

DEPARTMENT OF GEOGRAPHY, RAIGANJ UNIVERSITY

Interdisciplinary Course -1

ENVIRONMENTAL GEOGRAPHY AND DISASTER MANAGEMENT

Paper Code – PGGEOIDC1

End Term : 75 (6 credit)

Internal assessment - 25 (2 credit)

Total : 100 (8 credit)

UNIT I: Meaning and scope of Environmental Geography, Relations of Environmental Geography with other sciences, meaning, component and types of environment, approaches to the study of man-environment relationships.

UNIT II: Ecosystems, meaning, types and components of ecosystem, function of ecosystem, trophic levels, food chain and food webs. Ecological pyramid and flow of energy. Bio-Geo-Chemical Cycles-Nitrogen cycle, Carbon cycle and Hydrological cycle.

UNIT III: Environmental Degradation and Pollution: concept and types of Environmental Degradation, causes of Environmental Degradation, sources and types of Pollution, Air Pollution, adverse affect of air pollution on weather and climate, ozone depletion, green house effects, effects on human health, water pollution; surface and ground water, adverse effects on human health.

UNIT IV: Environmental Planning and Management: Environmental management – methods and approaches; Ecological basis of environmental management – Ecological principles; Survey, evaluation, preservation and conservation of resources. Environmental impact Assessment.

UNIT V: Disaster – meaning and concept; hazards, risk and vulnerability. Disaster – classification of disasters; Natural disaster – earthquake, floods, drought and global warming: causes, consequences and mitigation. Natural disaster – Examples from India. Disaster – man made disasters, their types – technological and industrial disasters. Social disasters: causes, consequences and mitigation. Man made disasters – Examples from India.

Unit VI: Disaster management – relief and response; reconstruction and rehabilitation. Disaster – strategies for survival, types of strategies. Disaster management: prevention, preparedness and mitigation. Importance of information in disaster management, significance of remote sensing and GIS; Mitigation and Management - Role of Government, NGOs, Plans and Policies and laws.

References

1. Chandna, R.C., 1998, Environmental Awareness, Kalyani Publishers, New Delhi.

2. Gaur, S., and Chandrashekhar, T., 2006, Global Environmental Crisis, Book Enclave, Jaipur.
3. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
4. Gupta, P.D., 2003, Environmental Issues for the 21st Century, Mittal Publications, New Delhi.
5. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Pub. , New Delhi.
6. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
7. Morris, D., Freeland, J., Hinchliff, S., Smith, S. (ed.), 2003, Changing Environments, Pd. John Wiley and Sons Ltd., The Open University, U.K.
8. Park, C.C., 1980, Ecology and Environmental Management, Butterworths, London.
9. Radha, S., and Sankhyan, A.S., (ed.), 2004, Environmental Challenges of the 21st Century, Deep Publications, New Delhi.
10. Rasure, K.A., 2007, Environment and Sustainable Development, Serials Publications, New Delhi.
11. Saxena, H.M., 2006, Environmental Studies, Rawat Publications, Jaipur.
12. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.
13. Singh Jagbir (2007) "Disaster Management Future Challenges and Oppurtunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India.
14. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi.
15. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
16. Singh, S., 1991, Environmental Geography, Prayag Publication, Allahabad.
17. Stoltman, J.P. et al. (2004) International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.
18. Strahler, A.N., and Strahler, A.M., 1997, Geography and Man's Environment, John Wiley and Sons, New York.
19. Taj, B., Murphy, P. and Rana, P.S., 2007, Environmental Impact Assessment, An Indo - Australian Perspective, Bookwell New Delhi.
20. Verma, S. B. and Shiva, K.S.,(ed.), 2005, Environmental Protection and Development, Deep Publications, New Delhi.

Notes:

1. *Question paper will be divided into Group A and Group B. Group A shall consist of long answer type questions and Group B brief answer type questions.*

2. *There shall be two questions each of 10 marks from each unit. Out of two, examinees are to answer one question from each unit. Thus, six units shall carry $6 \times 10 = 60$ marks of long answer type questions.*
3. *Group B shall consist of five questions each of 3 marks covering any five units. Thus, total marks for Group B shall be $3 \times 5 = 15$*
4. *For internal assessment total marks are 25.*

Interdisciplinary Course -2

LANDFORMS, ATMOSPHERE AND RESOURCES

Paper Code – PGGEOIDC2

End Term : 75 (6 credit)

Internal assessment - 25 (2 credit)

Total : 100 (8 credit)

UNIT I: Fundamental Concepts in Geomorphology - Geological structures and landforms; principles of uniformitarianism; Cycle of Erosion - concepts of Davis and Penck; Isostasy – Doctrine of Isostasy, Views of Airy and Pratt; Continental Drift Theory – concept of Wegener; Plate Tectonics – concept and related views.

UNIT II: Earth's Movement – endogenetic forces, folds, faults, rift valleys, exogenetic forces; Weathering and Mass movement; Dynamics of fluvial processes and resulting landforms; Dynamics of glacial processes and resulting landforms; Dynamics of Aeolian processes and resulting landforms; Ground water Dynamics and Karst Landforms.

UNIT III: Nature and scope of climatology and its relationship with meteorology. The atmosphere: Structure and composition, insolation, heat-balance of the earth. Distribution of temperature: Temporal, vertical and horizontal, Green House effect. Distribution of atmospheric pressure and winds: Jet streams - their origin, types and distribution, monsoon winds.

UNIT IV: Climatic Phenomena: Air masses and fronts, origin, growth, classification. Frontogenesis, types and weather associated with fronts. Climatic Classifications: Koppen's Thornthwaites - A critical appraisal of each classification, Climates of the World: Tropical, Temperate, Desert.

UNIT V: Nature, scope and significance of Geography of Resources. Definition and concept of natural resources. Classification of resources. Characteristics of natural resources: Resource conservation and management with reference to land and forest resource.

UNIT VI: Theories of Resource Use. Theories of agricultural location; Theories of industrial location: Weber and Losch; Trade blocs. Energy resources-Conventional energy resources - coal, petroleum, non - conventional - solar and geothermal energy.

References

A. For Landforms

1. Ahmed, E. (1985): Geomorphology. Kalyani Publishers, New Delhi.
2. Bloom, A. L. (1998/ 2001): Geomorphology. 3rd edition. Prentice Hall of India, New Delhi.
3. Chorley, R.J., Schumm, S. A. and Sugden, D. E. (1984): Geomorphology. Methuen and Company Ltd., London.
4. Dayal, P. (1994): A Text Book of Geomorphology. Kalyani Publishers, New Delhi.
5. Fairbridge, R.W. (ed.) (1968): Encyclopaedia of Geomorphology, Reinhold Book Corporation., New York
6. Gregory, K.J. and Walling, D.E. (1973): Drainage Basin Form and Process. Edward Arnold, London.
7. Jog, S. R. (ed.) (1995): Indian Geomorphology (2 vols.). Rawat Publications, Jaipur
8. Kale, V. and Gupta, A. (2001): Introduction to Geomorphology. Orient Longman, Hyderabad.
9. King, C.A.M. (1966): Techniques in Geomorphology. Edward Arnold, London.
10. Pethick, J. (1984): An Introduction to Coastal Geomorphology. Arnold, London. Indian, reprint , 2000.
11. Sharma, P. R. (ed.), (1993): Applied Geomorphology in Tropics. Rishi Publications, Varanasi.
12. Singh, S. (2004): Geomorphology. Prayag Pustak Bhawan, Allahabad.
13. Sparks, B.W. (1986): Geomorphology. Longmans, London.
14. Thornbury, W.D. (2005): Principles of Geomorphology. John Wiley and Sons, New York.
15. Wooldridge, S.W. and Morgan, R.S. (1959): The Physical Basis of Geography- An Outline of Geomorphology. Longman, London.

B. For Atmosphere

1. Barry & Perry., Synoptic Climatology.
2. Blair, T.A., Climatology-General and Regional.
3. Chorley, R.J. & Barry, R.G., Atmospheric Weather and climate.
4. Donn, W.L., Meteorology.
5. Jackson, I.J., Climate, Water and Agriculture in the Tropics, 1977.
6. Kendrew, W.G., Climates of the Continents.
7. Lal, D.S., Climatology.
8. Mather, J.R., Climatology: Fundamental and Applications, 1974.
9. Patterson., Introduction to Meteorology.
10. Rama sastery, A.A., Weather & Weather fore casting.

11. Rummey, G., Climatology and the world's climate.
12. Stringer., Foundation of Climatology.
13. Stringer., Techniques in Climatology.
14. Trewartha, G.T., An Introduction to Climate.

C. For Resources

1. Alexander, J.W., Economic Geography, New Jersey, 1965.
2. Ali, S.A., Resources for Future Economic Growth, New Delhi, 1979.
3. Behends, William, W., The Dynamics of Natural Resource Utilization in D. Meadow(Ed.), Masachusetts, 1972.
4. Duncan, G., Resource Utilization and Conservation, New York, 1975.
5. Earl, D.K., Forest Energy and Economic Development, Oxford, 1975.
6. Ranner, G.T., Conservation of Natural Resources, New York, 1942.
7. Zimmerman, E.W., Introduction to World Resources (edited by H.L. Honker, The Ohio State University, New York, 1964.
8. Zimmermann, E.N., World Resources & Industries, New York.

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New Syllabus for Post Graduate Studies (M. Sc.) in Botany

(w.e.f. the academic session 2017 – 2018)

***Includes Interdisciplinary Courses (IDC) as part of Choice
Based Credit System (CBCS)***



**Department of Botany
Raiganj University**

Raiganj University

New Syllabus for P. G. Studies (M. Sc.) in Botany

Duration: 2 years (Four Semesters); Total Marks -1600; Total Credit - 128

Semester I

Course/ Paper	Name of the Course	Marks			Credit	Hours		
		Class Test	Final	Total		CT	L	Total
Theoretical								
SI-BOT-1/T	Biochemistry and Molecular Biology of Plants	20	55	75	6	3	57	60
SI-BOT-2/T	Mycology and Plant Pathology	20	55	75	6	3	57	60
SI-BOT-3/T	Cytology and Genetics	20	55	75	6	3	57	60
SI-BOT-IDC1	Inter Disciplinary Course (IDC)-I*	30	70	100	8	5	75	80
Practical								
SI-BOT-4/P	Biochemistry and Molecular Biology of Plants			25	2			55
SI-BOT-5/P	Mycology and Plant pathology			25	2			55
SI-BOT-6/P	Cytology and Genetics			25	2			55

Tutorials – 55 hours
Total – 480 hours

Semester II

Course/ Paper	Name of the Course	Marks			Credit	Hours		
		Class Test	Final	Total		CT	L	Total
Theoretical								
SII-BOT-1/T	Plant Physiology and Metabolism	20	55	75	6	3	57	60
SII-BOT-2/T	Taxonomy of Angiosperms and Plant Developmental Biology	20	55	75	6	3	57	60
SII-BOT-3/T	Microbiology	20	55	75	6	3	57	60
SII-BOT-IDC2	Inter Disciplinary Course (IDC)-II*	30	70	100	8	5	75	80
Practical								
SII-BOT-4/P	Plant Physiology and Metabolism			25	2			55
SII-BOT-5/P	Taxonomy of Angiosperms and Plant Developmental Biology			25	2			55
SII-BOT-6/P	Microbiology			25	2			55

Tutorials – 55 hours
Total – 480 hours

Semester III

Course/ Paper	Name of the Course	Marks			Credit	Hours		
		Class Test	Final	Total		CT	L	Total
Theoretical								
SIII-BOT-1/T	Biology and Diversity of Algae, Bryophytes, Pteridophytes, Gymnosperms, Palaeobotany and Palynology	20	55	75	6	3	57	60
SIII-BOT-2/T	Ecology, Evolution and Plant resource utilization	20	55	75	6	3	57	60
SIII-BOT-3/T	Bioinformatics and Biostatistics	20	55	75	6	3	57	60
Practical								
SIII-BOT-4/P	Biology and Diversity of Algae, Bryophytes, Pteridophytes, Gymnosperms, Palaeobotany and Palynology.			25	2			55
SIII-BOT-5/P	Ecology, Evolution and Plant resource utilization			25	2			55
SIII-BOT-6/P	Bioinformatics and Biostatistics			25	2			55
Continuing Evaluation								
SIII-BOT-7/S	Seminar	50			4	40		
SIII-BOT-8/G	Group Discussion	50			4	40		

Tutorials – 55 hours

Total – 480 hours

Semester IV

Course/ Paper	Name of the Course	Marks			Credit	Hours		
		Class Test	Final	Total		CT	L	Total
Theoretical								
SIV-BOT-1/T	Plant Biotechnology and Genetic Engineering	20	55	75	6	3	57	60
SIV-BOT-2/ET	Special/Elective - Paper – I**	20	55	75	6	3	57	60
SIV-BOT-3/ET	Special/Elective - Paper – II**	20	55	75	6	3	57	60
Practical								
SIV-BOT-4/P	Plant Biotechnology and Genetic Engineering			25	2			55
SIV-BOT-5/EP	Corresponding to both the Special papers*			50	4			100
Continuing Evaluation								
SIV-BOT-6/DR	Project Work/Dissertation/Review	100			8	90		

Tutorials – 55 hours

Total – 480 hours

**IDC-I and IDC-II mentioned here are to be pursued by students other than M. Sc. in Botany. Students of M. Sc. Botany will pursue IDCs in other PG Department(s) and it will be a 08+08=16 credit course spread over two semesters (Semester-I & II).*

****Special/Elective Course (any one to be selected; each course contains two theory and one practical paper):**

1. Cytogenetics,
2. Microbiology,
3. Mycology and Plant Pathology,
4. Plant Physiology, Biochemistry and Molecular Biology
5. Taxonomy of Angiosperms and Biosystematics

Semester-I (SI)

Paper SI-BOT-1/T - Biochemistry and Molecular Biology of plants (Theory)

1. **Carbohydrates:** Structure and function; Plant storage carbohydrates; Cell wall-structure & function; Glycoproteins & proteoglycans; sugar code.
2. **Lipids and membranes:** Structure and function; types and function of membrane lipids.
3. **Lipid metabolism:** Fatty acid biosynthesis and breakdown; Synthesis of storage and membrane lipids.
4. **Proteins:** Amino acid components and structural features; Primary, secondary, tertiary, quaternary and supra-molecular structures domains, motif and folds; Non-covalent interactions in relation to structural conformation; Ramachandran plots.
5. **Membrane Transport:** Membrane transport proteins; Primary and secondary active transport; Kinetic analysis of transport mechanisms; Membrane H⁺ and Na⁺-K⁺ ATPase. Importins and exportins.
6. **Amino acid biosynthesis:** α -Ketoglutarate and Oxaloacetate families.
7. **Nucleic acids:** Composition, three dimensional structures; helix (A, B, Z), different forms of RNA; DNA replication; Nucleic acid biosynthesis.
8. **Enzymology:** General catalytic properties; Enzyme kinetics- Michaelis- Menten and Lineweaver Burke plots; Negative and Positive co-operativity; Regulation of enzymes; Allosteric enzymes; Isozymes; Role of coenzymes and cofactors.
9. **Cell signaling:** Signaling molecules and their receptors, functions of cell surface receptors (G-protein coupled receptor, receptor PTK, cytokine and non-receptor PTK), second messengers. Cell interactions: Cellular adhesions, junctional proteins and receptors.
10. **DNA hybridization & sequencing:** Generation of radio-labeled probe and blotting techniques; Southern and Northern hybridization; DNA Sequencing methods; Polymerase chain reaction: Principles & methods.

Paper SI-BOT-2/T - Mycology and Plant Pathology (Theory)

MYCOLOGY

1. Introduction to Mycology: General principles of classification of fungi, Major Groups of Fungi; Fungal reproduction, Spore forms, Fungal Phylogeny and Evolution, fungal physiology, nutrition, and growth.
2. Ultrastructure of fungal cell and composition
3. Genetics and Cell cycle in yeast
4. Applied mycology: Overview; Fungi in fermentation technology; mycorrhiza in agriculture; Bioremediation;
5. Cultivation of edible mushroom: *Pleurotus* sp, and *Agaricus* sp
6. Lichens: Thallus structure, reproduction and economic importance.

PLANT PATHOLOGY

7. Principles of Plant Pathology.

8. Host pathogen interactions: Mechanism of penetration and the process of disease development.
9. Mode of infection and role of enzymes and toxins in plant disease.
10. Plant defense mechanism: Preexisting structural and induced structural and chemical defense
11. Structural and chemical decay of wood by wood decaying microorganisms
12. Major Fungal, Bacterial, Viral and Nematode diseases of Crop Plants.
13. Molecular methods for detection of plant pathogens
14. Methods of plant disease control
15. Epidemiology of plant diseases

Paper SI-BOT-3/T - Cytology and Genetics (Theory)

1. Chromosome structure and packaging of DNA; Euchromatin and heterochromatin; Karyotype analysis and evolution; specialized type of chromosomes; Molecular basis of chromosome pairing.
2. Cellular organelles: ultrastructure, function and their evolution.
3. Molecular mechanism of recombination; Plasmids, IS elements; Transposons and retro-elements; Sex-linked, sex-limited and sex-influenced traits; Sex determination; Sex differentiation; Dosage compensation and genetic imprinting; Maternal effects and cytoplasmic inheritance.
4. Mutation at morphological, biochemical and molecular level; modification and repair of DNA; Repetitive and unique DNA sequences.
5. Transcription in prokaryotes and eukaryotes; RNA processing; RNA editing; Regulation of gene expression; Operon circuits.
6. The genetic code and its evolution; Translation in prokaryotes and eukaryotes.
7. Population Genetics- populations, gene pool, gene frequency; Hardy-Weinberg Law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; molecular clock and phylogenetic evolution.
8. DNA fingerprinting; RAPD, RFLP, AFLP; genetic, cytogenetics and physical mapping using molecular markers; Fluorescent in situ hybridization (FISH) and Genomic in situ hybridization (GISH) and their implications.
9. Genomics; The Human genome project and its importance; Functional and comparative genomics.
10. Principles of Plant breeding; conventional methods of breeding self and cross-pollinated plants; Polyploidy and Evolution of major crop plants wheat, cotton, rice; pre-breeding for crop improvement; green revolution and rice breeding.

