



बस्तर विश्वविद्यालय, जगदलपुर (छ.ग.)
BASTAR VISHWAVIDYALAYA, JAGDALPUR (C.G.)

SYLLABUS
B.Sc. PART-II
SESSION 2020-21

बस्तर विश्वविद्यालय, जगदलपुर (छ.ग.)
धरमपुरा, जगदलपुर, जिला-बस्तर (छ.ग.) 494001
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संशोधित पाठ्यक्रम
बी.ए./बी.एस-सी./बी.कॉम./बी.एच.एस.-सी. भाग-दो,
आधार पाठ्यक्रम
प्रश्न पत्र-प्रथम
हिन्दी भाषा

पूर्णांक- 75

खण्ड-क निम्नलिखित 5 लेखकों के पाठ शामिल होंगे -

अंक-35

1. महात्मा गांधी - चोरी और प्रायश्चित
2. आचार्य नरेन्द्र देव - युवकों का समाज में स्थान
3. वासुदेव भारण अग्रवाल - मातृभूमि
4. हरि ठाकुर - डॉ. खूबचंद बघेल
5. पं. माधवराव सप्रे - सम्भाषण-कुशलता

खण्ड-ख हिन्दी भाषा और उसके विविध रूप

अंक-16

1. कार्यालयीन भाषा
2. मीडिया की भाषा
3. वित्त एवं वाणिज्य की भाषा
4. मशीनी भाषा

खण्ड-ग हिन्दी की व्याकरणिक कोटियाँ

अंक-24

संज्ञा, सर्वनाम, विशेषण, क्रिया विशेषण, समास, संधि एवं संक्षिप्तियाँ
अनुवाद व्यवहार : अंग्रेजी से हिन्दी में अनुवाद

इकाई विभाजन-

इकाई-1 चोरी और प्रायश्चित : महात्मा गांधी / कार्यालयीन भाषा, मीडिया की भाषा

इकाई-2 युवकों का समाज में स्थान : आचार्य नरेन्द्र देव / वित्त एवं वाणिज्य की भाषा, मशीनी भाषा

इकाई- 3 मातृभूमि: वासुदेवशरण अग्रवाल / संज्ञा, सर्वनाम, विशेषण, क्रिया विशेषण

इकाई- 4 डॉ. खूबचंद बघेल : हरि ठाकुर / समास, संधि

इकाई- 5 सम्भाषण-कुशलता : पं. माधवराव सप्रे, / अनुवाद - अंग्रेजी से हिन्दी में अनुवाद, संक्षिप्तियाँ

मूल्यांकन योजना -

प्रत्येक इकाई से एक-एक प्रश्न पूछे जाएंगे। प्रत्येक प्रश्न में आंतरिक विकल्प होगा। प्रत्येक प्रश्न के 15 अंक होंगे। प्रत्येक इकाई को दो-दो खण्डों (क्रमांक 'क' और 'ख' में) विभक्त करते हुए निर्धारित पाठ से 8 एवं पाठ्य सामग्री से 7 अंक के प्रश्न होंगे। इस प्रकार पूरे प्रश्न-पत्र के पूर्णांक 75 होंगे।

पाठ्यक्रम संशोधन का औचित्य : विद्यार्थी चर्चित एवं सुप्रसिद्ध व्यक्तियों के लेख के माध्यम से समाज एवं राष्ट्रहित के साथ-साथ व्यक्तित्व विकास विषयक मुद्दों से परिचित हो सकें तथा व्याकरणिक एवं भाषा विषयक प्रस्तावित पाठ्यक्रम के माध्यम से हिन्दी भाषा संबंधित प्रयोग पक्ष से परिचित होते हुए प्रतियोगी परीक्षाओं की दृष्टि से ज्ञानार्जन कर सकें।

अध्यक्ष- हिन्दी अध्ययन मंडल

B.A/B.S.c./B.Com/B.H.S.c Part-II
Foundation Course
PAPER - II
ENGLISH LANGUAGE

M.M. 75

The question paper B.A/B.S.c./B.Com/B.H.S.c English Language cultural valuers shall comprise the following units:

UNIT-I	Short answer questions to be asked by (Five short answer questions of three marks each)	
UNIT-II	(a) Reading comprehension of an unseen passage	15 Marks
	(b) Vocabulary	05 Marks
UNIT-III	Report-Writing	10 Marks
UNIT-IV	Expansion of an idea	10 Marks
UNIT-V	Grammar and Vocabulary based on the prescribed text book	20+15 Marks

Note : Question on all the units shall be asked from the prescribed text which will comprise specimens of popular creative/writing and the following if any

- (a) Matter & technology
 - (i) State of matter and its structure
 - (ii) Technology (Electronics Communication, Space Science)
- (b) Our Scientists & Institutions
 - (i) Life & Work of our eminent scientist Arya Bhatt. Kaard Charak Shusruta, Nagarjuna, J.C. Bose and C.V. Raman, S. Ramanujam, Homi J. Babha Birbal Sahani.
 - (iii) Indian Scientific Institutions (Ancient & Modern)

Book Prescribed:

1. Foundation English for U.G. Second Year - Published by M.P. Hindi Granth Academy, Bhopal.

SULLABUS FOR ENVIRONMENTAL STUDIES "FOR UNDERGRADUATE COURSES"

1. इन्वाइरमेंटल साइंसेस के पाठ्यक्रम को स्नातक स्तर भाग-एक की कक्षाओं में विश्वविद्यालय अनुदान के निर्देशानुसार अनिवार्य रूप से शिक्षा सत्र 2003-2004 (परीक्षा 2004) से प्रभावशील किया गया है। स्वशासी महाविद्यालयों द्वारा भी अनिवार्य रूप से अंगीकृत किया जाएगा।
*भाग 1, 2 एवं 3 में किसी भी वर्ष में पर्यावरण प्रश्न-पत्र उत्तीर्ण करना, अनिवार्य है। तभी उपाधि प्रदाय योग्य होगी।
2. पाठ्यक्रम 100 अंकों का होगा, जिसमें से 75 अंकर सैद्धांतिक प्रश्नों पर होंगे एवं 25 अंक क्षेत्रीय कार्य (Field Work) पर होंगे।
3. सैद्धांतिक प्रश्नों पर अंक-75 (सभी प्रश्न इकाई आधार पर रहेंगे जिसमें आंतरिक विकल्प रहेगा)
(अ) लघु प्रश्नोत्तर -25 अंक
(ब) निबंधात्मक -50 अंक
4. Field Work - 25 अंकों का मूल्यांक आंतरिक मूल्यांकन पद्धति से कर विश्वविद्यालय को प्रेषित किया जावेगा। अभिलेखों की प्रयोगिक उत्तर पुस्तिकाओं के समान संबंधित महाविद्यालयों द्वारा सुरक्षित रखेंगे।
5. उपरोक्त पाठ्यक्रम से संबंधित परीक्षा का आयोजन वार्षिक परीक्षा के साथ किया जाएगा।
6. पर्यावरण विज्ञान विषय अनिवार्य विषय है, जिसमें अनुत्तीर्ण होने पर स्नातक स्तर भाग-एक के छात्र/छात्राओं को एक अन्य विषय के साथ पूरक की पात्रता होगी। पर्यावरण विज्ञान के सैद्धांतिक एवं फील्ड वर्क में संयुक्त रूप से 33% (तीस प्रतिशत) अंक उत्तीर्ण होने के लिए अनिवार्य होंगे।
7. स्नातक स्तर भाग-एक के समस्त नियमित/भूतपूर्व/अमहाविद्यालयीन छात्र/छात्राओं को अपना फील्ड वर्क सैद्धांतिक परीक्षा की समाप्ति के पश्चात् 10 (दस) दिनों के भीतर संबंधित महाविद्यालय/परीक्षा केन्द्र में जमा करेंगे एवं महाविद्यालय के प्राचार्य/केन्द्र अधीक्षकों/परीक्षकों की नियुक्ति के लिए अधिकृत रहेंगे तथा फील्ड वर्क जमा होने के सात दिनों के भीतर प्राप्त अंक विश्वविद्यालय को भेजेंगे।

**SULLABUS FOR
ENVIRONMENTAL STUDIES**

M.M. 100

UNIT-I THE MULTI DISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, Scope and Importance

Natural Resources:

Renewable and Nonrenewable Resources :

Natural resources and associated problems.

- (a) Forest resources: Use and over-exploitation, deforestation, Case Studies, Timber extraction, mining, dams and their effects on forests and tribal people.
- (b) Water resources: Use and over-utilization of surface and ground water, floods drought, conflicts over water, dams benefits and problems.
- (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Case studies.
- (d) food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging , Case studies.
- (e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- (f) Land resources: Land as a resource, land degradation, man induced landslides soil erosion and desertification.
 - Role of an individual in conservation of natural resources.
 - Equitable use of resources for sustainable life-styles.

UNIT-II ECOSYSTEM

Concept, of an ecosystems.

Structure and Function of and ecosystem

- Producers, consumers and decomposers.
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, Types, Characteristics Features, Structure and Function of The following ecosystem:
 - a. Forest, Ecosystem.
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (Ponds, streams, lakes, rivers, oceans, estuaries)

UNIT – III Biodiversity and its Conservation

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, national and local levels.
- India as mega diversity nation.”
- Hot spots of biodiversity
- Threats to biodiversity : habitat loss, poaching of wildlife, man/wildlife conflicts.
- Endangered and endemic species of india.
- Conservation of biodiversity : In situ and Ex-situ conservation of biodiversity

UNIT-IV Environmental Pollution

Definition

- Causes, effects and control measures of
 - a. Air pollution
 - b. Water pollution
 - c. soil pollution
 - d. Marine pollution
 - e. Noise pollution
 - g. Nuclear hazards.
- Solid waste management : Causes, effects and control measures of urban and industrial
- Wastes.
- Role of an individual in prevention of pollution.
- pollution case studies
- Disaster management : floods, earthquake, cyclone and landslides.

Human Population and the Environment

- population growth, variation among nation,
- population explosion - Family Welfare programme.
- Environment and human health.
- Human Rights.

UNIT - V Social Issues and the Environment

- From Unsustainable to Sustainable development.
- urban problems related to energy.
- Water conservation. rain water harvesting watershed management.
- Resettlement and rehabilitation of people, its problems and concerns. Case studies.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone Layer depletion nuclear accidents and holocaust Case studies.
- Wasteland reclamation.
- Consumerism and Waste products. Environment Protection Act
- Air (Prevention and Control of pollution) Act.
- Water (Prevention and Control of pollution) Act.
- Wildlife protection Act.
- Forest Conservation Act.
- Issues involved in enforcement of Environment legislation.
- public awareness.
- Value Education
- HIV/AIDS
- Women and Child Welfare.
- Role of Information Technology in Environment and Human Health.
- Case Studies.

