Learning Outcomes-based Curriculum Framework (LOCF)

for Post-graduate Programme

NAME OF THE PROGRAMME

M.Sc. BIODIVERSITY CONSERVATION

(Syllabus effective from 2020 Admission)

UNIVERSITY OF KERALA

DEPARTMENT OF BOTANY

2020

PREAMBLE

The role of higher education is vital in securing the gainful employment and providing further access to higher education comparable to the best available in the world-class institutions elsewhere. The improvement in the quality of higher education, therefore, deserves to be given tom-most priority to enable the young generation of students to acquire skill, training and knowledge to enhance their thinking, comprehension and application abilities and prepare them to compete, succeed and excel globally. Sustained initiatives are required to reform the present higher education system for improving and upgrading the academic resources and learning environments by raising the quality of teaching and standards of achievements in learning outcomes across all undergraduate programs in science, humanities, commerce and professional streams of higher education.

One of the significant reforms in the undergraduate education is to introduce the Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. The University Grants Commission (UGC) took the initiative of implementing the LOCF in the Colleges and the Universities of the country. Accordingly, the University of Kerala has decided to implement the LOCF in all its departments under the auspices of Internal Quality Assurance Cell (IQAC). A series of teacher training workshops were organised by IQAC and the office of the Credit and Semester System (CSS), and the departments have revised the syllabus accordingly, through workshops and in consultation with academic experts in the field.

GRADUATE ATTRIBUTES (GAs)

The Graduate Attributes (GAs) reflect particular qualities and abilities of an individual learner including knowledge, application of knowledge, professional and life skills, attitudes and human values that are required to be acquired by the graduates of University of Kerala. The graduate attributes include capabilities to strengthen one's professional abilities for widening current knowledge and industry-ready skills, undertaking future studies for global and local application, performing creatively and professionally, in a chosen career and ultimately playing a constructive role as a socially responsible global citizen. The Graduate Attributes define the characteristics of learners and describe a set of competencies that are beyond the study of a particular area and programme.

The GAs of University of Kerala

- Continue life-long learning as an autonomous learner
- Continuously strive for excellence in education
- Apply and nurture critical and creative thinking
- Promote sustainable development practices
- Promote co-operation over competition
- Balance rights with responsibilities
- Understand and respect diversity & difference
- Not be prejudiced by gender, age, caste, religion, or nationality.
- Use education as a tool for emancipation and empowerment of humanity

ABOUT THE DEPARTMENT

Department of Botany, University of Kerala, was established in the year 1959 at Kariavattom, Thiruvananthapuram, Kerala by Late Prof. (Dr.) A. Abraham, a visionary, an institution builder and a doyen in Cytogenetics and Plant Breeding. The Department actively serves the society through dissemination of knowledge and training the younger generation through unique courses and offering training in frontier areas of Plant Sciences. The Department is internationally known for its major contributions in Cytogenetics and Cytotaxonomy and for running a novel postgraduate programme in Genetics and Plant Breeding. The Department is also active in Plant Biotechnology research and has well established Cell/Tissue culture and Molecular Biology Laboratories. More than 250 students/teachers have taken PhD from the Department on various and diverse topics and more than 280 students have successfully completed their M. Phil programme in Advanced Botany.

The Vision….

- To serve the society through dissemination and field orientation of knowledge and training the best talents in Plant Sciences.

The Mission….

- To provide quality education in Plant Sciences;
- To develop human resources with hands on experience on basic/ applied Plant Science research;
- To act as a centre for mining of biomolecules, genes and technologies of immense practical application for human welfare;
- To undertake basic, strategic and applied research for generating fool-proof technologies for the advancement of plant science
- Create social awareness in biodiversity conservation and sustainable utilization of bioresources and
- To become a Center of Excellence in Plant Science teaching and research in next five years

UNIVERSITY OF KERALA
DEPARTMENT OF BOTANY

Syllabus for M.Sc. Programme in Biodiversity Conservation

Programme Code 850

Programme Specific Outcomes (PSO) for M Sc Biodiversity conservation

PSO 1	**Mastery in biodiversity and its conservation strategies.**
PSO 2	**Experience and identify the diversity of plant and animal kingdom, from lower to higher level**
PSO 3	**Recognize the need to conserve the wealth of Biodiversity**
PSO 4	**Address environmental issues related to biodiversity**
PSO 5	**Create social awareness in biodiversity conservation and sustainable utilization of bioresources**

Programme Structure of M.Sc Biodiversity Conservation

Programme Code 850

Semester	Course Code	Name of the course	Credits
I	Core Courses (CC)		
	BDC-CC- 511	Biodiversity and Conservation Biology	4
	BDC-CC- 512	Diversity in Algae, Fungi and Microbes	4
	BDC-CC- 513	Cell Biology, Genetics and Evolution	4
	Discipline-Specific Elective (DE)		
	BOT-DE- 514	Diversity in Cryptogamae and Gymnospermae	**2**
II	Core Courses (CC)		
	BDC-CC-521	Environmental Biology	4
	BDC -CC-522	Animal Diversity	4
	BDC-CC-523	Diversity in Bryophytes, Pteridophytes and Gymnosperms	4
	BDC-CC-524	Biochemistry, Physiology and Immunology	4
	Discipline-Specific Elective (DE)		
	BDC-DE-525	Bioinformatics	**2**
III	Core Courses (CC)		
	BDC-CC-531	Angiosperm Taxonomy, Economic Botany and Ethnobotany	4
	BDC-CC-532	Forest Botany and Phytogeography	4
	BDC-CC- 533	Conservation of Natural Resources and Policies	4
	BDC-CC-534	Molecular Biology and Biotechnology	4
	Discipline-Specific Elective (DE)		
	BDC-DE-535	Remote Sensing Applications and GIS	**2**

	BDC-DE-536	Climate Change and Crop Adaptations	**2**
IV	Core Courses (CC)		
	BDC-CC-541	Environmental Impact Assessment (EIA) and Auditing	**4**
	BDC-CC-542	Agrobiodiversity & Wetland Management	**4**
	BDC-CC-543	Costal and Marine Biodiversity and Management	**4**
	DISSERTATION BDC-D-444	Dissertation	**4**
Any semester (I-IV)	Generic Courses (GC)		
	BDC-GC-501	Germplasm Conservation	**2**

SEMESTER I	Course Code: BDC- CC- 511	Credits: 4

NAME OF THE COURSE: BIODIVERSITY AND CONSERVATION BIOLOGY

Course Outcomes (CO)

CO1: Get a deep knowledge on biodiversity richness in global scale and biogeography of India.

CO2: Assess the value of biodiversity wealth of our Nation.

CO3: Analyze various threats to our biodiversity and able to suggest measures for conservation Strategies.

CO4: Trained effectively and scientifically to convey the message of sustainable use of resources and conservation of biodiversity to the public and young generation.

COURSE CONTENT

MODULE I: Introduction- Definition, Genetic diversity, Species diversity, Ecosystem diversity: Structural and functional aspects. Bio-geographic classification of India. Basic concepts of conservation biology, history of conservation biology, the value of biodiversity and conservation, current practice in conservation, conservation of genetic diversity, conservation of species diversity, conservation of ecosystem diversity, relevance of ecosystem diversity as well as services in conservation

MODULE II: Value of Biodiversity- Intrinsic, consumptive, productive use, social, ethical, aesthetic and option values. Utilitarian values of biodiversity- goods, services and information. Biodiversity and ecosystem functioning. Biodiversity and stability of ecosystem functioning. Biodiversity at global, national and local levels India as a Mega Diversity Nation. Hotspots of Biodiversity**:** Criteria for determining hot spots. Indo-Burma (Eastern Himalaya), Western Ghats and Sri Lanka.

MODULE III: Threats to Biodiversity- Habitat loss, pollution, species introduction, global climate change, overexploitation, poaching of wildlife. Rare species, genetic diversity of rare species, habitat loss and fragmentation. Extinction: mass extinction, extinction process, ecosystem degradation, over exploitation, invasive species. Human factors: social factors, economics, politics and action. Man-wildlife conflicts. Endangered and endemic species of India, common plant species, common animal species.

MODULE IV: Conservation of Biodiversity- Strategies for conservation: *In-situ* and *ex-situ* conservation- environmental assessment, protected areas-biosphere reserves, national parks, sanctuaries, tiger reserves-project tiger. *Ex situ* conservation-Managed ecosystems, biological resources and gene banks, botanical gardens, bio-parks, simulated *ex situ* conservation strategies, valuing biological resources, ecotourism, .Strategies for Conservation: Top-down and bottom- up protocols for conservation. *In situ* conservation.- Protected areas, Wildlife sanctuaries, National parks,

Biosphere reserves. Strategies for *ex situ* conservation – Botanical Gardens, Seed banks, Field gene banks, Test tube gene banks, pollen banks, DNA bank, *in vitro* conservation.

MODULE V: Ecosystem Restoration and Management Practices- Global biodiversity and its importance, Different approaches of biodiversity conservation and management, registering biodiversity. Valuing biodiversity resources and their contribution to agriculture, community health and environment. Causes of biodiversity loss. Techniques of species reintroduction and restoration of the degraded habitat. Biodiversity policy and legislation. Wildlife conservation and management: Status of biodiversity conservation in India

MODULE VI: Conservation Practices in India and World- Organizations involved in resource conservation IUCN, WWF, UNEP, UNESCO, Biodiversity International, IPGRI, FAO, BSI, ZSI. Phytogeography – Hotspots of India and world. General account on activities of DBT, BSI, NBPGR, ZSI, FSI, NBFGR and NBAGR NFPTCR, Sacred groves, Biodiversity register.