Paper SI-BOT-4/P - Biochemistry and Molecular Biology of plants (Practical)

1. Preparation of buffers, solutions and dilutions.
2. Extraction of proteins from plant materials and estimation by Lowry's method using BSA standard curve.
3. Extraction of carbohydrates from plant materials and estimation of reducing sugars by Somogyi-Nelson method.
4. Determination of acid value of fat.

5. Extraction of plant phenolics and estimation of total phenols and O-dihydroxy phenols.
6. Separation of amino acid mixture by thin layer chromatography.
7. SDS-PAGE analysis of proteins
8. Isolation of plant genomic DNA, estimation by UV spectroscopy.
9. Isolation of plant total RNA, estimation by UV spectroscopy and gel electrophoresis.

Paper SI-BOT-5/P - Mycology and Plant Pathology (Practical)

1. Sterilization and incubation- principles and uses of instruments.
2. Culture media and their preparation.
3. Preparation of stabs, slants and pouring of plates.
4. Isolation of fungi from water/soil/air by culture plate technique.
5. Isolation of pathogen from diseased tissues.
6. Preparation of pure culture and sub culturing.
7. Inoculation of tuber and fruit.
8. Morphological and reproductive structure of some macro and micro fungi.
9. Symptomology and histopathology of some common diseases with diagnostic characteristics.
10. Isolation of fungal DNA and PCR based analysis.
11. Fungal tissue- culture; Preparation of spawn and cultivation of *Pleurotus*.
12. Identification of specimens from field trip.

Paper SI-BOT-6/P - Cytology and Genetics (Practical)

1. Orcein and Feulgen staining of metaphase plates; Preparation of karyotype and idiogram with analysis.
2. Linear differentiation of chromosomes through G-banding, C-banding and Q-banding
3. Induction of polyploidy using colchicine; different methods of application of colchicines
4. Study of Meiosis in *Allium*, *Tradescantia*, *Petunia*, and other plants.
5. Study of chromosomal aberrations with chemical mutagen treatments.

Semester-II (SII)

Paper SII-BOT-1/T - Plant Physiology and Metabolism (Theory)

1. **Transport and translocation of water and solutes** Properties and movement of water molecules; Water balance of the plant; Water transport through xylem; Mechanism of loading and unloading of photoassimilates and translocation in the phloem

2. **Sensory Photobiology:** Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; Photophysiology of light induced responses; Stomatal movement; photoperiodism and biological clocks
3. **Plant growth regulators and elicitors:** Physiological effects, mechanism of action and signal transduction of auxins, gibberellins, cytokinins, ethylene and abscisic acid; Biological action of Brassinosteroids and peptide hormones.
4. **Physiology of plant development and flowering:** Embryogenesis - apical-basal & radial patterning; Developmental control of root and shoot apical meristem; leaf development and; Endogenous clock and its regulation; Concept of Florigen; Genetic and molecular analysis of floral induction and development.
5. **Stress Physiology:** Concept of tolerance and acclimation; Plant responses to biotic (pathogen and insects) and abiotic water deficit, salinity, metal toxicity, freezing and heat stress; Mechanism of oxidative stress and abiotic stress tolerance
6. **Secondary metabolites:** Characteristic features of secondary metabolites of plant origin; Basic metabolic pathways and origin of secondary metabolites; biosynthesis and biological significance of terpenes, phenolics and nitrogen-containing compounds.
7. **Photochemistry and photosynthesis:** General concepts; photosynthetic pigments and light harvesting complexes; photo-oxidation of water; mechanisms of electron and proton transport; Benson-Calvin cycle; CO₂ concentrating mechanisms
8. **Respiration:** Overview of plant respiration; Glycolysis; TCA cycle, Electron Transport systems and ATP synthesis; Photorespiration Alternative oxidase system.

Paper SII-BOT-2/T - Taxonomy of Angiosperms (Theory)

1. **Nomenclature** - different methods. Sources of Names
2. Concept of ICBN and ICN; brief knowledge of nomenclatural types as per Melbourne-ICN (2012); Major Rules: (a) Type concept; (b) Principle of priority; (c) Valid publication; (d) Starting points of Nomenclature, and (e) Limitations to the principle of priority
3. Evolution of characters and differentiation of species
4. **Taxonomic Data Sources:** (a) Anatomy, (b) Cytology, (c) Embryology, (d) Palynology, (e) Phytochemistry, (f) Genome Analysis, (g) Nucleic acid hybridization
5. **Taxonomic Tools:** Herbaria, Floras, Serological & Molecular Techniques
6. **Botanic Gardens** - importance, examples and acronyms. Processing of herbarium specimens
7. Taxonomic hierarchy
8. History of Plant Classification, Phenetic versus phylogenetic systems, cladistics; Current systems of Classifications; broad outline of APG-III (2009) including its merits and demerits.
9. Taxonomic literature and artificial keys
10. **Salient features, Floral range and phylogenetic importance of the following families:**
11. *Dicots*- Amborellaceae, Annonaceae, Papilionaceae, Caryophyllaceae, Apocynaceae, Lamiaceae, Droseraceae, Nepenthaceae, Rubiaceae, Ericaceae, Asteraceae, Dipsacaceae.
12. *Monocots*- Alismataceae, Potamogetonaceae, Zingiberaceae, Commelinaceae, Orchidaceae, Poaceae, Iridaceae, Juncaceae.
13. **Biodiversity** - importance and preservation; Conservation Hotspots, IUCN guide lines; invasions & introductions, endemism

14. **Numerical Taxonomy:** Aims and objectives, characters and attributes, OTUs. Coding cluster analyses, merits and demerits.
15. **DNA bar-coding** for identification of plants.

Paper SII-BOT-3/T - Microbiology (Theory)

1. **Diversity:** Phototrophic bacteria; Chemolithotrophic bacteria; Spirochetes; Rickettsias; Chlamydias; Mycoplasmas; Myxobacteria and Archaea.
2. **Taxonomy:** Classification and survey of microorganisms; Microbial phylogeny as revealed by rRNA sequencing Nomenclature; Species concept; Criteria for classification; Bergey's Manual
3. **Functional anatomy of cells:** Cell surfaces (glycocalyx, cell wall, flagella and pili) and their role; Plasma membrane (bacterial and archaeal) and transport across them; Survival through the production of spores and cysts
4. **Metabolism:** Photosynthesis (anoxygenic and oxygenic); Chemosynthesis; Fermentation (alcoholic, Entner-Doudoroff pathway; lactic acid – homo and hetero, propionic acid, mixed acid, butanediol and butanol; Stickland reaction); Respiration (anaerobic and aerobic), Nitrogen metabolism and Biological nitrogen fixation
5. **Growth:** Measurements of growth; Growth cycle of populations; Generation time; Continuous culture; Synchronized growth; Diauxy; Growth on solid media; Environmental factors influencing growth
6. **Genetics:** Storage and expression of genetic information (prokaryotic chromosome, plasmid and ribosome); Replication of prokaryotic chromosomes; Molecular basis of mutation; Isolation of mutants; Gene transfer mechanisms (transformation, transduction and conjugation); Regulatory mechanisms in bacteria- induction, repression, feedback inhibition, catabolite repression and attenuation; Vital operons
7. **Medical Microbiology:** Pathogenic properties of bacteria: toxins and extracellular enzymes; brief account of major human disease and their bacterial pathogens. Principles of chemotherapy, general account of chemotherapeutic agents, sulfa drugs and antibiotics.
8. **Fundamentals of Immunology:** History of immunology, innate and acquired immunity, humoral and cell mediated immunity, organ and cells involved in immunity, T cells and B cells; antigens: characteristics and types, adjuvants. Immunoglobins: types, structure and properties.
9. **Viruses and acellular microbes:** Nomenclature and classification, distinctive properties of virus, morphology and ultrastructure, capsid and their arrangements, types of envelopes and their composition, viral genome, their types and structure, virus related agents (viriods and prions). Viral replication: lytic and lysogenic.

Paper SII-BOT-4/P - Plant Physiology and Metabolism (Practical)

1. Determination of amylase activity of monocot seeds in different stages of germination.
2. Assay of catalase of seedlings growing in different environment.

3. Study of mobilization of starch during seed germination by amylases.
4. Determination of total acidity of cell sap.
5. Effect of kinetin on cotyledon enlargement.
6. Effect of different solutes and temperature on membrane permeability.
7. Effect of solutes on the response of membranes to different chemicals.
8. Preparation of standard curve and estimation of protein
9. Preparation of standard curve and estimation of amino acids
10. Determination of Hill activity by isolated chloroplasts
11. Extraction of chloroplast pigments and quantitative estimation.

Paper SII-BOT-5/P - Taxonomy of Angiosperms (Practical)

1. Workout of plant specimens and description of vegetative and reproductive characters from representative families locally available.
2. Training in using local floras and other literature and herbaria for identification of specimens described in the classes.
3. Study of various taxa of a genus, location of key characters and preparation of keys at species level.
4. Field excursion for familiarization with and study of vegetation type(s) and flora(s) of different areas in and outside the state, and in the local areas, and training in collection and preservation methodologies.

Paper SII-BOT-6/P - Microbiology (Practical)

1. Differential Staining (Gram and endospore) and study of morphology of prokaryotic cells.
2. Isolation of bacteria using streak-plate, pour-plate and spread-plate techniques.
3. Evaluation of disinfectants (phenol coefficient) as a measure of controlling microbial growth.
4. Isolation and enumeration of viable microorganisms from soil by serial dilution-agar plate method; isolation and study of rhizobia from root nodules.
5. Study of bacterial growth using turbidimetric method.
6. Measurement of wet weight and dry weight of bacterial cells during growth.
7. Determination of quality of milk using Breed's and methylene blue reduction methods.
8. Antibiotics sensitivity test using paper disc method.
9. Determination of the influence of temperature, pH, osmotic pressure and aeration on microbial growth.

Semester—III (SIII)

Paper SIII-BOT-1/T - Phycology, Bryology, Pteridology, Gymnology, Paleobotany and Palynology (Theory)

Phycology

1. Algae in diversified habitats: Terrestrial, fresh water and marine
2. Thallus organization,
3. Cell ultrastructure
4. Reproduction
5. Criteria for classification: Pigments, Reserve foods and flagella
6. Salient features of major groups: Cyanophyta, Prochlorophyta, Chlorophyta, Bacillariophyta, Phaeophyta and Rhodophyta.
7. Economic importance: Algal blooms, Algal biofertilizers, Algae as food, feed and uses in industry

Bryology

1. Salient features of major groups
2. Spore germination in liverworts and mosses
3. Alternative pathways in life cycles of bryophytes
4. Bryophytes as indicators of pollution
5. Useful chemical constituents
6. Fossil bryophytes as indicators of past environment and past plant communities

Pteridology

1. Basic adaptation on land
2. Salient features of major groups
3. Origin and evolution of pteridophyta
4. Stelar evolution in pteridophyta
5. Telome theory and origin of megaphyll
6. Eusporangiate and leptosporangiate ferns
7. Useful chemical constituents
8. Economic importance

Gymnology

1. Classification and salient features of major taxa
2. Origin and evolution of gymnosperms
3. Distribution through different era
4. Distribution in India: Fossil and living

Palaeobotany

1. Sedimentary rocks; Stratigraphy; Geological Time Scale; Basic concepts of continental drift and plate tectonics
2. Taphonomy
3. Coal, petroleum – origin and depositional environment coal and petroliferous basins of India
4. Reconstruction of fossil plants
5. Dating of fossils

6. Colonization of land; emergence of seed plants; appearance of angiosperms
7. Fundamentals of palaeogeography, palaeoecology and palaeoclimatology

Palynology

1. Branches of palynology
2. Spore, pre-pollen and pollen morphology,
3. Wall chemistry, exine ornamentation
4. Evolution of aperture types
5. Application of neopalynology and palaeopalynology

Paper SIII-BOT-2/T - Ecology, Evolution and Plant resource utilization (Theory)

Evolution:

1. Origin of cells and unicellular evolution- origin of basic biological molecules; concept of Oparin and Haldane; Miller's experiment (1953); evolution of prokaryotes; origin of eukaryotic cells and evolution of unicellular eukaryotes.
2. Theories of organic evolution: Lamarck; Darwin-concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; the evolutionary synthesis.
3. Molecular evolution; Concepts of neutral evolution; Molecular divergence and molecular clocks; origin of new genes and proteins; gene duplication and divergence.
4. Adaptive radiation; isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution.

Ecology:

1. Concept and dynamics of ecosystem, components, food chain and energy flow, ecological pyramids; productivity and biogeochemical cycles; Different types of ecosystems (grassland and Savannas, shrubland and deserts, Tundra and taiga, Temperate forests, Tropical forests, Lakes and ponds, freshwater wetlands, Streams and rivers, Oceans, Estuarine and mangrove)
2. Population ecology (Basic characteristics with examples, life table, survivorship curves, growth curves) and biological control; Community structure and organization; Environmental pollution; Sustainable development
3. Ecosystem dynamics and management; Stability and complexity of ecosystems; Environmental Impact assessment, Principles of conservation; conservation strategies; cryopreservation, Sustainable development.

Plant resource utilization:

1. Traditional knowledge on the use of Bioresources: - Utilization, need, survey, evaluation and conservation. Non-Timber Forest Producers
2. Microbial Resources: - Biofertilizers, Biopesticides, Mycorrhizae, Edible Mushroom (*Agaricus*, *Pleurotus* and *Volvariella*) - cultivation and management
3. Plants and Civilization: Centres of origin and gene diversity; Botany, utilization, cultivation and improvement of food plants, drug, fibre and industrial values; Unexploited plants of potential economic value; Plants as a source of renewable energy; Genetic resources and their conservation, cryopreservation

Paper SIII-BOT-3/T - Bioinformatics and Biostatistics (Theory)

Bioinformatics:

1. Introduction to the concept of hardware and software.
2. Introduction to Windows, UNIX and Linux; Introduction to Perl and Python.
3. Different types of biological databases like sequence databases, structural, genomic and pathway interaction databases; information retrieval from biological databases; sequence analysis overview.
4. Introduction to genome browsers; Online bioinformatics tools; Different types of file formats used in bioinformatics analysis; Genome annotation.
5. Nucleotide and protein sequence analysis, sequence alignment and applications.
6. Phylogenetic analysis.
7. Introduction to protein structure prediction and analysis; drug designing.

Biostatistics:

1. Sampling and sample designs; Classification and tabulation of data; Visualizing data (diagrammatic and graphical presentation)
2. Measures of central tendency and dispersion
3. Probability distributions
4. Difference between parametric and non-parametric statistics
5. Confidence interval; Errors; Levels of significance
6. Regression and correlation; t-test; ANOVA; Chi-square test
7. Basic introduction to multivariate statistics
8. Application of SPSS, Sigmaplot, XLSTAT etc. in solving statistical problems

Paper SIII-BOT-4/P - Phycology, Bryology, Pteridology, Gymnology, Paleobotany and Palynology (Practical)

1. Morphological study of representative members of Cyanophyceae, Chlorophyceae, Phaeophyceae, Bacillariophyceae, Rhodophyceae
2. Study of reproductive members of different groups of Bryophytes
3. Study of reproductive structures of different groups of Pteridophyta.
4. Detection and bioassay of allelopathic substances of fern.
5. Comparative study of vegetative and reproductive structures of representatives of different groups of Gymnosperms
4. Study of important fossil Gymnosperms from prepared slides and specimens

Paper SIII-BOT-5/P - Ecology, Evolution and Plant resource utilization (Practical)

1. Estimation of dissolved oxygen content.
2. Estimation of dissolved carbonate & bicarbonate content.
3. Determination of soil pH.
4. Determination of soil quality: i) organic matter or ii) Exchangeable calcium and magnesium
5. Mushroom culture techniques

6. Nursery techniques of propagation
7. Study of economically important plants

Paper SIII-BOT-6/P - Bioinformatics and Biostatistics (Practical)

1. Nucleic acid and protein sequence retrieval
2. Sequence analysis techniques
3. Scripting and Perl/Python programming
4. Application of online tools and workflow design
5. Computer-oriented statistical techniques for solving descriptive and inferential statistical problems and performing different statistical techniques mentioned in the theoretical syllabus.

Semester—IV (SIV)

Paper SIV-BOT-1/T - Plant Biotechnology and Genetic Engineering (Theory)

1. Introduction and history of plant Tissue culture, culture media, Initiation and maintenance of Callus and suspension cultures; single cell clones
2. Biochemical production
3. Organogenesis; somatic embryogenesis; transfer and establishment of whole plants in soil
4. Rapid clonal propagation and production of virus -free plants
5. In vitro pollination; embryo culture and embryo rescue
6. Protoplast fusion, selection of hybrid cells; symmetric and asymmetric hybrids, cybrids.
7. Nuclear cytology of cultured plant cells and somaclonal variations
8. Production of haploid plants and their utilization
9. Cryopreservation and slow growth for germplasm conservation
10. Proteomics: Proteomics basic principles and applications. Protein-protein interaction *via* pull-down and yeast two-hybrid assay. DNA-protein interactions: DNase I footprinting.
11. Protein sequencing – principle and methods. MS/MS techniques for protein identification (PMF).
12. Basic principles of genetic engineering; Applications of recombinant DNA in agriculture and medicine; Restriction endonucleases, Modification methylases and other enzymes needed in genetic engineering.
13. Cloning vectors; Plasmids and plasmid vectors, Phages and Phage Vectors, phagemids, cosmids, artificial chromosome vectors (YAC, BAC), Animal virus derived vectors - SV40 and retroviral vectors; Cloning strategies & screening of recombinant clones.
14. Molecular cloning: Recombinant DNA techniques, construction of genomic DNA and cDNA libraries, screening of libraries
15. Expression strategies for heterologous genes
16. Use of transposons in genetic analysis: Transposon tagging and its use in identification and isolation of genes
17. Biosafety regulation: Physical and Biological containment

Paper SIV-BOT-1/T - Plant Biotechnology and Genetic Engineering (Practical)

1. Meristem tip culture
2. Somatic embryogenesis
3. Separation of amino acid mixture by thin layer chromatography.
4. SDS-PAGE analysis of proteins
5. Isolation of plant genomic DNA, estimation by UV spectroscopy
6. RAPD amplification and data analysis of a typical plant and dendrogram preparation and genetic distance measurement.
7. Isolation of plant total RNA, estimation by UV spectroscopy and gel electrophoresis.