FIELD WORK

- visit to a local area to document environmental assets- river/fores/grassland/hill/mountain.
- visit to local polluted site : urban/Rural/Industrial/Agriculture. Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes. etc. (Field work Equal to 5 lecture Hours)

REFERENCES:

1. Agarwal k.c. 2001 Environmental Biology. Nidi Pubi. Ltd. Bikaner.
 2. Bharucha Erach the Biodiversity of India Mapin publishing Pvt Ltd. Ahmedabad 380013. India Email : Mapin@icenet.net
 3. Bruinner R.C. 1989 Hazardous Waste Incineration Mc Graw Hill Inc. 480p.
 4. Clark R.S. Marine Pollution, Clanderson Press Oxford (TB).
 5. Cuningham, W.P, Cooper T.H. Gorhani, E& Hepworth. M.T.200.
 6. Dr A.K. Environmental Chemisry, Wiley Estern Ltd.
 7. Down to Earth Centre for Science and Environment
 8. Gloick, H.P. 1993 Water in crisis, Pacifec Institute for Studies in Deve Environment & Security Stockholm Eng. Institute. Oxford Univ. Press. 437p.
 9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural. History Society, Mumbai ®.
 10. Heywood, V.H. & Wastson, R.T. 1965 Global Biodiversity Assessment, Cabridge Univ. Press. 1140p.
 11. Jadhav H. & Bhosale, V.H. 1965 Environmental Protection and Laws. Himalaya Pub. House. Delhi 284p.
 12. Mckinney M.L. & School R.M. 1996. Environmental Science Systems & Solutions, Web enhanced editio. 639p.
 13. Mhqaskar A.K. Matter Hazardous, Techno-Science Publication (T.B.).
 14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (T.B.).
 15. Odurn E.P. 1971 Fundamentals of Ecology, W.B. Saunders Co. USA, 574p.
 16. Rao M.N. & Datta A.K. 1987, Waste Water Treatment. Oxford & IBH Publ. co. Pvt. Ltd. 345p.
 17. Sharma B.K. 2001 Environmental Chemistry, Goel Publ. House, Meerut.
 19. Townsend C. Harper J. and Michael Begon Essentials of Ecology, Blackwll science (T.B).
 20. Trivedi R.K. Handbook of Environment Environmental Laws. Rules, Guidelines, Compliances and Standards, Vol. I and II Environmenta Media (R.).
 21. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Tchno Science Publlication (T.B.).
 22. Wagner K.D., 1998, Environmental Management. W.B. Saunders Co. Philadelphia,USA499p. |
- (M) Magazine (R) Reference
(TB) Textbook.

B.Sc. Part-II
ANTHROPOLOGY
PAPER-I
ARCHAEOLOGICAL ANTHROPOLOGY

Total Marks: 50

Pass Marks: 17

- UNIT – I** Meaning and scope of Archaeological Anthropology, branches of Archaeology: Classical Archaeology, Historical Archaeology, Prehistoric Archaeology and Protohistoric Archaeology. Anthropology as Archaeology. Differences between the Old world and new world Archaeological Traditions. Absolute and Relative Dating.
- UNIT – II** Geological time scale.
The Great Ice Age Stratigraphy and other evidences of Ice Age: River terraces. Moraines etc. Pluvial and interpluvials Stone Age tools: Types and Technology.
- UNIT – III** Age of Paleolithic savagery:
European lower Paleolithic period: Stone tools and cultures
Indian lower Paleolithic period: Sohan Culture & Madrasian Culture.
European Middle Paleolithic Period: Tools & culture; Flake tool complex in India
European Upper Paleolithic period; Tools and Culture, main characteristics of the European Paleolithic Home and Cave art and its significance.
- UNIT-IV** Mesolithic complex in North Europe. Mesolithic complex in Western Europe, Mesolithic Culture in India. Chief feature of Neolithic revolution. Neolithic complex in India.
- UNIT – V** Metal Age: Copper, Bronze and Iron Age
Urban revolution: General Features
Indus valley civilization: Main Features, Town Planning, Economic activities, origin and decay

B.Sc. Part-II
ANTHROPOLOGY
PAPER-II
TRIBAL CULTURE OF INDIA

Total Marks: 50

Pass Marks: 17

- UNIT-I** Define tribe and scheduled tribe. Geographical distribution of Indian tribes and their racial and linguistic classification. Contribution of Anthropology in the study of Indian tribes. S
acred complex, Universalisation and parochialisation, Sanskritisation, westernization, dominant caste.
Tribes and caste, Difference between S.C. and S.T.
Particularly Vulnerable Tribes Group (PVTG) of Chhattisgarh (Kamar, Birhor, Hill Korwa, Abujmariya, Baiga)
- UNIT-II** Primitive economy:-
Stages of tribal economy: Hunting, food gathering, fishing, shifting and settled agriculture.
Concept of Property and ownership in tribal societies
Problems of tribal people: land alienation, bonded labour, indebtedness, shifting cultivation, irrigation, Unemployment, agricultural labour; Forest and Tribals
New economic anthropology: Exchange- Gifts, barter, trade, ceremonial exchange and market economy
- UNIT-III** The problems of culture contact: Problems due to urbanization and industrialization, Regionalism
Tribal religion: origin & function, animism, totemism. Concept and practices of Magic and witchcraft, shamanism, head hunting.
- UNIT-IV** Political organisation of Indian tribes: Distinction between state and stateless society, law in primitive society
Social organization of Indian Tribes: Matriarchal and patriarchal family, Lineage and clan, Ways of acquiring mates in tribal societies.
Youth dormitories: Type, organisation and functions.
- UNIT-V** Tribal development: History of tribal development, the constitutional safeguards for the scheduled tribes.
Tribal problem: isolation, migration, acculturation, detribalization.
Policies, plans and programmes of tribal development and their implementation. Tribal revolts in India. Contributions of anthropology to tribal development. Response of the tribal people for development programs of government and NGO

RECOMMENDED READINGS:

1. Chaudhary, Bhudadeb (Ed.). Tribal Development in India.
2. Elwin, V.A. Philosophy for NEFA.
3. Haimendorf. The Tribes of India: Struggle for survival.
4. Shara B.D. Basic Issues in tribal Development.

B.Sc. Part-II
ANTHROPOLOGY
PRACTICALS
MATERIAL CULTURE AND RESEARCH TOOLS

Total Marks: 50

Pass Marks: 17

OBJECTIVES:

The objective of this practical course is to introduce the student with the primitive material culture and technology used by primitive man and the student will be introduced with various techniques commonly used by social Anthropology.

MATERIAL CULTURE:

- Part – I.** Identification and technological descriptions of the following.
1. Implements for food gathering, hunting, fishing and agriculture
 2. Fire making implements
 3. Types of habitations
 4. Land and water transport
- Part-II** Sketching, identification and the description of Paleolithic, Mesolithic and Neolithic tools
(It is essential that students should draw at least five tools of each age)
- Part- III** Construction of schedule, Geneology and Questionnaire
Each student should collect information through above tools from 10 Respondents.
The Student will be required to maintain practical records of all work done in the practical class.

NEW CURRICULUM OF B.Sc. PART II CHEMISTRY

The new curriculum will comprise of three papers of 33, 33 and 34 marks each and practical work of 50 marks. The Curriculum is to be completed in 180 working days as per UGC norms and conforming to the directives of Govt. of Chhattisgarh. The theory papers are of 60 hrs. each duration and practical work of 180 hrs duration.

Paper – I INORGANIC CHEMISTRY

UNIT-I CHEMISTRY OF TRANSITION SERIES ELEMENTS

Transition Elements: Position in periodic table, electronic configuration, General Characteristics, *viz.*, atomic and ionic radii, variable oxidation states, ability to form complexes, formation of coloured ions, magnetic moment μ_{so} (spin only) and μ_{eff} and catalytic behaviour. General comparative treatment of 4d and 5d elements with their 3d analogues with respect to ionic radii, oxidation states and magnetic properties.

UNIT-II A. Oxidation and Reduction:

Redox potential, electrochemical series and its applications, Principles involved in extraction of the elements.

B. COORDINATION COMPOUNDS:

Werner's theory and its experimental verification, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelates, polynuclear complexes.

UNIT-III COORDINATION CHEMISTRY

Valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, Crystal field splitting and stabilization energy, measurement of $10 Dq$ (Δ_o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of $10 Dq$ (Δ_o , Δ_t). Octahedral vs. tetrahedral coordination.

UNIT-IV A. CHEMISTRY OF LANTHANIDE ELEMENTS

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

B. CHEMISTRY OF ACTINIDES

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from uranium, similarities between the later actinides and the later lanthanides

UNIT-V A. ACIDS BASES:

Arrhenius, Bronsted-Lowry, conjugate acids and bases, relative strengths of acids and bases, the Lux-flood, solvent system and Lewis concepts of acids and bases.

B. NON-AQUEOUS SOLVENTS

Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid ammonia and liquid sulphur dioxide, HF, H₂SO₄, Ionic liquids.

REFERENCE BOOKS

1. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus, Wiley
2. Concise Inorganic Chemistry, J. D. Lee, ELBS
3. Concepts of Models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J. Alexander, John Wiley.
4. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C. H. Langford, Oxford.
5. Inorganic Chemistry, W. W. Porterfield, Addison – Wiley.

6. Inorganic Chemistry, A. G. Sharp, ELBS.
7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agarwal and Agarwal
10. Advanced Inorganic Chemistry, Puri, Sharma, S. Naginchand
11. Inorganic Chemistry, Madan, S. Chand
12. Aadhunik Akarbanic Rasayan, A. K. Shrivastav & P. C. Jain, Goel Pub
13. Uchchattar Akarbanic Rasayan, satya Prakash & G. D. Tuli, Shyamal Prakashan
14. Uchchattar Akarbanic Rasayan, Puri & Sharma
15. Selected topic in Inorganic Chemistry by Madan Malik & Tuli, S. Chand.

Paper – II
ORGANIC CHEMISTRY

UNIT-I CHEMISTRY OF ORGANIC HALIDES

Alkyl halides: Methods of preparation, nucleophilic substitution reactions – S_N1 , S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution, elimination reactions.

Aryl halides: Preparation, including preparation from diazonium salts, Nucleophilic Aromatic Substitution; S_NAr , Benzyne mechanism. Relative reactivity of alkyl, allyl/benzylic, vinyl and aryl halides towards nucleophilic substitution reactions.

UNIT-II ALCOHOLS

A. Alcohols: Nomenclature, preparation, properties and relative reactivity of 1° , 2° , 3° alcohols, Bouvaelt-Blanc Reduction for the preparation of alcohols, Dihydric alcohols – methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

B. Trihydric alcohols - Nomenclature, methods of formation, chemical reactions of glycerol.

PHENOLS

A. Structure and bonding in phenols, physical properties and acidic character, Comparative acidic strength of alcohols and phenols, acylation and carboxylation.

B. Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

UNIT-III ALDEHYDES AND KETONES

A. Nomenclature, structure and reactivity of carbonyl group. General methods of preparation of aldehydes and ketones.

Mechanism of nucleophilic addition to carbonyl groups: Benzoin, Aldol, Perkin and Knoevenagel condensation. Condensation with ammonia and its derivatives, Wittig reaction, Mannich reaction, Beckmann and Benzil- Benzilic rearrangement.

B. Use of acetate as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen reduction, Wolf-Kishner reaction, $LiAlH_4$ and $NaBH_4$ reduction. Halogenation of enolizable ketones, An introduction to α,β -unsaturated aldehydes and ketones.

UNIT-IV A. CARBOXYLIC ACIDS

Preparation, Structure and bonding, Physical and chemical properties including, acidity of carboxylic acids, effects of substituents on acid strength, Hell-Volhard Zeilinsky reaction. Reduction of carboxylic groups, Mechanism of decarboxylation.

Di carboxylic acids: Methods of formation and effect of heat and dehydrating agents, Hydroxyacids.

B. CARBOXYLIC ACID DERIVATIVES

Structure of acid chlorides, esters, amides and acid anhydrides, Relative stability of acyl derivatives. Physical properties, inter-conversion of acid derivatives by nucleophilic acyl substitution.