PRACTICALS

1**.** Field Survey in Kariyavattom campus for studying plant species diversity
2. Ex- situ conservation of plant species using in vitro technique
3. Microproagation of an endangered plant species
4. Green pod (embryo culture) culture of orchid

LEARNING RESOURCES:

REFERENCES

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Model Question Paper

DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS1) Biodiversity Conservation Examination
BDC-CC-511. Biodiversity and Conservation Biology

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. Why do we need to protect biodiversity?
2. Give the year in which Project Tiger launched
3. What is the wildlife symbol of WWF?
4. Which sanctuary in Kerala was described as the richest bird habitat on peninsular India by Dr. Salim Ali?
5. Expand CITES.
6. Name a recently extinct species.
7. Name the national park famous for one-horned rhinoceros
8. Which day is celebrated as 'World environment day'?
9. Name two endangered animal species of India
10. Expand UNEP **(10X1= 10 marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Differentiate rare and exotic species?
12. What is co-extinction? Give suitable examples.
13. Explain how the invasion by an alien species reduces the species diversity of an area.
14. What is endemism? List any three endemic plant and animal species of India.
15. Give an account of the international organizations involved in the conservation of wildlife
16. Define biosphere reserve. Name the three zones of a biosphere reserve and the activities permitted in each.
17. Differentiate alpha, beta and gamma diversity **(5X2= 10 marks)**

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Describe the consumptive value of biodiversity as food, drugs & medicines, and fuel & fiber with suitable examples.
19. How does species diversity differ from ecological diversity?
20. Write an explanatory note on the efforts for conservation of biodiversity in India
21. What do you mean by hot spots of biodiversity? What are the criteria for identifying hot spots and name the biodiversity hotspots located in India
22. Enlsit major threats to biodiversity and suggest suitable preventive measures
23. Describe the different IUCN red list categories of species according to the basis of degree of threat.

(4X3= 12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. 'In situ and ex situ conservation strategies can be effectively utilized for conservation of RET enlisted plants' Substantiate with examples
25. Explain briefly about the bio geographical zones of India giving emphasis to the corresponding flora and fauna of each of them

(1X8= 8 marks)

SEMESTER I	Course Code: BDC- CC- 512	Credits: 4

NAME OF THE COURSE: DIVERSITY IN ALGAE, FUNGI AND MICROBES

Course Outcomes (CO)

CO1: Get knowledge to identify and classify algae and fungi

CO2: Analyze process of evolution, life cycle pattern, reproduction and economic importance of algae and fungal groups and its associations.

CO3: Develop skill in investigation procedure in microbiology and also familiarized with classification and economic uses of microbes

CO4: Know how microbes or principle can be used for the wellbeing of human

COURSE CONTENT

MODULE I: Algae- Principles and modern trends in taxonomy of algae; Contributions of Indian Algologists Classification of Algae (Fritsch F. E. 1935; Lee R. E. 2018). Characteristic features of major Divisions, Thallus organization and its morphological variations; Evolutionary trends. Ecological role of algae. Fossil algae - Brief account only. Cell structure - Prokaryotic, mesokaryotic and eukaryotic organizations.

MODULE II: Structure, reproduction and life cycle of the following types : *Hydrodictyon, Ulva, Pithophora, Draparnaldiopsis, Cephaleuros, Halimeda, Acetabularia, Nitella, Padina, Turbinaria, Amphiroa, Gracilaria, Ceramium, Spirulina, Scytonema* Economic Importance of Algae – Algae as biofuel. Algae as biofertilisers, as food, their uses in industry, water blooms and their ecological role

MODULE III: Fungi- Principles and modern trends of classification of Fungi- (Alexopoulos*etal.*1996*;* Kirk *et al.* 2001, 2008); Contributions of Indian Mycologists. Structure, reproduction and phylogeny of: Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Thallus structure, reproduction and life cycle of the following types: *Phytophthora, Pilobolus, Aspergillus, Uromyces, Polyporus, Lycoperdon, Geaster, Ganoderma, Nidularia, Schizophyllum Colletotrichum, Fusarium* and *Helminthosporium.*
Economic importance of fungi with special reference to secondary metabolites; Fungi as biocontrol agent.

MODULE IV: Lichens -Classification, thallus structure, reproduction, ecological significance and economic importance of Lichens. Thallus structure, reproduction and life cycle of the following types: *Parmelia, Graphis.*

MODULE V: Microbes- Brief history of Microbiology. Experiments of Pasteur and Tyndall, Koch's postulates. Methods of sterilization. Major groups of microorganisms and their characteristics -prions, viroids, viruses, bacteria, archaebacteria, mollicutes, actinomycetes, cyanobacteria, viable but

nonculturable (VBNC) bacteria.Bacteria - Classification based on Bergey's Manual. Significance of 16 S RNA in Bacterial identification. Morphology, and ultrastructure of typical bacterium. Growth and nutrition of microorganisms. Growth characteristics. Continuous culture devices - Chemostat. Extremophiles – Acidophilic, Alkalophilic, Thermophilic and halophilic bacteria. Stress response in bacteria. Microbial diseases. Human diseases: Bacteria (Rickettsia), Virus (AIDS). Animal diseases: Anthrax (Bacteria).

MODULE VI: Applications -Microbes in Agriculture: Rhizosphere, Nitrogen fixation, Mycorrhiza**,** Cyanobacteria. Industrial Microbiology: Microbial fermentation-Major industrial products from microbes. Beverages, Antibiotics, Secondary metabolites, Recombinant products. Applied Environmental Microbiology: Water Purification and Sanitary Analysis, Waste water treatment (primary secondary and tertiary), Bioremediation and Metal bioleaching.

PRACTICALS

1. A record of algal types mentioned above – A study of their morphology and structure.
2. Field trips to be conducted for students to get familiarized with the local flora.
3. Study of the morphology and reproductive structures of the types of Fungi mentioned in the syllabus.
4. Staining of fungal filaments by Cotton Blue, Methylene Blue
5. Practical involving preparation of media, principles of isolation, pure culturing aspects and maintenance of culture.
6. Differential staining -Gram staining of pure cultures of *Bacillus/Lactobacillus/Rhizobium/Escherichia coli.*
7. Demonstration of bacterial motility by hanging drop method.
8. Isolation of *Rhizobium* from root nodule of legumes.
9. Test for coliforms in contaminated water.
10. Isolation of pure bacterial culture by streak plate method

LEARNING RESOURCES:

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Model Question Paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS 1) Biodiversity Conservation Examination
BDC-CC- 512. Diversity in Algae, Fungi and Microbes

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. What is glomerule?
2. What is swimmers itch?
3 Which organism causes red tide?
4 What is palmella stage?
5. Name causative organism of leaf spot disease in mango?
6. Which are the secondary metabolites produced in fungi?
7. What are the salient features of plant quarantine law?
8. Differentiate cyphellae from soredia?
9. What is rhizomorph?
10. What is gelatinous lichen? Give example. **(10X1= 10 marks)**

II. **Answer any *five* questions. Each answers not exceeding 50 words.**

11. Comment on cytoplasmic inclusions of cyanobacteria.
12. Give an account on pycnidiospores.
13.Point out diverse features of fungal nutrition
14.What is the function of heterocyst?
15.Write down the economic importance of Spirulina
16. List out the ecological significance of Usnea
17.What do.you mean by haplo-diplontic lifecycle? **(5X2= 10 marks)**

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Describe the reproduction in rhodophyceae.
19. Discuss the economic importance of diatoms.
20. Explain the structure and reproduction in acetabularia.
21. Give an account on various methods to control plant diseases
22. Explain the asexual reproduction in fungi
23. Describe the evolution of chlorophyceae with suitable examples **(4X3= 12 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

24. Explain the symptoms, disease cycle and control measures of any two bacterial disease
25. Compare the structure, reproduction and life cycle of *Padina* with *Turbinaria*

(1X8= 8 marks)

SEMESTER I	Course Code: BDC- CC- 513	Credits: 4

NAME OF THE COURSE: CELL BIOLOGY, GENETICS AND EVOLUTION

Course Outcomes (CO)

CO1: Students get a deep knowledge base on cell biology, genetics and evolution.

CO2: Analyse the role of different cell organelles in various physiological process.

CO3: Outline the events in cell cycle process and identify various stages of cell division.

CO4: Gain knowledge on population and developmental genetics.

COURSE CONTENT

MODULE I: Introduction to cell biology – Cellular organization of Prokaryotic and Eukaryotic cells. Ultrastructure, chemistry, functions, interrelationships and origin of the cell, organelles and membrane systems-Cell-wall, Plasma membrane, Cytoplasm, endoplasmic reticulum, ribosomes, Golgi-bodies, plastids, mitochondria, centrioles, lysosomes, peroxisomes, spherosomes. Cytoskeletal structures - microtubules, microfilaments, intermediate filaments. Nucleus - nuclear envelope**,** nucleoplasm, nucleolus, chromatin reticulum. Chemistry of chromosomes – DNA, histone and non-histone proteins, RNA and organization of these in the three dimensional configuration of the chromosome. A study on the structure and function of the kinetochore, Nucleolar organizer region (NOR) and other secondary constrictions, satellites, heterochromatic segments and telomeres.

