY (MDEE) – 1 **OR** BIOINFORMATICS (BIF) -1	4	-	4	4	3	80	20	100	40	
3T4	**PAPER-IV** DRUG AND DISEASE MANAGEMENT (DDM)	4	-	4	4	3	80	20	100	40	
3P1	PRACTICAL-V	-	8	8	4	3-8	100	-	100		40
3P2	PRACTICAL-VI	-	8	8	4	3-8	100	-	100		40
3S1	SEMINAR	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

M. Sc. Microbiology Semester IV											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
4T1	**PAPER-I** VIROLOGY (VIR)	4	-	4	4	3	80	20	100	40	
4T2	**PAPER-II** MICROBIAL FERMENTATION TECHNOLOGY (MFT)	4	-	4	4	3	80	20	100	40	
4T3	**PAPER-III** MICROBIAL DIVERSITY, EVOLUTION AND ECOLOGY (MDEE) – 2 **OR** BIOINFORMATICS (BIF)-2	4	-	4	4	3	80	20	100	40	
4T4	**PAPER-IV** VACCINES AND DELIVERY SYSTEM (VDS)	4	-	4	4	3	80	20	100	40	
4P1	PRACTICAL-VII	-	8	8	4	3-8	100	-	100		40
4PROJ 1	PROJECT WORK	-	8	8	4	3-8	100	-	100		40
4S1	SEMINAR	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

NOTE Semester III & IV:

Foundation Course: Candidate can opt for any one foundation course paper in the semester III and IV. However, Student shall opt for this paper from any other subject other than his / her main subject for post graduation. If the candidate decides to opt for foundation course papers then he/she shall not be eligible to opt for Core (Subject Centric) papers in their respective subjects.

Core (Subject Centric): Candidate can opt for this paper as shown in the semester III and IV in their main subject of post graduation only. If the candidate decides to opt for Core (Subject Centric) papers in their main subject of post graduation then he/she shall not be eligible to opt for foundation course papers neither in their own subject nor in any other subjects.

SYLLABUS
FOR
M. Sc CHOICE BASED CREDIT SYSTEM (CBCS) IN MICROBIOLOGY SUBJECT
RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY,
NAGPUR (M.S.) INDIA

SEMESTER – I

CORE PAPER :-			**MARKS**
PAPER-I	1T1	MICROBIAL METABOLISM (MM)	**80 + 20**
PAPER-II	1T2	ENZYMOLOGY AND TECHNIQUES (ET)	**80 + 20**
PAPER-III	1T3	ADVANCE TECHNIQUES IN MICROBIOLOGY (ATM)	**80 + 20**
PAPER-IV	1T4	MEMBRANE STRUCTURE AND SIGNAL TRANSDUCTION (MSST)	**80 + 20**

PRACTICALS

PRACTICAL-I	1P1	**100**
PRACTICAL-II	1P2	**100**
SEMINAR	1S1	**25**

SEMESTER – II

CORE PAPER :-			**MARKS**
PAPER-I	2T1	MICROBIAL METHODS FOR ENVIRONMENT MANAGEMENT (MMEM)	**80 + 20**
PAPER-II	2T2	MICROBIAL METABOLITES (MMT)	**80 + 20**
PAPER-III	2T3	MEDICAL MICROBIOLOGY AND PARASITOLOGY (MMP)	**80 + 20**
PAPER-IV	2T4	IMMUNOLOGY AND IMMUNODIAGNOSTICS (IID)	**80 + 20**

PRACTICALS

PRACTICAL-III	2P1	**100**
PRACTICAL-IV	2P2	**100**
SEMINAR	2S1	**25**

SEMESTER – III

CORE PAPER :-			**MARKS**
PAPER-I	3T1	MOLECULAR BIOLOGY AND GENETICS (MBG)	**80 + 20**
PAPER-II	3T2	RECOMBINANT DNA TECHNOLOGY AND NANOBIOTECHNOLOGY (RDTN)	**80 + 20**
ELECTIVE PAPER :-			
PAPER-III	3T3	ANY ONE OF THE FOLLOWING: -	
		1) MICROBIAL DIVERSITY, EVOLUTION AND ECOLOGY (MDEE) – 1	**80 + 20**
		2) BIOINFORMATICS (BIF) - 1	**80 + 20**

CORE (SUBJECT CENTRIC) :

PAPER-IV	3T4	DRUG AND DISEASE MANAGEMENT (DDM) (To be opted by students of Microbiology only)	**80 + 20**