Elective/Special Courses

(Anyone elective/special course to be opted for the 4th Semester; each course contains two theoretical and one practical paper)

Elective/Special Course: Cytogenetics

SIV-BOT-2/ET [Special paper – I (Theoretical)]

1. **Gene structure:** Genetic fine structure, *cis-trans* test, complementation test, overview of promoter structures and 5' capping, 3' polyadenylation in eukaryotic gene transcription, RNA transport, splicing-editing.
2. **Genome organization and Analysis:** An overview with nucleosome packaging, DNA structure, 'A', 'B' & 'Z' forms, Chromosome sorting by FACS, PFGE and microdissection.
3. **NGS:** High-throughput DNA sequencing (Illumina/Solexa technique), genome probing using DNA microarray (DNA chip), DNA databases and accessing genetic information *via* Bioinformatics algorithms.
4. **Recombinant DNA Technology:** Gene cloning principles; Tools-techniques, construction of genomic and cDNA libraries and screening-expression, choice of vectors and their structural features, *In vitro* mutagenesis and application. Antisense, ribozyme and RNAi technology and importance.
5. **Genome function:** Characterization of gene transcripts-transcriptomics *via* SAGE, Differential display, RNase protection assay, Northern blotting, nuclear run-on assay and genetic information passed on to protein-proteomics, and protein-protein interaction *via* pull-down and yeast two-hybrid assay, FRET; DNA-protein interactions: EMSA, DNase I footprinting, ChIP
6. **Transgenic crops:** Strategies to develop transgenic crops through *Agrobacterium* mediated or physical mediated gene transfer methods. Control and silencing of transgene expression.
7. **GM crops and ecological concern:** GM crops for disease/drought /insect/ herbicide tolerance and terminator technology. Advantages of Transplastomics and its development. Gene targeting through gene-knock-out using Cre-LoxP system and gene tagging in plants. Ecological risk and ethical issues of GM crops

SIV-BOT-3/ET [Special paper – II (Theoretical)]

1. **Genetic Markers and PCR amplification:** RFLP, RAPD, SNPs, FISH & Chromosome painting, Gene amplification and PCR: Basic principles and methodologies of PCR, design of PCR primers, RT-PCR and Real-Time PCR and their utility.
2. **Genome mapping:** Genetic mapping, physical mapping, sequencing genomes- assembly of a continuous DNA sequence, understanding of genome sequence- ORF, homology search and comparative genomics, exon-intron boundaries.
3. **Molecular plant breeding:** Theory and practices, molecular breeding tools- markers and maps; molecular techniques in Omics- functional and comparative genomics; breeding populations – DH, RIL, NIL, CSSL; marker assisted selection (MAS)- theory and practice; breeding informatics-plant Databases, prospects of breeding informatics, rice genome analysis- SNPs and InDels variations, analyses based on different genome browser-NCBI, Gramene, RAP-DB.
4. **Molecular dissection of complex traits-** QTLs, QTLs mapping across species (Rice); Rice biology in the genomic era; Development of improved rice varieties through molecular breeding - submergence tolerance, blight - blast resistant rice, salt tolerance rice- through gene introgression from donor parents and gene pyramiding.
5. **Genomes of prokaryotes and eukaryotic organelles:** Chromosomes of prokaryotes, genetic features of prokaryotic genomes; physical features of organelle genome and genetic content of organelle genomes.
6. **Molecular phylogenetics:** The origins of genome; RNA genome and DNA genome, acquisition of new genes, noncoding DNA and genome evolution; reconstruction of DNA-based phylogenetic trees and applications of molecular phylogenetics.
7. **Gene manipulation and applications:** Producing useful therapeutic molecules, pharmacogenomics, new drugs, improving agronomic traits by genetic modification. Metabolomics and global biochemical networks; analysis of transcriptomics and proteomics; gene inhibition at the protein level.

SIV-BOT-5/EP [Special paper – Practical]

1. Plant DNA isolation and its quantification by UV Spectrophotometer and Preparation of "Cot-curve" from isolated DNA
2. Restriction enzyme digestion of genomic DNA and its separation on 1% agarose gel electrophoresis and visualization on UV - transillumination after staining by Ethidium bromide
3. rDNA construction: Isolation of plasmid DNA and cut with restriction enzyme and ligation into known Vector pBR322/pUC series/pGEM-T.
4. Transformation of *E. coli* host using constructed chimeric plasmid
5. PCR and multiple arbitrary amplicon profiling (AP-PCR/RAPD) and data analysis with genetic distance measurement and dendrogram construction for phylogenetic study.
6. RT-PCR using reverse transcriptase and cellular mRNA as substrate.
7. Callus initiation and plantlets regeneration from tissue explants.

8. Rice genome analysis based on genome sequencing data of IRGSP-2005 or MSU7.
9. SSR marker profiling using rice genomic DNA and their analysis.
10. SNPs and InDels variation analysis based on whole genome sequencing data of rice, codon bias analysis and GC% analysis.

Elective/Special Course: Microbiology

SIV-BOT-2/ET [Special paper – I (Theoretical)]

1. **Microbial Systematics:** Classical and modern approaches to bacterial taxonomy, chemo-taxonomic characteristics (peptidoglycan, lipids, fatty acids and proteins) and genotypic characteristics (DNA-base composition, -fingerprinting, -relatedness; RNA sequence analysis, DNA-RNA hybridization); bacterial phylogeny.
2. **Genetics:** Genetic code- its nature and deciphering; Transcription; Translation; Plasmid biology (Types; Detection and purification; Replication); Transposons– Insertion sequences and composite transposons, phages as transposons, replicative, non-replicative and conservative transposition. Transformation; Conjugation; transduction; Bacterial genome mapping; Mutation and detection.
3. **Environmental microbiology:** Biofilms; Microbial competition and cooperation; Biogeochemical cycles (nitrogen, sulfur, phosphorus and iron); Microbial leaching of ores; Wastewater treatments; Biodegradation of petroleum and xenobiotics; Bacterial plastics; Metagenomics; Brief idea of exobiology; Methods in microbial ecology.
4. **Food Microbiology:** Food produced by microbes: Fermented foods (fermented dairy products, alcoholic beverages, vinegar, fermented vegetables), microbial cells as food. Food as substrate for microorganism, food borne disease; contamination and spoilage of food (meat and meat products, fish, fruits and vegetables, milk and milk products), methods of food preservation (physical and chemical); Probiotics
5. **Microbes in Agriculture:** Biological nitrogen fixation, nitrogenase and alternative nitrogenase system, *nif* genes; degradation of cellulose, hemicellulose and lignin, production of biofertilizers. Microbial control of insects. Use of viruses in agriculture.
6. **Bioinformatics & Computational Biology:** Advanced biological sequence analysis; Predictive methods using nucleotide and protein sequences; Advanced BLAST techniques; Codon usage analysis; Advanced molecular phylogenetics; Molecular modelling; Concepts of Next Generation Sequencing and NGS data analysis.

SIV-BOT-3/ET [Special paper – II (Theoretical)]

1. **Medical Microbiology:** Normal microbiota of human body; host-parasite relationship in bacterial pathogenicity: non-specific mechanisms of host defense, mechanism of bacterial virulence, genetics of bacterial virulence; chemotherapy: antibiotics (origin, classification, chemistry and mode of action); semisynthetic antibiotics; antibiotic resistance in bacteria, mechanism(s) of antibiotic resistance.

2. **Immunology:** Theories of antibody production, antibody diversity; antigen-antibody reactions; immunoassay methods and their applications, major histocompatibility complex (structure and function), complement system and complement activation; monoclonal antibodies (production and applications); Immunological techniques like immunoelectrophoresis and ELISA.
3. **Water microbiology:** Waterborne diseases; Microbial contamination of water; Examination of potability of water; Purification of water.
4. **Biotechnology and Industrial microbiology:** Major products of industrial microbiology; Biofuel production; Microorganisms used in industrial microbiology and their genetic manipulation.
5. **Virology:** Mechanism of virus adsorption and entry into the host cell including genome replication and mRNA production, mechanism of RNA synthesis, mechanism of DNA synthesis, transcription mechanism and post transcriptional processing, translation of viral proteins, assembly, exit and maturation of progeny virions, multiplication of bacteriophages.
6. Host and virus factors involved in pathogenesis, patterns of infection, pathogenesis of animal viruses, pathogenesis of plant and insect viruses. Host cell transformation by viruses and oncogenesis of DNA and RNA viruses; Characteristics of interferons; Induction and regulation of interferon production; Mechanism of interferon action.

SIV-BOT-5/EP [Special paper – Practical]

1. Quantifying the thermal death (D-values) of microorganisms
2. Study of physiological and biochemical activities of bacteria (hydrolysis of starch, lipid, protein and urea; degradation of cellulose and pectin; catalase; β -galactosidase; nitrate reduction; Voges-Proskauer reaction; indole production; liquefaction of gelatin; citrate utilization; fermentation/oxidation of sugars)
3. Study of bacterial growth and determination of generation time
4. Assay of antibiotics using tube dilution, well diffusion and agar dilution methods
5. Detection of coliforms using membrane filter method to determine water purity
6. Enrichment and isolation of anoxygenic phototrophic, endospore-forming and diazotrophic bacteria
7. Induction of mutation, and selection of mutants using replica plating technique
8. Isolation of antibiotic-resistant mutants
9. DNA isolation from bacteria/environmental sample and its quantification.
10. Restriction enzyme digestion of DNA
11. Polymerase Chain Reaction and Gel Electrophoresis.
12. Transformation of *E. coli*
13. Quantitative estimation of proteins by Folin-Lowry / Biuret method.
14. Chromatographic techniques
15. Nucleic acid and protein sequence analysis

16. Basic techniques of molecular modeling

17. Basics of NGS data analysis.

Elective/Special Course: MYCOLOGY

SIV-BOT-2/ET [Special paper – I (Theoretical)]

- 1. Fungal diversity in different ecosystems:** The structure and composition of fungal cell, effect of environment on fungal growth and behavior.
- 2. Fermentation technology:** Feedstock for fermentation process, fermentor design and operation, solid substrate fermentations.
- 3. Enzyme technology:** Fungal enzymes of commercial importance, production of fungal enzymes, free and immobilized cells and enzymes.
- 4. Fungal toxins:** Mycotoxicoses- fungi in dermatomycosis, aspergillosis and fungi allergenic to man and animal.
- 5. Fungi as food and beverage:** Alcoholic beverage, mushrooms and other macro fungi, edible biomass from yeast and moulds, single cell proteins (SCP).
- 6. Fungi in food processing:** Bread, soybean products, cheese and fermented milk, other fermented foods
- 7. Fungal metabolites:** Primary metabolites of economic importance, secondary metabolites in medicine and agriculture
- 8. Future of fungal biotechnology:** Production of mammalian proteins by fungi, other applications of gene cloning in fungi and their importance
- 9. Recombinant DNA technology:** Manipulation of industrially important fungi, edible mushroom and bio-control agents

SIV-BOT-3/ET [Special paper – II (Theoretical)]

- 1. Biology of Mycorrhizae:** Diversity of Mycorrhizae and its development, Ectophytic and endophytic mycorrhiza (VAM), mycorrhiza in plant growth promotion, mycorrhizal interactions with soil microorganisms, mycorrhiza in plant disease control.
- 2. Molecular tools and methods:** Detection of Mycorrhiza; plant pathogens in soil, water and plant tissues.
- 3. Plant defense mechanisms:** Plants defense against infection: Preexisting structural and induced structural and chemical defense, hypersensitive reaction, role of phytoalexins and other phenolic compounds,
- 4. Management of plant diseases:** Cultural, chemical, biological, biopesticides, breeding for resistant varieties, plant quarantine, integrated pest management.
- 5. Post-harvest pathology:** Fungal deterioration of food commodities, mycotoxins and health hazards, control measures.
- 6. Molecular plant pathology:** Molecular aspects of host pathogen interactions - Systemic Acquired Resistance (SAR) and Induced systemic resistance (ISR), defense enzymes. PR proteins, degradation of phytoalexins; application of molecular biology to plant disease control - transgenic approach for crop protection, engineering chemicals that elicit defense response to plants.
- 7. Plant Diseases:** Study of major plant diseases caused by fungi, bacteria, viruses, nematode and mycoplasma like organisms

SIV-BOT-5/EP [Special paper – Practical]

1. Isolation of fungal/plant DNA and its quantification by spectrophotometric method.
2. Separation of DNA by agarose gel electrophoresis.
3. Restriction endonuclease digestion of fungal / plant DNA.
4. DNA blot hybridization.
5. Isolation of fungal protoplast.
7. Polymerase chain reaction.
8. Extraction and bioassay of phytoalexin(s) from plant tissue induced by biotic and abiotic stresses.
9. Partial purification of antifungal compounds by TLC methods and UV spectrophotometric analysis.
10. Extraction and SDS-PAGE analysis of defense protein in artificially inoculated plants/induced by abiotic elicitor(s).
11. Separation of proteins/polyphenols by column chromatography.
12. Extraction and assay of defense enzyme(s).
13. Immunological characterization of defense enzyme(s).
14. Preparation and purification of plant and fungal antigens.
15. Production of polyclonal antibody and purification of IgG.
16. Evaluation of antigens in raising antibodies using immunodiffusion and immuno-electrophoretic test.
17. Optimization of antigen and antisera dilution by ELISA.
18. Detection of pathogen in artificially inoculated plant using DAC-ELISA formats.
19. Detection of pathogen in soil by dot blot and western blot method.
20. Detection of pathogen in host tissue by indirect immunofluorescence test.

Elective/Special Course: Plant Physiology, Biochemistry and Molecular Biology

SIV-BOT-2/ET [Special paper – I (Theoretical)]

1. **Nitrogen metabolism:** Nitrate assimilation in plants, structure, function and regulation of nitrate assimilation enzymes, nif genes, nod genes - structure, function and regulation.
2. **Stress physiology:** Physiology and molecular biology of abiotic stress, biotic stress, reactive oxygen species and their protection mechanisms, role of polyamines in stress physiology.
3. **Senescence and its regulation:** Programmed cell death (PCD): Types, developmental and Molecular Biology of PCD, fruit ripening.
4. **Pumps, carriers and channels:** Structure and function, energetics of active transport, isophore and ionophore; Vacuoles – origin, structure and function.
5. **Sulfate metabolism:** Sulfur chemistry and function; Uptake and transport; reductive sulfate assimilation pathway; synthesis and function of glutathione and its derivatives.
6. **Floral induction and development:** Hormonal control, molecular genetics of floral development and floral organ differentiation; Effect of low temperature on floral bud initiation (FBI) through silencing of FLC gene.

7. **Protein targeting:** Protein transport in cell organelles, common features of the transport mechanism, chaperon, chaperonin and protein folding, protein glycosylation and its significance.
8. **Cell signalling:** Signal molecules, signal perception and transduction in plants; MAP-kinase, Ca-calmodulin complex – role in plant signaling.
9. **Protein chemistry:** Protein purification, characterization, methods for the determination of amino acids sequences in proteins, protein folding pathways and Levinthal Paradox.
10. **Alkaloids and carotenoids:** Classification, occurrence and biological properties, biosynthesis, and biological significance.

SIV-BOT-3/ET [Special paper – II (Theoretical)]

1. **Antisense technology and regulatory RNAs:** RNAi antisense oligonucleotides, basic principles and mechanisms. Small interfering RNAs (siRNA), MicroRNA (miRNA); synthesis and function of miRNA molecules.
2. **Protein modification:** Site specific and PCR-based random mutagenesis, characterization of the mutants.
3. **Epigenomics:** DNA methylation, Histone modifications (methylation, acetylation) their role in epigenetic control of gene.
4. **Importance of weak chemical interactions:** Concept of free energy, weak bonds in biological systems, hydrophobic bonds stabilize macromolecules; weak bonds attach enzymes to substrate, protein-protein interactions, protein-DNA interactions; specific conformation of a protein depends on pattern of Hydrogen bonds.
5. **Transcriptional regulation:** In prokaryotes and eukaryotic systems, gene silencing by modifications of histones and DNAs.
6. **Gene regulation in development and evolution:** Strategies for establishing differential gene expression in developmental stages, Homeotic genes- an important class of developmental regulators, positive autoregulation delays gene expression.
7. **Biogenesis, traffic, and functions of cellular membrane system,** Protein synthesis and folding in the cytoplasm; translocation into the endoplasmic reticulum- the signal hypothesis; Golgi function in biosynthetic processing.
8. **Catalytic RNA:** Introduction, group I and group II introns, catalytic activity of RNase P, Viroids have catalytic activity, protein splicing is autocatalytic.
9. **Somatic recombination and hypermutation in the immune systems:** Introduction, clonal selection amplifies lymphocytes, allelic exclusion; class switching is effected by DNA recombination.

SIV-BOT-5/EP [Special paper – Practical]

1. Protein extraction, precipitation by salting out, desalting by dialysis/ Sephadex G 25 column
2. Fractionation of proteins by molecular exclusion chromatography on Sephadex G 100.
3. SDS-PAGE analysis of the proteins and determination of molecular weights.
4. Enzyme extraction/assay of activity and isozyme analysis by PAGE.

5. Isolation of chloroplast and determination of Hill activity.
6. Separation of pigments by TLC and their identification.
7. Extraction and estimation of carotenoid pigments.
8. Determination of pKa values of amino acids.
9. Immunological techniques- ELISA and Western Blotting.
10. Separation and detection of secondary metabolites through TLC.
11. Determination of antioxidant fingerprint on TLC.
12. Isolation, purification and identification of alkaloids by application of column chromatography.