MODULE II: Cell division cycle mechanism and regulation- Stages of cell cycle (Mitosis and Meiosis). Cytoskeleton- microfilaments, microtubules and intermediate filaments, Spindle formation and disintegration, mechanism of chromosome movement and separation during anaphase, actin-myosin cytoskeleton, role of cohesins and condensins, role of motor proteins. Cell cycle control mechanisms (Check points), Role of cyclins and cyclin dependent kinases, cdk activating kinase (CAK), cdk inhibitory proteins (CKIs). Synaptonemal complex, structure and function, molecular mechanism of crossing over. Structural (deletions, duplications, inversions and translocations) and numerical (euploid and aneuploid) variations in chromosomes. Meiotic behavior of structural and numerical variants. Genetic and evolutionary significance of chromosomal variations.

MODULE III: Mendelian, Microbial and Biochemical Genetics–Brief account of Mendel's experiments, linkage, recombination and linkage maps – Bateson's concept of coupling and repulsion. Morgan's concept of linkage, linear arrangement of genes, linkage groups, complete and partial linkage, recombination linkage maps, three point test crosses, interference, coefficient of coincidence and negative interference. Mechanisms of sex determination- genetic, hormonal, environmental and chromosomal mechanisms. Dosage compensation, Barr body, Lyon's hypothesis. Microbial Genetics – Genetic recombination in viruses, bacteria, fungi, Biochemical Genetics –Inborn errors of metabolism- Major types of metabolic errors in man, Gene concept – Allele, Multiple alleles, pseudoallele, polygenes. Gene-Enzyme relationship, One gene - One enzyme hypothesis. Benzer's concepts of cistron, muton and recon, types of genes- smart genes (luxury genes), housekeeping genes,

Barbara Mc Clintock's transposons, overlapping genes, split genes, homeotic genes, pseudogenes, orphan genes, selfish genes, gene cluster, gene families**.**

MODULE IV: Molecular and Environmental Genetics- DNA as the genetic material, DNA constancy, C-value paradox, structure of B-DNA and Z-DNA. DNA replication –Mode and mechanism, unidirectional and bidirectional replication. Genetic code–features, exceptions. Gene Regulation - Central dogma, Transcription, organization of transcriptional units. Gene Regulation in Prokaryotes and Eukaryotes, Transcriptional regulation – signal transduction - upstream and downstream regulators. Post transcriptional regulation – RNA processing – split genes, hn RNA, introns and exons, capping, polyadenylation, splicing, snRNAs and spliceosomes. Post transcriptional silencing, MicroRNAs, RNA inhibition. Translational regulation and Post Translational regulation - Cleavage and processing of proteins. Genetic imprinting. Environmental regulation of gene expression. Epigenetics. Gene synthesis – Khorana's artificial synthesis of the gene for alanine transfer RNA and tyrosine transfer RNA of yeast. DNA damage and repair- Genetic diseases caused by defects of DNA repair system, Types of mutations and methods of detection Molecular mechanism of spontaneous and induced mutations, site directed mutagenesis. Environmental mutagenesis and toxicity testing, high radiation belts of Kerala. Mutagenic effects of food additives and drugs. Ames test.

MODULE V: Population Genetics and Developmental Genetics- Systems of mating and their genetic effects. Hardy Weinberg law and its applications. Factors affecting gene frequencies – mutation, migration, selection, genetic drift, genetic polymorphism and selection, founder effect, genetic load. Consanguinity and its genetic effect. Human genetics: Pedigree analysis, Karyotypes, genetic disorders. Developmental genetics- Genetic control of development in plants and animals with stress to developmental genes in *Arabidopsis* and *Drosophila.* Role of cytoplasm in development.

MODULE VI: Evolution- Origin and evolution of life. Concepts and theories of evolution. Classical and synthetic theories of evolution, Forces and mechanism of evolution, Speciation. Isolation mechanism, Evolution above species level, Molecular evolution.

PRACTICALS

1. Meiosis - *Rhoeo, Chlorophytum, Crotalaria, Datura* (at least one should be recorded).
2. Mitosis – Metaphase and Anaphase
3. Calculation of Mitotic index.
4. Work out problems in linkage, chromosome mapping, microbial genetics, molecular genetics and population genetics.

LEARNING RESOURCES:

REFERENCES

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Model Question Paper

DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS1) Biodiversity Conservation Examination
BDC-CC- 513. CELL BIOLOGY, GENETICS AND EVOLUTION

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. What are cohesins?
2. What is nucleoplasm?
3. What is consanguinity?
4. What is kinetochore?
5. What is a test cross?
6. Give an example for sex limited trait in humans
7. What is non-recurrent mutation?
8. What is gene pool?
9. Define 'photoreactivation'
10. What is RAD? **(10X1=10 marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Distinguish between euchromatin and heterochromatin.
12. Give the functions of golgibodies.
13. Describe the major events in different phases of interphase stage of cell division.
14. Differentiate between coupling phase and repulsion phase and predict the outcome of progenies.
15. Who proposed the chromosome theory of heredity?
16. Define site directed mutagenesis. Write steps involved in oligonuleotide directed mutagenesis
17. What is gene frequency? How is the gene frequency calculated for codominant and dominant recessive autosomal loci? (**5x2=10 marks)**

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Distinguish between euchromatin and heterochromatin
19. Describe the structure and functions of golgibodies
20. Describe the different modes of speciation.
21. Morgan crossed red eyed female drosophila with white male flies. What was the result obtained in F1 and F2 generation? What is the result of reciprocal cross? Give a genetic explanation for the results.
22. What is the difference between dominance and epistasis? Explain two types of epistasis with examples of the respective altered dihybrid ratio.
23. Explain the different mechanisms of genetic recombination in bacteria.

(4X3=12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. What is the genetic code? Enlist the important features of the genetic code. Explain the steps involved in gene translation in prokaryotes.
25. State the Hardy-Weinberg equilibrium and its applications. **(1X8= 8 marks)**

SEMESTER I	Course Code: BDC- DE- 514	Credits: 2

NAME OF THE COURSE: RESEARCH METHODOLOGY & INSTRUMENTATION

Course Outcomes:

CO1: Prepare scientific reports, proposals and research papers

CO2: Analyze scientific data using statistical tools

CO3: Aware of principle and applications of instruments used in biological research

CO4: Know the principles, types and application of microscopy, chromatography, electrophoresis and spectroscopy

COURSE CONTENT

MODULE I: Research methodology- Introduction, Need for research, stages of research; Generation of a research problem, execution of work, and interpretation of results. Review of literature Books, Journals: Indexing journals, abstracting journals, research journals, review journals, e-journals. Impact factor of journals, NCBI-Pub Med. Other sources of references (iii) Internet, open access initiative, INFLIBNET, INSDOC. Bibliography management system-Mendeley, End Note. Preparation of project proposals, Presentation and publication of research outcomes Preparation of a dissertation, Preparation of research paper, Preparation of review articles. Proof reading - standard abbreviations for proof correction. Presentation of research findings in seminars and workshops. Plagiarism- Plagiarism checking softwares.

MODULE II: Basic principles of Biostatistics - Methods of collection and classification of data; Primary and secondary data, qualitative and quantitative data. Frequency distribution, graphical representation, normal distribution. Measures of central tendency, Measures of dispersion Mean deviation, Standard deviation, variance, standard error, co-efficient of variation.Probability - Definition, mutually exclusive events – sum rule, independent events – product rule. Probability of unordered combination of events. Tests of significance, Statistical inference – estimation - testing of hypothesis - t-test, Chi square test (goodness of fit, independence or association, detection of linkages), F-test, ANOVA. Correlation and Regression, correlation (simple and multiple). Data Analysis with Statistical software packages- SPSS.Design of experiments- replication and randomization. Common designs in biological experiments: Completely randomized design, randomized block design, Latin square design, and Factorial design.

MODULE III: Physical forces and chemical bonds -Ionic bond, covalent bond, electrostatic bond hydrogen bond, hydrophobic bond and Van der Waals forces. Examples of biological molecules. Principles of biophysical chemistry: pH, buffer, reaction kinetics, thermodynamics, colligative properties. Photobiological phenomena: Fluorescence, phosphorescence, Birefrinence and dichroism. Bioenergetics: Concepts of entropy, free energy, enthalpy, redox potential.

MODULE IV: Microscopy- phase contrast, fluorescence, polarizing, Confocal microscopy, scanning and transmission electron microscopy, STEM: Cytophotometry and flow cytometry, cameralucida and photomicrography.Basic principle and application of pH meter

MODULE V: Centrifugation and chromatographic techniques- Basic principles of sedimentation – Types of centrifuges and their uses – Preparative and Analytical centrifuge – Sedimentation equilibrium method, Sedimentation velocity method – Density Gradient Centrifugation – Isokinetic and isopycinic centrifugation – Differential centrifugation.General principles–Adsorption and Partition Chromatography–Thin layer chromatography, paper chromatography, Gas-liquid chromatography (GLC), High performance liquid chromatography (HPLC), Ion-Exchange Chromatography and Affinity Chromatography. Electrophoretic techniques– Moving boundary electrophoresis and zone electrophoresis – Paper electrophoresis starch gel, agarose gel and polyacrylamide gel electrophoresis – SDS, Non-SDS, DISC electrophoresis Isoelectric focusing, Istotachophoresis and immuno electrophoresis.