PRACTICALS

PRACTICAL-V	3P1	**100**
PRACTICAL-VI	3P2	**100**
SEMINAR	3S1	**25**

SEMESTER – IV

CORE PAPER :-			**MARKS**
PAPER-I	4T1	VIROLOGY (VIR)	**80 + 20**
PAPER-II	4T2	MICROBIAL FERMENTATION TECHNOLOGY (MFT)	**80 + 20**

ELECTIVE PAPER:-

PAPER-III	4T3	ANY ONE OF THE FOLLOWING: - 1) MICROBIAL DIVERSITY, EVOLUTION AND ECOLOGY (MDEE) – 2 2) BIOINFORMATICS (BIF) -2	 **80 + 20** **80 + 20**

CORE (SUBJECT CENTRIC) :

PAPER-IV	4T4	VACCINES AND DELIVERY SYSTEM (VDS) (To be opted by students of Microbiology only)	**80 + 20**

PRACTICALS

PRACTICAL-VII	4P1	**100**
PROJECT WORK	4PROJ 1	**100**
SEMINAR	4S1	**25**

SEMESTER - I
Paper-I
1T1
Microbial Metabolism (MM)

UNIT-I: - Carbohydrate and Lipid
Carbohydrates as informational Molecules:-Sugar code, Plant Lectins: - ConA, GS4, WGA. Animal:- Galectin A, MBP-1.Viral:- HA, VPI. Bacterial:- LT,CT.
Reverse TCA cycle, Biosynthesis of cell wall polysaccharides and bacterial peptidoglycan.
Lipid:-Membrane lipids, biosynthesis of membrane phospholipids, ketone bodies.

UNIT-II: - Proteins and Nucleic acids
Proteins:-Determination and characteristics of alpha-helix and β-sheets. Concept of protein domain and motif, common motifs and their role in metabolism, protein folding and denaturation curves, role of Chaperones and chaperonins, Biosynthesis of all amino acids.
Nucleic acids:-Structural details of Duplex DNA, Unusual structures: palindrome, inverted repeats, mirror repeats, triplet DNA,G tetraplex ,secondary structure of RNA purine and pyrimidine biosynthesis, degradation and regulation, salvage pathway, Inhibitors.

UNIT-III: - Photosynthesis
Anoxygenic photosynthesis:-Green sulphur bacterial, non-sulphur bacterial, purple phototrophic bacteria.
Oxygenic photosynthesis:-Cyanobacterial.
Chemolithotrophy:- Hydrogen oxidation and autotrophy in hydrogen bacteria. Oxidation of reduced sulphur compounds and Iron.
Bioluminiscence

UNIT-IV:-Nitrogen and Sulphur metabolism and methanogenesis.
Nitrification and Anammox. Nitrate reduction and Denitrification.
Nitrogen fixation: Symbiotic, nonsymbiotic. Sulphate reduction.
Methanogenesis, Acetogenesis, Acetate use and autotrophy.

SEMESTER - I
Paper-II
1T2
Enzymology and Techniques (ET)

UNIT-I: - Enzymes kinetics
Overview of Michaelis-Menten equation and its transformation, Evaluation of kinetic parameters, Kinetics of bisubstrate reaction, multistep reactions, kinetics of enzyme inhibition, Classification of enzymes

UNIT-II: - Catalytic mechanisms
Concept of active site, determination of active site, acid –base catalysis, covalent catalysis, metal ion cofactors, proximity and orientation effects, preferential binding.
Active site determination and mechanism of lysozyme, Active site determination and mechanism of serine protease.

UNIT-III: - Regulation of Enzyme activity
Allosterism, Kinetic analysis of allosteric enzymes
Covalent Modification, Feed -back inhibition
Membrane bound enzymes, isoenzymes and marker enzymes.
Constituitive and inducible enzymes.

UNIT-IV: - Techniques
Protein: ligand binding studies: association and dissociation constants, co-operative ligand binding MWC or concerted model, sequential model.
Enzyme biosensors: General concept, glucose biosensor. Industrial applications of enzymes. Protein engineering.

SEMESTER - I
Paper –III
1T3
Advance Techniques in Microbiology (ATM)

UNIT-I: - Biophysical Techniques-I
Determination of size, shape and Molecular weight of Macromolecules:- by Viscosity, CD/ORD, Light scattering, diffusion sedimentation and Centrifugation techniques.

UNIT-II: -Biophysical Techniques-II
Electrophoresis: Agarose Gel, SDS-page, two-dimensional gel electrophoresis, capillary electrophoresis, immune-electrophoresis.