Elective/Special Course: Taxonomy of Angiosperms and Biosystematics

SIV-BOT-2/ET [Special paper – I (Theoretical)]

1. History of studies in Taxonomic Botany in India
2. Survey of Taxonomic Literature: Dictionaries, Indices, Monographs, Manuals, Floras, Journals, and taxonomic websites
3. The Species Concept
4. International Code of Botanical Nomenclature: Principles, articles, recommendations and special provisions; application of code with problems; nomenclature of cultivated and hybrid plants; taxonomic hierarchy.
5. Biocode and Phylocode
6. Use of Herbaria; role of Botanic Gardens in the 21st Century.
7. Biosystematics: definition, importance and categories. Major areas of biosystematic studies:
 - A. *Palynology*: morphology, chemistry of exine, bearing on phylogeny, reconstruction of vegetation structure
 - B. *Embryology*: Diversity in structures of gametophytes, endosperm formation, developing embryo; ovule morphology
 - C. *Cytology, genetics and breeding*
 - D. *Phytochemistry* (including serology, pigments & secondary metabolites)
 - E. *Molecular Biology*: Definition, determination of relationship through Protein & Nucleic Acid studies; uses of electrophoresis, PCR & HPLC.
 - F. *Remote sensing & GIS*.
8. Analysis of data; commonly available software, construction of dendrograms

SIV-BOT-3/ET [Special paper – II (Theoretical)]

1. Philosophy of classification. Recent trends in classification.
2. Indian flora. Endemism- in Indian perspective
3. Migration, dispersal and discontinuous distribution of plants
4. Management of Herbarium: Methods of collection, identification and documentation

5. Biodiversity Conservation: IUCN categories, Effects of Rio de Janeiro world summit, Hotspots, India as a megadiversity country; Ramsar sites
6. Methods of *in situ* and *ex situ* conservation. Biodiversity protected areas in India
7. Concise accounts of the phylogeny and economic importance of the following taxa:
 - a. SUBCLASSES:
 - i) Magnoliidae, (ii) Dilleniidae, (iii) Caryophyllidae, (iv) Alismatidae, (v) Commelinidae.
 - b. ORDERS:
 - i) Nymphaeales, (ii) Fagales, (iii) Gentiales, (iv) Dipsacales, (v) Liliales/Zingiberales, (vi) Orchidales.
8. Traditional knowledge: Ethnobotanical resources in India; documentation and utilization of ethnic knowledge. Traditional methods of conservation; sacred groves

SIV-BOT-5/EP [Special paper – Practical]

1. Seasonal collection of local flora, processing, Herbarium management.
2. Phenology of some common weeds.
3. Seed, endosperm, embryo and seedling morphology.
4. Identification of plants by matching.
5. Working out of different angiospermic plants (fresh and dry), their identifications using literature and preparation of artificial keys.
6. Phytosociological studies; Biological Spectrum; Determination of Diversity Indices (Shannon-Wiener, Species Richness & β -diversity).
7. Use of GPS and demonstration on the use of at least one remote-sensing software
8. Familiarity with Taxonomic Literature (e.g. Index Kewensis, Wall-Cat., Icones, Bibliographies, Dictionaries, Keys, Floras, etc.).
9. Preparation of temporary and permanent pollen slides; description of common palynomorphs, preparation of identification keys.
10. Variation of characters - influence of ecological factors.
11. Ethnobotanical survey in a forest village/ village market.
12. Use of Electrophoresis, PCR, HPLC and other instruments useful in molecular taxonomy.
13. Basic techniques of micropropagation.
14. Identification of secondary metabolites and pigments.

Interdisciplinary Courses (IDC)

(for students pursuing PG courses other than M. Sc. in Botany)

Course: IDC-I

Environment, Biodiversity Conservation and sustainable development

- I. **Environment and Ecosystems:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Food chains, food webs and ecological pyramids, characteristic features, structure and function of the following ecosystem- Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems,
- II. **Biogeochemical Cycles:** Importance, gaseous and sedimentary cycles, Carbon, Nitrogen, Phosphorus and Sulphur Cycles, Oxygen Cycles, Hydrological cycles.
- III. **Succession:** Concepts of succession, Types of Succession, plan succession, Climax and stability.
- IV. **Biomes:** Major biomes of India, Characteristics of terrestrial fresh water and marine ecosystems, Forests, grasslands, lake, river and marine ecosystems of India.
- V. **Population:** Basic concepts, population characteristics – density, natality, mortality, age-structure, population growth, Ecological niche and habitat, Positive and negative interactions of populations – competition, predation, parasitism, mutualism.
- VI. **Community:** Basic concepts, community structure, growth forms, life form, Analytical and synthetic characters of plant community, Methods of plant community analysis, Concept of keystone species and ecotone.
- VII. **Biodiversity and conservation:** Basic concepts, Levels of biodiversity, biodiversity loss, Conservation of biodiversity- In-situ and Ex-situ conservation of biodiversity, needs and its issues, Sacred groove, Hot-spots of biodiversity, Overexploitation and its common pattern, international trade, problems in controlling in international trade (enforcement illegal trade), sustainable development, Value of biodiversity- consumptive use, productive use, social, ethical, aesthetic and option values; India as a mega-diversity nation.
- VIII. **Environmental problems:** Pollution-basic concepts of pollution (air, land and water), Pollutants (chlorinated hydrocarbon, organophosphate, and heavy metals) and impact, Greenhouse effect, acid rain, ozone depletion, deforestation, desertification, salination, chemical and radiation hazards, pesticide pollution, eutrophication, biological magnification, Solid waste management.
- IX. **Environmental protection act:** Environmental laws, national movement, environmental policies, environmental ethics-holistic approach of environmental

protection and conservation, IUCN-role in environmental protection, environmental protection agency (EPA).

- X. **Phytoremediation:** oil spills, wastewater treatment, chemical degradation, heavy metal.
- XI. **Renewable and non-renewable resources: Forest resources-** Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forest and tribal people; **Water resources-** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems; **Energy resources-** Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.
- XII. **Human Population and the Environment:** Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.
- XIII. **Field work:**
 - a. Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
 - b. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
 - c. Study of common plants, macro fungi, insects, birds
 - d. Study of simple ecosystems-pond, river, hill slopes, etc.

Course: IDC-II Biotechnology

- I. **Carbohydrates:** Structural aspects – Introduction & Occurrence, Classification of Mono-, Di- and Polysaccharides, Reducing & Non-reducing Sugars, Constitution of Glucose & Fructose.
- II. **Lipids:** Structural aspects – General introduction, Classification & Structure of Simple & Compound lipids, Properties of Lipid aggregates (elementary idea), Biological membrane, Membrane protein – structural aspects, Lipoproteins (elementary idea).
- III. **Protein Structural aspects:** General introduction, Classification & General characteristics, Structure of Primary, Secondary, Tertiary & Quaternary proteins (elementary idea), Classification of Amino acids.
- IV. **Nucleic acid Structural aspects:** Components of DNA and RNA, Nucleosides & Nucleotides (introduction, structure & bonding), Double helical structure of DNA (Watson-Crick model), various forms of DNA.

- V. **Genes are DNA:** DNA as genetic material, DNA double helix, semiconservative replication, mutations and Genetic code.
- VI. **Mutation:** Occurrence, kinds of Mutation, spontaneous & induced Mutation, Mutagens, detection of Mutation, Lethal Mutations, Biochemical Mutations, Phenotypic effects of Mutation, Molecular basis of Mutation, Significance & Practical applications of Mutation.
- VII. **Basics of Cell Biology (structure & function):** Discovery of cell and Cell Theory; Comparison between plant and animal cells; Cell wall; Plasma membrane; Modification of plasma membrane and intracellular junctions; Cytoskeleton; Protoplasm; Mitochondria; Chloroplast; ER; Golgi complex; Lysosome, endosome and microbodies; Ribosome; Centriole; Nucleus; Chemical components of a cell; Catalysis and use of energy by cells.
- VIII. **Structure and function of Prokaryotic cell & its components:** The Slime and the cell wall of bacteria; Concept of Gram-negative and Gram-positive bacteria, Mesosomes, flagella, Pilus, fimbriae, ribosomes, carboxysomes, sulfur granules, glycogen, polyphosphate bodies, fat bodies, gas vesicles; endospores, exospores, cysts.
- IX. **Pathogenic Microorganisms:** List of common bacterial, fungal and viral diseases of human beings and plants [Name of the disease, causative pathogen, parts affected].
- X. **Basic concepts of Virology:** General characteristics of viruses, differences between bacteria and viruses. Physical and chemical Structures of different Viruses- helical (TMV) and complex (Bacteriophage)
- XI. **Applications of Plant Genetic Engineering:** crop improvement, herbicide resistance, insect resistance, virus resistance, plants as bioreactors.
- XII. **Genetic modification in Agriculture:** transgenic plants, genetically modified foods, application, future applications, ecological impact of transgenic plants.
- XIII. **Cloning and PCR amplification:** Clone, Overview of the procedure, The importance of DNA Cloning, Gene library, Hybridization, PCR- basic features and application, Principles of Cell-based DNA Cloning, Cloning System for amplifying different sized fragments.
- XIV. **Purification and Separation of nucleic acids:** Extraction and Purification of nucleic acids, Detection and Quantitation of Nucleic acids, Gel Electrophoresis,
- XV. **Cutting and Joining DNA:** Restriction Endonucleases, Ligation, Alkaline Phosphate, Double Digest, Modification of Restriction Fragments ends, Other Ways of joining DNA Molecules.
- XVI. **Vectors:** Plasmid vectors, Vectors based on the lambda Bacteriophage, Cosmids, M13 vectors, Expression vectors, Vectors for cloning and expression in Eukaryotic cells, YACs and BACs.
- XVII. **Nucleic Acid Hybridization:** Principle and application - Preparation of nucleic probes, Principle of Nucleic acid hybridization, Nucleic acid hybridization assays, Southern blotting technique.
- XVIII. **Computational Genomics and bioinformatics:** Internet basics, biological data analysis and application, sequence data bases, NCBI model, file format, Protein primary

sequence analysis, DNA sequence analysis, pair wise sequence alignment, FASTA algorithm, BLAST, multiple sequence alignment, DATA base searching using BLAST and FASTA, Small molecules data bases, protein information, resources, protein data bank.

- XIX. **Genetic modification in Medicine:** Gene therapy, types of gene therapy, vectors in gene therapy, molecular engineering, human genetic engineering, problems & ethics.
- XX. **Genetic engineering in plants:** Use of *Agrobacterium tumefaciens*, Ti plasmids, Strategies for gene transfer to plant cells, Direct DNA transfer to plants, Gene targeting in plants, Use of plant viruses as episomal expression vectors.
- XXI. **Human Genome Project (HGP):** an overview of the project, goals of the project, major scientific strategies & approaches used in HGP, expected scientific & medical benefits of this project, about the organizations behind this project.

Suggested Readings

Bio-resource utilization

1. Advances in Mushroom Biotechnology- M.C. Nair, Ed.
2. A text book of Biotechnology-R.C. Dubey (S. Chand & Co.)
3. Food and Natural Resources- D.Pimentel and C.W.Hall, Academic Press
4. Plant Genetic Resources Conservation and Management- R.S.Paroda and R.K.Arora, IPGRI
5. Sustainable Management of Non-Wood Forest Products- M.N.B.Nair
6. The Useful Plants of India- CSIR, Publication and Information Directorate

Biostatistics

1. Fundamentals of Biometry – L.N.Balaam
2. Fundamentals of Biostatistics – I.A>Khan and A.Khanum,Ukaaz Publications
3. Principles of Biometry- C.M.Woolf
4. Statistical Methods – G.W.Snedecor and W.G.Cochran

Bryology

1. Bryophyta - N.S.Parihar , Central Book Depot, Allahabad
2. Bryophye Ecology – A.J.E.Smith (Ed)
3. Bryophytes – P.Puri, Atma Ram & Sons Publishers, N.Delhi
4. Cryptogamic Botany, Vol.II – G.M.Smith
5. Liverworts of the Western Himalayas and Punjab Plain – S.R.Kashyap

Cytology and Genetics

1. Genetics: PJ Russell. Benjamin Cummings Pub. Inc. USA.
2. Principles of Genetics: Snustad and Simmons, John Wiley and Sons, USA
3. Concepts of Genetics: Klug and Cummings, Pearson Education, USA
4. Genome 3: T.A. Brown, Pearson Education, USA
5. Principles of Gene Manipulation and Genomics: Primrose and Twyman, Blackwell Scientific, Oxford.
6. Plant chromosome: Analysis; Manipulation and Engineering: Sharma & Sharma, Harwort Academic Pub. Australia
7. The Science of Genetics: Sauders College Publishing, Fort Worth, USA
8. Genetics: Principles and Analysis, Hartl and Jones, EW Jones & Bartlett Pub, USA.
9. Gene IX: Lewin, B. Oxford University Press, USA.
10. Essential Genes, Lewin, B. Pearson Education.
11. Functional Genomics: A practical Approach. Hunt And Rick, Oxford University Press.
12. Genetic Engineering: An Introduction to Gene Analysis and Exploitation in Eukaryotes: Kingsman &Kingsman, Blackwell Scientific .Pub. Oxford.
13. Molecular Biotechnology: Glick & Pasternock, Indian Edition.

14. Molecular Cloning: A Laboratory Manual, Sambrook & Russel, CSHL press, N.York.
15. DNA Cloning: A Practical Approach, Glover & Hames, IRL press, Oxford.
16. Methods in Enzymology, Guide to molecular Technique, Vol. 152. Berger & Kimmel, Academic Press, San Diego.
17. DNA Science: A first course in recombinant Technology, Mickloss & Freger, CSHL Press, NY.
18. Recombinant DNA Technology: Watson, Academic Press.

Ecology

1. Basic Ecology –E.P. Odum , Saunders Publication
2. Fundamentals of Ecology-E.P. Odum , Saunders Publication
3. Elements of Ecology – R.L. Smith & T.M. Smith , Benjamin/ Cummings Publishers
4. Air pollution and Plant Life –M.T. reshow , Willy Interscience
5. Concepts of ecology- E.J. Kormondy, Prentice-Hall of India
6. Fundamentals of Ecology- M.C. Dash , Tata McGraw Hill
7. Environmental Science-S.C. Santra , New Central Book agency(P) Ltd. Kolkata.
8. Biology of Fresh water pollution-C.F. Mason , Longman Publishers

Gymnology

1. An Introduction to Gymnosperms – S.C. Dutta
2. Comparative Morphology of Vascular Plants – A.S. Foster and G.M. Gifford
3. The Morphology of Vascular Plants – D.W. Bierhorst

Microbiology

1. Bacterial Metabolism - G. Gottschalk, Springer
2. Bergey's Manual of Systematic Bacteriology, 4 vols, - N.R. Krieg & J.G. Holt, eds, Springer
3. Brock Biology of Microorganisms - M.T. Madigan, J.M. Martinko & J. Parker, Prentice-Hall
4. Encyclopedia of Microbiology, 4 vols - J. Lederberg, ed, Academic Press
5. Food Microbiology - M.R. Adams & M.O. Moss, RSC
6. Food Microbiology- Fundamentals and Frontiers, 3rd edition, M.P. Doyle & L.R. Beuchat, ASM Press
7. Foundations in Microbiology - K.P. Talaro & A. Talaro, WCB/McGraw-Hill
8. Fundamentals of Microbiology - Alcamo, Benjamin/Cummings
9. Fundamentals of Microbiology and Immunology - A.K. Banerjee & N. Banerjee, Central
10. General Microbiology - H.G. Schlegel, Cambridge University Press
11. General Microbiology - R.Y. Stanier, E.A. Adelberg & J.L. Ingraham, McMillan
12. Genes VIII - B. Lewin, Oxford University Press
13. Immunology - J. Kuby, Freeman
14. Introduction to Modern Virology - N.J. Dimmock & S.B. Primrose, Blackwell Science
15. Microbial Energetics - E. A. Dawes, Blackie

16. Microbial Physiology - A.G. Moat & J.W. Foster, John Wiley & Sons
17. Microbiology - B.D. Davis et al., Harper & Row
18. Microbiology - L.M. Prescott, J.P. Harley & D.A. Klein, McGraw-Hill
19. Microbiology - M.J. Pelczar, E.C.S. Chan & N.R. Krieg, McGraw-Hill
20. Microbiology – An Introduction - G.J. Tortora, B.R. Funke & C.L. Case, Addison Wesley, Longman
21. Microorganisms in Our World - R.M. Atlas, Mosby

Molecular Plant Pathology and Fungal Biotechnology

1. Molecular Plant Pathology - M. Dicinson. Bios Scientific Publishers, Taylor and Francis group , London and New York
2. Fungal genetics: Principles and practice - Cees J. Bos , ed. Marcel Dekker, Inc.
3. The Mycota: Vol. I -XII : Ed. K. Esser :Springer Verlag, Berlin
4. Gene VI-Gene IX: Benjamin Lewin, Oxford University press.
5. Molecular and cellular biology of filamentous fungi-Nick Talbot , Oxford University Press.
6. Plant Pathology- 4th Edn. -G. N. Agrios, Elsevier Publications.
7. An Introduction to mycology - R. S. Mehrotra and K. R. Aneja., New age International publishers, New Delhi.
8. Topics in Mycology and Plant Pathology - L.N. Nair, New Central Book agency(P) Ltd. Kolkata.
9. Plant Pathology -concepts and laboratory Exercises - Robert N. Trigiano, Mark T. Windham and Alan S. Windham eds., CRC Press.
10. A text book of Plant Pathology - A.V.S.S. Sambamurty
11. Plant Pathology - Mehrotra and Agarwal, Tata McGraw Hill
12. Applications of PCR in Mycology – P.D. Bridge, D. K. Arora, C. A. Reddy and R. P. Elander Eds. , CAB International.
13. Molecular Plant Pathology: A practical approach, Vol. I & II- S.J. Gurr, M. J. McPherson and D. J. Bowles, Eds., Oxford University Press.
14. Introduction to plant viruses- C.L. Mandahar , S. Chand & Co.
15. A text book of Biotechnology-R.C. Dubey , S. Chand & Co.