MODULE VI: Spectroscopic techniques- General principles, Types of spectra and their biochemical usefulness, visible and UV spectrophotometry, Infra-red (IR) Circular Dichroism (CD), NMR, ESR and mass spectroscopy, Spectro-fluorimetry, Luminometry, Atomic/Flame spectrophotometry, Atomic absorption and plasma emission spectroscopy, ICP-MS. Detection and measurement of different types of radioactive isotopes normally used in biology-– Geiger-Muller, Liquid Scintillation Counting, ionization chamber, Pocket dosimeters-film badge. Radioactive material, safety guidelines. Application of radioisotopes in biological research, radioisotope tracer technique and autoradiography.

LEARNING RESOURCES:

REFERENCES

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Model Question Paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS1) Biodiversity Conservation
BDC-DE-514 Research Methodology and Instrumentation (Elective)

Time: Three hours **Maximum marks: 60**

I. Answer all questions in one word or sentence

1. What is ligand?
2. What is sedimentation co-efficient?
3. Name various types of media used for electrophoresis
4. What is redox couple?
5. Define standard deviation
6. Define partition coefficient
7. What is retention time?
8. Explain moving boundary electrophoresis
9. What is meant by plagiarism? Name any two plagiarism checking software
10. What are INFLIBNET and INSDOC? **(10x1=10marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Give an account on different types of centrifuges
12. Point out uses of radio active isotopes in biological experiments
13. Give an account on the various applications of radioisotopes in biology
14. Explain procedure of immuno-electrophoresis
15. What is proof reading? What are standard abbreviations used in proof reading?
16. Give an account on measures of dispersion
17. What are the features of Chi-square test? **(5x3=15 marks)**

III. Answer any *five* of the following. Each answer not exceeding 150 words

18. Explain density gradient centrifugation and mention applications
19. Briefly explain iso-electro-focusing
20. 'Specific interaction between molecules can be used in chromatographic separation of molecules' Explain how
21. Explain the principle and applications of phase contrast microscope
22. Give an account on common designs in biological experiments
23. What are the components of a research paper? Explain
24. Compare correlation and regression analysis **(5X5= 25 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

25. Give an account principle, instrumentation and application of spectrophotometry
26. What are the major components of project proposal? Explain how a project proposal can be prepared with example **(1X10= 10 marks)**

SEMESTER II	Course Code: BDC- CC- 521	Credits: 4

NAME OF THE COURSE: ENVIRONMENTAL BIOLOGY

Course Outcomes (CO)

CO1: Identify the interactions between environment and biota

CO2: Assess the dynamics and types of ecosystem

CO3: Gain knowledge about population and community

CO4: Gain knowledge about the global climate change and its impact

CO5: Skill to evaluate soil and water quality

COURSE CONTENT

MODULE I: Introduction- Levels of organization and habitat- interaction between environment and biota. Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement. Application of Law of thermodynamics, food chain, food web, trophic levels, ecological pyramids and recycling - energy flow and transaction. Productivity and Biogeochemical cycles

MODULE II: Concepts and dynamics of ecosystems- Ecosystem: Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; Types – Freshwater, marine and terrestrial. Components of ecosystem, Development and evolution of ecosystems. structure and function of some Indian ecosystems: Grass land, terrestrial, forest, and aquatic (fresh water, marine, estuarine). Ecosystem management.

MODULE III: Characteristics of a population- population growth curves; population regulation; life history strategies (*r* and *K* selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations. Concept of carrying capacity, Population fluctuation and regulation. Nature of communities; community structure and attributes; levels of species diversity and its measurement; edge effect and ecotone. Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

MODULE IV: Ecological interactions - interspecific competition, herbivory, carnivory, Neutralism, symbiosis, commensalism, mutualism, antagonism, antibiosis, parasitism, predatism, competition – intra-specific and inter- specific; Ecological and environmental significance of interactions.

MODULE V: Study of climate- their distribution and adaptation to the environment. Deserts (dry and cold) Tundra, Grassland, Savannah, Temperate forests, Tropical rain forests, Mangrove Ecological concepts of species: Autecological level (genecology), Synecological level.

MODULE VI: Applied ecology- Environmental pollution; global environmental change; biodiversity-status, management approaches, Current environmental issues in India, Environmental

education and awareness. Green Protocol. Disaster management, Global environmental problem, ozone depletion, greenhouse effect, global warming, acid rain, nuclear hazards – Climate change, Eutrophication.

PRACTICALS

1. Analysis of vegetation - Quadrat /line transects to find frequency and interpret the vegetation in terms of Raunkier's frequency formula.
2. To find out the dissolved oxygen content in the given water sample (pond, lake, well etc).
3. To find out the primary production in the given water sample using light and dark bottle method.
4. Estimation of carbonate and bicarbonate content in water samples.
5. Estimation of total organic carbon content in the given soil sample
6. Visit to a local area to document environmental assets river/ forest/grassland/hill/mountain
7. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
   Report of the items 6 and 7 should be included in the record.

LEARNING RESOURCES:

REFERENCES

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Model Question Paper

DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS 2) Biodiversity Conservation Examination
BDC-CC-521. ENVIRONMENTAL BIOLOGY

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. Mention importance of green protocol
2. Write about causes of ozone depletion
3. What is antibiosis?
4. Explain concept of metapopulation
5. What are ecological pyramids?
6. What is eutrophication?
7. What is mineral cycling?
8. Define ecotone
9. Explain K selection
10. List out causes of acid rain **(1X10= 10 marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Enumerate and explain characteristic features of Tundra
12. What are age structured population?
13. Write about disaster management
14. Explain interspecific competition
15. Write a note on population growth curve
16. Differentiate autecology and synecology
17. Analyse how adaptations of plants help them to survive in mangrove ecosystem

(5X2= 10 marks)

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. " Organisms are highly adapted for their life in desert ecosystem". Substantiate
19. Give an account of biogeographical zones of India
20. Explain how species diversity can be measured
21. Explain different types of ecological interactions
22. Write an account of status of biodiversity in India
23. Explain ecosystem management and its significance **(4X3= 12 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

24. Write an account on different types of ecosystems enlisting the salient features.
25. What is pollution? Give an account of environmental pollution leads to global warming. Mention the importance of environmental education in preventing global warming

(1X8= 8 marks)

SEMESTER II	Course Code: BDC- CC- 522	Credits: 4

NAME OF THE COURSE: ANIMAL DIVERSITY

Course Outcomes (CO)

CO1: Identity and classify major groups of animal kingdom

CO2: Apply techniques of animal collection and preservation

CO3: Differentiate the characters and life history of lower and higher invertebrates

CO4: Compare salient features of phylum chordate and Mammalia.

COURSE CONTENT

MODULE I: Introduction to Animal Diversity and Taxonomy - Principles and rules of Taxonomy, ICZN Rules, Concepts of taxon, categories, holotype, paratype, topotype etc. Ethical and Humane treatment to animals, DOs and DON'Ts, Preservation of animal specimens for taxonomic purposes, Field data collection for taxonomic studies.

MODULE II: Animal Study Techniques - Methods of Field data collection for taxonomic studies Use of techniques like net sweeping, pit fall traps, light traps, Berlese funnel, smoking, aspirators, mark-recapture, Use of Taxonomic literature and study of key characters for identification of the specimen.

MODULE III: Lower invertebrate phyla, General Characters – Strictly restrict to salient features only .Classification up to Classes with two examples – Brief account only. General Characters and Classification up to classes in Kingdom Protista: Phylum Porifera: Phylum Cnidaria, Phylum Nemathelminthes. Locomotory Organelles and Locomotion in Protozoa, Canal System in Porifera, Polymorphism in Hydrozoa, Life history of *Taenia solium* Life history of *Ascaris lumbricoides* and its parasitic adaptations

MODULE IV: Higher invertebrate phyla, General Characters – Strictly restrict to salient features only. Classification up to Classes with two or three examples – Brief account only

Phylum Annelida, Phylum Arthropoda, Phylum Mollusca, Phylum Echinodermata. Metamerism in Annelida Vision in Arthropoda, Metamorphosis in Insects. Torsion in gastropods Water-vascular system in Asteroidea. General features and Phylogeny of Protochordata

MODULE V: Animal Diversity-Phylum: Chordata- General Characters – salient features only Classification up to Classes with two examples – Brief account only Agnatha: General features of Agnatha and classification of cyclostomes up to classes Pisces: General features and Classification up to orders; Osmoregulation in Fishes Amphibia: General features and Classification up to orders; Parental care. Reptiles: General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes Aves: General features and Classification up to orders; Flight adaptations in birds, Birds Songs

MODULE VI: Animal Diversity-Phylum: Mammalia- General Characters – Strictly restrict to salient features only classification up to classes with two or three examples – Brief account only Oviparity; ovoviviparity and viviparity in mammals. Dentition; adaptive radiation; convergent evolution of placental and Australian mammals, Primates, Classification of living Primates, Specific features of Anatomy, Physiology and Morphology, Unique Behavioural characters in Primates.