Mechanism of acid and base catalyzed esterification and hydrolysis.

UNIT-V ORGANIC COMPOUNDS OF NITROGEN

A. Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium.

B. Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl

amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalimide reaction, Hofmann-Bromamide reaction, Reactions of amines, electrophilic aromatic substitution of aryl amines, Reaction of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, Azo coupling.

REFERENCE BOOKS

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, L. G. Wade Jr. Prentice Hall.
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Organic Chemistry, Vol I, II, III S. M. Mukherjee, S. P. Singh and R. P. Kapoor, Wiley Eastern (New Age).
5. Organic Chemistry, F. A. Carey, McGraw Hill.
6. Introduction to Organic Chemistry, Struieisser, Heathcock and Kosover, Macmillan.
7. Organic Chemistry, P. L. Soni.
8. Organic Chemistry, Bahl and Bahl.
9. Organic Chemistry, Joginder Singh.
10. Carbanic Rasayan, Bahl and Bahl.
11. Carbanic Rasayan, R. N. Singh, S. M. I. Gupta, M. M. Bakidia & S. K. Wadhwa.
12. Carbanic Rasayan, Joginder Singh.

Paper – III
PHYSICAL CHEMISTRY

- UNIT-I** **A. THERMODYNAMICS-I**
Intensive and extensive variables; state and path functions; isolated, closed and open systems; Zeroth law of thermodynamics. First law: Concept of heat, work, internal energy and statement of first law; enthalpy, Relation between heat capacities, calculations of q , w , U and H for reversible, irreversible and free expansion of gases under isothermal and adiabatic conditions. Joule-Thompson expansion, inversion temperature of gases, expansion of ideal gases under isothermal and adiabatic condition
- B. THERMO CHEMISTRY**
Thermochemistry, Laws of Thermochemistry, Heats of reactions, standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions, Adiabatic flame temperature, explosion temperature.
- UNIT-II** **A. THERMODYNAMICS-II**
Second Law of Thermodynamics: Spontaneous process, Second law, Statement of Carnot cycle and efficiency of heat engine, Carnot's theorem, thermodynamic state of temperature.
Concept of entropy: Entropy change in a reversible and irreversible process, entropy change in isothermal reversible expansion of an ideal gas, entropy change in isothermal mixing of ideal gases, physical signification of entropy, Molecular and statistical interpretation of entropy.
- B. Gibbs and Helmholtz free energy, variation of G and A with pressure, volume, temperature, Gibbs-Helmholtz equation, Maxwell relations, Elementary idea of Third law of Thermodynamics, concept of residual entropy, calculation of absolute entropy of molecule.**
- UNIT III** **A CHEMICAL EQUILIBRIUM**
Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Concept of Fugacity, Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exergonic and endergonic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Thermodynamic derivation of relations between the various equilibrium constants K_p , K_c and K_x . Le Chatelier principle (quantitative treatment). Equilibrium between ideal gas and a pure condensed phase.
- B IONIC EQUILIBRIA**
Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono protic acids (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.
- UNIT-IV** **A. PHASE EQUILIBRIUM**
Phase rule, Phase, component and degree of freedom, derivation of Gibbs phase rule, Clausius-Claperon equation and its applications to Solid-Liquid, Liquid-Vapor and solid-Vapor, limitation of phase rule, applications of phase rule to one component system: Water system and sulphur system.

Application of phase rule to two component system: Pb-Ag system, desilverization of lead, Zn-Mg system Ferric chloride-water system, congruent and incongruent, melting point and eutectic point.

Three component system: Solid solution liquid pairs.

B. Nernst distribution law, Henry's law, application, solvent extraction

UNIT V PHOTOCHEMISTRY

Characteristics of electromagnetic radiation, Interaction of radiation with matter, difference between thermal and photochemical processes, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry: Grothus-Drapper law, Stark-Einstein law, quantum yield, actinometry, examples of low and high quantum yields, Photochemical equilibrium and the differential rate of photochemical reactions, Quenching, Role of photochemical reaction in biochemical process.

Jablonski diagram depicting various process occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), photosensitized reactions, energy transfer processes {simple examples}, photostationary states, Chemiluminescence.

REFERENCE BOOKS

1. Physical Chemistry, G. M. Barrow, International student edition, McGraw Hill.
2. University General Chemistry, C. N. R. Rao, Macmillan.
3. Physical Chemistry, R. A. Alberty, Wiley Eastern.
4. The elements of physical chemistry, Wiley Eastern.
5. Physical Chemistry through problems, S. K. Dogra & S. Dogra, Wiley Eastern.
6. Physical Chemistry, B. D. Khosla,.
7. Physical Chemistry, Puri & Sharma.
8. Bhautik Rasayan, Puri, Sharma and Pathania, Vishal Publishing Company.
9. Bhautik Rasayan, P. L. Soni.
10. Bhautik Rasayan, Bahl and Tuli.
11. Physical Chemistry, R. L. Kapoor, Vol I-IV .
12. Chemical kinetics, K. J. Laidler, Pearson Educations, New Delhi (2004).

LABORATORY COURSE

INORGANIC CHEMISTRY

Qualitative semi micro analysis of mixtures containing 5 radicals. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:

CO_3^{2-} , NO_2^- , S^{2-} , SO_3^{2-} , $\text{S}_2\text{O}_3^{2-}$, CH_3COO^- , F^- , Cl^- , Br^- , I^- , NO_3^- , BO_3^{3-} , $\text{C}_2\text{O}_4^{2-}$, PO_4^{3-} , NH_4^+ , K^+ , Pb^{2+} , Cu^{2+} , Cd^{2+} , Bi^{3+} , Sn^{2+} , Sb^{3+} , Fe^{3+} , Al^{3+} , Cr^{3+} , Zn^{2+} , Mn^{2+} , Co^{2+} , Ni^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Mg^{2+} .

Mixtures should preferably contain one interfering anion, or insoluble component (BaSO_4 , SrSO_4 , PbSO_4 , CaF_2 or Al_2O_3) or combination of anions e.g. CO_3^{2-} and SO_3^{2-} , NO_2^- and NO_3^- , Cl^- , Br^- , and I^- .

Volumetric analysis

- Determination of acetic acid in commercial vinegar using NaOH.
 - Determination of alkali content-antacid tablet using HCl.
 - Estimation of calcium content in chalk as calcium oxalate by permanganometry.
 - Estimation of hardness of water by EDTA.
 - Estimation of ferrous & ferric by dichromate method.
 - Estimation of copper using thiosulphate.
- Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions: i. Ni (II) and Co (II) ii. Fe (III) and Al (III)

ORGANIC CHEMISTRY

- Detection of elements (X, N, S).
- Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, nitro, amine, amide, and carbonyl compounds, carbohydrates)
- Preparation of Organic Compounds:
 - m-dinitrobenzene, (ii) Acetanilide, (iii) Bromo/Nitro-acetanilide, (iv) Oxidation of primary alcohols-Benzoic acid from benzylalcohol, (v) azo dye.

PHYSICAL CHEMISTRY

Transition Temperature

- Determination of the transition temperature of the given substance by thermometric/dilatometric method (e.g. $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ / $\text{SrBr}_2 \cdot 2\text{H}_2\text{O}$). Thermo chemistry
- Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).
- Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
- To determine the solubility of benzoic acid at different temperature and to determine ΔH of the dissolution process.
- To determine the enthalpy of neutralization of a weak acid/ weak base versus strong base/ strong acid and determine the enthalpy of ionization of the weak acid/ weak base.
- To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Phase Equilibrium

- To study the effect of a solute (e.g. NaCl, Succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
- To construct the phase diagram of two component system (e.g. diphenylamine-benzophenone) by cooling curve method.
- Distribution of acetic/ benzoic acid between water and cyclohexane.
- Study the equilibrium of at least one of the following reactions by the distribution method:

~~Paper IV~~
LABORATORY COURSE

INORGANIC CHEMISTRY

Qualitative semi micro analysis of mixtures containing 5 radicals. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:

CO_3^{2-} , NO_2^- , S^{2-} , SO_3^{2-} , $\text{S}_2\text{O}_3^{2-}$, CH_3COO^- , F^- , Cl^- , Br^- , I^- , NO_3^- , BO_3^{3-} , $\text{C}_2\text{O}_4^{2-}$, PO_4^{3-} , NH_4^+ , K^+ , Pb^{2+} , Cu^{2+} , Cd^{2+} , Bi^{3+} , Sn^{2+} , Sb^{3+} , Fe^{3+} , Al^{3+} , Cr^{3+} , Zn^{2+} , Mn^{2+} , Co^{2+} , Ni^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Mg^{2+} .

Mixtures should preferably contain one interfering anion, or insoluble component (BaSO_4 , SrSO_4 , PbSO_4 , CaF_2 or Al_2O_3) or combination of anions e.g. CO_3^{2-} and SO_3^{2-} , NO_2^- and NO_3^- , Cl^- , Br^- , and I^- .

Volumetric analysis

- (a) Determination of acetic acid in commercial vinegar using NaOH.
- (b) Determination of alkali content-antacid tablet using HCl.
- (c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- (d) Estimation of hardness of water by EDTA.
- (e) Estimation of ferrous & ferric by dichromate method.
- (f) Estimation of copper using thiosulphate.
 - Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions: i. Ni (II) and Co (II) ii. Fe (III) and Al (III)

ORGANIC CHEMISTRY

- Detection of elements (X, N, S).
- Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, nitro, amine, amide, and carbonyl compounds, carbohydrates)
- Preparation of Organic Compounds:
 - (i) m-dinitrobenzene, (ii) Acetanilide, (iii) Bromo/Nitro-acetanilide, (iv) Oxidation of primary alcohols-Benzoic acid from benzylalcohol, (v) azo dye.

PHYSICAL CHEMISTRY

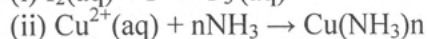
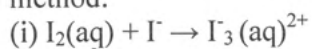
Transition Temperature

- Determination of the transition temperature of the given substance by thermometric/dilatometric method (e.g. $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}/\text{SrBr}_2 \cdot 2\text{H}_2\text{O}$). Thermo chemistry
- Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).
- Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
- To determine the solubility of benzoic acid at different temperature and to determine ΔH of the dissolution process.
- To determine the enthalpy of neutralization of a weak acid/ weak base versus strong base/ strong acid and determine the enthalpy of ionization of the weak acid/ weak base.
- To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Phase Equilibrium

- To study the effect of a solute (e.g. NaCl, Succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
- To construct the phase diagram of two component system (e.g. diphenylamine-benzophenone) by cooling curve method.
- Distribution of acetic/ benzoic acid between water and cyclohexane.

- Study the equilibrium of at least one of the following reactions by the distribution method:



Molecular Weight Determination

- Determination of molecular weight by Rast Camphor and Landsburger method.

Note: Experiments may be added/ deleted subject to availability of time and facilities.

Reference Books

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)
3. Ahluwalia, V.K. & Agarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000). 22
4. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).
5. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011). Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
6. Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York

Hrs.5

PRACTICAL EXAMINATION

M.M.50

Three Experiments are to be performed.

1. Inorganic–Qualitative semi micro analysis of mixtures.

12 marks

OR

One experiment from synthesis and analysis by preparing the standard solution.

2. (a) Identification of the given organic compound & determine its M.Pt./B.Pt.

6 marks

(b) Determination of R_f value and identification of organic compounds by paper chromatography.