Paleobotany

1. An Introduction to Paleobotany – C.A.Arnold
2. An Introduction to the study of fossil plants – J.Walton
3. Paleobotany and evolution of plants- W.N.Stewart and G.W.Rathwell, Cambridge University Press
4. Studies in Paleobotany – H.N.Andrews

Phycology

1. Algae and Water Pollution – C.M. Palmer
2. An Introduction to Algae – I. Morris, Cambridge University Press
3. Phycology – R.e.Lee
4. Structure and Reproduction of Algae – F.E. Fritsch
5. The Algae – V.J. Chapman and D.J. Chapman
6. The Ecology of Algae – F.E. Round, Cambridge University Press

Plant Biochemistry

1. Biochemistry- A.L. Lehninger, D.L. Nelson and M.M. Cox, CBS Publishers & Distributors, New Delhi
2. Biochemistry- J.M. Berg, J.L. Tymoczko and L. Stryer, Freeman Publishers
3. Biochemistry- L. Stryer, Freeman Publishers
4. Biochemistry- F.B. Armstrong, Oxford University Press
5. Biochemistry- J.H. Weil, New Age International Publishers
6. Biochemistry- G. Zubay, W.C. Brown Publishers
7. Biochemistry- D.Das, Academic Publishers
8. Biochemistry & Molecular Biology of Plants- B.B. Buchanan, W. Gruissen and R.L. Jones, I.K. International Publishers
9. Introduction to Plant Biochemistry - Goodwin and Mercer, CBS Publishers & Distributors.
10. Outlines of Biochemistry- E. Conn, P.K. Stumpf, G. Bruening and R.H. Doi, John Wiley & Sons
11. Outlines of Biochemistry- P.W. Kuchel and G.B. Ralston, Tata McGraw Hill Publishers
12. Photosynthesis- D.O. Hall and K.K. Rao, Cambridge University Press
13. Photosynthesis- D.W. Lawlor, Viva Books Pvt. Ltd.
14. Plant Biochemistry – Eds. P.M. Dey and J.B. Harborne, Hacourt Asia Pvt. Ltd and Academic Press
15. Plant Biochemistry & Molecular Biology- P.J. Lea and R.C. Leegood, John Wiley & Sons
16. Plant Metabolism-D. Richter, George Thieme Publishers
17. Plant Metabolism- D.t. Dennis, D.H. Tupin, D.D. Lefebure and D.B. Layzell eds., Longman Publishers
18. Principles of Biochemistry- H.R. Horton, L.A. Moran, R.S. Ochs, J.D. Rawn and K.G. Saimgeour, Prentice Hall Publishers, USA
19. Analytical Biochemistry- D.J. Holme and H. Peck, Longman Publishers
20. Basic Separation Techniques in Biochemistry- R.O. Okotore, New Age International
21. Biochemical Methods- S.Sadasivam and A.Manickam,, New Age International
22. Class Experiments in Plant Physiology- H. Meidner, George Allen & Unwin
23. Experimental Biochemistry: Theory and exercise in Fundamental methods- R.Switzer and L. Garritty, Freeman Publishers
24. Molecular Cloning: A Laboratory Manual- J.Sambrook, E.F.Fritsch, T.Maniatis, eds., Cold Spring Harbor Laboratory Press
25. Phytochemical Methods- J.B. Harborne, Chapman & Hall Publishers
26. Practical Biochemistry- K. Wilson and J. Walker, eds. Cambridge University Press

Plant Physiology and Pharmacognosy

1. Basic biophysics for Biologists – M. Daniel, Agro Botanica Publishers
2. Biochemistry and Physiology of Plant Hormones – T.C Moore, Springer-Verlag, New York, USA
3. Class experiments in Plant Physiology – H. Meidner, George Allen and Unwin

4. Concepts of Photobiology: Photosynthesis and Photomorphogenesis – G.S Singhal, G Renger, S.K Sopory, K.D Irrgang and Govindjee, Narosa Publishing House, New Delhi
5. Cultivation and Utilization of Medicinal Plants – C.K Atal and B.N Kanpur, Eds., Regional Research Laboratory, CSIR, Jammu Tawai
6. Encyclopaedia of Plant Physiology, Volume III: Secondary plant Products – E.A Bell and B.V Charlwood, Springer-Verlag
7. Experiments in Plant Physiology: A Laboratory Manual – D Bajracharya, Narosa Publishing House, New Delhi
8. Gel Electrophoresis of Proteins: A Practical Approach – B.D Hames, PAS, Oxford University Press, Oxford, U.K.
9. The Embryology of Angiosperms S.S Bhojwani and S.P Bhatnagar, Vikas Publishing House, New Introduction to Plant Physiology - E.G Hopkins, John Wiley & Sons, Inc., New York, USA
10. Medical Botany, Plants affecting Man's Health – W.H Lewis and M.P.F Elvin-Lewis, Wiley International Publication
11. Metabolism and Regulation of Secondary Plant Products – V.C Runneckles and E.F Conn.
12. Molecular Embryology of Flowering Plants – V Raghavan, Cambridge University Press, Cambridge
13. Patterns of Plant Development – T.A Steeves and I.M Sussex, Cambridge University Press, Cambridge).
14. Pharmacognosy – G.E Trease and W.C Evans, Bailliere Tindall Publishers
15. Pharmacognosy – S.B Gokhale and C.K Kokate, Pragati Prakashan
16. Pharmacognosy – V.E. Tyler, L. Brady and J.E Robbers, Varghese
17. Plant Anatomy – A Fahn, Pergamon Press, Oxford
18. Plant Growth and Development: A Molecular Approach - D.E Fosket, Academic Press, San Diego
19. Plant Physiology – F.B Salisbury and C.W Ross, Wadsworth Publishing Co., California, USA
20. Plant Physiology - L Taiz and E Zeiger, Sinauer Associates, Inc., Publishers, Massachusetts, USA
21. Polarity in Plants; Annual Plant reviews, Volume 12 – Keith Lindsey Ed. Blackwell publishing and CRC Press
22. Practical Biochemistry: Principles and techniques – K Wilson and J Walker, Cambridge University Press, Cambridge, UK
23. Practical Pharmacognosy – C.K Kokate, Vallabh Prakashan, Delhi)
24. Practical Pharmacognosy – P.K. Lala, Lina, MG Road, Kolkata
25. Phytochemical Methods: A Guide to Modern techniques of Plant analysis – T.C Harborne, Chapman and Hall, London
26. Research Experiences in Plant Physiology: A Laboratory Manual – T.C Moore, Springer-Verlag, New York, USA
27. Seeds: Physiology of Development and Germination - J.D Bewley and M Black. Plenum Press, New York
28. Stress Physiology – D.P. Singh, New Age International (P) Limited, Publishers, New Delhi.
29. The Embryology of Angiosperms S.S Bhojwani and S.P Bhatnagar, Vikas Publishing House, New Delhi

30. Techniques and Practice of Chromatography – R.P.W Scott, Marcel Dekker, Inc., New York

Pteridology

1. Comparative Anatomy of Vegetative Organs of the Pteridophytes – Y. Ogura
2. Morphology of Vascular Plants (Lower Groups) – A.J.Eames
3. The Ferns – F.O. Bower
4. The Morphology of Pteridophytes – K.K. S Porne, B.I. Publishing
5. The Pteridophyte Flora of the Upper Gangetic Plain – N.P. Chowdhury

Taxonomy of Angiosperms

1. Flora of India (all vols.) - Botanical Survey of India
2. Taxonomy of Vascular Plants - G.H. Lawrence
3. The Identification of Flowering Plant Families - P.H. Davis & J. Cullen
4. Botanical Latin - W.T. Stearn
5. A Dictionary of Flowering Plants - J.C. Willis
6. An Integrated System System of Classification of Flowering Plants - A. Cronquist
7. The Evolution and Classification of Flowering Plants - A. Cronquist
8. The Families of Monocotyledons - R.M.T. Dahlgren, H.T. Clifford & P.F. Yeo
9. Flowering Plants of the World - V.H. Heywood
10. The Families of Flowering Plants (3rd Edn.) - J. Hutchinson
11. Plant Systematics - S.B. Jones & L.E. Luchsinger
12. A Handbook of Systematic Botany - S.C. Datta
13. Biodiversity – Principles and Conservation - U. Kumar & M.J. Asija
14. Advances in Ethnobotany - A.P. Das & A.K. Pandey
15. Plant Systematics - Gurucharan Singh
16. Text Book of Plant Taxonomy - V.N. Naik

IDC-I:
Physical Organic Chemistry
Credit: 8

Marks: 100

120hrs

Unit-I: Thermodynamics

[24 hours]

Classical thermodynamics and Statistical basis of thermodynamics. Probability, thermodynamic probability. Boltzmann distribution Law. Partition Function. Thermodynamic functions from partition function. Thermodynamics of biological system and Biological redox reactions. Ion channels, Voltage gates.

Unit-II: Chemical kinetics

[20 hours]

Order, determination of rate constant, collision theory, Lindemann theory, fast reactions, application to bio systems.

Unit-III: Symmetry and Group Theory-I

[20 hours]

Introduction to symmetry. Symmetry elements and Symmetry operations. Definition of a Group. Point symmetry groups.

Unit –II Quantum theory and elementary quantum mechanics, Operators, particle in a box and its application, tunnelling, mutation of DNA, emission of alpha particle. Computational chemistry and molecular modelling.

Unit-IV: Electrochemistry

[20 hours]

Conductance, hydrogen and hydroxyl ion conductance, Ion Solvent interactions, quantitative treatment of ion solvent interaction, Born model, Ion-Ion interaction, Ionic atmosphere, Debye-Huckel theory, asymmetry and electrophoretic effect, applications in biological systems.

Energy storage devices: Lithium ion battery, cathode and anode materials, electrolyte, mechanism.

Unit- V: Spectroscopy

[36 hours]

Principles, Transition probability, transition moment, selection rules, intensity of spectral lines, width of spectral lines and its various causes.

Rotational spectra: diatomic molecules as rigid rotors – energy levels, selection rules and spectral features, isotope effect, intensity distribution.

vibrational spectra of diatomics: potential energy of an oscillator, Harmonic Oscillator approximation, energy levels and selection rules, anharmonicity and its effect on energy levels and spectral features: overtones and hot bands.

IR Spectra: Modes of molecular vibrations, application of Hooke's law, characteristic stretching frequencies of O-H, N-H, C-H, C-D, C=C, C=N, C=O functions; factors effecting stretching frequencies (H-bonding, mass effect, electronic factors, bond multiplicity, ring size).

UV Spectra: Electronic transition ($\sigma\text{-}\sigma^*$, $n\text{-}\sigma^*$, $\pi\text{-}\pi^*$ and $n\text{-}\pi^*$), Selection rules for electronic transition, Lambert's Beer's Law, Determination of λ_{max} by Woodward-Fieser rule for

conjugative dienes, polyenes and α,β -unsaturated compounds, relative positions of λ_{\max} considering conjugative effect, steric effect, solvent effect, red shift (bathochromic shift), blue shift (hypsochromic shift), hyperchromic effect, hypochromic effect (typical examples), photosensitizers and its role in photochemical reactions, charge transfer spectra.

IDC-II
Bioinorganic, Supramolecular and Medicinal Chemistry
Marks: 100 Credit: 8
Group A

Bioinorganic and Supramolecular Chemistry F.M:50 60hrs

I Metal Storage Transport and Biomineralization 5 Hrs

Ferritin, transferrin, and siderophores

II Calcium in Biology 6 Hrs

Calcium in living cells, transport and regulation, molecular aspects of intramolecular processes, extracellular binding proteins

III Metalloenzymes 20 Hrs

Zinc enzymes – carboxypeptidase and carbonic anhydrase. Iron enzymes – catalase, peroxidase and cytochrome P-450. Copper enzymes – superoxide dismutase. Molybdenum oxatransferase enzymes – xanthine oxidase. Coenzyme vitamin B₁₂

IV Metal–Nucleic Acid Interactions 6 Hrs

Metal ions and metal complex interactions. Metal complexes - nucleic acids

V Metals in Medicine 5 Hrs

Metal deficiency and disease, toxic effects of metals, metals used for diagnosis and chemotherapy with particular reference to anticancer drugs

VI Supramolecular Chemistry 18 Hrs

Concepts and language.

(A) Molecular recognition : Molecular receptors for different types of molecules including arisonic substrates, design and synthesis of coreceptor molecules and multiple recognition.

(B) Supramolecular reactivity and catalysis.

(C) Transport processes and carrier design.

(D) Supramolecular devices. Supramolecular photochemistry, supramolecular electronic, ionic and switching devices.

Some example of self-assembly in supramolecular chemistry

Group B

Medicinal Chemistry F.M:50 60Hrs

1 Drug Design**15 Hrs**

Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structure-activity relationship (SAR), factors affecting bioactivity, resonance, inductive effect, isosterism, bio-isosterism, spatial considerations. Theories of drug activity: occupancy theory, rate theory, induced fit theory. Quantitative structure activity relationship. History and development of QSAR. Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physico-chemical parameters: lipophilicity, partition coefficient, electronic ionization constants, steric, Shelton and surface activity parameters and redox potentials. Free-Wilson analysis, Hansch analysis, relationships between Free-Wilson and Hansch analysis. LD-50, ED-50 (Mathematical derivations of equations excluded).

II Pharmacokinetics**5 Hrs**

Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition and in therapeutics. Mention of uses of pharmacokinetics in drug development process.

III Pharmacodynamics**5 Hrs**

Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, sulphonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

IV Antineoplastic Agents**5 Hrs**

Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors.

Synthesis of mechlorethamine, cyclophosphamide, melphalan, uracil, mustards, and 6-mercaptopurine. Recent development in cancer chemotherapy. Hormone and natural products.

V Cardiovascular Drugs**5 Hrs**

Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators.

Synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolol, oxyprenolol.

VI Local Antiinfective Drugs

10 Hrs

Introduction and general mode of action.

Synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapson, amino salicylic acid, isoniazid, ethionamide, ethambutal, fluconazole, econazole, griseofulvin, chloroquin and primaquin.

VII Psychoactive Drugs- The Chemotherapy of Mind

7 Hrs

Introduction, neurotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, anti-anxiety drugs, benzodiazepines, buspirone, neurochemistry of mental diseases. Antipsychotic drugs - the neuroleptics, antidepressants, butyrophenones, serendipity and drug development, stereochemical aspects of psychotropic drugs.

Synthesis of diazepam, oxazepam, chlorazepam, alprazolam, phenytoin, ethosuximide, trimethadione, barbiturates, thiopental sodium, glutethimide

VIII Antibiotics

8 Hrs

Cell wall biosynthesis, inhibitors, β -lactam rings, antibiotics inhibiting protein synthesis. Synthesis of penicillin G, penicillin V, ampicillin, amoxycillin, chloramphenicol, cephalosporin, tetracyclin and streptomycin.



Choice Based Credit System (CBCS)

Syllabus

INTER-DISCIPLINARY COURSES

(IDC)

w.e.f. 2017

DEPARTMENT OF EDUCATION

(ESTD- 2015)



2015

RAIGANJ UNIVERSITY

Raiganj, Uttar Dinajpur, - 733134

West Bengal, India



MAEDNID-1 Information and Communication Technology (ICT) Total Marks = 100

Unit-1: a. ICT: Origin, Concept, Growth and Uses. b) Role of ICT in Higher Education and its Advantages and Limitations.

Unit-II: a. Fundamentals of Computer System – Concept, Types, Components, Hardware and Software system/Approach; b. Using the Computer and Managing Files and Folders (What & How)

Unit-III: a. Basics of Internet and Emailing, b. Microsoft Office -2003, 2007, 2013/16: its uses and Advantages.

Unit- IV: a. Microsoft Word – Creating, Formatting, Checking spelling & Grammar, Saving & Enhancing a Document, Inserting Table, Creating a Graph from the Table, Adding Headers & Footers, Changing Page Settings.

b. Application of MS Word for Students, Creating Student and Teacher support materials, Creating Organizational Chart, Developing Plans for Implementation.

Unit- V: a. Microsoft Power point: Exploring knowledge in MS Power Point – Beginning of Multimedia Presentation;

b. Creating a power point presentation (.ppt) file, formatting, designing and all related activities.

Unit- VI: a. Microsoft Excel - Exploring knowledge in MS Excel window – Setting up the Spreadsheet to data input and analyze that; b. Setting up of Spreadsheet with Rows and Columns for entering and calculating data, Creating simple calculations, Using built-in formulas in Excel, Formatting a Worksheet & its cells, Using appropriate Charts and Graphs and etc.

Unit- VII: a. Exploring knowledge in Internet, E-mail, Audio-video and Data CD etc. – Understanding and

Using Directories and Search Engines, Exploring Copyright Laws related to Computer and Software use, E-resources; b. concept of eLearning and mLearning in Higher Education.

Suggested Readings:

1. Mrunalini, T. and Ramakrishna, A. - Information & Communication Technology (ICT) In Education, Neelkamal Publication
2. Dr. S. Arulsamy - Application of ICT in Education, Neelkamal Publication
3. Vanaja, M. and Rajasekar, S. - Information & Communication Technology (ICT) In Education, Neelkamal Pub.
4. Ronghuai Huang and Kinshuk - ICT in Education in Global Context



5. Dr. A.B. Bhatnagar and Dr. Anurag Bhatnagar - Educational Technology and ICT
6. Rajendra Kumar - Information and Communication Technologies
7. Asha Sharma - Information, Communication and Education Technology – Amit Pub.
8. Pandey, V. C. - Information and Communication Technologies, Gyan Books

MAEDNI - 2: Fundamentals of Research Methodology Full Marks – 100

Unit I: a) Research: Meaning, Nature, Characteristics b) Educational Research: Fundamental, Applied & Action, Longitudinal and Cross Sectional, & Interdisciplinary. c) Identification of research worthy Problems, d) Planning of Scientific Investigation & Research Designs e) Research Objectives & Questions f) Review of related studies,

Unit – II: a) Hypothesis: Meaning, type, Formulation & Testing; Characteristics of Good Hypothesis b) Variables: Concepts, types & Method of Control

Unit –III: a) Population and Sample, Sampling methods: Probability & Non Probability.

b) Tools and techniques of data collection: needs criteria of good research tools, Construction and uses of – observation, interview, questionnaire, rating, and attitude scale.

Unit – IV: a) Strategies of Research: Historical, Descriptive and Experimental. Importance & critical Evaluation of the strategies b) Writing Research Report: As per style & format c) Evaluating a research report, its criteria.