PRACTICALS:

1. Identification of Type Specimen from the invertebrate and chordates mentioned in the syllabus and record submission

LEARNING RESOURCES:

REFERENCES

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- Smith, M. A. (1943). The fauna of British India, Ceylon and Burma including the whole Indo-Chinese Sub- region Reptilia and Amphibia.3 (Serpents) London: Taylor and Francis.

Model Question Paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS 2) Biodiversity Conservation Examination

BDC-CC- 522 Animal Diversity

Time: Three hours **Maximum marks:40**

I. Answer all questions in one word or sentence

1. Name the larvae of Ambystoma
2. What is the major function of Cnidocytes?
3. What is the major distinguishable feature of Vertebrates?
4. Why can't echinoderms live in freshwater?
5. What is the criteria used for the classification of Sponges'?
6. Name the organism which possess Malpighian Tubules
7. What do you mean by Agnatha?
8. List out the characteristics of Eutherians
9. Name the compound in Bufo Melanost?
10. What is unique about protozoa? **(10X1= 10 marks)**

II. Answer any *five* questions. Each answers not exceeding 100 words.

11. Discuss Polymorphisms in Cnidarians?
12. Explain Reproduction in Sponges?
13. List out Major Features of Echinodermata?
14. What is Ommatida?
15. Discuss Osmoregulation Mechanisms in Aquatic Fishes?
16. Write about Lung Fishes and their Unique Features?
17. Explain classifications of Living Amphibians? **(5X2= 10marks)**

III. Answer any *five of* the following. Each answer not exceeding 150 words

18. Explain Canal Systems in Sponges?
19. Discuss the Locomotoray and Feeding Organs in Protozoans
20. Briefly explain Unique Behavioral responses in Primates
21. 'Flight Adaptations in Birds' Explain with Examples.
22. Discuss the Biting Mechanisms in Snakes?
23. Different types Metamorphosis, Explain with Examples? **(4X3= 12marks)**

IV. Answer any *one* of the following, not exceeding 350 words ?

24. Elaborate the Life Cycle of *Ascaris lumbricoides* and their parasitic adaptations?
25. Elaborate Mammalian Classifications and their Unique Features **(1X8= 8 marks)**

SEMESTER II	Course Code: BDC- CC- 523	Credits: 4

NAME OF THE COURSE: DIVERSITY IN BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS

Course Outcomes (CO)

CO1: Identify and classify Bryophytes, Pteridophytes and Gymnosperms

CO2: Compare life cycles of different groups of Bryophyes, pteridophytes and Gymnosperms

CO3: Distinguish morphological and anatomical variations of Bryophyta, Pteridophytes and Gymnosperms

COURSE CONTENT

MODULE I: Bryophyta- General characters and recent systems of classification (Shofield, 1985); Contributions of Indian Bryologists. A general account of morphological and anatomical features, reproduction, life history and phylogeny of: Sphaerocarpales, Marchantiales, Jungermanniales, Calobryales, Anthocerotales, Sphagnales, Andreales, Funariales, Polytrichales.

MODULE II: Life cycle study of the following types: *Lunularia, Targionia, Cyathodium, Reboulia, Pallavicinia, Porella, Anthoceros, Sphagnum,Polytrichum.*Origin and evolution of Bryophytes, Brief account on Fossil Bryophytes, Economic importance of Bryophytes, Bryophytes as indicators of water and air pollution.

MODULE III: Pteridophytes- General characters, classification (Bierhost, 1971) and life cycle of Pteridophytes; Contributions of Indian Pteridologists. Comparative morphology, Anatomical structure, ecology and phylogeny of the following groups: Psilopsida, Lycopsida, Sphenopsida, Pteropsida.

MODULE IV: Structure, reproduction and life cycle of the following types: *Isoetes, Ophioglossum, Angiopteris, Osmunda, Ceratopteris, Blechnum, Lygodium,Adiantum, Trichomannes, Acrostichum, Salvinia, Azolla.*

MODULE V: Telome theory-basis, elementary proves- origin of sporophylls in Lycopsida, Sphenopsida and Pteropsida- origin of root- merits and demerits of telome theory; Evolutionary trends in the gametophytes of Pteridophytes, Conservation of Pteridophytes: Pteridophytes as ecological indicators. Principles of Paleobotany, Fossil pteridophytes: *Rhynia, Lepidocarpon, Sphenophyllum, Zygopteris.*

MODULE VI: Gymnosperms- General characters, affinities, distribution and classification (Sporne, 1965; Christenhurz *et al.* 2011; Christenhurz & Bing, 2016); phylogeny and economic importance of Gymnosperms. Structural details of vegetative and reproductive parts, phylogeny and inter

relationships of the following orders: Cycadofilicales, Caytoniales, Bennettitales, Pentoxylales, Cycadales, Ginkgoales, Coniferales, Gnetales. Structure, reproduction and life cycle of the following types: *Zamia, Araucaria, Cupressus, Podocarpus, Ephedra*

PRACTICALS

1. Morphological and anatomical studies of the Bryophytes mentioned in the syllabus.
2. Anatomical structural details of the vegetative and reproductive parts of the Pteridophytes (types mentioned in the syllabus).
3. Identification of fossil Pteridophytes (types mentioned).
4. Structural details of the following fossil types: *Heterangium, Medullosa.*
5. Anatomy of stem (TS, RLS, TLS), leaf and reproductive structures of the types mentioned in the syllabus.

LEARNING RESOURCES:

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Model Question Paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. Degree (CSS 2) Biodiversity Conservation Examination
BDC-CC- 523. Diversity in Bryophytes, Pteridophytes & Gymnosperms

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. Name any two fossil pteridophytes.
2. Mention asexual reproductive methods of Porella.
3 What are pseudoelaters?
4. Which group of plants are known as amphibians of plant kingdom?
5. What are Protonema?
6. Define Paleobotany
7. What is sorus?
8. Define indusium?
9. What is the ploidy of endosperm in gymnosperm? Why?
10. Differentiate TS,TLS and RLS. **(10x1=10marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Write on post fertilization changes in Marchantia.
12. Distinguish between apogamy and apospory.
13. In which plant coralloid roots are present? Mention the significance
14. Write note on economic importance of pteridophytes
15. Write short note on male strobilus of Gnetum
16. Describe the structure of Rhynia
17. What do you mean by heterospory in pteridophytes **(5X2= 10 marks)**

III. **Answer any *four* of the following. Each answer not exceeding 150 words**

18. Briefly explain life cycle of *Ephedra.*
19. Give similarities in gymnosperms and *pteridophytes.*
20. Briefly describe about the spore producing structure of *Ophioglossum.*
21. Write note on development and features of *Psilotum* prothallus.
22. Write account on structure of sporangium of *Sphagnum.*
23. Write adaptive features of coniferales. **(4X3=12 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

24. Briefly explain the stellar evolution in Pteridophytes
25. Explain how Gymnosperms are classified by Sporne. **(1X8= 8 marks)**

SEMESTER II	Course Code: BDC- CC- 524	Credits: 4

NAME OF THE COURSE: BIOCHEMISTRY, PHYSIOLOGY AND IMMUNOLOGY

Course Outcomes (CO)

CO1: Differentiate types and metabolism of major primary metabolites

CO2: Explain various physiological process in animal/ plant systems

CO3: Analyze functioning and significance of immune system and signaling molecules

CO4: Develop skill for performing experiments in physiology and biochemistry

COURSE CONTENT

MODULE I: Biochemistry – Introduction, pH and buffers. Properties of water, acids bases and buffers. Henderson Hasselbalch equation, pH, pKa. Common buffers. Structure, function and metabolism of carbohydrates – Synthesis of starch, cellulose and sucrose. Interconversion of hexoses and pentoses. Biosynthesis of lipids: Biosynthesis of fatty acids. Biosynthesis of Triacyl glycerol, diacyl glycerol monoacyl glycerol. Gluconeogenesis. Membrane lipids. Lipid oxidation.

MODULE II: Proteins and amino acids- Structure and classification of amino acids. Biosynthesis of aminoacids. Classification of protein based on structure, function and localization sites. Primary, secondary, tertiary and quaternary structure. Protein domains. Ramachandran plot. Purification of proteins. Enzymes: IUB system of classification and nomenclature. Distribution of plant enzymes. Soluble and membrane bound enzymes. Co enzymes, substrate specificity, regulation of enzyme activity, Inhibitors, allosteric enzymes. Isozymes. Ribozymes, Abzymes. Enzyme kinetics. The Michaelis–Menten equation, Lineweaver-Burk plot Km and Vmax. Multienzymes.

MODULE III: Animal Physiological processes I - Nutritional Physiology: Introduction, types of nutrition, mechanical and chemical changes of food in the alimentary canal**,** balanced diet, nutritional disorders – PEM, vitamin deficiency, deficiency of iron, iodine and calcium**,** lifestyle diseases**,** role of fibres.