UNIT-III: -Microscopical Techniques.
Electron Microscopy: SEM, TEM, Staining procedures and microscopy. Fluorescent Microscopy: Staining procedures and Microscopy, FISH. Laser scanning, confocal microscopy. Scanning tunneling and atomic force microscopy. Immunoelectron microscopy, cryoelectron microscopy.

UNIT-IV: -Other advance techniques
Blotting techniques: Western, Southern, Northern, Radioimmunoassay. NMR and its biological importance. Site-directed mutagenesis, transcriptional start point mapping.

SEMESTER - I
Paper-IV
1T4
Membrane structure and Signal Transduction (MSST)

UNIT-I: - Structure and organization of membranes
Mitochondria, endoplasmic reticulum, prokaryotic membrane, membrane junctions (Gap & tight junctions), techniques for membrane study: electron microscopic method, membrane vesicles, differential scanning colorimetry, flouroscence photobleaching recovery, flow cytometry.

UNIT-II: - Membrane Transport
Active and Passive transport, uniport, ATP powered pumps, non-gated ion channels, cotransport by symporters and antiporters, transepithelial transport.

UNIT-III: - Signal Transduction
General concept of cell signaling, G-protein coupled receptors and their effectors.
RTK and MAP Kinases. Down regulations of pathways. Cytokine receptors and their mechanism (JAK-STAT pathway).

UNIT-IV: - Bacterial signal transduction
Basic two component system. Histidine kinase pathway. Sporulation as a model of bacterial signal transduction. Osmoregulatory pathways. Heat shock proteins. Mating types of yeast.

PRACTICAL-I
1P1

1) Detection of enzyme activity of lipase, Urease, invertase, protease, Tween 80 hydrolysis.
2) Determination of kinetic constant of amylase:-Amylase activity, Vmax, Km.
3) Effect of pH and temperature on amylase activity.
4) Effect of inhibitors on amylase activity.
5) Estimation of protein:
6) Production, isolation and purification of enzyme and determination of fold purification (any one enzyme)
7) Estimation of sucrose in presence of glucose.
8) UV absorption of proteins, DNA and RNA.
9) Estimation of L-leucine by colorimetric method.
10) Determination of pka of an amino acid.

Minimum seven experiments must be performed in the semester.

PRACTICAL-II
1P2

1) Separation of DNA by agarose gel electrophoresis and estimation of DNA by Diphenylamine method.
2) Estimation of RNA by Orcinol method.
3) Separation of amino acids by paper chromatography.
4) Separation of serum proteins by paper electrophoresis.
5) Thin layer chromatography of mycotoxins
6) SDS-Page of proteins.
7) Performance of affinity chromatography.
8) Performance of Gel filtration chromatography.
9) Demonstration of blotting technique.[any one].
10) Ion exchange chromatography

Minimum seven experiments must be performed in the semester.

SEMESTER - II
Paper-I
2T1
Microbial Methods for Environment Management (MMEM)

UNIT-I: - Eutrophication, Biodeterioration and Biomagnification
Eutrophication: Microbial changes induced by organic and inorganic pollutants, factors influencing eutrophication process and control of eutrophication.
Biodeterioration: Definition and concept of biodeterioration, biodeterioration of woods and pharmaceutical products.
Biomagnification: concept and consequences, Biomagnifications of chlorinated hydrocarbons and pesticides.

UNIT-II: - Biotransformation and Bioleaching, Biodegradation
Biotransformations: metals and metalloids, mercury transformations, biotransformation of pesticides such as hexachlorobenzene.
Bioleaching: Bioleaching of ores, leaching techniques and applications.
Biodegradation: Biodegradation of plastics.

UNIT-III: - Pollution Management
Waste water management using activated sludge, aerated lagoons, trickling filter, rotary biological contractors, fluidized bed reactors, stabilization ponds. Concept of phytoremediation and applications.

UNIT-IV: - Global Environmental Problems
Ozone depletion, UV-B, green house effect, acid rain, their impact and biotechnological approaches for management. Acid mine drainage and associated problems. Global warming and climate change.

SEMESTER - II
Paper –II
2T2
Microbial Metabolites (MMT)

UNIT-I:- Overview of metabolites
Metabolites: General account of metabolites, secondary metabolites. Classification, structure and mode of action of secondary metabolites. Plants secondary metabolites: Digitoxine, Salicylic acid, Mycotoxins-Aflatoxin, Ochratoxin, Patulin.
Biopolymers: Polypeptides (collagen, casein and serum albumin), Polynucleotides and polysaccharides(amylose, amylopectin, alginate, cellulose) and other biopolymers like chitin, Xanthan, dextrin, Gellan, Pullulan, curdlan and hyluronic acid.
Polyamines: Brief outline and functions of polyamines. Synthesis of linear polyamine-putrescine, cadoverine, spermidine and spermine.