6 marks

3. Any one physical experiment that can be completed in two hours including calculations.

12 marks

4. Viva

10 marks

5. Sessional

04 marks

In case of Ex-Students one marks will be added to each of the experiment.

**B.Sc. Part-II
GEOLOGY
PAPER –I
PETROLOGY**

- UNIT-I**
- (i) Magma, definition, origin & composition
 - (ii) Bowen's reaction series, magmatic differentiation & assimilation
 - (iii) System, phases & component, principles of thermodynamics,
Bi-component magma: Albite-Anorthite and Diopside-Anorthite
Tri-component magma: Diopside-Albite-Anorthite
 - (iv) Texture, structures & classification of igneous rocks
 - (v) Forms of igneous rocks
- UNIT-II**
- (i) Rock association in Time & Space, concepts of rock kindreds
 - (ii) Petrographic studies of Acid igneous rocks.
 - (iii) Petrographic studies of Alkaline igneous rocks
 - (iv) Petrographic studies of Basic igneous rock
 - (v) Petrographic studies of Ultra basic igneous rocks.
- UNIT-III**
- (i) Origin, transportation & deposition of sediments
 - (ii) Dynamics of sedimentary depositional environment; Aeolian, fluvial, coastal and abyssal environment.
 - (iii) Concepts of sedimentary facies
 - (iv) Concepts of diagenesis
 - (v) Textures & structures of sedimentary rocks.
- UNIT-IV**
- (i) Classification of sedimentary rocks.
 - (ii) Petrography of sedimentary rock; rudaceous, argillaceous, calcareous
Sedimentary rocks
 - (iii) Metamorphism; definition, agents, facies & grade
 - (iv) Textures, structures & classification of metamorphic rocks.
 - (v) Equilibrium & non-equilibrium reactions in metamorphism.
- UNIT-V**
- (i) Paragenetic diagrams; projective analysis A.C.F & A.K.F. diagrams
 - (ii) Progressive metamorphism of Argillaceous rocks.
 - (iii) Progressive dynamo-thermal metamorphism of impure lime-stone.
 - (iv) Progressive dynamo-thermal metamorphism of basic igneous rocks.
 - (v) Petrographic provinces of India.

PRACTICAL:

- (1) Diagrammatic representation of various form & structures of igneous, sedimentary & Metamorphic rocks
- (2) Megascopic studies of various sedimentary, metamorphic & igneous rocks.
- (3) Microscopic studies of various sedimentary, metamorphic & igneous rocks.
- (4) Norm calculation
- (5) Diagrammatic representation of petrography provinces of India in outline map of India.

Suggested Readings:-

- | | | | |
|------|--|-----------------|---------------------------------------|
| (1) | शैलिकी के सिद्धान्त | — | डॉ.अंबिका प्रसाद अग्रवाल |
| (2) | शैलिकी के सिद्धान्त | — | ए.जी. झिंगरन |
| (3) | Principles of petrology | - | G.W. Tyrell |
| (4) | Petrology | - | H.William, F.J. Turner & E.M. Gilbert |
| (5) | Petrology of igneous & metamorphic rocks of India- | S.C. Chatterjee | |
| (6) | A text book of sedimentary petrology | - | Verma & Prasad |
| (7) | Metamorphism & Metamorphic rocks of India- | S.Ray | |
| (8) | Sedimentary rocks | - | F.J. Pettijohn |
| (9) | Introduction of sedimentology | - | S.Sengupta |
| (10) | Sedimentary environment | - | H.G. Readings |

B.Sc. Part-II
GEOLOGY
PAPER –II
STRUCTURAL GEOLOGY

- UNIT-I**
- (i) Definition and scope of Structural Geology. Study of outcrops. Effects of dip and slope on outcrops.
 - (ii) Identification of bedding. Dip and strike measurement.
 - (iii) Clinometers and Brunton compass.
 - (iv) Recognition of top and bottom of beds.
 - (v) Concept of rock deformation. Concept of stress and strain ellipsoids.
- UNIT-II**
- (i) Fold morphology.
 - (ii) Geometric and genetic classification of folds.
 - (iii) Recognition of folds in the field and on geological maps.
 - (iv) Effect of folds on outcrops.
 - (v) Elementary idea of mechanics of folding.
- UNIT-III**
- (i) Fault morphology. Slip and separation.
 - (ii) Geometric and genetic classification of faults.
 - (iii) Recognition of faults in the field and on geological maps.
 - (iv) Effect of faults on outcrops.
 - (vi) Elementary idea of mechanics of faulting.
- UNIT-IV**
- (i) Joint morphology; geometric and genetic classification of joints.
 - (ii) Foliation; terminology, kinds, origin and relation to major structures.
 - (iii) Lination: terminology, Kind, origin and relation to major structures.
 - (iv) Salt domes.
 - (vii) Plutons; tectonics & emplacement.
- UNIT-V**
- (i) Types and recognition of Unconformity.
 - (ii) Outlier and inlier. Overlap & of flap.
 - (iii) Concept of tectonics.
 - (iv) Tectonic framework of Peninsula, Indo-Genetic Plains and Extra-Peninsular India.
 - (v) Stereographic projection & it use in Structural geology.

PRACTICAL-

- (1) Study of Natural Structures on specimens.
- (2) Study of structures with the help of models.
- (3) Completion of outcrops.
- (4) Preparation of geological section from simple to complex geological maps and its Interpretation.
- (5) Application of stereographic projection in structural geology.
- (6) Geological excursion for seven days.

BOOKS RECOMMENDED:

- (1) संरचनात्क भूविज्ञान – डॉ.डी.के. श्रीवास्तव
- (2) भूवैज्ञानिक संरचनाएँ – डॉ. भरत सिंह राठौर
- (3) प्रायोगिक भूविज्ञान (भाग-2) – आर.पी. मांजरेकर
- (4) Structural Geology. M.P. Billings.
- (5) Theory of Structural Geology; Gokhale, N.W. CBS
- (6) Exercises on Geological maps and dip-Strike: Gokhale, N.W. CBS.
- (7) Outlines of structural Geology. E.S.Hills.
- (8) Structural Geology- Hobbs. Means and Williams.
- (9) Geological maps- Chiplonkar and Pawar.

B.Sc. II
BIOTECHNOLOGY
PAPER – I
MOLECULAR BIOLOGY & BIOPHYSICS

M.M. 50

UNIT-I

1. Nucleic Acid: Bases, Nucleosides and Nucleotides, DNA and RNA structure.
2. Plasmids.
3. Transposons: Repetitive elements, LINEs & SINEs, Structure of Gene.

UNIT-II

1. DNA Replication: Enzymes involved and mechanism of DNA Replication in Prokaryotes.
2. Mutation: Molecular level of Mutation, Types of Mutagens, Spontaneous and Induced Mutation.
3. DNA Repair: NER, BER and Mismatch Repair.

UNIT-III

1. Genetic Code: Features, Condon Assignment and Wobble hypothesis.
2. Transcription: Initiation, Elongation and Termination in Prokaryotes.
3. Translation: Initiation, Elongation and Termination Translation machinery in Prokaryotes. Operon-Concept of Operator, Regulator, Promoter gene, Inducer and Co-repressor.

UNIT –IV

1. Biophysics : Introduction, Scope and Application
2. Principle, Structure, Functions of the following:
 - a. Microscopy
 - b. Colorimeter and Spectroscopy
 - c. Electrophoresis
 - d. Centrifugation
 - e. Chromatography.

UNIT –V

1. Radioisotopes techniques: Measurement of radioactivity, Ionization Chambers, Geiger Muller and Scintillation Counter.
2. Autoradiography and DNA Fingerprinting.
3. Biosensor.

List of Books

1. Gerald Karp - Cell and Molecular biology, 4th Edition (2005).
2. Lewis J.Klein Smith and Valerie M.Kish-Principles of cell and molecular biology-Third Edition (2002)
3. P.K. Gupta- Cell and molecular biology, Second Edition (2003), Rastogi publications
4. Richard M-Twyaman-Advanced Molecular Biology, First South Asian Edition (1998), VivaBooks Pvt. Ltd
5. K. Wilson and J.Walker (2012) Principle and Techniques of Biotechnology and Molecular Biotechnology
6. Upadhyaya and Upadhyaya: Biophysical Chemistry
7. David, I. Nelson and Michael M.Cox: Lehninger: Principal of Biochemistry 4th Edition. W.H. Freeman and Company, New York
8. Buchanan, Gruissem & Jones (2015) Biochemistry & Molecular Biology of Plant, 2nd edition.

B.Sc. II
BIOTECHNOLOGY
PAPER II
RECOMBINANT DNA TECHNOLOGY AND GENOMICS

M.M. 50

UNIT-I

1. Recombinant DNA technology: General concept. Steps in gene cloning and application.
2. Host controlled Restriction Modification System, Ligases and Polymerases, Klenow fragment, Taq, Pfu polymerase and Nuclease (Endo, Exo and restriction endonuclease).
3. Modification Enzyme (Kinase, Phosphates and terminal deoxynucleotidyl transferase). Reverse Transcriptase.

UNIT-II

1. Vectors: Plasmid, Bacteriophages, Cosmid, SV40 and Expression vectors.
2. Gene Library: Genomic and cDNA library.
3. Selection and Screening of Recombinants: Genetic and Hybridization methods.

UNIT-III

1. PCR: Types of PCR, Steps (Denaturation, Annealing and Extension); Applications, Advantages and Limitation of PCR.
2. Molecular Marker-RFLP, RAPD and Micro array.
3. Human Genome Project.

UNIT-IV

1. Basic concept of Gene Transfer Methods: Microinjection, Electroporation, Lipofection and Microprojectile.
2. Gene Therapy: In vivo and Ex vivo, Germ line and Somatic gene therapy.
3. Basic idea of Stem cell technology: Types of stems cell cultures and their Significance.

UNIT-V

1. Introduction to Bioinformatics: History, Objective and Application.
2. Major Bioinformatics Resource – NCBI , Types of Databases (Primary and Secondary Databases) , BLAST and FASTA
3. Basic concept of Genomics and Proteomics

List of Books

1. B.D. Singh (2004) Biotechnology, Expanding Horizons. First Edition. Kalyani Publishers, Ludhiana.
2. P.K. Gupta (2005) Biotechnology and Genomics, Rastogi Publication, Meerut.
3. Stanbury and Whittaker - Principles of Sterilization techniques, First Indian reprint Edition
4. (1997). Aditya Book (P) Ltd. New Delhi.
5. L.E. Casida (1994) Industrial Microbiology Edition .
6. A.H. Patel (2003) Industrial Microbiology 4th Edition.
7. K.S. Bilgrami and A.K. Pandey(1998) Introduction to Biotechnology Edition 2nd (1998)
8. U Satyanarayan (2005) Biotechnology, First Edition Books and Allied (P) Ltd. Kolkata.
9. Atul kumar and Vandana A.Kumar (2004) Plant Biotechnology and tissue culture, Principle and Perspectives, International Books Distributing Co. Lucknow.
10. S Choudhari, and DB Carlson (2008) Genomics: Fundamentals and applications, 1st edition.
11. TK Attwood and DJ Parry (2009) Introduction of Bioinformatics.
12. Philip E Bourne Helga Whisking (2003) Structural Bioinformatics.
13. Des Higgins and Willie Taylor (2000) Bioinformatics Sequence, Structure and Databanks.