Circulatory Physiology: Blood- Composition and functions of blood plasma and formed elements, blood groups, mechanism of blood clotting, intrinsic and extrinsic pathways, disorders of blood clotting, anticoagulants**,** heartbeat, conducting system and pace maker, pulse and blood pressure, common cardio vascular diseases – arteriosclerosis, atherosclerosis

Respiratory Physiology: Gas exchange, respiratory pigments- structure of haemoglobin**,** transport of O_2- Oxyhaemoglobin curve, Bohr effect, transport of CO_2 -carbonic acid, carbamino haemoglobin, bicarbonate and chloride shift. Renal Physiology**:** Nephron – Structure, Urine formation, Role of

hormone in urine formation and concentration, Counter-current multiplier system, Role of kidney in osmoregulation, composition of urine, abnormal constituents of urine, regulation of kidney functions.

MODULE IV: Animal Physiological Processes II - Nerve Physiology: Neurons – structure, types of neuron (self-study). Synapse and types of synapse, nerve impulse propagation, synaptic transmission. Reflex action, refractory period, neuro transmitters, electro encephalogram. Sensory Physiology: Structure of eye and ear. Physiology of vision, visual elements and pigments, photo chemistry of vision. Structure of ear and mechanism of hearing. Reproductive physiology: Male and female reproductive organs (self-study). Reproductive Cycles (role of hormones), puberty, adolescence, pregnancy, parturition, lactation and birth control. Endocrinology**:** Endocrine glands in man, hormones.

MODULE V: Plant Physiology- Photosynthesis: Efficiency and turn over. Light harvesting complexes. Photosystem I and II - Structure and function. Mechanism of electron transport. Water oxidizing clock. Rubisco. Structure and function. Photo inhibition. Phytochromes. CO2 fixation: C3, C4 and CAM pathways. Energetics of CO2 fixation. Photorespiration and glycolate metabolism. Mechanism of photorespiration in C3 and C4 plants. Factors regulating photorespiration. Respiration. Anaerobic, aerobic. Glycolysis, TCA cycle, ETS and ATP synthesis, transporters involved in exchange of substrate of products, Pentose phosphate pathway. Transport of metabolites – Xylem and Phloem sap translocation. Photoregulation and growth responses. Plant morphogenesis. Physiology of flowering, fruit ripening, senescence and abscission. Biological clock and circadian rhythm Seed metabolism, glyoxylate cycle in fatty seeds during germination. Nitrogen metabolism. Nitrate and ammonium assimilation. Symbiotic and non symbiotic. Role of leg haemoglobin, Physiological response of plants to stresses like drought, heat and cold. Salt tolerance in plants. Role of phytoalexins. Defense mechanism. Phenyl propanoid pathway in plants. Allelopathy – Plant derived compounds. Plant hormones – Physiological effects and mechanism of action.

MODULE VI: Immunology and Cell signalling - Immunity-mechanism; Innate and adaptive immune system: cells and molecules involved in innate and adaptive immunity. Antigens, antigenicity and immunogenicity. Structure and function of antibody molecules, Antigen antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cell, Humoral and cell mediated immune responses, primary and secondary immune modulation, Inflammation, hypersensitivity and auto immunity. Cell signaling and communications: types of signals and signaling molecules, Cell surface receptors, G Protein coupled receptors.

PRACTICALS

1. Preparation of buffers. Phosphate, carbonate, Tris HCl.
2. Extraction and estimation of total proteins by TCA precipitation and Lowry's method.
3. Isolation of chloroplast from fresh leaves and estimation of chlorophyll proteins.
4. Chlorophyll survey of five plants. Quantification, absorption spectra of chlorophyll and carotenoids using different solvents.
5. Hill activity by DCPIP/ ferricyanide reduction.
6. Extraction and estimation of total phenols.
7. Physiological identification of CAM in plant species.
8. Setting up of Plant Physiology experiments.

LEARNING RESOURCES:

REFERENCES

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Model Question Paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS 2) Biodiversity Conservation Examination

BDC-CC- 524. BIOCHEMISTRY, PHYSIOLOGY AND IMMUNOLOGY

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1.What is a buffer?
2.Explain signal transduction
3.What is senescence?
4.What is LB plot
5.What are lifestyle diseases?
6.What are anticoagulants?
7.Write about pKa
8. What happens if you never blink?
9.What is hyperopia?
10. Which chemical is responsible for happiness?

(10X1= 10 marks)

II. Answer any *five* questions. Each answers not exceeding 50 words.

11Explain photorespiration
12. When your blood is bright red?
13.'Chemical changes happens to food in alimentary canal'. Explain
14.Write a note on secondary signal molecules
15. Why are reflex actions so quick?
16.Illustrate and explain gluconeogenesis
17.Write about physiological effects of plant hormones

(5X2= 10 marks)

III. Answer any *four* of the following. Each answer not exceeding 150 words

18.Describe structure of proteins
19.Explain regulation of enzyme activity
20.Differentiate innate and adaptive immune system
21. What hormone prepares the body for emergency situations?. Explain the mechanism
22Explain biosynthesis of lipids.
23.Write about composition of blood and functions of each components

(**4X3= 12 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

24.Illustrate and explain glycolysis and TCA cycle.
25.Explain structure and function of nephrons. Write about role of hormone in urine formation.

(1X8= 8 marks)

SEMESTER II	Course Code: BDC- DE- 525	Credits: 2

NAME OF THE COURSE : BIOINFORMATICS

Course Outcomes (CO)

CO1: Develop technical skills to retrieve and submit nucleic acid sequence data, align them and identify sequence similarities.

CO2: Analyse the bioinformatics resources in the public domain for deriving phylogenetic relationships

CO3: Predict gene and protein structure and study drug interactions.

COURSE CONTENT

MODULE I: Introduction to Bioinformatics, Definition, Terminology, Applications: Biotechnology and Pharmaceutical industry, Business, Employment opportunities,Journals in Bioinformatics

MODULE II: Bioinformatics resources –NCBI, NCBI data model, File formats-FASTA, Biological databases- Organism, Sequence (Primary and Secondary, Nucleotide and Protein), Structure and Mapping databases; Biological data-mining, Information retrieval-Entrez; Submitting sequences-Sequin; Biomark up languages-HTML,XML, Bio-Programming languages

MODULE III: Genome annotation and Gene prediction: Predictive methods - DNA sequences and proteins: Gene finding strategies - Detecting open reading frames, Gene prediction programs: Hidden Markov model based gene discovery softwares-GENSCAN, GLIMMER, Artificial neural network based gene discovery software- GRAIL, GENE PARSER.

MODULE IV: Secondary databases of functional domains - Structure analysis tools- RASMOL, PYMOL, Tools at Ex Pasy–Motifs and patterns PROSITE, Pfam, Protein sequence analysis tools-PEPTOOL, Predictive methods –PSIPRED, SOPMA.

MODULE V: Phylogenetic analysis-Sequence similarity searches - Comparing nucleotide and amino acid sequences - Distance metrics. Similarity and homology. Scoring matrices. Methods of sequence alignment- Nucleotide BLAST, Protein BLAST, PSI-BLAST, Pairwise and Multiple sequence alignments, Methods of phylogenetic analysis: UPGMA, WPGMA, Neighbour joining method, Fitch/Margoliash method, Character Based Methods Molecular phylogenetic programmes. CLUSTAL, MEGA, PHYLIP, PAUP, PHASE, TREEVIEW.

MODULE VI: Pharmacogenomics and drug designing, drug designing tools- ARGUSLAB. Molecular docking software- ArgusLab.

LEARNING RESOURCES:

REFERENCES

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Model question paper

DEPARTMENT OF BOTANY

UNIVERSITY OF KERALA

Branch: M.Sc. (CSS 2) Biodiversity Conservation Examination

BDC-DE- 525 BIOINFORMATICS

Time: Three hours Maximum marks: 6**0**

I. Answer ***all*** questions in one word or sentence

1. Expand the term 'PHYLIP'
2. Name one gene prediction program.
3. Give the website address of NCBI
4. What is PAM?
5. Name one biomarkup language
6. What is HMM?
7. What are ligands?
8. Mention the utility of SWISS-PROT database
9. What is a FASTA format?
10. Name the different versions of CLUSTAL.

(10X1 =10 marks)

II. Answer any ***five*** of the following. Each answer not exceeding 150 words

11. Compare 'orthologues' and 'paralogues'.
12. What is the difference between local and global alignment?
13. What is a database? Describe the different types of databases.
14. Describe the process of querying the database with ENTREZ
15. What is the utility of gene prediction programmes?
16. Describe homology modeling.
17. Mention at least five journals in the field of bioinformatics

(5X3 =15 marks)

III. Answer any ***five*** of the following. (Each answer not exceeding 250 words

18. What is data-mining? Discuss the role of internet in data-mining and knowledge discovery
19. Give a short account on the bio-programming languages
20. Explain the gene finding strategies. Give examples of softwares that are used to predict genes in DNA sequences
21. Name the different types of protein databases
22. Explain the role of the molecular visualization tools in structure analysis.
23. What is the utility of BLAST in sequence analysis?

(5X5 = 25 marks)

IV. Answer any *one* of the following (Each answer not exceeding 500 words)

24. Highlight the importance of sequence analysis in biological research. Add a note on molecular phylogeny. Describe the operation of CLUSTAL in phylogenetic analysis
25. Describe the process of computer aided drug-designing and molecular docking Explain the role of ARGUS Lab in drug-designing

(1X10=10 marks)

SEMESTER III	Course Code: BDC- CC- 531	Credits: 4

NAME OF THE COURSE: ANGIOSPERM TAXONOMY, ECONOMIC BOTANY AND ETHNO BOTANY

Course Outcomes (CO)

CO1: Gain knowledge about systems of plant classification, nomenclature, and Botanical gardens

CO2: Analyse the relationships of plants between families, genus and species level.