UNIT-II:- Antimicrobial drugs: Secondary metabolites
Antibiotics: History and discovery of antibiotics, Antibiotic resistance, Mechanisms of antibiotic resistance.
Structure and mode of action of antibiotics:
Aminoglycosides (Amikacin), Carbapenems (Imipenim), Microlids (Azithromycin), Nitrofuran (Nitrofurantoin), Penicillin (Amoxicillin), Quinolones (Gatifloxacin/Ciprofloxacin), Sulphonamides (Sulfamethoxazole),Tetracyclines (Doxycyclines), Chloramphenicol, Fucanazole.

UNIT-III:-Pigments as secondary metabolites
General account of pigments, Chlorophylls, Carotenoids of eukaryotes, phycobilliproteins. Hemoglobin, Myoglobin, Melanin and bile pigments. Microbial pigments: Bacteriochlorophylls, Carotenoids of prokaryotes, rhodopsin and accessory pigments(Pulcherrimin, indigoidin, voalecin) Defensive role of pigments.

UNIT-IV:-Microbial vitamins
Characteristics of fats and water soluble vitamins.
Structure, function and chemistry of: Retinol (vitamin A), Riboflavin (vitamin B_2), Cynocobalamine (Vitamin B_{12}) and ascorbic acid (vitamin C).
Deficiency diseases in humans:
Xerophthalmia, Beri Beri, Pellegra, Scurvey, Keratomalacia, osteoporosis, Osteomalacia, Cheilosis, Glossitis, Pernicious anemia and Erythroid hypoplassia.

SEMESTER - II
Paper-III
2T3
Medical Microbiology and Parasitology (MMP)

UNIT-I: - Infection
Infection: Definition, Types, stages of infection, process of infection.
Establishment of pathogenic microorganisms: Entry, spread and tissue damage. Mechanism of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts. Aggresssins and toxins.

UNIT-II: - Bacteriology
Pathogenic Bacteria: Morphological characteristics, Pathogenesis and Laboratory diagnosis including rapid methods of following pathogenic bacteria;
Klebsiella pneumoniae; Proteus vulgaris; Proteus mirabilis; Shigella dysenteriae; Pseudomonas aeruginosa: Vibrio cholerae; Streptococcus pneumoniae.
New emerging infections:- *Streptococcus suis; community associated Methicilin resistant Staphylococcus aureus* (MRSA), *Bordetella pertusis, Clostridium difficile, Multi drug resistant tuberculosis.*

UNIT-III: - Mycology
Pathogenic Fungi: Morphological characteristics, pathogenesis and laboratory diagnosis of following pathogenic fungi:-
Microsporum; Trichophyton; Histoplasma capsulatum; Blastomyces dermatitidis; Candida albicans; Cryptococcus neoformans; Pneumocystis carinii.

UNIT-IV: - Parasitology
Parasites: *Entamoeba histolytica; Giardia lamblia; Plasmodium vivax; Leishmania donovani.*
Helminths*: Taenia saginata; Taenia solium; Hymenolepis nana; Schistosoma haematobium*.

SEMESTER - II
Paper –IV
2T4
Immunology and Immunodiagnostics (IID)

UNIT-I: - Overview of the Immune system and CMI
Cells involved in Immune system: Hematopoiesis, Lymphocytes, mononuclear phagocytes, Antigen presenting cells, Granulocytes.
Lymphoid organ: Lymphatic system, Primary and Secondary lymphoid organs.
Complement System: Pathways of complement activation, regulation of complement system, Biological functions of complement system.
Inflammation: Intracellular cell adhesion molecules, Mechanism of cell migration, Inflammation. Pathways of antigen processing and presentation.
Cell Mediated Immunity: General properties of effector T cells, Cytotoxic T Cells, Natural Killer cells, Antibody-Dependent cell mediated cytotoxicity. T-Cell dependent and T-cell independent defense mechanisms.

UNIT-II: - Specific Immune Response
Cancer and the Immune system: Origin and Terminology, Malignant Transformation of cells, oncogenes and cancer induction, Tumor Antigens, Immune surveillance theory, Tumor evasion of the Immune system, Cancer Immunotherapy.
Transplantation Immunology: Immunological basis of Graft Rejection, Mechanism of Graft rejection. Immunosuppressive therapy: General and specific. Clinical Transplant.
Tolerance: Central and peripheral tolerance to self antigens, Mechanism of induction of natural tolerance.