List of Practical's
MOLECULAR BIOLOGY, BIOPHYSICS, RECOMBINANT DNA TECHNOLOGY AND
GENOMICS

1. Isolation of DNA from Plant cell.
2. Estimation of DNA by DPA method.
3. Isolation RNA from yeast cells

Experiment based on-

4. Centrifugation
5. Spectrophotometer/Colorimeter
6. Electrophoresis
7. Paper chromatography/TLC

Experiment based on Bioinformatics -

8. Retrieve DNA /Protein sequence from Biological Data Bases (NCBI).
9. Use of tools studied

SCHEME FOR PRACTICAL EXAMINATION

Time: 4 hrs. M.M.: 50

- | | |
|---------------------------------------|----------|
| 1. Experiment based on DNA/RNA | 10 marks |
| 2. Experiment based on Instruments | 10 marks |
| 3. Experiment based on Bioinformatics | 10 marks |
| 4. Spotting | 10 marks |
| 5. Viva - Voce | 05 marks |
| 6. Record / Sessional | 05 marks |

B.Sc. Part-II
BOTANY
PAPER-I
PLANT TAXONOMY, ECONOMIC BOTANY, PLANT ANATOMY AND EMBRYOLOGY

- UNIT-I** Bentham and Hooker system of classification. Binomial Nomenclature, International Code of Nomenclature for Algae, Fungi, and plants (IUCN), Typification, numerical Taxonomy and chemotaxonomy. Preservation of Plant material and Herbarium techniques. Important botanical gardens and herbaria of India, Kew Botanical garden, England.
- UNIT-II** Systematic position, distinguishing characters and economic importance of the following families, Ranunculaceae, Magnoliaceae, Brassicaceae, Rosaceae, Papaveraceae, Caryophyllaceae, Rutaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Malvaceae, Convolvulaceae, Orchidaceae, Acanthaceae, verbenaceae, Lamiaceae, Asteraceae, Fabaceae, Euphorbiaceae, Poaceae and Liliaceae.
- UNIT-III** Economic Botany: Botanical name, family, part used and uses of the following economically important plants, fiber yielding plants; Cotton, jute, sun, hemp, coir. Timber yielding plants: Sal, Teak, Shisham and Pine. Medicinal plants: Kalmegh, Ashwangandha, Ghritkumari, Giloy, Brahmi, sargandha, ---of medicinal plants of C.G. Food plants: Pearl millet, Buck of wheat, Sorghum, Soyabean, gram, Ground nut, Sugarcane and Potato. Fruit plants: Pear, Peach, Litchi. Spices: Cinnamon, Turmeric, Ginger, Asafoetida and Cumin. Beverages : Tea, Coffee Rubber Cultivation of important flowers: Chrysanthemum, Dahelia, Biodiesel plants Jatropa, Pongamia Ethnobotany in context of Chhattisgarh.
- UNIT-IV** Plant Anatomy: Root and shoot apical meristems theories of root and shoot apex organization, permanent tissues, anatomy of root, stem and leaf of dicot and monocot, secondary growth in root and stem, Anatomical anomalies in the primary structure of stems (Nyctanthes, Boerhaavia, Casuarina), Anamolous secondary growth in Dracaena, Bignonia, Laptadenia.
- UNIT-V** Embryology: Flower as a reproductive organ, anther, microsporogenesis, types of ovules, megasporogenesis, development of male and female gametophyte, pollination, mechanisms, self-incompatibility, fertilization, endosperm, embryo, polyembryony, apomixes and parthenocarpy.

Books Recommended:

1. Singh, Pandey, Jain. **Diversity and Systematic of Seed Plants**, Rastogi Publications Merrut
2. Sharma OP, **Plant Taxonomy**, Tata Mc Graw Hill, New Delhi
3. Pandey BP, **Taxonomy of Angiosperms**, S. Chand Publishing, New Delhi
4. Pandey, BP, **Plant Anatomy**, S.Chand Publishing, New Delhi
5. Pandey, BP, **Economic Botany**, S.Chand Publishing, New Delhi
6. Bhojwani, SS and Bhatnagar SP, **Embryology of Angiosperm**, Vikas Publication House, New Delhi
7. Singh, Pandey, Jain, **Embryology of Angiosperms**, Rastogi Publication, Meerut
8. Sharma, V, Alum, A. **Ethnobotany**, Rastogi Publications, Meerut
9. Tayal, MS **Plant Anatomy**, Rastogi Publication, Meerut

B.Sc. Part-II
BOTANY
PAPER-II
ECOLOGY AND PLANT PHYSIOLOGY

- UNIT-I** Introduction and scope of ecology, environmental and ecological factors, Soil formation and soil profile, Liebig's law of minimum, Shelford's law of tolerance, morphological and anatomical adaptations in hydrophytes, xerophytes and epiphytes.
- UNIT-II** Population and community characteristics, Raunkiaer's life forms, population interactions (e.g. Symbiosis, Amensalism etc.), succession, ecotone and edge effect, ecological niches, ecotypes, keystone species
- Concept of ecosystem, trophic levels, flow of energy in ecosystem, food chain and food web, concept of ecological pyramids
- Biogeochemical cycles: carbon cycle, nitrogen cycle and phosphorus cycle
- UNIT-III** Plant water relations: Diffusion, permeability, osmosis, imbibitions, plasmolysis, osmotic potential and water potential, Types of soil water, water holding capacity, wilting, Absorption of water, theories of Ascent of sap, Mineral nutrition and absorption, Deficiency symptoms, Transpiration, stomata movement, significance of transpiration, Factors affecting transpiration, guttation.
- UNIT-IV** Photosynthesis: Photosynthetic apparatus and pigments, light reaction mechanism of ATP synthesis. C3, C4 CAM pathway of carbon reduction, photorespiration, factors affecting photosynthesis.
- Respiration: Aerobic and anaerobic respiration, Glycolysis, Krebs's cycle, factors affecting respiration, R.Q.
- UNIT-V** Plant growth hormones: Auxin, Gibberellins, Cytokinin, Ethylene and Abscisic acid. Physiology of flowering, Florien concept, Photoperiodism and Vernalization. Seed dormancy and germination, plant movement.

Books Recommended:

1. Koromondy, E.J. **Concepts of Ecology**, Prentice Hall, USA
2. Singh, JS Singh SP and Gupta SR. **Ecology and Environmental Science and Conservation**, S. Chand Publishing, New Delhi
3. Sharma, PD. **Ecology and Environment**, Rastogi Publications, Meerut
4. Hopkins, WG and Huner, PA. **Introduction to Plant Physiology**, John Wiley and Sons.
5. Pandey SN and Sinha BK, **Plant Physiology**, Vikas Publishing, New Delhi
6. Taiz, Land Zeiger. E. **Plant Physiology**, 5th edition, Sinauer Associates Inc. M.A, USA
7. Srivastava, HS **Plant Physiology and Biotechnology**, Rastogi Publications, Meerut

**B.Sc. Part-II
BOTANY
PRACTICAL**

1. Taxonomy: Detailed description and identification of locally available plants of the families as prescribed in the theory paper.
2. Economic Botany: Identification and comment on the plants and plant products belonging to different economic use categories
3. Preparation of Herbarium of local wild plants.
4. Quantitative vegetation analysis of a grassland ecosystem.
5. Anatomical characteristics of hydrophytes and xerophytes.
6. Demonstration of root pressure.
7. Demonstration of transpiration.
8. Demonstration of evolution of O₂ in photosynthesis, factors affecting of photosynthesis.
9. Comparison of R.Q. of different respiratory substrates.
10. Demonstration of fermentation.
11. Determination of BOD of a water body.
12. Demonstration of mitosis.

PRACTICAL SCHEME

TIME: 4 Hrs.

M.M.: 50

1. Anatomy	08
2. Economic Botany	04
3. Physiology	08
4. Ecology	10
5. Spotting	10
6. Viva-Voce	05
7. Project Work/ Field Study	10

B.Sc.-II
COMPUTER SCIENCE
PAPER-I
COMPUTER HARDWARE

M.M. 50

AIM - The emphasis is on the design concepts & organizational details of the common PC, leaving the complicated electronics of the system of the computer Engineers.

OBJECT OF THE COURSE -

1. To introduce the overall organisation of the microcomputers.
2. To introduce the common peripheral devices used in computers.
3. to introduce the hardware components, use of micro processor and functions of various chips in microcomputer.

N.B. Since the computer organisation study is very vast & complicated, so the study is restricted to only the description and understanding part, hence the paper setter is requested to Keep this important factor in mind.

- UNIT-I CLASSIFICATION AND ORGANIZATION OF COMPUTERS**
Digital and analog computers and its evolution, Major components of digital computers; Memory addressing capability of CPU; word length and processing speed of computers. Microprocessors single chip microcomputers; large and small computers. Users interface Hardware software and firmware. multi programming multi user system. Dumb smart and intelligent terminals computer network and multi processing, LAN parallel processing. Flin's classification of computers. Computer flow and data flow computers.
- UNIT-II CENTRAL PROCESSING UNIT.**
CPU organization, ALU control unit registers. Instructions for INTEL 8005, Instruction word size, Various addressing mode interrupts and exceptions, some special Control signals and I/O devices. Instruction cycle fetch and execute operation, time Diagram, data flow.
- UNIT-III MEMORY OF COMPUTERS.**
Main memory secondary memory, backup memory, cache memory; real and virtual Memory Semiconductor memory, Memory controller and magnetic memory; RAM; disks, optical disks Magnetic bubble memory; DASD, destructive and non destructive. readout. Program of data Memory and MMU.
- UNIT-IV I/O DEVICES.**
I/O devices of micro controller; processors. I/O devices, printer, plotter, other out put devices, I/O port serial data transfer scheme, Micro controller, Signal processor, I/O processor I/O processor arithmetic processor.
- UNIT-V SYSTEM SOFTWARE AND PROGRAMMING TECHNIQUE.**
ML, AL HLL, stac subroutine debugging of programs macro, micro programming, program Design, software development, flow & chart multi programming, multiuser, multi tasking Protection, operating system and utility program, application package.

RECOMMENDED BOOKS:

1. Computer Fundamentals : Architecture and Organization - By B. Ram (Wilwy East- en Ltd.)
2. Computer Today : By Donal H. Sanders
3. Computer Fundamental : By Rajaraman
4. IBM PC - XT Clones : By Govinda Rajalu

B.Sc.-II
COMPUTER SCIENCE
PAPER-II
SOFTWARE

AIM- Introduction to the web-language-HTML & problem solving through the concept of object oriented programming.

OBJECT OF THE COURSE-

1. To introduce the internet & web related technology & learn the intricacies of web-page designing using HTML.
2. To introduce the object oriented programming concept using C++ language.
3. To introduce the problem solving methodology using the C++ programming features.

N.B.: Examiners are requested to prepare unit-wise questions papers.