Unit – V: a) Educational Data- Quantitative & Qualitative; Descriptive & Inferential b) Tabulations of Educational data c) Graphical Presentation- Histogram, Polygon and Ogive, d) NPC and Non-normality: Skewness & Kurtosis e) Percentile & Percentiles Rank f) Measures of Central Tendencies and variability's: Uses and computation

Unit – VI: Measures of Correlation a) Product moment, Rank differences, bi-serial and point – biserial, partial and multiple correlations (concepts & Uses only) b) Regression and Prediction: concepts, types, methods for estimation of linear regression and prediction.

Unit – VII: a) Parametric Statistics-Significance of Statistics, one tailed & two tailed tests, Types C. R.-test, t-test, ANOVA b) Non-Parametric Statistics: Chi-Square, Median test, c) Standard Scores-Derived Score, Z-Score, T-score.

Suggested Readings:

1. Mangal, S.K & Mangal, S. - Research Methodology in Behavioural Sciences, PHI, Delhi
2. Kerlinger, F.N. – Foundations of behavioural research.



3. Best and Kahn. – Research in education.
4. Koul, L. – Methodology of educational research.
5. Guilford, J.P. – Fundamental statistics in psychology and education.
6. Guilford, J.P. – Psychometric methods.
7. Anastasi, A. – Psychological Testing.
8. Freeman, - Psychological testing.
9. Fergusson, G.A. – Statistical analysis in psychology and education.
10. Nunnally, J.C. – Educational measurement and evaluation.
11. Siegal, S. – Nonparametric statistics for the behavioural sciences.
12. Van Dalen, D.B. – Understanding Educational Research : an introduction.
13. W.L. Neuman – Social Research Method – Qualitative and quantitative approaches, Pearsan Education.
14. Ram Ahuja – Research Methods, Rauat Publication Jaipur and New Delhi.
15. J.W. Best & J.V. Kahn – Research in Education, Prentice Hall of India, New Delhi.
16. L. Koul – Methodology of Educational Research, Vikas Publishing House, New Delhi.
17. . Radha Mohan – Research Methodology in Education, Neelkamal Publication, New Delhi.
18. C.R. Kothari – Research Methodology - method and techniques, Wishwa Prakashan, New Delhi.
19. K.S. Sidhu – Methodology Research in Education, Sterling Publishers, New Delhi.

Raiganj University

Department of History

Syllabus of Inter-Disciplinary Courses for PG Students (w.e.f. 2017-18)

(IDC-I)

HISTORY OF INDIAN POLITICAL THOUGHT

Unit I: Introduction to Indian Polity: Vedic Polity, *Kautilya's Arthashastra*, *Manusmriti*, *Sukraniti*. Medieval period: Islamic Polity— Delhi Sultanate & Mughal Monarchy.

Unit II: Theoretical background of Political Thought in Modern India: Response and Reaction, Raja Rammohan Roy, Swami Dayananda Saraswati & Arya Samaj Movement.

Unit III: Some Political Thinkers of Modern India: Bankim Chandra Chattopadhyay, Swami Vivekananda, Sri Aurobindo, B G Tilak, V.D.Savarkar, Dr. S.P. Mukherjee, Sir Syed Ahmed Khan, M A Jinnah, Maulana Azad, Fazlul Haque

Unit V: Nationalism and its Contestation: Political thinking of Surendra Nath Banerjee, Gokhale, Mahatma Gandhi, Jawaharlal Nehru, Subhas Chandra Bose, Dr. Ambedkar, M.N.Roy, Jai Prakash Narayan, Vinoba Bhave.

(IDC-II)

Local / Regional History with special reference to the History of Dinajpur (1757-1971)

Unit I: Sources – Understanding Local History: Methodological Issues, Relationship with Oral History

Unit II: Historiography of Local / Regional History of Bengal.

Unit III: Introducing the Region: Dinajpur- Administrative Boundaries and the Cultural Boundaries — Location, Geography and the Natural World, Population and Migration, Language and Castes.

Unit IV: Dinajpur: Colonial Administration, Cultural Response and Reaction (Press and Literature), Growth of National Consciousness, Missionary activities, Peasant & Tribal Movements, Tebhaga Movement.

Unit V: Post-Colonial Dinajpur: Refugee influx, Socio-Economic Movements, Anti -Merger Movement of 1956, Food Movement, Peasant & Tribal Movements.

SYLLABUS OF IDC



DEPARTMENT OF LAW

RAIGANJ UNIVERSITY

2017- 18

IDC- 1:

100 marks

LAW OF CONSTITUTION AND SOCIO- ECONOMIC OFFENCES

Module- 1: INTRODUCTION

- An introduction to the Constitution of India: Different Parts- Preamble, FR, DPSP, FD, Amendment
- Crimes- wrongs- offences
- Theories of punishments
- Rights of the victims

Module- 2 FUNDAMENTAL RIGHTS

- Equality
- Life
- Freedom
- Religion
- Exploitation
- Unlawful detention
- Remedy

Module- 3 DIRECTIVE PRINCIPLES OF STATE POLICY

- Concept of Social justice
- Distribution of national wealth
- Uniform Civil Code

Module- 4 SOCIAL OFFENCES

- Dowry
- Sati
- Cruelty
- Witch hunting
- Superstition
- Untouchability
- Trafficking
- Smuggling

- Honour killing
- Illegal termination of pregnancy

Module- 5 ECONOMIC OFFENCES

- Black money
- White- collar crimes
- Disproportionate asset
- Benami transactions
- Money laundering
- Evasion of tax

LAW AND TECHNOLOGY

Module- 1: INTRODUCTION

- An introduction to law and technology
- Crimes- wrongs- offences
- Rights of the victims
- Punishment
- Ethical issue with respect to biological sciences

Module- 2: HEALTH & ROLE AND REGULATION OF TECHNOLOGY

- Organ donation
- Illegal termination of pregnancy
- Issues of negligence
- Medical ethics
- Hippocratic oath

Module- 3: AGRICULTURE & REGULATION OF TECHNOLOGY

- Plant variety protection
- Fertility of soil and regulation of fertilisers and other agricultural implements
- Quarantine and pest management
- Environmental issues
- Micro- organism and Law

Module- 4: SOCIAL INTEGRATION & REGULATION OF TECHNOLOGY

- Social networking- Positive and Negative Effects
- Regulation of social networking

Module- 5: REGULATION OF TECHNOLOGY VIS A VIS SAFETY & PRIVACY

- Concept of privacy and the issues of safety
- Surveillance- CCTV; Blocking; Throttling etc.; Interception
- Offences pertaining to safety and privacy
- Statutory norms pertaining to the offences

Module- 6: LAW OF EVIDENCE & ROLE OF TECHNOLOGY

- Concept of evidence and Law
- Recognition of electronic evidence in Law
- Relevance of electronic evidence

Module- 7: ELIMINATION OF CORRUPTION & ROLE OF TECHNOLOGY

- Concept of e- governance
- Corruption and role of e- governance
- Scientific mechanisms to control corruption

RAIGANJ UNIVERSITY
DEPARTMENT OF MATHEMATICS

SYLLABUS FOR IDC. 1 AND IDC. 2 (P.G.)

Semester 1

1. IDC.- 1 [Mathematical Logic, Integral Methods, Differential Equations and Vector Algebra] [Marks 25+75 (I.A.+S.E.) Credit 8]

1.1. Mathematical Logic [Marks 25].

1. Simple and compound statements/propositions.
2. Logical connectives: negation, conjunction, disjunction, implication, equivalence.
3. Truth tables, tautology, logical equivalence, contradiction.
4. The algebra of propositions.

1.2. Integral Methods [Marks 25]. Simple problems on definite integral as the limit of sum. Working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelation (without proof). Use of the result:

$$\Gamma(m)\Gamma(1-m) = \frac{\pi}{\sin m\pi}, \text{ where } 0 < m < 1.$$

Computation of the following integrals using Beta and Gamma functions (when they exist):

$$\int_0^{\frac{\pi}{2}} \sin^n x \, dx, \int_0^{\frac{\pi}{2}} \cos^n x \, dx, \int_0^{\frac{\pi}{2}} \tan^n x \, dx \text{ etc.}$$

Working knowledge of double and triple integrals.

1.3. Differential Equations [Marks 25].

1. **Basics of ordinary differential equations:** Significance of ordinary differential equation. Geometrical and physical considerations. Formation of differential equation by elimination of arbitrary constants. Meaning of the solution of ordinary differential equation. Concepts of linear and non-linear differential equations.
2. **Equations of first order and first degree:** Existence theorem (statement only). Exact equation. Condition for exactness, Integrating factor. Rules of finding integrating factors (statements of relevant results only). Equations reducible to first order linear equations.
3. **Equations of first order but not of first degree:** Clairaut's equation. Singular solution.
4. **Applications:** Geometric applications, Orthogonal trajectories.
5. **Higher order linear equations with constant coefficients:** Complementary function. Particular Integral. Method of undetermined coefficients. Symbolic operator D . Method of variation of parameters. Euler's homogeneous equation and reduction to an equation of constant coefficients.

1.4. Vector Algebra [Marks 25].

1. Conditions for collinearity of three points and coplanarity of four points. Rectangular components of a Vector in two and three dimensions. Scalar and Vector products and triple products. Product of four vectors. Direct applications of Vector Algebra in
 - (i) Geometrical and Trigonometrical Problems,
 - (ii) Problems of Mechanics (Work done by a force, Moment of a force about a point).

2. Vector equations of straight lines and planes. Volume of a tetrahedron. Shortest distance between two skew lines.

Semester 2

2. IDC.- 2 [Discrete Mathematics, Boolean Algebra, Graph Theory and Vector Analysis] [Marks 25+75(I.A.+S.E.) Credit 8]

2.1. Discrete Mathematics [Marks 25].

1. Principle of inclusion and exclusion. Pigeon-hole principle. Finite combinatorics. Generating functions. Partitions. Recurrence relations. Linear difference equations with constant coefficients.
2. Partial and linear orderings. Chains and antichains. Lattices. Distributive lattices. Complementation.

2.2. Boolean Algebra [Marks 25].

Huntington postulates for Boolean Algebra. Algebra of sets and Switching Algebra as examples of Boolean Algebra. Duality. Boolean functions. Normal forms. Karnaugh maps. Design of simple switching circuits.

2.3. Graph Theory [Marks 25].

1. **Graphs:** Undirected graphs. Directed graphs. Basic properties. Walk, Path, Cycle, Trail. Connected graphs. Components of a graph. Complete graph. Complement of a graph. Bipartite graphs. Necessary and sufficient condition for a Bipartite graph.
2. **Euler graphs:** Necessary and sufficient condition for a graph to be Euler graph. Konigsberg Bridge Problem.
3. **Planar graphs:** Face-size equation, Euler's formula for a planar graph. To show: the graphs K_5 and $K_{3,3}$ are non-planar.
4. **Tree:** Basic properties. Spanning tree. Minimal Spanning tree. Kruskal's algorithm. Prim's Algorithm. Rooted tree. Binary tree.

2.4. Vector Analysis [Marks 25].

1. Vector differentiation with respect to a scalar variable: Vector functions of one scalar variable. Derivative of a vector. Second derivative of a vector. Derivatives of sums and products. Velocity and Acceleration as derivatives.
2. Elements of Differential Geometry: Curves in space. Tangent to a curve at a point, Normal plane, Serret-Frenet formulae, Principal Normal and Binormal, Osculating plane, Rectifying plane, Darboux vector, Twisted cubic.
3. Differential Operators: Concept of scalar and vector fields. Directional derivative. Gradient, Divergence, Curl and Laplacian.
4. Vector Integration: Line integrals as integrals of vectors, circulation, irrotational vector, work done by a vector. Conservative force, potential orientation. Statements (only) and verification of Green's theorem, Stoke's theorem and Divergence theorem.

Remark 1. *I.A.=Internal Assessment and S.E.=Semester Examination.*

IDC Course Title: IT & Digital Society

Paper Code: CIS-IDC-01

Credit: 08

(Not for MSc CIS Students)

Unit: 1

Information as a Field of Study (Basics of Information Systems, Information Management, Information Technology, Information Science), Computing as a Field of Study (Basics of Computing, Computer Science, Computer Engineering, Computer Applications), Merging Domains and its importance- Computer and Information Science, Information Science and Technology, Information Systems and Technology etc. Information and Types, Role of Information, Communication and Fundamentals

Unit: 2

Information Policy- Meaning, Types, Need, Function, Case Studies, Need, Convergence, Information Divide, Digital Divide, Information Literacy, Network Literacy, Digital Humanities & Sociology, Information and IT Policy as a Discipline and Degrees worldwide

Unit: 3

Information Society, Knowledge Society, Development and Knowledge Societies, Worldwide Tour and Knowledge Society, Digital Transformation, Information Industry and Revolution, Network Society

Unit: 4

Digital Addict, Digital Dark Ages, Digital Tools, Emerging Digital Technologies, Offence in Digital Age, India and Digital India, Governance Projects in India, E Governance in West Bengal, Digital Phobic, Video Game Addiction, Digital Dark Age

Unit: 5

Digital Education-Meaning, Types, Trends and Future, Digital Business- Meaning, Types, Trends and Future, Digital Technologies in Hands On, Basic Digital tools for Education

Text/References:

- 1.Laudon, Kenneth C., and Jane Price Laudon. Management information systems. Vol. 8. New Jersey: Prentice Hall, 2011.
- 2.Lucey, T. (2005). Management information systems. Cengage Learning EMEA.
- 3.Leeuwen, J. V., Hartmanis, J., & Goos, G. (1995). Computer science today: recent trends and developments. Springer-Verlag New York, Inc..
- 4.Ten Teije, A., Miksch, S., & Lucas, P. (Eds.). (2008). Computer-based medical guidelines and protocols: a primer and current trends (Vol. 139). Ios Press.
- 5.Davis, C. H., Shaw, D., Katz, J. M., Tejedor, F. J., Allard, C. K., Allard, K., & Martín, A. G. (2011). Introduction to information science and technology (No. 004 004). e-libro, Corp..
- 6.Pour, M.K. (2015), Encyclopedia of information science and technology, 3rd Edition, IGI Global, USA

Semester- I
Choice Based Credit System
Department of Philosophy
PG (Interdisciplinary Course)

COURSE IDC - 1 Indian Philosophy

Unit-I Indian Epistemology

- i. Carvaka
- ii. Buddha
- iii. Jaina
- iv. Nyaya
- v. Vaisesika
- vi. Samkhya
- vii. Yoga
- viii. Mimamsa
- ix. Vedanta

Unit-II Metaphysics

- i. Carvaka
- ii. Bauddha
- iii. Jaina
- iv. Nyaya
- v. Vaisesika
- vi. SAmkhya
- vii. Yoga
- viii. Mimansa
- ix. Vedanta

Unit-III Ethics

- i. Carvaka
- ii. Buddha
- iii. Jaina
- iv. Nyaya
- v. Vaisesika
- vi. SAmkhya
- vii. Yoga
- viii. Mimansa
- ix. Vedanta

Semester- II
Choice Based Credit System
Department of Philosophy
PG (Interdisciplinary Course)

COURSE IDC - 2 ETHICS AND SOCIETY

This course aims at encouraging the student to engage in critical thinking on such individual and social issues which have important moral bearings. The course has two sequential segments. First, the theoretical and second, the applied. The theoretical part introduces major nonnative theories, both the classical (the Greek and the Indian) and those that are currently prevalent (utilitarianism, Kantianism and ethical relativism). The second part deals with a variety of issues which pertain to individual's personal and social spheres and hence demand moral reflection.

Unit- I

1. Individual and social morality
2. The classical Indian perspective: purusarthas, sadharalna dharma, varnasrama dharma and the idea of niskama karma
3. The Greek perspective: Plato: constitution of human soul and society; ethics and the health of the soul
4. Aristotle: moral virtues
5. Relativism: for and against
6. Kant: the ethics of duty; respect for persons: for and against
7. Mill: utilitarianism: for and against
8. Annette Baier: the feminist ethic

Unit- II

1. Sexual morality: for and against
2. Abortion: for and against
3. Euthanasia: for and against
4. Capital punishment: for and against
5. Social justice: for and against
6. Job discrimination: for and against
7. Animal rights: for and against
8. Environmental ethic: for and against

Suggested Readings:

- Cahn & Markie (ed.) *Ethics: History, Theory and Contemporary Issues*, New York: Oxford University Press, 1998
- Louis P. Pojman (ED.): *Ethical Theory: Classical and Contemporary Readings*, Belmont: Wadsworth, 1998.
- Jeffrey Olen & Vincent Barry (Ed.): *Applying Ethics*
- Rajendra Prasad: *Karma Causation and Retributive Morality*
- Saral Jhingram: *Aspects of Hindu Morality*

IDC 1 and IDC 2 Syllabus

Department of Political Science

Raiganj University

Course Code: POLSIDC – 1

Course Title: Government and Politics in India

Unit I

Constitutional Framework: Historical Background, Composition and function of the Constituent Assembly, Philosophy of the Constitution, the Preamble, Salient features of the Constitution, Fundamental Rights and Duties and Directive Principles; Nature of Indian federation

Unit II

Union Executive and Legislature: President – Power, Position and Role; Vice-President – Power, position and Role; Prime Minister: Power, Position and Role; Union Legislature: Rajya Sabha and Lok Sabha – Composition, Power and Functions; Relation between the two Houses; Committee System, Speaker – Power and Position; Central Council of Ministers – Composition and Responsibility

Unit III

State Executive: Governor – Position, Functions and Role; Chief Minister: Position, Functions and Role; State Legislature: Composition and Functions (Special reference to West Bengal); Council of Ministers – Composition and Responsibility

Unit IV

The Judiciary: Supreme Court and High Courts – Composition, powers and functions; Amendment procedure of the Constitution of India

Unit V

Constitutional and Non-Constitutional Bodies: Election Commission – Composition, powers and functions; UPSC - Composition, powers and functions; National Commission for SCs and STs - Composition, powers and functions; Comptroller and Auditor General of India – Appointment, powers and functions; NITI Ayog - Composition, powers and functions; National Development Council - Composition, powers and functions.

Course Code: POLSIDC – 2

Course Title: Local Government and Politics in India

Unit- I

Local Government – the concept- Origin and Evolution of local Government in India

Unit-II

Local Government and the Political Process in India since independence

Panchayati Raj and Municipal Governance in India

Unit-III

73RD and 74th Amendment Acts.