UNIT-III: - Immune Dysfunction
Immunodeficiency disorders:- Phagocytic cell defect (Chediak-Higashi syndrome); B-cell deficiency (Bruton's X-linked hypogammaglobulinemia); T-cell deficiency disorder (DiGeorge Syndrome); Combined B-cell & T-cell deficiency disorder (SCID-Severe combined immunodeficiency diseases, Wiskott-Aldrich syndrome); Complement deficiencies and secondary immunodeficiency conditions carried by drugs, nutritional factors & AIDS.
Autoimmunity and autoimmune diseases:-General consideration, Etiology, Clinical categories, Diagnosis and treatment. RA(Rheumatoid arthritis); SLE (Systemic Lupus Erythematosus); Guillain-Barre Syndrome; Multiple sclerosis; Mysthenia gravis; Grave's disease; Goodpasture syndrome, Autoimmune haemolytic disease; Pernicious anaemia.
Hypersensitivity :- Type I, Type II, Type III & Type IV

UNIT-IV: - Immunodiagnostics
Precipitation reactions: Immunodiffusion, immunoelectrophoresis,
Agglutination reactions: Bacterial Agglutination, Hemagglutination, Passive agglutination, Reverse passive agglutination and agglutination inhibition.
Immunodiagnostic techniques: Radioimmuno assay, ELISA, Chemiluminiscence immunoassay, Western blotting technique, Complement fixation test, Immunofluorescence, Immunoelectron microscopy.

PRACTICAL-III
2P1

1) Different staining:

a) Acid fast staining,
b) Giemsa staining,
c) Leishmann staining,
d) Flurochrome staining
e) Special staining methods to demonstrate granules, capsule and spores.

2) Isolation of pathogens from clinical samples pus, blood and urine.
3) Conventional and rapid methods of isolation and identification of following pathogenic bacteria, fungi and parasites.
Bacteria: *Staphylococcus aureus, Escherichia coli, Klebseilla pneumoniae, Proteus vulgaris, Proteus mirabilis Salmonella typhi, Salmonella paratyphi, Shigella dysentriae, Shigella flexneri, Pseudomonas aeruginosa, Vibrio cholerae*. **[Any five]**
Fungi: *Candida albicans, Cryptococcus neoformans, Microsporum, trichophyton, Histoplasma capsulatum.* **[Any one]**
Parasite: *Entamoeba histolytica, Girdia lamblia, Plasmodium spp, Trichomonas vaginalis; Taenia solium, Taenia saginata* **[Any one].**

4) Antibiotic sensitivity testing by various methods:

a) Kirby-Bauer's disc diffusion method.
b) Well plate method.
c) Broth dilution method.
d) Agar dilution method.
e) E-strip method for MIC testing.

PRACTICAL-IV
2P2

Diagnostic immunologic principles and methods of followings:-

1) Immunodiffusion
2) Immunoelectrophoresis
3) Blood grouping
4) Widal [slide and tube] tests.
5) TRUST [Toludine Red Unheated Serum Test]
6) Syphcard test
7) Australian latex antigen test.
8) Antistreptolysin 'O'test [ASO]
9) Pregnancy test.
10) Rhematoid arthritis test [RA]
11) RPR [rapid plasma reagin] test.
12) Treponema pallidum haemagglutination test (TPHA).
13) One step test for Qualitative detection of HBs.
14) ELISA [Enzyme Linked Immunosorbent Assay]-HIV and HBs.

SEMESTER-III
Paper-I
3T1
Molecular Biology and Genetics (MBG)

UNIT-I: - Replication Repair and Recombination
Replication:-Initiation-Priming in *E.coli* and Eukaryotes.
Elongation:-Holoenzyme and processivity of replication.
Termination:-In prokaryotes and eukaryotes.
DNA Repair:-Direct reversal of DNA damage, Base excision repair by nucleotide excision.
Homologous recombination:-Rec BCD; gene conversion.

UNIT-II: - Gene Expression
Transcription:-Comparative study of prokaryotic and eukaryotic transcription process, Class I, II, III promoters, Enhancers and silencers, General and specific transcription factors.
Post transcriptional events:-mRNA, rRNA and tRNA processing through splicing mechanism, trans splicing, RNA editing, post transcriptional control of gene expression, gene silencingly, RNA interference, Catalytic RNA and antisense RNA.
Translation:-Initiation, elongation and termination mechanism. Post translational modifications.

UNIT-III: - Gene Regulation Expression
Lac, Arabino and trp operons.
Chromatin remodeling and mRNA and protein degradation control.