UNIT-I HTML BASICS & WEB SITE DESIGN PRINCIPLES

Concept of a Web site, Web Standards, What is HTML? HTML Versions, Naming Scheme for HTML Documents, HTML document/file, HTML Editor, Explanation of the Structure of the homepage, Elements in HTML Documents, HTML Tags, Basic HTML tags, Comment tag in HTML, Viewing the Source of a web page, How to download the web page source? XHTML, CSS Extensible Markup Language (XML), Extensible Style sheet language (XSL), some tips for designing web pages, HTML Document Structure, HTML Document Structure-Head Section, Illustration of Document Structure, <BASE> Element, <ISINDEX> Element, <LINK> Element, META, <TITLE> Element, <SCRIPT> Element, Practical Applications, HTML Document Structure-body Section: Body elements and its attributes: Background; Background Color; Text: Link; Active Link (ALINK); Visited Link (VLINK); Left margin; Top margin, organization of Elements in the BODY of the document: Text Block Elements, Text Emphasis Elements; Special Elements - Hypertext Anchors; Character-Level Elements; Character References, Text Block Elements: HR (Horizontal Line); Hn (Headings); P (Paragraph); Lists; ADDRESS; BLOCKQUOTE; TABLE; DIV (HTML 3.2 and up) PRE (Preformatted); FORM, Text Emphasis Elements, Special Elements - Hypertext Anchors, Character-Level Elements: line breaks (ER) and Image (IMG), Lists, ADDRESS Element, BLOCKQUOTE Element, Table Element, COMMENTS in HTML, CHARACTER Emphasis Modes, Logical & Physical Styles, Netscape, Microsoft and Advanced Standard Elements List, FONT, BASEFONT and CENTER.

UNIT-II IMAGE, INTERNAL AND EXTERNAL LINKING BETWEEN WEBPAGES

Netscape, Microsoft and Advanced Standard Elements List, FONT, BASEFONT and CENTER Insertion of image using the element IMG (Attributes: SRC (Source), WIDTH, HEIGHT, ALT (Alternative), ALIGN), IMG (In line Image) Element and Attributes; Illustration of IMG Alignment, Image as Hypertext Anchor, Internal and External Linking between web pages Hypertext Anchors, HREF in Anchors, Links to a Particular Place in a Document, NAME attribute in an Anchor, Targeting NAME Anchors, TITLE attribute, Practical IT Application Designing web pages links with each other, Designing Frames in HTML, Practical examples.

UNIT-III INTRODUCTION TO OOP

Advantages of OOP, The object Oriented Approach, Characteristics of object oriented Languages- Object, Classes, Inheritance, Reusability, Polymorphism and C++.

Function: Function Declaration, Calling Function, Function Defines, Passing Argument to function, Passing Constant, Passing Value, Reference Argument, returning by reference, Inline function, Function Overloading, Default Arguments in function.

UNIT-IV OBJECT CLASSES AND INHERITANCE

Object and Class, Using the Class, Class constructor, Class destructors, object as function argument, Copy constructor, Struct and classes, array as class member, Static Class Data, Static Member Functions, Friend function, Friend class, operator overloading. Type of inheritance, Base class, Derive class Access Specified: Protected Function Overriding, member function, String, Template Function.

UNIT-V POINTERS AND VIRTUAL FUNCTION

pointers: and * operator variables, pointer to pointer, void pointer, pointer and array, pointer and function, pointer and string, memory management, new and delete, pointer to object, this pointer Virtual Function: Virtual Function, Virtual member function, accesses with pointer, pure Virtual function.

File and Stream: C++ streams, C++ Manipulators, Stream class, string I/O char I/O, Object I/O, I/O with multiple object, Disk I/O,

RECOMMENDED BOOKS:

1. Introduction to HTML : Kamlesh Agarwala, O.P. Vays, Prateek A. Agarwala (Kitab Mahal Publication)
2. Let us C++ : Y. Kanetkar B.P.B Publication
3. Programming in C++ : E. Balaguruswami
4. Mastering in C++ : Venu Gopal
5. Object Oriented Programming in C++ : Lafore R, Galgotia Publications.

B.Sc.-II
INFORMATION TECHNOLOGY
PAPER-I
DIGITAL CIRCUITS & COMPUTER H/W

UNIT-I

a) Number Systems:

Octal and hexadecimal number, decimal rep, complements, addition, subtraction, multiplication, division, fixed point rep, floating point rep, other binary code gray code, excess 3 gray, excess-3, 2421, etc. error detection code.

b) Boolean Algebra:

Laws, demerger's theorm, simplification Boolean expression & logic diagram, positive & negative logic, K-map and simplification of K-map.

UNIT-II

Combinational circuits:

Half adder, full adder, flip-flop: SR, JK, D,T, sequential circuits: encoder, decoder, multiplexer, shift resister, binary counters, BCD adder.

UNIT-III

Multivibrator Circuits:

Monostable, astable, bistable, smitt trigger, clocked RS, master-slave flip-flop, edge-triggered flip-flop, latch.

Integrated circuits:

RTL, DITL, TTL, CMOS, MOS.

UNIT-IV

a) Central Processing unit:

Introduction, register organisation, stack organisation, Instruction formats, Addressing modes.

b) I/O Organisatin:

I/O interfaces, Data transfer, types and modes, interrupts, DMA, IOP.

UNIT-V

Memory organisation:

Memory hierarcy, main memory, Auxiliary memory, Associative memory, cache memory, virtual memory, memory management techniques.

REFERENCE TAXT BOOK:

- | | | |
|--|---|--------------------|
| 1. Integrated Electronics | - | Mill man & Halkias |
| 2. Principle of Electronics | - | V.K. Mehta |
| 3. Digital Electronics | - | R.P. Jain |
| 4. Computer System Architecture | - | Morris Mano |
| 5. Digital Electronics & Computer Hardware | - | Morris Mano |

PAPER-II

- UNIT-I** Introduction to OPP: Advantages of OPP, the Object oriented approach, characteristics of object oriented languages: object, Classes, inheritance, reusability, polymorphism and C++.
- UNIT-II** Function: function declaration, calling function, function, passing arguments to function, passing constant, passing value, reference argument, returning by reference, inline function overloading, default arguments in function.
- UNIT-III** Object and Classes, using the Classes, Class constructor, Class destructor, object as function argument, copy constructor, struct and classes, array as class member, static class data, static member functions, friend function, friend class, operator overloading, type of inheritance, base class derive class, access specifier, protected, member function.
- UNIT-IV** Pointers: & and* operator pointer variables, pointer to pointer, void pointer, pointer and array, pointer and functions, pointer and string, memory management, new and delete, pointer to object, this pointer, virtual function: virtual function, virtual member function, accesses with pointer, pure virtual function.
- UNIT-V** File and stream: C++ manipulators, Stream class, string I/O, Char I/O; object I/O, I/O with objects, disk I/O.

REFERENCE TEXT BOOKS:

- | | | |
|---------------------------------------|---|------------------|
| 1. Programming in C++ | - | E. Balaguruswami |
| 2. Mastering in C++ | - | Venu Gopal |
| 3. Object Oriented Programming in C++ | - | Robert Lafore |
| 4. Let us C++ | - | Y. Kanetkar |

PRACTICAL WORK

1. The sufficient practical work should be done for understanding the paper
2. At least five programs on each unit from unit 2 to unit 5 be prepared.
3. All Practical works should be prepared in form of print outs and be valued while practical examination.

MATHEMATICS

There shall be three compulsory papers. Each paper of 50 marks is divided into five units and each unit carry equal marks.

B.Sc. Part-II

Paper-I

ADVANCED CALCULUS

- UNIT-I** Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion. Series of non-negative terms. Comparison tests, Cauchy's integral test, Ratio tests, Raabe's, Logarithmic, De Morgan and Bertrand's tests. Alternating series, Leibnitz's theorem. Absolute and conditional convergence.
- UNIT-II** Continuity, Sequential continuity, Properties of continuous functions, Uniform continuity, Chain rule of differentiability, Mean value theorems and their geometrical interpretations. Darboux's intermediate value theorem for derivatives, Taylor's theorem with various forms of remainders.
- UNIT-III** Limit and continuity of functions of two variables. Partial differentiation. Change of variables. Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables. Jacobians.
- UNIT-IV** Envelopes, evolutes. Maxima, minima and saddle points of functions of two variables. Lagrange's multiplier method.
- UNIT-V** Beta and Gamma functions, Double and triple integrals, Dirichlet's integrals, Change of order of integration in double integrals.

REFERENCES:

1. Gabriel Klaumber, Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
2. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
3. R.R. Goldberg, Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970.
4. D. Soma Sundaram and B. Chaudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
5. P.K. Jain and S.K. Kaushik, An introduction to Real Analysis, S. Chand & Co., New Delhi, 2000.
6. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
7. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York.
8. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
9. S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
10. O.E. Stanaitis, An Introduction to Sequences, Series and Improper Integrals, Holden-Dey, Inc., San Francisco, California.
11. Earl D. Rainsville, Infinite Series, The Macmillan Company, New York.
12. Chandrika Prasad, Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.
13. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.
14. Shanti Narayan, A Course of Mathematical Analysis, S.Chand and Company, New Delhi.

B.Sc. Part-II
Paper-II
DIFFERENTIAL EQUATIONS

- UNIT-I** Series solutions of differential equations- Power series method, Bessel and Legendre functions and their properties-convergence, recurrence and generating relations, Orthogonality of functions, Sturm-Liouville problem, Orthogonality of eigenfunctions, Reality of Eigen values, Orthogonality of Bessel functions and Legendre polynomials.
- UNIT-II** Laplace Transformation- Linearity of the Laplace transformation, Existence theorem for Laplace transforms, Laplace transforms of derivatives and integrals, Shifting theorems. Differentiation and integration of transforms. Convolution theorem. Solution of integral equations and systems of differential equations using the Laplace transformation.
- UNIT-III** Partial differential equations of the first order. Lagrange's solution, Some special types of equations which can be solved easily by methods other than the general method, Charpit's general method of solution.
- UNIT-IV** Partial differential equations of second and higher orders, Classification of linear partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Monge's methods.
- UNIT-V** Calculus of Variations- Variational problems with fixed boundaries- Euler's equation for functional containing first order derivative and one independent variable, Extremals, Functional dependent on higher order derivatives, Functional dependent on more than one independent variable, Variational problems in parametric form, invariance of Euler's equation under coordinates transformation.
- Variational Problems with Moving Boundaries- Functional dependent on one and two functions, One sided variations.
- Sufficient conditions for an Extremum- Jacobi and Legendre conditions, Second Variation. Variational principle of least action.

REFERENCES:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999.
2. D.A. Murray, Introductory Course on Differential Equations, Orient Longman, (India), 1967.
3. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd., London.
4. Lan N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company, 1988.
5. Francis B. Hildebrand, Advanced Calculus for Applications, Prentice Hall of India Pvt. Ltd., New Delhi, 1977.
6. Jane Cronin, Differential equations, Marcel Dekkar, 1994.
7. Frank Ayres, Theory and Problems of Differential Equations, McGraw-Hill Book Company, 1972.
8. Richard Bronson, Theory and Problems of Differential Equations, McGraw-Hill, Inc., 1973.
9. A.S. Gupta, Calculus of variations with-Applications, Prentice-Hall of India, 1997.
10. R. Courant and D. Hilbert, Methods of Mathematical Physics, Vols. I & II, Wiley-Interscience, 1953.
11. I.M. Gelfand and S.V. Fomin, Calculus of Variations, Prentice-Hill, Englewood Cliffs (New Jersey), 1963.
12. A.M. Arthurs, Complementary Variational Principles, Clarendon Press, Oxford, 1970.
13. V. Kornkov, Variational Principles of Continuum Mechanics with Engineering Applications, Vol. I, Reidel Publ. : Dordrecht, Holland, 1985.
14. T. Oden and J.N. Reddy, Variational Methods in Theoretical Mechanics, Springer-Verlag, 1976.

**B.Sc. Part-II
Paper-III
MECHANICS**

STATICS

UNIT-I Analytical conditions of Equilibrium, Stable and unstable equilibrium. Virtual work, Centenary.