Rural Governments: Composition, power and functions; Urban Local Governments: composition, power and functions.

Women and Political Participation, women and electoral politics in India - Focus on Panchayati Raj Institutions

Unit-IV

Local Government and Bureaucracy in India

Unit-V

Leadership at the local level-Women in Local Governments in India

Autonomy of Local Government in India: Local Self Government- Local Democracy.

Raiganj University

Dept. of Sanskrit

IDC Syllabus

M.A. in Sanskrit

1st Semester

IDC-I

75 Marks

Unit-I Nitisatakam

15 Marks

Unit-II General idea of Sanskrit Grammar

30 Marks

Unit-III Basic Concept of Indian Philosophy

30 Marks

***Internal Examination for IDC-I**

25 Marks

2nd Semester

IDC-II

75 Marks

Unit-I Basic concept of Vedic Literature

30 Marks

Unit-II Court Epics in Sanskrit Literature

30 Marks

Unit-III Tales & Fables of Sanskrit Literature

15 Marks

***Internal Examination for IDC-II**

25Marks

3rd Semester

***Internal Evaluation (8 Credits)**

100 Marks

Seminar (4Credits)

50 Marks

Viva (02 Credits)

25 Marks

Group Discussion (02 Credits)

25 Marks

DEPARTMENT OF MICROBIOLOGY

RAIGANJ UNIVERSITY

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(03523) 252564

IDC-1 (Semester – I)

General Microbiology

Unit 1: Overview of Bacteria and Virus

Bacteriology: Cell size, shape and arrangements, capsule, flagella and pili, Composition and detailed structure of gram- positive and gram- negative cell wall and archaeal cell wall, Structure, chemical composition and functions of bacterial and archaeal cell membranes.

Virology: Properties of viruses; general nature and important features; viroids, prions and their importance Morphological characters: Capsid symmetry and different shapes of viruses with examples. Viral multiplication in the Cell.

Unit 2: Microbial growth and growth control:

Measurements of growth: cell mass and cell number.

Growth cycle of populations: phases of growth in batch culture; mean generation time.

Environmental factors affecting growth: nutrient concentration; temperature; pH; oxygen concentration; water availability; specific factors (quality and quantity of light; salt concentration).

Growth in a continuous culture; diauxy.

Sterilization using heat, radiation, chemicals, and filter.

Unit 3: Antibiotics

Concept of Sanitizers, Disinfectants, Antiseptics. Bactericidal and bacteriostatic agents. Antimicrobial spectrum and mode of action of antibacterial antibiotics- Penicillins, Cephalosporins, Chloramphenicol, Streptomycin, Rifampicin, Tetracycline, Erythromycin, Vancomycin, Nalidixic acid. Mode of action of Antifungal antibiotics- Amphotericin B, Ketoconazole. Antiviral agents: Interferon and Chemical antiviral agents. Antibiotic resistance

Unit 4: Food Microbiology

Factors effecting growth and survival of microorganisms in foods: intrinsic (substrate limitations: nutrient content; buffering capacity; redox potential; antimicrobials; water activity) and extrinsic (environmental limitations: relative humidity; temperature; gases atmosphere).

Microbiology of food (raw, cooked or canned) spoilage: vegetables; fruits; fish; meat.

Microbiology of food preservation: heat processing (Pasteurization; aseptic packaging); irradiation (microwave, UV and ionizing radiation); high-pressure processing (Pascalization); low-temperature storage chilling and freezing).

Production of Alcohol and alcoholic beverage and Vinegar

Unit 5: Immunology

Cells and organs of immune system; Antibody specificity, diversity, memory, and self and non-self discrimination; Theories of antibody production; Immunogens, Immunoglobulines-fine structure, classification , function,synthesis and evolutionary aspects; Hybridoma production; Monoclonal antibodies- general properties and applications; Antigen-antibody reactions

Complement system; Basic biology of B cells and T cells – their ontogeny ,subsets and functions; Phagocytosis; Triggering of immune response-both humoral and cell-mediated antibody formation; Atopy, Allergy and Hypersensitivity reaction; Auto-immunity; Mechanism of development of autoimmune diseases; Vaccines.

Immunological methods – Immunofluorescence, Immunoelectrophoresis, Counter current Immunoelectrophoresis, RIA, ELISA, and Immunoblotting

IDC-2 (Semester – II)

Advanced Microbiology

Unit 1: Molecular Biology of Microorganisms

DNA replication: Prokaryotic DNA polymerases, uni- and bi-directional replication, initiation of DNA replication in Bacteria, Events at the bacterial and eukaryotic replication forks, Okazaki fragments, rolling circle mode of replication; Topological problems, Termination of replication in E. Coli.

Transcription: Prokaryotic RNA polymerases, bacterial sites and assembly of transcription initiation complex, transcription initiation; synthesis of bacterial mRNA- capping, elongation, termination, poly adenylation; Strategies for controlling bacterial transcription initiation

Synthesis & processing of proteins: Role of tRNA in protein synthesis, tRNA structure, aminoacylation, codon, anticodon interactions; bacterial initiation of translation, elongation, termination

Unit 2: Industrial Microbiology

Industrial microorganisms and fermentation products: origin of industrial strains; strain improvement; properties of a useful Industrial microorganism; primary metabolites (biosurfactants and extracellular polysaccharides) and secondary metabolites (antibiotics).

Fermentation scale-up: construction of an aerobic fermentor; process control and monitoring; steps towards commercial production of ascorbic acid, cyanocobalamin; glutamic acid, protease, benzylpenicillin, alcohol and alcoholic beverages, yeasts and vinegar.

Microbiology of traditional food fermentations: Tempe; yogurt; dhokla; idli; kinema.

Activities of lactic acid bacteria in foods: antimicrobial activity; health promotion effects; type of foods.

Unit 3: Agriculture and environmental microbiology

Soil microorganisms in Agro-ecosystems: Types of microbial communities; soil microbial diversity; significance and conservation; Effect of agriculture practices on soil organisms

Biofertilizer: Mass cultivation of microbial inoculants; Green manuring; Algalization; Biopesticides

Microorganisms in nature: surfaces and biofilms; nutrient levels and growth rates; microbial competition and cooperation.

Sewage treatment and water purification: chemical and microbiological characteristics of waste water; treatment process; determining sanitary quality.

Unit 4: Microbial genetics

DNA as genetic material; Physical basis of heredity; Chromosomes; Cell division Gene transfer mechanisms: Transformation, Conjugation, Transduction Extra-chromosomal genetic elements and their inheritance; Mitochondrial DNA IS element and Transposons.

Regulation of gene expression in prokaryotes and eukaryotes: Operon concept-lac, ara and trp operons, nif regulon; Environmental factors of gene regulation; Chromosome remodeling; RNA dittoing; SiRNA and RNA Interference.

Unit 5: Genetic Engineering and Recombinant DNA Technology

DNA sequencing, Polymerase chain Reaction. Cloning Enzymes- Restriction enzymes, DNA ligase, Klenow enzyme, T4 DNA ligase, Polynucleotide kinase, Alkaline phosphatase. Cloning vectors- Plasmid (pBR322, pUC). Cloning of DNA. Transgenesis

Interdisciplinary course (IDC-1)

General Sociology

Unit I: Emergence of Sociology in the west as an academic discipline: Early Sociology: Historical circumstances, content and methodological issues, Sociology and Social Sciences: Approaches and Perspectives.

Unit II: Concepts and Subject matter of Sociology: Society, Community, Institution, Association, Status and Role, Social Control, Social Groups, Religion, Culture: mass culture, popular culture; Individual and Society Interrelationship -Socialization, Self and Agency; Stratification and Social change.

Unit III: Major Perspectives: Functionalism, Marxism, Interpretive Approach, Structuralism, Feminism, Postmodernism.

Unit IV: Reflexivity: The Sociological Imagination; Social-humanistic Perspective; Sociology as an art form; Reflexive Sociology

Readings:

Bauman, Z. 2010. Towards a Critical Sociology: An Essay on Common-sense and Imagination. London: Routledge.

Berger, P. 1963. Invitation to Sociology. New York: Doubleday.

Beteille, A. 2005. Sociology: Essays on Approach and Method. New Delhi: Oxford University Press.

Durkheim, E. 1964. The Rules of Sociological Method. New York: The Free Press.

Giddens, A. 1971. Capitalism and Modern Social Theory: An Analysis of the Writings of Marx, Durkheim and Max Weber. Cambridge: Cambridge University Press.

Horton, P.B. and Chester L. H. 1972. Sociology. Blacklick, Ohio: McGraw-Hill Book Co.

Inkeles, A. 1987. What is Sociology? New Delhi: Prentice-Hall.

Marx, K. 1969. The Communist Manifesto. Moscow: Progress Publishers.

Merton, R. K. Social Theory and Social Structure. New York: The Free Press.

Mills, C. W. 1959. The Sociological Imagination. New York: Oxford University Press.

Nisbet, R. 1976. Sociology as an Art form. London: Transaction Publishers.

Parsons, T. 1951. *The Social System*. London: Routledge.

Radcliffe-Brown, A.R. 1952, *Structure and Function in Primitive Society*. London: Cohen and West Ltd.

Ritzer, G. 1992. *Sociological Theory*. New York: McGraw-Hill.

Weber, M. 1949. *Methodology of Social Sciences*. Illinois: The Free Press of Glencoe.

Interdisciplinary Course (IDC-2)

Indian Social System

Unit I: Indian social organization

Basic elements, historical moorings, Continuity and change, Unity in diversity, Textual and field view, Approaches to the study of Indian society

Unit II: Social institutions and their changing dimensions

Family, caste (and Varna), Jajmani system, tribe, religion
Marriage among Hindus, Muslims and Christians, Caste among non-Hindus

Unit III: Dynamics of Social Exclusion and Inclusion

Rural-urban interactions and the emerging society
Scheduled Tribes, Scheduled Castes, Other Backward Castes, Women, Minorities
Role of market, media and education in social convergence and integration in India

Unit IV: Cultural traditions and social change

Great and Little Traditions–Universalisation and Parochialisation, Sanskritisation and Westernisation

Unit V: Social structure and social change

Secularisation, urbanisation, industrialisation, modernisation, nation-building

Readings:

Ahmed, Imtiaz (ed), 1978: Caste and Social Stratification among the Muslims, Delhi: Manhor

Bose, N.K, 1967: Culture and Society in India, Bombay: Asia Publishing House

Bose N. K, 1975: Structure of Hindu Society, New Delhi

Bendix, R. 1969: Nation–Building and Citizenship Studies of our Changing Social Order, New York: Doubleday Anchor

Dube, S.C, 1990: Society in India, New Delhi: National Book Trust

Dube, S.C, 1995: Indian Village, London: Routledge

Dube, S.C, 1958: India's Changing Villages, London: Routledge and Kegan Paul

Ghurye, G.S. 1969: Caste and Race in India, Bombay: Popular Prakashan (5th Edition) Joy, Edward, J. 1970: A Tribal Village of Middle India, Calcutta: Anthropological Survey of India

- Karve, Irawati, 1961: Hindu Society: An Interpretation, Poona: Deccan College
- Lannoy, Richard, 1971: The Speaking Tree: A Study of Indian Society and Culture, Delhi: Oxford University Press
- Mandelbaum, David, G, 1970: Society in India, Bombay: Popular Prakashan
- Marriott, Mckim, 1960: Caste Ranking and Community Structure in Five Regions of India and Pakistan, Poona, Deccan College
- Marriott, Mckim (ed.), 1955: Village India, Chicago, Chicago University Press
- Nagla, B K. 2014. Indian Sociological Thought. Jaipur/Delhi: Rawat Publications.
- Singer, Milton, 1972: When a Great Tradition Modernises: An Anthropological Approach to Indian Civilisation, Delhi: Vikas Publishing House Pvt. Ltd
- Singh, Yogendra, 1986: Modernisation of Indian Tradition, Jaipur: Rawat Publications
- Srinivas, M.N, 1965: Religion and Society among the Coorgs of South India, London: J.K. Publishers
- Srinivas, M.N, 1960: India's Villages. Bombay: Media Promoters and Publishers Pvt. Ltd
- Srinivas, M.N, 1962: Caste in Modern India and Other Essays. Bombay: Asia publishing House
- Srinivas, M.N, 1969: Social Change in Modern India, Berkeley: University of California Press
- Srinivas, M. N, 1980: India's Social Structure, New Delhi Hindustan Publishing Corporation
- Uberoi, Patricia, 1993: Family, Kinship and Marriage in India, New Delhi: Oxford University Press

POST GRADUATE CBCS SYLLABUS

Department of Physics

Raiganj University

(Introduced from the Current Session 2017-18)

Semester I

Inter disciplinary Course: IDC – 1

Computational Methods and Programming –I Programming: Instructions to a computer; machine language; high level language; different programming languages; Interpreter and compiler; overview of FORTRAN language; input-output statements; mathematical assignment statements; control statements; function and subroutine subprogrammes; subscripted variables; string variables; files.

Liquid Crystals:

Types of liquid crystals; Identification of liquid crystalline phases; molecular theories of nematic liquid crystals; Molecular theories of Smectic A liquid crystals, Landau-de Gennes theory of phase transition in liquid crystals; X-ray diffraction studies of liquid crystals, Liquid crystal displays.

Semester II

Inter disciplinary Course: IDC – 2

Computational Methods and Programming –II Interpolation: Newton's formulas; Lagrange's interpolation; inverse interpolation.

Numerical differentiation and integration: Numerical differentiation; numerical integration - Simpson's, Weddle's and trapezoidal rules; Gauss' quadrature formula; accuracy of quadrature formulas.

Fundamental Electronics:

Basic small signal amplifiers: Classification of amplifiers, BJT/FET amplifier circuits, model and generalised amplifier circuits, Bootstrapped and Darlington amplifier circuit. Audio power amplifiers. Audio power amplifier requirements, Class A, Class B and Class C power amplifiers, Push pull and tuned power amplifiers. Cascade amplifiers, Difference amplifiers, Multistage R-C coupled amplifiers. Noise in electronic circuits

Block diagram of a typical OP-AMP circuit: Open-loop configuration. Practical OP AMP: Input offset voltage and current, input bias current, total output offset voltage, CMRR and frequency response. Inverting and non-inverting amplifiers. OP AMP with negative feedback - voltage series feedback. Effect of feedback on closed loop gain, input resistance, output resistance, bandwidth, offset voltage and current, voltage follower.

Note:

Only Computational Methods and Programming – I for IDC 1 will be followed in semester I.

Only Computational Methods and Programming – II for IDC 2 will be followed in semester II.

DEPARTMENT OF SERICULTURE

(Centre for Applied Biology)

RAIGANJ UNIVERSITY

INTERDISCIPLINARY COURSE

Paper Code – PGSER-IDC1

End Term: 75 (6 credit)

Internal assessment: 25 (2 credit)

Total: 100 (8 credit)

MULBERRY BIOLOGY AND PHYSIOLOGY (IDC-I)

Unit-I: Mulberry-Taxonomy, morphology, floral biology& anatomy

1. Salient features, economic importance and affinity of the family Moraceae. Phytogeography and systematics of the genus *Morus* L. and its species. Botanical nomenclature; taxonomy and their characteristics; botanical description of mulberry. Centers of origin of crop plants.
2. **Reproductive biology of mulberry:** Sexual polymorphism, development of anther, pollen and male gametophyte, development of ovary, megaspore and female gametophyte, pollination, fertilization, embryo and seed development; polyembryony, parthenocarpy and apomixis.
3. Anatomy of mulberry leaf, stem and root; secondary growth: structure and organization of shoot and root meristems.

Unit-II: Propagation and agro-climatic factors

1. **Propagation of mulberry:** Sexual and asexual methods-significance. Raising of nursery for production of seedlings and saplings.
2. Grafting and layering in mulberry - types and techniques.
3. Weather elements; influence of climatic factors on growth and productivity of mulberry, agro-climatic zones, agricultural applications of remote sensing.
4. Popular mulberry cultivars of tropical and temperate regions, rainfed and irrigated conditions. Assessment of mulberry leaf yield and quality.

Unit-III: Farming systems and nutrient management

1. Basic principles of crop production; classification of crops; methods of crop production; farming systems; planting seasons.
2. **Soils for mulberry cultivation:** Soil profile and classification; physical, chemical and biological properties.
3. **Concept of soil fertility and productivity:** Soil organic matter and humus. Soil sampling and testing; problematic soils and their reclamation.
4. **Irrigation management:** Sources, methods and schedules; quality of irrigation water; conservation of soil moisture in dry land farming.

5. **Plant nutrient management:** Essential plant nutrients, organic manures, inorganic fertilizers and biofertilizers-importance, classification and application; integrated nutrient management.

Unit-IV: Mulberry agronomy and farm management

1. Establishment and maintenance of mulberry gardens; package of practices for mulberry gardens under rainfed and irrigated conditions, gardens for rearing of young-age silkworms and silkworm seed crop.
2. **Pruning of mulberry:** Objectives and methods. Harvesting, transportation and preservation of mulberry.
3. **Weed management in mulberry:** Principles, methods and integrated management.
4. **Farm management:** Scope and concept, basic farm management decisions, cost computation procedures and maintenance of farm records.
5. By-products of mulberry and their utilization.

Unit-V: Respiration and Transpiration

1. Whole plant respiration, Glycolysis in plants and its regulation.
2. Regulation of Pentose Phosphate Pathway and TCA Cycle.
3. Regulation of electron transport chain and role of alternate oxidase.
4. Significance of transpiration, types; mechanism of stomatal opening and closing.
5. Anti transpirants; guttation, factors affecting rate of transpiration.

Unit VI: Photosynthesis

1. History, significance and outline of the process.
2. Biosynthesis of chlorophyll, Photosynthetic pigments and their characteristics.
3. Mechanism of electron transport: Calvin cycle; Kranz anatomy: C4 cycle; CAM pathway; RUBISCO and PEP Case.
4. Factors affecting photosynthesis.