UNIT-IV:- Genetics of Bacteria and Bacteriophages
Gene mapping in bacteria by conjugation, transformation and transduction.
Mapping bacteriophage gene by recombination analysis, deletion mapping and complementation.
Transposons: Bacterial, P elements and retroposons

SEMESTER - III
Paper –II
3T2
Recombinant DNA technology and Nano Biotechnology (RDTN)

UNIT-I: - Molecular Cloning Methods.
DNA cloning, restriction enzymes, cloning vectors, genomic library, cDNA library and chromosome libraries.
Screening and identification of genes, Expression vectors, heterologous probes, oligonucleotide probes, microarrays.
PCR: Steps, advantages, limitations, application, RT-PCR,

UNIT-II:- Other molecular tools for studying genes
Restriction mapping: DNA sequencing dideoxy and pyrosequencing, DNA fingerprinting.
S1 Mapping, primer expressions, Dnase footprinting, DMS footprinting.
Nuclear run on transcription, reporter gene transcription.

UNIT-III:- Tissue Culture and stem cell technology
Tissue culture: Tissue culture media and supplements, serum-free media, cell lines and cryopreservation of cells. Primary culture, subculture, suspension culture techniques, transformation and immortalization. Quantitation and characterization of cells.
Stem cell technology-embryonal stem cell and multipotent stem cells, present perspective.

UNIT-IV:- RDT Products.
Tissue plasminogen activator [TPA].Tissue growth factor B. Dnase; **PDGF.**
GEMS/GMO.
Transgenic plants and plant products, Comparative account, Concept of nano biotechnology and its application.

SEMESTER - III
Paper –III
3T3
Microbial Diversity, Evolution and Ecology (MDEE) - 1

UNIT-I: - Microbial Evolution and Systematic
Evolution of Earth and early life forms.
Primitive life forms:-RNA world, molecular coding, energy and carbon metabolism, origin of Eukaryotes, endosymbiosis.
Methods for determining evolutionary relationships:-Evolutionary chronometers, Ribosomal RNA sequencing, signature sequences, phyllogenetic probes, microbial community analysis.
Derivation of Microbial Phyllogeny:- characteristics of domain of life, classical taxonomy, chemotaxonomy, bacterial speciation.

UNIT-II: -Microbial Diversity: Archea
General Metabolism and Autotrophy in archea
Phylum Euryarchaeota:- Halophilicarchaea, methanogens, thermoplasma.
Phylum Crenarchaeota:- Energy metabolism, Thermoproteales, sulfolobales, desulfolobales.
Phyllum Nanoarchaeota:- Nanoarchaeum.
Heat stable biomolecules and extremophiles, Evolutionary significance of hyperthermophiles.

UNIT-III :-Microbial Diversity: Bacteria
Phylum Proteobacteria:-Free living N2 fixing bacteria, purple phototrophic bacteria nitrifying bacteria, sulphur and iron oxidizing bacteria, sulphate and sulphur reducing bacteria.
Phylum prochlorophytes and cyanobacteria,
Phylum: Planctomyces,
Phylum: Verrucomicrobia.

UNIT-IV :- Microbial Diversity.
Phylum: Cytophaga, Phylum: Green Sulfur Bacteria. Phylum: Deinococci.
Phylum: Green non –sulfur bacteria.
Phylum: Branching Hyperthermophiles, Thermotoga and Aquifex.
Phylum: Nitrospira and Deferribacter.

SEMESTER - III
Paper –III
3T3
Bioinformatics (BIF) - 1

UNIT-I: -

Basic Concept of Computer Organization, Internet, File Transfer Protocol, Browser, Home Page, Hyper text transfer protocol, Uniform Resource Locator, Hyperlink and Web Applications.

UNIT-II: -

Database types, levels of omics, genome projects.
C-value paradox, reassociation kinetics.
Data researches and pairwise alignments:-
Dot Plots, Simple alignments, Dynamic programming global and local alignments
BLAST, FASTA, Scoring matrices, and alignment scores. Multiple sequence alignments. Pattern of substitution within genes, substitution number estimations, molecular clocks.

UNIT-III: - Phyllogenetics

Phyllogenetic trees, Pair wise alignment, distance matrix method, maximum likelihood approach, multiple sequence analysis,
Parsimony, Inferred ancestral sequence, consensus tress, comparison of phyllogenetic methods.

UNIT-IV:- Genomics and Gene recognition

Prokaryotes genomes, prokaryotic gene structure GC content prokaryotic gene density, eukaryotic genomes, eukaryotic gene structure, ORF,GC content expression, Tranposition, Repetetive elements, gene density.