CO3: To acquire the skill for plant identification and herbarium techniques

CO4: Recognize economically important crop plants.

CO5: Identify the ethnic societies of Kerala and the applications of ethnobotanical research.

COURSE CONTENT

MODULE I: Taxonomy of angiosperms- Scope and importance of taxonomy. Taxonomic structure - Taxonomic hierarchy, Taxonomic categories – supra specific and infra specific categories; Concept of species, genus and family. Systems of classification: Brief study of Artificial (Linnaeus), Natural (Bentham and Hooker) and Phylogenetic (Bessey and Takhtajan) systems. History and development of taxonomy in India. Contributions of pioneers of Indian taxonomy - William Roxburgh, J. D. Hooker and J. S. Gamble. Taxonomical literature: General indices, floras, revisions, manuals, icons, monographs, reviews and Journals. Study of basic principles and recent Angiosperm Phylogeny Group (APG) system of classification.

MODULE II: Plant nomenclature: Brief history on the origin and development of nomenclature; Contents and major provisions of latest International Code of Nomenclature for algae, fungi, and plants (ICN) - Author citation, Typification and different kinds of types, Effective and valid publication of names, Principle of priority and its limitations, Conservation of names, Names of hybrids. Definition of nomenclature terms- autonym, homonym, basionym, tautonym and nomen nudum. A very brief account on International Code of Nomenclature of Cultivated Plants (ICNCP)

Module III: Herbarium & Botanical Garden- Definition, techniques involved in the preparation of herbarium, utility of herbarium and their maintenance. General account of national and regional herbaria - Central National Herbaria, Calcutta (CAL) Madras Herbarium (MH), Botanical Survey of India (BSI). Construction of taxonomic keys (indented and bracketed) and its utilization.

Botanical garden and its importance in taxonomic studies. Important National and International Botanical gardens - Royal Botanical Garden, Kew; Indian Botanical Garden, Calcutta; National Botanical Garden, Lucknow and Tropical Botanical Garden, Trivandrum. Role, organization and achievements of Botanical Survey of India.

MODULE IV: Biosystematics – Turesson's concept and categories. Trends in plant taxonomy – i. Cytotaxonomy ii. Chemotaxonomy iii. Numerical taxonomy iv. Molecular taxonomy v. Phylogenetic systematics - basic principles. Current ideas on the origin of angiosperms - Bennettilean, Pteridospermean and Caytonialean ancestry.

Study of the following angiosperm families giving importance to morphological peculiarities, if any. Special emphasis should be given on morphological and phylogenetic interrelationships, recent revisions and rearrangements between and within the families and its critical analysis.

Ranunculaceae	Magnoliaceae	Capparidaceae	Polygalaceae
Caryophyllaceae	Portulacaceae	Dipterocarpaceae	Malvaceae
Rhamnaceae	Vitaceae	Sapindaceae	Leguminosae
Combretaceae	Rhizophoraceae	Myrtaceae	Melastomataceae
Passifloraceae	Cucurbitaceae	Apiaceae	Rubiaceae
Asteraceae	Sapotaceae	Oleaceae	Asclepiadaceae
Boraginaceae	Solanaceae	Scrophulariaceae	Acanthaceae
Verbenaceae	Lamiaceae	Amaranthaceae	Aristolochiaceae
Piperaceae	Lauraceae	Loranthaceae	Euphorbiaceae
Urticaceae	Orchidaceae	Scitaminae	Amaryllidaceae
Liliaceae	Arecaceae	Araceae	Cyperaceae
Poaceae.			

MODULE V: Economic Botany-Detailed study of the occurrence, morphology of the useful part and uses of the following crop plants with their botanical details.

a) Cereals and Millets: Rice, Maize and Ragi.

b) Pulses: Soybean, Horse gram.

c) Sugar yielding plants: Sugarcane.

d) Plantation crops: Coconut, Cocoa, Coffee, Tea and Rubber.

e) Spices and condiments: Pepper, Ginger, Turmeric, Cardamom and Nutmeg.

e) Tuber crops-: Potato, Sweet potato, Taro and Tapioca.

f) Fruits: Mango, Banana, Citrus, Guava, Cashew nut and Jack fruit.

g) Vegetables: Brinjal, Cucumber, little gourd, Bitter gourd, Winged bean and Sword bean.

h) Medicinal plants: Sarpagandha, *Vinca*, *Glycirrhiza*, *Adhatoda* and *Andrographis*.

i) Narcotics: Cannabis, Opium.

j) Timber yielding plants: Rose wood, Teak Wood.

MODULE VI: Ethnobotany- Plants and civilization. Ethnobotany- relevance in Modern medicine. Ethnic societies of Kerala and their traditional herbs. Methodology and documentation of ethnobotanical research. Medicines derived from herbal drugs. Status of ethnobotanical studies in Kerala. Contributions of S. K. Jain and E. K. Janaki Ammal. Relevance of IPR in Ethnobotany.

PRACTICALS

1. Study of representative members of all the prescribed families as evidenced by record of practical work (to be submitted during the practical examination).
2. Identification of fresh specimens using flora and other supportive documents like monographs.
3. Visit to a recognized herbaria (The report of the same should be submitted separately).
4. Field work for familiarizing the local flora under the supervision of teachers, and documentation of the proceedings.
5. Study tour of minimum three days should be conducted to biodiversity rich zones of Western Ghats, for familiarizing the floristic wealth (The report of the same should be submitted for evaluation).
6. Preparation of dichotomous key (minimum 5 keys).
7. A minimum of 10 abbreviations of authors' names to be presented in the record.
8. Expansion of 10 floral formulas.
9. Exercises in nomenclatural citations and solving nomenclatural problems (At least 10).
10. A minimum of 50 herbarium specimens giving representation of minimum of 40 families to be submitted for valuation
11. Identification of economically important plants and plant parts, and submission of five botanical specimens/ products of economic importance

LEARNING RESOURCES:

REFERENCES

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Model Question Paper

DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS 3) Biodiversity Conservation
BDC-CC-531. Angiosperm Taxonomy, Economic Botany and Ethnobotany

Time: 3 Hours **Max. Marks: 40**

I. Answer the following questions.

1. Which is the binomial of Nutmeg
2. What do you mean by the Latin term *nomina conservanda*?
3. Which is the native place of Ooralikuruma'tribes in Kerala?
4. What is Linnaean hierarchy?
5. Expand KIRTADS.
6. In which family teak is included as per APG11 classification?
7. Write Botanical name and ethnomedicinally useful part of Arogyappacha.
8. What is the morphology of coconut milk?
9. What is the characteristic inflorescence type in Lamiaceae?
10. What are condiments? **(10x1=10marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Mention the use of dendrograms in evolutionary taxonomy.
12. What do you mean by Ethnotaxonomy and ethnoecology?
13. What is double citation in taxonomy? Give an example
14. Name the binomial of two ethnomedicinal herbs and the drugs obtained from them
15. Name an eminent Indian ethnobotanist. Mention his/her important contribution.
16. Describe the special type of pollination mechanism and adaptation seen in grasses.
17. Point our significance of IPR in ethnobotany. **(5X2= 10 marks)**

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Discuss the role of BSI in the floristic and conservation studies in India.
19. Write a short essay on molecular evolution.
20. Critically evaluate the present status and need of ethnobotanical documentation in India
21. Describe with examples the advanced features seen in family Poaceae and Orchidaceae.
22. Mention the primitive features of the families Ranunculaceae and Magnoliaceae with suitable examples.
23. Prepare a model questionnaire for analyzing ethnomedicinal uses of herbs used by tribal people in Kerala **(4X3= 12 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

24. Write an essay on modern concepts and trends in Plant Taxonomy.
25. Write an essay on the ethnic societies of Kerala and medicines derived from their traditional herbs. Add notes on their uses. **(1X8= 8 marks)**

SEMESTER III	Course Code: BDC- CC- 532	Credits: 4

NAME OF THE COURSE: FOREST BOTANY AND PHYTOGEOGRAPHY

Course Outcomes (CO)

CO1: Identify the different types of forest ecosystems and phytogeographical zones.

CO2: Analyse the relationships of soil, climate and vegetation in India.

CO3: Gain knowledge about forestry practices and dynamics

CO4: Analyse the applications of remote sensing in ecosystem management.