Unit VII: Role of Mineral nutrition in Mulberry and Biological nitrogen fixation

1. Introduction to mineral nutrition and its physiological role in mulberry.
2. Macro and micronutrients, Mechanism of nutritional uptake in mulberry
3. Deficiency symptoms in mulberry, mineral toxicity.
4. Types, mechanism & genetics of biological nitrogen fixation in mulberry- role of nif, huf genes & leghemoglobin.

Unit VIII: Plant and water relationship and Stress physiology

1. Concept of water potential.
2. Absorption of water – active and passive absorption; absorption of minerals.
3. Translocation of solutes; Munch hypothesis, source and sink relationship.
4. Biotic and abiotic stresses in crops and its effects in mulberry.
5. Mechanism of resistance to drought, salinity, mineral toxicity.

Unit IX: Plant growth, development and physiology of flowering

1. **Growth and Morphogenesis:** Meristems in plant development. A brief idea about development of plant organs: root, stem, leaf and flower.
2. **Photomorphogenesis:** History and discovery of phytochromes and cryptochromes and their photochemical and biochemical properties. A brief idea about phytochrome biosynthesis, cellular localization, roles, mechanism of action of photomorphogenetic receptors.
3. **Plant movements:** Phototropism, geotropism and nastic movements.
4. **Plant hormones:** Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action and PGRs in mulberry.
5. **Physiology of flowering:** Photoperiodism and vernalization; Senescence; dormancy and seed germination.

Suggested Readings:

1. Bongale, U.D (1995) Fertilizers in mulberry cultivation. Pushpa Sree Publications, Thalaghattapura, Bangalore.
2. Darwin, F., Acton, E.H., (2011) - Practical Physiology of Plants, Cambridge University Press.
3. Dilip Kumr Das (2015). Introductory Soil Science. Kalyani Publisher; 4 edition
4. Experimental plant physiology – J. Arditti and Dunn, Publ. Academic Press (1970).
5. FAO Manuals- I Mulberry cultivation. FAO Rome.
6. Foth, H.D. (1984) Fundamentals of Soil Science. 7th Edn., John Wiley & Sons, New York.
7. Gupta, R.K & Mittal, R.K (1983) Bibliography of Indian Weeds. Associated Pub. Co. New Dehli.
8. Hopkins, WC (1995): Introduction to Plant Physiology.
9. Hortmann and Kesler (1993) Plant Propagation, principles and practices. Prentice Hall, Hemel Nemstead.
10. Kichisaburo M. (1997) Moriculture – Science of Mulberry Cultivation. Oxford & IBH
11. Kolay, A.K. (1996) Basic Concepts of Soil Science. New Age International Pvt. Ltd., New Delhi.
12. Krishnamurthy, N. (1981) Plant growth substances including application in Agriculture. Tata McGraw Hill Pub. Co. Ltd. New Delhi.
13. Marschner, H. W. (1986): Mineral nutrition of Higher Plants.
14. Mukharjee, S.P. and Ghosh A.N. (1996): Plant Physiology.
15. Noggle, G.R. and Fritz, G. J. (1976): Introductory Plant Physiology.
16. Pandey, S.N and Sinha, B.K. (1995) Plant Physiology. Vikas Pub. House Pvt. Ltd., NewDelhi.
17. Pessarkli, M. (2004): Handbook of Plant and Crop Physiology, Marcel Dekkar Inc. NY.
18. Rajanna, L., Das, P.K., Ravindran, S., Bhogेशa, K., Mishra, R.K., Singhvi, N.R., Katiyar, R.S. and Jayaram, H. (2005) Mulberry Cultivation and Physiology. Central Silk Board, Bangalore.
19. Rathinasamy A (2014). Fundamentals Of Soil Science. Scientific Publisher; First edition
20. Shankar, M.A (1998) Handbook on mulberry Nutrition, Multiplex, Bangalore.
21. Steward, FC (1976): Growth and Organization in plant.
22. Subba Rao, N.S (1998) Biofertilisers in Agriculture. Oxford & IBH Pub. Co, Pvt. Ltd, New Delhi.
23. Taiz, L. and Ziegler, F. (1998): The Plant Physiology.
24. Taiz, L., Zeiger, E., Møller, I.M., Murphy, A. (2014) Plant Physiology and Development, Sinauer Associates, Incorporated, 6th edition.

Interdisciplinary Course -2

Paper Code-PGSEIDC-2

End Term: 75 (6 credit)

Internal assessment: 25 (2 credit)

Total: 100 (8 credit)

SILKWORM BIOLOGY & REARING TECHNOLOGY (IDC-II)

Unit-I: Classification of insects and metamorphosis

1. General characteristic features of insects.
2. Classification of sericigenous insects.
3. Characteristic features of order Lepidoptera and families-Bombycidae and Saturniidae.
4. Importance of metamorphosis in insects, types and hormonal influence.
5. Geographical distribution of silkworm-moulting, voltinism, cocoon colour and shape.

Unit-II: Insect and silkworm egg

1. A general overview on morphology and structure of insect/silkworm egg.
2. Embryonic development in *Bombyx mori*.
3. Spermatogenesis and oogenesis in *Bombyx mori*.
4. Oviparity, ovoviviparity and viviparity, polyembryony and pedogenesis.

Unit-III: Morphology of silkworm and its classification

1. Morphology of various stages (egg, larva, pupa and moth) of mulberry silkworms.
2. Morphology of various stages (egg, larva, pupa and moth) of non-mulberry silkworms.
3. Morphological structure of silk gland of mulberry and non-mulberry silkworm.
4. Histological structure and development of silk gland in silkworm.

Unit-IV: Anatomical features of silkworm, *Bombyx mori*

- | | |
|---|-----------------------|
| 1 Digestive | 2 Nervous |
| 3 Circulatory | 4 Respiratory systems |
| 5 Excretory | 6 Silk gland |
| 7 Reproductive system and sex separation in larva and adult | |

Unit-V: Silk Synthesis

1. Biosynthesis of Silk.
2. Types of silk protein and constituents of silk.
3. Effect of exogenous and endogenous factors on silk synthesis.
4. Role of environmental conditions on silk gland development.

Unit-VI: Planning for silkworm rearing

1. Estimation of leaf quality and yield- appropriate time for estimation of leaf yield, method and calculation of brushing capacity based on yield, selection of silkworm races / breeds and hybrids.
2. Rearing houses, types, location, orientation; Model rearing house: advantages and disadvantages; rearing houses for chawki and late age silkworms; rearing appliances- design and cost- requirements of rearing appliances for 100 dfls.
3. Disinfection- types, mode of application and importance; preparation of spray solution, quantum of spray solution required, disinfection method, mode of action of disinfectants and hygiene practices in silkworm rearing.

Unit-VII: Incubation of silkworm eggs and brushing techniques

1. Incubation- definition- environmental requirement for incubation and their influence on egg development- methods of incubation- conventional method, low cost incubation devices- earthen pot, double brick wall chamber- black boxing.
2. Brushing- definition- different brushing methods, loose eggs and sheet eggs- tapping and net method- advantages and disadvantages of different types of brushing- cellular and mass brushing.
3. Qualitative and quantitative requirements of mulberry leaf for young and late-age silkworms; Harvesting, transportation and preservation of mulberry leaves.
4. Artificial diet for silkworm rearing- composition, merits and demerits.

Unit-VIII: Young and late age silkworm rearing technology

1. Environmental requirements for silkworm egg incubation, young and late-age silkworm rearing; Qualitative and quantitative requirements of mulberry for young and late-age silkworms.
2. Chawki silkworm rearing: Rearing methods and operations; chawki rearing centres –importance and functions.
3. Late age silkworm rearing: Rearing methods and operations.
4. Moulting: Characteristic features - before, at and after moult; care during moulting.

Unit-IX: Cocoon harvesting methods and practices

1. Mounting - types of mountages, methods of mounting matured silkworms, environmental requirements during spinning and density of mounting.
2. Cocoon harvesting, sorting, packing, transportation and marketing, preparation of crop harvest report.

Unit-X: Byproducts of sericulture

1. By-products of silkworm rearing and their utilization.
2. By-products of grainage operations and their utilization.
3. By-products of silk and its bio-medical importance.

Suggested Readings

1. Charsley, S.R. (1982). Culture and Sericulture. Academic Press Inc., New York, U.S.A

2. Dokuhon, Z.S. (1998). Illustrated Textbook on Sericulture. Oxford & IBH publishing Co., Pvt. Ltd. Calcutta.
3. Ganga, G., and J. Sulochana Chetty. (1991) An introduction to sericulture. Oxford & IBH Publishing Company.
4. Hasao Aruga (1994). Principles of Sericulture (Translated from Japanese) Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.
5. Krishnaswami, S.; Narasimhanna, M.N.; Suryanarayan, S.K and Kumararaj, S. (1973) Sericulture Manual-2 - Silkworm Rearing. Agriculture Service Bulletin, FAO, Rome.
6. Madan Mohan Rao, M. (1999) Comprehensive Sericulture Manual. PS Publications, Hyderabad.
7. Omura, S. (1973) Silkworm Rearing Techniques in Tropics. Overseas Technical Cooperation Agency, Tokyo, Japan.
8. Rajan, R.K. and Himantharaj, H.T. (2005) Silkworm Rearing Technology. Central SilkBoard, Bangalore.
9. Tazima, Y. (1972) Handbook of Silkworm Rearing. Fuji Pub.Co. Ltd., Tokyo, Japan.
10. Techniques of Silkworm rearing in the tropics. Economic and Social commission of Asia and the Pacific. United Nations, New York. 1993.

Interdisciplinary Course -3

Paper Code – PGSERIDC-3

End Term: 75 (6 credit)

Internal assessment: 25 (2 credit)

Total: 100 (8 credit)

ADVANCED CONCEPT IN SERIBIOTECHNOLOGY (IDC-III)

Unit- I: Genomics

1. The structure, function and evolution of the insect and human genome.
2. Strategies for large-scale sequencing projects.
3. Whole genome sequencing project in silkworm.
4. Baculovirus as *piggyBac* model - Baculoviruses, retroviruses, DNA transposons (*piggyBac*), and insect cells.

Unit-II: Genome mapping in mulberry

1. Molecular markers and their application in genome analysis.
2. Molecular linkage and genetic map – construction based on RFLP, RAPD, AFLP, SSR and ISSR.
3. Physical map-construction based on clone (BAC-FISH), ESTs, STSs. Long range restriction mapping (with special reference to silkworm).

Unit-III: Comparative and functional genomics

1. A brief account on *Bombyx*, *C. elegans*, *Drosophila*, human and rice genome projects and their relationship.
2. Gene variation and SNPs, SNPs and disease associations, repetitive and coding sequences, transcriptome.

3. DNA chip and micro array in functional genomics.

Unit-IV: Protein structure

1. Secondary structure and super-secondary structure.
2. Mechanisms of protein folding, tertiary folds. Formation of oligomers.
3. Relationship between protein structure and function. Prions.

Unit-V: Proteomics

1. Structure prediction and human proteomics. Mutant proteins.
2. Use of computer simulations and knowledge-based methods in the design process.
3. De-novo design; making use of databases of sequence and structure.
4. Protein structure and drug discovery, Proteins in disease

Unit-VI: Silk Biomaterials

1. Fundamental, types and processing of silk biomaterials.
2. Application of silk biomaterials in tissue engineering and regenerative medicine.
3. Processing of *B. mori* silk for biomedical application
4. Electrospun silk sericin nanofibers for biomedical applications.
5. Silk powder for regenerative medicine.
6. Properties and behavior of silk biomaterials.

Unit-VII: Bioinformatics

1. Bioinformatics for the analysis of sequence data.
2. Approaches for determining gene expression patterns and functions.

Suggested reading:

1. Asakura, T., Mille, T., (2013) Biotechnology of Silk, Springer Science & Business Media.
2. Brown, T. A. (2016). Gene cloning and DNA analysis: an introduction. John Wiley & Sons.
3. Gautham, N., (2006) Bioinformatics: Databases and Algorithms, Alpha Science.
4. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
5. Harisha, S., Harisha, S., (2010) Fundamentals of Bioinformatics. I. K. International Pvt Ltd.
6. Kundu, S. (Ed.). (2014). Silk biomaterials for tissue engineering and regenerative medicine. Elsevier.
7. Mount, D.W., (2004) Bioinformatics: Sequence and Genome Analysis, CSHL Press.
8. Murray, D.R. (1991) Advanced Methods in Plant Breeding Biotechnology. CAB, International, Wallingford, Oxon, United Kingdom.
9. Mussig, J., (2010) Industrial Applications of Natural Fibres: Structure, Properties and Technical Applications, John Wiley & Sons.
10. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. John Wiley & Sons.
11. Rajkhowa, Rangam, Wang, Xungai (2014) Silk Biomaterials for Tissue Engineering and Regenerative Medicine, Elsevier, Amsterdam, The Netherlands.

Interdisciplinary Course -4

Paper Code-PGSERIDC-4

End Term: 75 (6 credit)

Internal assessment: 25 (2 credit)

Total: 100 (8 credit)

SERICULTURE EXTENSION & RURAL ECONOMICS (IDC-IV)

Unit-I: Fundamentals of Agri-/Sericultural Extension and Communication

1. Meaning, certain concepts of agricultural extension and communication; History of agricultural extension in India and other countries; relevance and scope of extension education in Agricultural Rural Development.
2. Philosophy of extension; Objectives of extension, Functions of extension, Principles of extension; Human behavioral dimensions related to extension.
3. Extension Education process; Teaching-Learning process, Principles of participation and learning as applicable to extension- concept, role and significance of Participatory Learning and Action (PLA) and Participatory Rural Approach (PRA) in sustainable rural development.
4. Technology Dissemination and Sericulture Extension- technology transfer- concept, components; appropriate and affordable technology for sustainable rural development; scope and role of sericulture extension in rural development.

Unit-II: Basics of Rural Sociology

1. Basics of rural sociology- basic concepts, relationship with extension; characteristics of Indian rural society, differences and relationships between rural and urban society.
2. Understanding of basic rural institutions, social structure, culture and norms; social values and social control; social stratification- meaning, form, class and caste system.
3. Social and technological change processes; Group- social group and their classification, group dynamics, groups in extension; Concept, theories, typology and functions of rural leadership, opinion leader; identification and development of rural leadership.

Unit-III: Communication and its application in Extension

1. Basic Concept of Communication- Definition, concept and purpose of communication; Types and models of communication; Function and Effectiveness of Communication; Problems in communication; Communication for technology transfer.
2. Extension Communication/Teaching Methods: Modes, Channels and Tools of extension communication, newspaper, radio and television channels, audio-visual

aids- role and importance; Sericultural journalism-bulletins, popular and scientific articles in magazines and journals, annual report etc.

3. Adoption and Diffusion of Innovations- Concept and elements of diffusion and adoption; Stages of Innovation, its attributes and measurement, factors of adoption.

Unit-IV: Sericultural Extension System and Programmes

1. Sericultural Extension Systems: Ministry of Textiles, Role of Central Silk Board (CSB), Technology Mission of CSB and networking of State Development Departments (DoS), State Agricultural Universities, ICAR, NGOs, Cooperatives and private organizations.
2. Sericultural Extension Organizations at various level-development, research, training and policy at state and national levels, Role of Regional Sericultural Research Stations (RSRS) and Regional Extension Centres (RECs).
3. Sericultural marketing organizations- traditional and regulated markets, merits and limitations, Government intervention- legislation, implications.

Unit-V: Rural economics of India and Role of Sericulture in Economic Development

1. Sphere of rural economics of India, Paradigms of rural development from economic point of view, theories of development modernization.
2. Ruseustein- Roden's Theory of Big Push; Lewis model, Lenbestentis model and Gandhian model of development.
3. Product, factor and market contribution, GDP-share, foreign exchange contribution.
4. Sericultural growth in pre- and post-independence period in India, Sericulture and income generation, Recent trends in sericultural development from economic point of view, Economics of sericulture, value addition, profitability vis-à-vis other cash crops.

Unit-VI: Poverty and Economic Planning

1. Meaning and concepts, measurement of poverty and poverty-line criteria.
2. Rural unemployment- types, causes, disguised unemployment; Rural employment generation schemes; Govt. poverty alleviation and employment generation scheme.
3. Concept of Indian economic planning, Rural development in annual budget, Price index, WTO: Rules, regulation, impact in Indian and rural economy.

Unit-VII: Cooperation

1. Introduction to Managing Cooperatives- Role of Cooperative,
2. Technology: Production and Marketing, Agri- and Seri-business Cooperatives.
3. Coordination Strategy; Emergence, Endurance and Growth of Cooperatives.
4. Evolution of Cooperative Enterprise, Issues in establishing agri-/sericultural cooperatives.
5. Cooperatives Principles- Impact of Democratic Governance in Cooperatives and Economic Rationality; Understanding Performance of Cooperatives- Problem of Multiple Objectives & Equitable sharing.

Unit-VIII: Credit System and Microfinance

1. SHG- opportunity of SHG in Entrepreneurship development; Village industry: types, problems and scope; Govt. agencies, trends; Banking system, NABARD etc.
2. Micro-finance, Role and importance of public distribution system.

Suggested Readings

1. Adavi Reddy (1978): Extension education, Sree Lakshmi Press Bapatla.
2. Carver, T. N. (1911). Principles of rural economics. Ginn.
3. Desai, V. (1990). A study of rural economics. A study of rural economics.
4. Dhama, O.P. and Bhatnagar (1984): Education and communication for development
5. FAO Agricultural Extension Manual (Second edition).
6. Fulmer, R.M (1976): Supervision-principles of professional management, Gleucoc Press Lodon.
7. Govindan, R.; Chinnaswamy, K.P.; R.; Krishnaprasad, N.K. and Reddy, D.N.R. (2000) Non-Mulberry Sericulture, Silk Technology and Sericulture Economics and Extension. Vol. 3 – Proceedings of NSTS – 1999, UAS, Bangalore.
8. Kumaresan, P. and Srinivasa, G. (2005) Sericulture Extension Management and Economics. Central Silk Board, Bangalore.
9. Mc Grath, E.H (1986): Basic managerial skill for all. Prentice Hal of India Pvt, Ltd.,New Delhi
10. Supe, S.V (1999): An introduction to extension education. O &IBH, New Delhi (Second edition)
11. Taylor (1961) Agricultural extension –world wise institutional and force of change. Amsterden.