SEMESTER - III

Core (Subject Centric)

(To be opted by students of Microbiology only)

Paper –IV

3T4

Drugs and Disease Management (DDM)

UNIT-I: -

Drug latentiation and Prodrug: History, carrier-linked prodrugs, bioprecursors prodrugs, carboxylic acids and alcohols, amines, carboxyl compounds.

Drug-microbe: Host relationship, mechanism of drug action and drug resistance including MDR.

UNIT-II:-

Antiinfective agents: Iodophores (providone-Iodine), Benzylkonium chloride, gentian violet, mercury compounds.

Antifungal agents: Clotrimazole, Ketoconazole, Tolnaftate, Amphotericin B, Nystatin, Griscofulvin.

Antitubercular agents: Isoniazid, Ethambutol, rifamycin, cycloserine.

UNIT-III: -

Antiprotozoal agent: Metranidazole, 8-hydroxyquinoline

Antimalarials: Quininesulphate, Chloroquine, Primaquine phosphate, Pyrimethamine.

UNIT-IV:-

Histamines and Antihistaminicagents: Cimetidine, Ramitidine, Omeprazole.

Analgesic agents: Morphine and their derivatives anti-inflammatory analgesics- Phenylbutazone and oxyphenbutazone, Prostaglandins.

PRACTICAL-V
3P1

1) Isolation of genomic DNA of bacteria.
2) Isolation of plasmid DNA.
3) Amplification of DNA by PCR.
4) Restriction digestion and RFLP
5) Demonstration of bacterial transformation.
6) Demonstration of cloning
7) Demonstration of UV induced mutagenesis in *E.coli*.
8) Demonstration of ligation.

PRACTICAL-VI
3P2

1) Preparation of plant tissue culture media.
2) Growth of Callus.
3) Isolation of single cell from intact plant organs.
4) Microscopic observation of cultured cells.
5) Determination of starch in plant tissue.
6) To study Phytochemical analysis (qualitative detection) of plant

SEMESTER - IV
Paper-I
4T1
Virology (VIR)

UNIT-I: - History, Classification and composition of viruses
Brief outline on discovery of viruses (Origin and evolution), Terminology, Differentiation with other groups of microorganisms.
Nomenclature and classification of viruses (Regenmortel et.al.2005, 8th Report of ICTV).
Genetic classification
Morphology and structure of viruses (size and shape/symmetry).
Chemical composition of viruses (viral capsid, spikes, envelopes and types of viral nucleic acids).
Assay of Viruses.

UNIT-II:-Bacterial viruses
Bacteriophages- Structural organization; life cycle (Extracellular phase; attachment, penetration of nucleic acid, transcription, translation, replication, maturation and release of phage particles) of ΦX174,T4,lambda, M_{13} and MUPhages. Bacteriophage typing, One step growth curve.

UNIT-III:-Animal and Plant viruses
Life cycle, pathogenesis and laboratory diagnosis of following viruses.
Animal Viruses:-
RNA viruses: Picorna, Orthomyxo, Rhabdovirus and HIV.
DNA viruses: Pox, Herpes, Adeno and Hepatitis viruses.
Oncogenic viruses: Papova viruses, EB virus, HTLV viruses.
Plant virus: TMV, Cauliflower mosaic virus, potato virus.

UNIT-IV:-General methods of Diagnosis and antiviral drugs
Serological methods: -Haemadsorption; Haemadsorption inhibition; haemagglutination; Haemagglutination inhibition(HAI);Complement fixation immunofluorescence methods. ELISA and Radioimmunoassays (RIA).
Antiviral agents: Types of IFN, induction and Molecular basis of antiviral effect of interferon
Structure and Mechanism of action of:
Amantadine,Rimantidine,Vidarabine,Acyclovir,Ganciclovir,Ribavirin,Foscarnet, Stavudine, Lamivudine.
NNRTIS(non-nucleoside RT inhibitors)-Nevirapine; Delavirdine and Efavirenz.
Protease inhibitors- Saquinavir, Indinavir and Ritonavir.

SEMESTER - IV
Paper-II
4T2
Microbial Fermentation Technology (MFT)

UNIT-I:- General Principles of Fermentation
Bioreactors: Bioreactor types, immobilized bioreactors, types of fermentation.
Fermentation kinetics and Monods Model:-Growth kinetics and Monod's Model, Substrate accelerated death, specific growth rate, stringent response, Ntr and Pho system, growth limiting substrate, maintenance energy, growth yield and product formation.
Process optimization: factors of optimization, rheology of fermentation fluid, oxygenation, and oxygen transfer kinetics. chemostat, turbidostat.