UNIT-II Forces in three dimensions, Poinot's central axis, Null lines and planes.

DYNAMICS

UNIT-III Simple harmonic motion. Elastic strings. Velocities and accelerations along radial and transverse directions, Projectile, Central orbits.

UNIT-IV Kepler's laws of motion, velocities and acceleration in tangential and normal directions, motion on smooth and rough plane curves.

UNIT-V Motion in a resisting medium, motion of particles of varying mass, motion of a particle in three dimensions, acceleration in terms of different co-ordinate systems.

REFERENCES:

1. S.L. Loney, Statics, Macmillan and Company, London.
2. R.S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
3. S.L. Loney, An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956.

B.Sc.-II
MICROBIOLOGY
PAPER- I
MOLECULAR BIOLOGY AND GENETIC ENGINEERING

- UNIT-1 FUNDAMENTALS OF MOLECULAR BIOLOGY**
History and scope of molecular biology, concept and mechanism of heredity. DNA as genetic material- experimental evidences. DNA replication- mechanism, process and enzymes/proteins involved in replication.
- UNIT-2 CENTRAL DOGMA OF PROTEIN SYNTHESIS**
Transcription- initiation, elongation, termination, RNA polymerases and sigma factor. Transcription inhibitors (antibiotics, drugs). Translation- initiation, elongation and termination. Factors involved in translation. Genetic code.
- UNIT-3 MUTATION AND DNA REPAIR MECHANISM**
Introduction and Types of Gene mutations- Base substitution, frame shift mutation (insertion, deletion, miss-sense, nonsense mutation.) mutagens – physical and chemical. Reverse mutation in bacteria. DNA repair mechanism (mismatch repair, photo-reactivation, excision and SOS repair). Beneficial and harmful effect of mutation.
- UNIT-4 GENE REGULATION**
Concept of gene- Cistron, Recon, Mutton. Operon Concept- lac Operon, tryptophan Operon, His Operon. Activator, Co-activator and Repressor. Introduction to Bioinformatics- Elementary genome Database.
- UNIT-5 GENETIC ENGINEERING**
Basic concept of Genetic Engineering, DNA modifying enzymes Restriction endonuclease, DNA ligase, terminal transferase. Vectors- pBR322, pUC19, BAC and YAC. Phage based vectors, expression of vector. Transformation – physical and chemical method. Bacterial Host. Screening of recombinant vector Blue white Screening, Colony Hybridization.

Text Books Recommended:

1. Gene Cloning by T.A. Brown.
2. General Microbiology by Power and Daganiwala.
3. Zinssers Microbiology by KJ Wolfgang, McGraw- Hill Company.
4. Microbial Genetics by RM Stanley, F David and EC John.
5. Bacteriological Techniques by FJ Baker.
6. Molecular Biology of the Cell; 3rd Edition; Bruce Albert's, et.al; Garland Publishing.
7. Cell biology; C.B. Power; Himalaya Publishing House; Fifth edition
8. Cell & Molecular Biology; Gerald Karp; Fourth edition
9. A Textbook of Microbiology; Dubey & Maheshwari; S.Chand & Sons.
10. Cell biology & Genetics; P. K. Gupta
11. Introduction to Bioinformatics; T K Atwood and D J Parry-Smith; Pearson Education Ltd

B.Sc.-II
MICROBIOLOGY
PAPER- II
BIOINSTRUMENTATION AND BIOSTATISTICS

- UNIT-1 MICROSCOPY AND CENTRIFUGATION**
Simple and compound light microscope, Bright field, Dark field, Phase contrast and Electron microscope. Centrifugation- principle and types of centrifuges (analytical and preparatory), types of centrifugation- differential and rate zonal centrifugation.
- UNIT-2 pH metry and chromatography**
Principle of pH meter, types of electrodes, factors affecting pH measurements, and application of pH meter. Chromatography- principle, types- paper, TLC and column chromatography, HPLC.
- UNIT-3 SPECTROPHOTOMETRY**
Electromagnetic spectrum, Beers-Lamberts law, Types (Principles, working and application)- colorimeter, UV - Vis Spectrophotometer and IR- Spectrophotometer, Turbidometry.
- UNIT-4 Electrophoresis and X-Ray Diffraction**
Principle of electrophoresis, instrumentation and Application, types of Paper, Gel electrophoresis and Immunoelectrophoresis. X-ray diffraction- principle and application.
- UNIT-5 Biostatistics**
Data- Types, characteristics, presentation and distribution. Data analysis- central tendency (Mean, Median and Mode), Deviation (variance SD and SE). Concept of probability.

Text Books Recommended:

1. Introduction to Instrumental analysis by Robert Braun.
2. Instrumental Techniques by Upadhyay and Upadhyay.
3. Instrumental Methods of Chemical Analysis by BK Sharma.
4. Bio statistics; Sunder Rao
5. Statistical Methods; S. P. Gupta; Sultan Chand & Sons

**B.Sc.-II
MICROBIOLOGY
PRACTICAL**

M. M. 50

Determination of antibiotic resistance by plating method. Assaying of microbial enzymes; Catalase, Proteases, Peroxides, Cellulase, Cellobioases, Amylase, Diastase. Exercise on paper, thin layer, column chromatography. Exercise on paper and gel electrophoresis. Determination of pH of various water and soil sample. testing of lambert beer's law. Determination of lamda max of dye by spectrophotometer Isolation of resistant bacteria from soil and water sample

Scheme of Practical Examination

Time - 4 hours	M.M. 50
1. Exercise on spectrophotometer/ pH meter	10
2. Exercise on chromatography	10
3. Exercise on genetics	05
4. Spotting (1-5)	10
5. Viva-Voce	05
6. Sessional	10
	Total 50

B.Sc. Part-II
PHYSICS
OBJECTIVES OF THE COURSE

The undergraduate training in physics is aimed at providing the necessary inputs so as to set forth the task of bringing about new and innovative ideas/concepts so that the formulated model curricula in physics becomes in tune with the changing scenario and incorporate new and rapid advancements and multi disciplinary skills, societal relevance, global interface, self sustaining and supportive learning.

It is desired that undergraduate i.e. B.Sc. level besides grasping the basic concepts of physics should in addition have broader vision. Therefore, they should be exposed to societal interface of physics and role of physics in the development of technologies.

EXAMINATION SCHEME:

1. There shall be 2 theory papers of 3 hours duration each and one practical paper of 4 hours duration. Each paper shall carry 50 marks.
2. Numerical problems of at least 30% will compulsorily be asked in each theory paper.
3. In practical paper, each student has to perform two experiments one from each groups as listed in the list of experiments.
4. Practical examination will be of 4 hours duration- one experiment to be completed in 2 hours.
5. The distribution practical marks as follows:
Experiment: 15+15=30
Viva voce: 10
Internal assessment: 10
5. The external examiner should ensure that at least 16 experiments are in working order at the time of examination and submit a certificate to this effect.

B.Sc. Part-II
PHYSICS
PAPER-I
THERMODYNAMICS, KINETIC THEORY AND STATISTICAL PHYSICS

- UNIT-1** The laws of thermodynamics : The Zeroth law, first law of thermodynamics, internal energy as a state function, reversible and irreversible change, Carnot's cycle, Carnot theorem, second law of thermodynamics. Clausius theorem inequality. Entropy, Change of entropy in simple cases (i) Isothermal expansion of an ideal gas (ii) Reversible isochoric process (iii) Free adiabatic expansion of an ideal gas. Concept of entropy, Entropy of the universe. Entropy change in reversible and irreversible processes, Entropy of Ideal gas, Entropy as a thermodynamic variable, S-T diagram, Principle of increase of entropy. The thermodynamic scale of temperature, Third law of thermodynamics, Concept of negative temperature.
- UNIT-2** Thermodynamic functions, Internal energy, Enthalpy, Helmholtz function and Gibb's free energy, Maxwell's thermo dynamical equations and their applications, TdS equations, Energy and heat capacity equations Application of Maxwell's equation in Joule-Thomson cooling, adiabatic cooling of a system, Van der Waals gas, Clausius-Clapeyron heat equation. Blackbody spectrum, Stefan-Boltzmann law, Wien's displacement law, Rayleigh-Jean's law, Planck's quantum theory of radiation.
- UNIT-3** Maxwellian distribution of speeds in an ideal gas: Distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values. Doppler broadening of spectral lines. Transport phenomena in gases: Molecular collisions mean free path and collision cross sections. Estimates of molecular diameter and mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.
Behaviour of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO₂ Gas. Critical Constants.
- UNIT-4** The statistical basis of thermodynamics: Probability and thermodynamic probability, principle of equal a priori probabilities, statistical postulates. Concept of Gibb's ensemble, accessible and inaccessible states. Concept of phase space, γ phase space and μ phase space. Equilibrium between two systems in thermal contact, probability and entropy, Boltzmann entropy relation. Boltzmann canonical distribution law and its applications, law of equipartition of energy.
Transition to quantum statistics: 'h' as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator.
- UNIT-5** Indistinguishability of particles and its consequences, Bose-Einstein & Fermi-Dirac conditions, Concept of partition function, Derivation of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics, Limits of B-E and F-D statistics to M-B statistics. Application of B-E statistics to black body radiation, Application of F-D statistics to free electrons in a metal.

TEXT AND REFERENCE BOOKS:

1. B.B. Laud, "Introduction to Statistical Mechanics" (McMillan 1981)
2. F. Reef: "Statistical Physics" (Mcgraw-Hill, 1998).
3. K, Haung: "Statatistical Physics" (Wiley Eastern, 1988).
4. Thermal and statistical Physics: R.K. Singh, Y.M. Gupta and S. Sivraman.
5. Statistical Physics: Berkeley Physics Course, Vol. 5
6. Physics (Part-2): Editor, Prof. B.P. Chandra, M.P. Hindi Granth Academy.
7. Heat and Thermodynamics: K.W. Zeeman sky.
8. Thermal Physics: B.K. Agarwal.
9. Heat and Thermodynamics: Brij Lal and N. Subrahmanyam.
10. Heat and Thermodynamics: Dayal, Verma and Pandey.
11. A Treatise on Heat: M.N. Saha and B.N. Srivastava.

B.Sc. Part-II
PHYSICS
PAPER-II
WAVES, ACOUSTICS AND OPTICS

- UNIT-1** Waves in media: Speed of transverse waves on uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves. Waves over liquid surface: gravity waves and ripples. Group velocity and phase velocity and relationship between them. Production and detection of ultrasonic and infrasonic waves and applications.
Reflection, refraction and diffraction of sound : Acoustic impedance of a medium, percentage reflection & refraction at a boundary, impedance matching for transducers, diffraction of sound, principle of a sonar system, sound ranging.
- UNIT-2** Fermat's Principle of Extremum path, the aplanatic points of a sphere and other applications. Cardinal points of an optical system, thick lens and lens combinations. Lagrange equation of magnification, telescopic combinations, telephoto lenses. Monochromatic aberrations and their reductions; aspherical mirrors and Schmidt corrector plates, aplanatic points, oil immersion objectives, meniscus lens.
Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece, common types of eyepieces. (Ramsdon and Hygen's eyepieces).
- UNIT-3** Interference of light: The principle of superposition's, two slit interference, coherence requirement for the sources, optical path retardations, Conditions for sustained interference, Theory of interference, Thin films. Newton's rings and Michelson interferometer and their applications its application for precision determinations of wavelength, wavelength difference and the width of spectral lines. Multiple beam interference in parallel film and Fabry-Perot interferometer. Rayleigh refract meter, Twyman-Green interferometer and its uses.
- UNIT-4** Diffraction, Types of Diffraction, Fresnel's diffraction, half-period zones, phasor diagram and integral calculus methods, the intensity distribution, Zone plates, diffraction due to straight edge, Fraunhofer diffraction due to a single slit and double slit, Diffraction at N-Parallel slit, Plane Diffraction grating, Rayleigh criterion, resolving power of grating , Prism, telescope.
Polarized light and its mathematical representation, Production of polarized light by reflection, refraction and scattering. Polarization by double refraction and Huygens's theory, Nicoll prism, Retardation plates, Production and analysis of circularly and elliptically polarized light. Optical activity and Fresnel's theory, Biquartz polarimeter.
- UNIT-5** Laser system: Basic properties of Lasers, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, conditions for laser action, population inversion, Types of Laser : Ruby and, He-Ne laser and. Applications of laser : Application in communication, Holography and Basics of non linear optics and Generation of Harmonic.