UNIT-II:- Downstream Processing and scale up.
Downstream processes: types of processing units and systems, Storage and packaging methods.
Scale up; scale down, criteria involved in scale up.
Productivity, power requirements Basic control theory.

UNIT-III: - Industrial Fermentation Products
Biofuels:-Ethanol, Hydrogen, Methane
Antibiotics:-β-lactum antibiotics (Synthetic penicillin), Streptomycin, Cephalosporin.
Biopreservative: Lactobacillus sakei. Biopolymers:- Xanthan, Polyhydroxyalkanotes.
Thermostable enzymes:-Proteases. Biosurfectants: a comparative account.

UNIT-IV:-Food and Healthcare products SCP,
various types and processes. Carotenoides
Aminoacids:-Lysine, Glutamic acid.
Vitamins:-riboflavin,Vit.B12. Fatty acids (Palmetate, oleate).

SEMESTER – IV
Paper – III
4T3
Microbial Diversity, Evolution and Ecology (MDEE) - 2

UNIT-I: - Microbial Ecosystems
Population, guilds, communities, homeostatis, Environment and microenvironment.
Biofilms. Terrestrial environment, deep surface microbiology. Fresh water environment, lake and river microbiology. Marine Microbiology and Hydrothermal vents.

UNIT-II: - Diversity, stability and succession
Diversity indices, dominance indices, information statistics indices, Shannon index, Brillouin Index, Rank abundance diagrams, community similarity analysis, Jaccard Coefficient, Sorensen coefficient, cluster analysis. Community stability, stability hypothesis, Intermediate-disturbance hypothesis.
Meaning of succession: Tolerance and inhibition patterns of succession, theories of succession.

UNIT-III: - Ecology and Genetics
Genetic structure of population:- Genotype frequency, allele frequencies.
Hardy-Weinberg Law: - Assumptions, predictions, derivation, extension and natural selection.
Measuring genetic variation at protein level, measuring genetic variation at DNA level.
Factors effecting gene frequencies:-Mutation, Random genetic drift, migration, Hardy-Weinberg natural selection, Assortative mating, Inbreeding.

UNIT-IV: -Interactions and Ecosystem Management
Microbial Interactions: Competetion and coexistence, Gause hypothesis, syntrophy, commensalism and Mutualism, predation, parasitism, and antagonism, Interaction with plants and animals.
Concept of sustainable development: microbial technology and sustainable development.
Management and improvement of waste land/barren land.
Oil spills, damage and management petroleum and oil shore management.

SEMESTER – IV
Paper – III
4T3
Bioinformatics (BIF) - 2

UNIT-I: -
Data Mining- Definition, data mining problems, cluster analysis, data mining techniques and tools, data mining methods.

UNIT-II: -
Structure of proteins- primary, secondary, tertiary, quaternary. Protein motifs and folding, protein folding modeling, protein structure prediction**.**

UNIT-III: -
Structure of RNA, secondary structure of RNA, types of RNA, RNA structure prediction**.**

UNIT-IV: -
Insilico drug designing, insilico inhibitors designing, empirical methods of ligand screening, prediction techniques, post translational modification prediction**.**

SEMESTER - IV

Core (Subject Centric)

(To be opted by students of Microbiology only)

Paper – IV

4T4

Vaccines and Delivery System (VDS)

UNIT-I: - Vaccines

Definition and discovery of vaccines.

Active and passive prophylactive measures.

General account on :-

- Exhaltation & attenuation.
- Subunit vaccines
- DNA vaccines
- Vaccines additives and adjuvants

UNIT-II: -

Conventional vaccines

Contents and immunization schedule

- BCG
- Hepatitis vaccine
- Influenza vaccine
- Polio vaccine (Inactivated, live attenuated)
- DPT
- MMR

UNIT-III: -

Advanced vaccines

- Vaccines in development.
- Malaria vaccines
- Epstain Barr virus vaccines
- Cytomegalo virus vaccines
- HIV vaccines
- Herpes simplex viral vaccines

UNIT-IV: - Designing & delivery system.

- Drug designing
- Non-automated in vitro drug susceptibility testing.
- Rapid tests for susceptibility testing, and antibiotic assay in body fluid
- Drugs & vaccines delivery system.

PRACTICAL-VII
4P1

1) Isolation of viruses from water sources.
2) Microbiological examination of foods.
3) Production of penicillin in lab and its estimation.
4) Determination of microbial reaction kinetics for an inhibitory substrate in a fed batch system.
5) Determination of the parameters of oxygen transfer.
6) Immobilization of cells/Enzymes.