TEXT AND REFERENCE BOOKS:

1. A.K. Ghatak, 'Physical Optics'
2. D.P. Khandelwal, 'Optical and Atomic Physics' (Himalaya Publishing House, Bombay, 1988)
3. K.D. Moltev; 'Optics' (Oxford University Press)
4. Sears: 'Optics'
5. Jenkins and White: 'Fundamental of Optics' (McGraw-Hill)
6. B.B. Laud: 'Lasers and Non-linear Optics' (Wiley Eastern 1985)
7. Smith and Thomson: 'Optics' (John Wiley and Sons)
8. Berkely Physics Courses: Vol.-III, 'Waves and Oscillations'
9. I.G. Main, 'Vibrations and Waves' (Cambridge University Press)
10. H.J. Pain: 'The Physics of Vibrations and Waves' (MacMillan 1975)
11. Text Book of Optics: B.K. Mathur
12. B.Sc. (Part III) Physics: Editor: B.P. Chandra, M.P. Hindi Granth Academy.
13. F. Smith and J.H. Thomson, Manchester Physics series: optics (John wiley, 1971)
14. Born and Wolf: 'Optics'.
15. Physical Optics: B. K. Mathur and T. P. Pandya.
16. A textbook of Optics: N. Subrahmanyam, Brijlal and M. N. Avadhanulu.
17. Geometrical and Physical Optics: Longhurst.
18. Introduction to Modern Optics: G. R. Fowls.
19. Optics: P. K. Srivastav

**B.Sc. Part-II
PHYSICS
PRACTICALS**

Minimum 16 (Eight from each group)

Experiments out of the following or similar experiments of equal standard

1. Study of Brownian motion
2. Study of adiabatic expansion of a gas
3. Study of conversion of mechanical energy into heat
4. Heating efficiency of electrical kettle with varying voltage
5. Study of temperature dependence of total radiation
6. Study of temperature dependence of spectral density of radiation
7. Resistance thermometry
8. Thermo emf thermometry
9. Conduction of heat through poor conductors of different geometries.
10. Experimental study of probability distribution for a two-option system using a coloured dice.
11. Study of statistical distribution on nuclear disintegration data (GM counter used as a black box).
12. Speed of waves on a stretched strings.
13. Studies on tensional waves in a lumped system.
14. Study of interference with two coherent source of sound.
15. Chhandi's figures with varying excitation and loading points.
16. Measurements of sound intensities with different situations.
17. Characteristics of a microphone-loudspeakers system
18. Designing an optical viewing system.
19. Study of monochromatic defects of images.
20. Determining the principle point of a combination of lenses.
21. Study of interference of light (biprism or wedge film).
22. Study of diffraction at a straight edge or a single slit.
23. Study of F-P etalon fringes.
24. Study of diffraction grating and its resolving power.
25. Resolving power of telescope system.
26. Polarization of light by reflection; also cos-squared law.
27. Study of optical rotation for any system.
28. Study of laser as a monochromatic coherent source.
29. Study of a divergence of laser beam.
30. Calculation of days between two dates of a year.
31. To check if triangle exists and the type of a triangles.
32. To find the sum of the sine and cosines series and print out the curve.
33. To solve simultaneous equation by elimination method.
34. To prepare a mark-list of polynomials.
35. Fitting a straight line or a simple curve
36. Convert a given integer into binary and octal systems and vice versa .
37. Inverse of a matrix.
38. Spiral array.

TEXT AND REFERENCE BOOKS

1. D.P. Khandelwal, Optics and Atomic physics (Himalaya Publishing house, Bombay 1988).
2. D.P. Khandelwal, A Laboratory Manual for Undergraduate Classes (Vani Publishing House, New Delhi).
3. S. Lipschutz and a Poe, Schaum's outline of theory and Problems of Programming with Fortran (McGraw-hill Book Company 1986).
4. C Dixon, Numerical Analysis.

B.Sc. Part-II
ZOOLOGY
PAPER-I
ANATOMY AND PHYSIOLOGY

Comparative Anatomy of various organ systems of vertebrates:

UNIT-I

1. Integument and its derivatives: structure of scales, hair and feathers
2. Alimentary canal and digestive glands in vertebrates
3. Respiratory organs : Gills and lung , air-sac in birds

UNIT-II

1. Endoskeleton: (a) Axial Skeleton- Skull and Vertebrae, (b) Appendicular Skeleton Limbs and girdles
2. Circulatory System: Evolution of heart and aortic arches
3. Primogenital System: Kidney and excretory ducts

UNIT-III

1. Nervous System: General plan of brain and spinal cord
2. Ear and Eye: structure and function
3. Gonads and genital ducts

UNIT-IV

1. Digestion and absorption of dietary components
2. Physiology of heart, cardiac cycle and ECG
3. Blood Coagulation
4. Respiration: mechanism and control of breathing

UNIT- V

1. Excretion: Physiology of excretion, osmoregulation
2. Physiology of muscle contraction
3. Physiology of nerve impulse, Synaptic transmission

B.Sc. Part-II
ZOOLOGY
PAPER-II
VERTEBRATE ENDOCRINOLOGY, REPRODUCTIVE BIOLOGY BEHAVIOUR,
EVOLUTION AND APPLIED ZOOLOGY

UNIT-I

1. Structure and function of Endocrine glands
2. Hormone receptor
3. Biosynthesis and secretion of thyroid, adrenal, ovarian and testicular hormones
4. Endocrine disorder of pituitary, thyroid, adrenal and pancreas

UNIT-II

1. Reproductive cycle in vertebrates
2. Menstruation, lactation and pregnancy
3. Mechanism of parturition
4. Hormonal regulation of gametogenesis

UNIT -III

1. Evidences of organic evolution.
2. Theories of organic evolution.
3. Variation, Mutation, Isolation and Natural selection.
4. Evolution of Horse

UNIT-IV

1. Introduction to Ethology: Branches and concept of ethology.
2. Patterns of Behaviour, Taxes, Reflexes, Drives and Stereotyped behaviour.
3. Reproductive behavioural patterns.
4. Drugs and behavior, Hormones and behaviour

UNIT-V

1. Prawn Culture
2. Sericulture
3. Apiculture
4. Pisciculture
5. Poultry keeping
6. Elements of Pest Control: Chemical & Biological Control

**B.Sc. Part-II
ZOOLOGY
PRACTICAL**

The practical work in general shall be based on the syllabus prescribed and the students will be required to show the knowledge of the following:

- Study of the representative examples of the different chordates (Classified characters).
- Dissection of various systems of scoliodon-Afferent and Efferent bronchial cranial nerves, internal ear.

Alternative methods: By Clay/Thermacol/ Drawing/ Model etc.)

- Simple microscopic technique through unstained or stained permanent mount.
- Study of prepared slides histological, as per theory papers.
- Study of limb girdles and vertebrae of Frog, Varanus, Fowl and Rabbit.
- Identification of species and individual of honey bee.
- Life cycle of honey bee and silkworm.
- Exercise based on Evolution and Animal behavior.

Scheme of Practical Exam

Time: 3:30hrs

• Major dissection (Cranial nerves/efferent branchial vessel)	10
• Exercise based on evolution	05
• Exercise based on applied zoology	05
• Exercise based on animal behavior	04
• Spotting-8 (slides-4,bones-2,specimen-2)	16
• Viva	05
• Sessional marks.	05

UNIT 1- SOCIAL FORESTRY

- 1.1 - Scope, Object and types
- 1.2 - Important Social Forestry Schemes
- 1.3- Economic benefits of social forestry

UNIT 2- JOINT FOREST MANAGEMENT

- 2.1 - Definition, Scope and Objects
- 2.2 - People's Participation in JFM
- 2.3 - Constraints in obtaining people's participation

UNIT 3 - FOREST MANAGEMENT

- 3.1 - Definition, Scope and Objects
- 3.2 - Brief idea of the following –
 - 1. Growing stock
 - 2. Rotation
 - 3. Sustained yield
 - 4. Normal Forest

UNIT 4 - FOREST MENSURATION

- 4.1 - Definition, Scope and Object
- 4.2 - Measurement of height of trees
- 4.3 - Measurement of diameter of trees
- 4.4 - Measurement of girth of trees

UNIT 5 – FOREST ORGANISATION

- 5.1 - Geographical, climatic and functional classification
- 5.2 - Legal classification
- 5.3 - Territorial classification
- 5.4 - Administrative (Organisational) Classification
- 5.5- Management (silvicultural) classification-
Working circle, felling series, cutting section, coupes and periodic blocks.




UNIT 1- WOOD ANATOMY

- 1.1 - Introduction
- 1.2 - Anatomical structure of wood
- 1.3 - Physical properties of wood
- 1.4 - Mechanical properties of wood

UNIT 2 - LOGGING

- 2.1 - Felling and conversion
- 2.2 - Transport
- 2.3 - Storage
- 2.4 - Grading of timber

UNIT 3 - MINOR FOREST PRODUCTS (MFPs)

- 3.1 - Definition of minor forest product
- 3.2 - General idea of following MFPs of India –
 - 1. Fuel wood
 - 2. Fibre and flosses
 - 3. Grass, Bamboo
 - 4. Essential oils
 - 5. Oilseed
 - 6. Tans and dyes
 - 7. Medicinal plants

UNIT 4 - FOREST BASED OR WOOD BASED INDUSTRIES

- 4.1 - Pulp and paper
- 4.2 - Cutch and katha
- 4.3 - Lac and manufacture of shellac
- 4.4 - Resin tapping and manufacture of turpentine and rosin
- 4.5 - Charcoal burning

UNIT 5 - FOREST AND TRIBALS

- 5.1 - Life and livelihood : tribals
- 5.2- Tribals and forests
- 5.3 - Constitutional safeguards
- 5.4 - Tribal welfare and development

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List of Practicals (Forestry)

MM-50

1. Measurement of Diameter, Girth, Height etc.
2. Nursery management
3. Handling of nursery stock
4. Field planting method

Reference Books

Forestry for people	- S.A. Shah
Social forestry	- S.S. Negi
Forest Management	- Ram Prakash
A Hand book of forest Utilization	- Tribhuvan Mehta
Theory & Practiccs of Silvicultural systems	- Ram prakash and L.S. Khanna
Forest Mensuration	- A.N. Chaturvedi and L.S. Khanna
Forestry in India	- V.P. Agrawal
Bharat ki Janjatiyan	- Dr. Shiv Kumar Tiwari
Tribal in India	- Nadeem Hasnain