CO5: Acquainted with different vegetation types and geological history

CO6: Familiarize with important non-wood forest products

COURSE CONTENT

MODULE I: Forests- definition, General account on the forests of the world and India. Forest Types: Central characters and distribution of the different forest types of India with special emphasis to the Western Ghats. Forest products – Major and minor with reference to state of Kerala, different types of ecosystem services and their significance, sustainable use of bioresources

MODULE II: Influence of forest on environment**:** Climate of India, different climatic regions of India; Climate change and Forestry: Impact of climate change on forests, adaptation of trees to climate change. Forest Effects- General effects of forests on climate, control of runoff, effects on snow, soil erosion, wild life, pollution control, nutrient cycling, social values and ecotourism, economic values, floods, green belts and control of temperature

MODULE III: Forestry practices and dynamics: Forest - community interaction, disturbances and succession, Gap dynamics. Forest Protection - Causes and control of forest fires; Major diseases of forest plants. Forest Laws and Forest Conservation: Salient features of the Indian Forest Act 1972 (preliminary, reserved forests, protected forests), different methods employed for conservation of forests. Forest regeneration, tending, thinning, pruning and harvesting. Social forestry- social land allocation programmes (Taungya system). Economic benefits of social forestry. Agroforestry: Role in- soil conservation, soil restoration, conservation of biodiversity.

MODULE IV: Phytogeography **–** Definition, Phytogeographic regions of the world (Vegetational belts). Principles governing the static and dynamic plant distribution, different types of distribution of vegetations on the earth, continuous and discontinuous distribution.

s**MODULE V**: Geological history and evolution of plant life- Factors of plant distribution. Theories concerning present and past distributions-continental drift, glaciations, existence of land bridges and their effect on plant distribution.

MODULE VI: Soil, climate and vegetation of India - climate, vegetation and botanical zones of India, role of precipitation and temperature in determining the major types of vegetation and endemism in India. Remote sensing: Definition and data acquisition techniques. Application of remote sensing in vegetation classification, understanding the key environmental issues and ecosystem management.

PRACTICALS

1 Collection, identification and submission of non-wood forest products

2 Report on different vegetation types (minimum two)

3 Notes on Diseases of forest plants (any four)

LEARNING RESOURCES:

REFERENCES

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Model Question Paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS 3) Biodiversity Conservation
BDC-CC-532 Forest Botany and Phytogeography

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. What is a green belt?
2. What is the Taungya system of social forestry?
3. What is a glacier?
4. Define the term phytogeography.
5. Name states in India through which the Western ghats passes.
6. What is discontinuous plant distribution
7. Name two endemic plants from India.
8. What is continental drift?
9. What is ecotourism?
10. Define 'gap dynamics' in forests **(10X1= 10 marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Enlist difference between static and dynamic plant distribution?
12. Differentiate rare and exotic species?
13. What is forest effect?
14. What are the salient features of the Indian Forest Act, 1972.
15. Give an account on the forests of India
16. What are the factors that determine distribution of plant life on earth?
17. Discuss how the tribes undertake sustainable use of bio-resources. **(5X2= 10 marks)**

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Discuss the role of precipitation and temperature in determining the major types of vegetation in India
19. Explain the utility of laws implemented for the protection of trees in forests.
20. Write an account on the major and minor produce and other ecosystem services offered from the forests of Kerala
21. Highlight the difference between social forestry and agro-forestry. Enumerate the economic returns from each system
22. State the theories that govern the process of past and present plant distributions on earth
23. Describe the relation between soil types and vegetation in India. **(4X3= 12 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

24. What are the different forest types in the world? Discuss the impact of climate on forests and forests on the climate.
25. Explain briefly about the biogeographical zones of India giving emphasis to the corresponding plant distribution and evolution **(1X8= 8 marks)**

SEMESTER III	Course Code: BDC- CC- 533	Credits: 4

NAME OF THE COURSE: CONSERVATION OF NATURAL RESOURCES AND POLICIES

Course Outcomes (CO)

CO1: Discuss the basic concepts of global frame work, acts and policies in natural resource management.

CO2: Familiar with major activities of different committees and Biodiversity Board / BMC, NGO's with special reference to Biodiversity conservation in Kerala state.

CO3: Acquainted with National and International organizations and NGOS with special reference to UN and specialized agencies, institutional regulatory bodies and authorities.

COURSE CONTENT

MODULE I: Introduction: Legal and political environments in resource management. Global and localgovernance, challenges of good governance. Ostrom design principles and basic frameworks,organizational structure and stakeholders in NRM and livelihood. Natural Resource Governance in rapidly changing world. Local utilization and institutions: Joint Forest Management Committees (JFMCs), watershed committees, irrigation committees, Forest Rights Act (FRA) committees, NBA, State Biodiversity Boards, Biodiversity Management Committees (BMCs).

MODULE II: Overview of legal policy instruments in Natural Resource Management: National Forest Policy of 1988, National Environment Policy of 2004, National Conservation Policy, National Action Plan on Climate Change of 2008, and Coastal Protection Act. Wildlife Protection Act of1972, Forest Protection Act of 1980, Environment Protection Act of 1986, ICZM-Indian Coastal zone management, Water Act, 1981. Gadgil report and Kasturi Rangan Report.

MODULE III: Biological Diversity Act of 2002 and Rule 2004, Forest Rights Act of 2006. Green Tribunal Act, 2009. The precautionary principle and common responsibilities. On-Timber Forest Products (NTFP) related policies and other acts: (PESA 1996, FRA2006), sustainable harvesting rules of MP, Nistar Rights in MP and Chhattisgarh, product specific policies, taxation, Institutional/Organizational Arrangements.

MODULE IV: NTFP Deregulation, Policy of Odisha. Conflicts in resource management: Resource management planning, protecting traditional knowledge, Significance of PBR, customary laws and practice related to traditional knowledge, implications for access benefit sharing.

MODULE V: International and National efforts by Non-Governmental organizations on resource management**:** CITES and other international treaties and conventions, roles of international

organizations and NGOS with special reference to UN and specialized agencies, institutional regulatory bodies and authorities: direct intervention by the state, green business and green ethics, stakeholder analysis,

MODULE VI: Resource management- understanding and managing governance issue, governance tactics and tools, CSR (Corporate Social Responsibility) as a tool for sustainable NRM based business. Case studies about corporate social responsibility. Corporate social responsibility (CSR)-NRM based CSR action -E-governance - Climate change and corporate responses.

PRACTICALS

1. Preparation of Biodiversity Register of any locality
2. Preparation of report on the activities of any Biodiversity Board / BMC
3. List out the major activities of NGO's with special reference to Biodiversity conservation in Kerala state.

REFERENCES

LEARNING RESOURCES:

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- Knight, Richard L., editor, et al. (1995). A New Century for Natural Resources Management. Island Press.
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Model Question Paper

DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS 3) Biodiversity Conservation Examination
BDC-CC-533 Conservation of Natural Resources and Policies

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. What is green tribunal act?
2. What is the role of NBA?
3. When did Forest protection act came into force?
4. What do you mean by ICZM?
5. Name any two non-timber forest products
6. What do you mean by traditional knowledge?
7. Name two endemic plants from India.
8. What are natural resources?
9. What is E-governance?
10. Expand CITES **(10X1= 10 marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Enlist the significance of BMC's?
12. What are the salient features of the Indian Forest Act, 1972.
13. Give an account on Kasturi Rangan report
14. What are the implications of access & benefit sharing?
15. Describe the role of National action plan on climate change for the sustainable management
16. List out any two Non-Government organizations for natural resource management
17. What do you mean by corporate social responsibility **(5X2= 10 marks)**

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Distinguish between forest right act and forest protection act?
19. Write an account on natural resources
20. What do you mean by green ethics? Describe its significance in natural resource management
21. List out any two international agencies and their role in conservation of natural resources
22. Describe the role of local institutions in natural resource management by citing an example
23. Describe the procedure for the preparation of PB Register. **(4X3= 12 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

24. Give an account on legal policies and acts for the conservation and management of natural resources at national level
25. Discuss the social and corporate responsibility on natural resource management and conservation

(1X8= 8 marks)

SEMESTER III	Course Code: BDC- CC- 534	Credits: 4

NAME OF THE COURSE: MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Course Outcomes (CO)

CO1: Know the basic concepts of Molecular Biology and Biotechnology

CO2: Familiarize the techniques in genetic engineering, gene sequencing and gene expression studies.

CO3: Acquainted with the methods and applications of plant and animal biotechnology.

CO4: To gain the skill of performing tissue culture and molecular works in laboratory.

COURSE CONTENT:

MODULE I: Molecular Biology- Basics in molecular biology, The RNA World. Molecular Clock, DNA Topology- Twist and Writhe. Supercoiling. Proteins involved in DNA Replication, Telomere and Telomerase. Protein Folding. Role of Molecular Chaperones. Isolation and purification of RNA, DNA (genomic and plasmid), different separation methods.

MODULE II: Techniques in Molecular Biology- Polymerase chain reaction (PCR) Procedure and Components Types of PCR i) inverse PCR. ii) Rapid amplification of cDNA ends (RACE) iii) Real-time quantitative PCR. PCR applications DNA cloning. Cutting and joining DNA Molecules, Restriction endonucleases, Cloning vectors-features. Restriction digestion and ligation; Restriction mapping. Plasmids, Cosmids, Bacteriophage vectors;, Phagemids, Yeast artificial chromosome(YAC), Bacterial artificial chromosome (BAC) and P1 phage vectors. Selection and analysis of cloned DNA sequences.Generation of genomic and cDNA libraries.

MODULE III: Gene Sequencing and Gene Expression - Sequencing genes and short stretches of DNA including Sanger dideoxy sequencing and Next Generation Sequencing (NGS brief account only). In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms. Protein sequencing methods, detection of post translation. Modification of proteins. Foot Printing Assay. Methods for analysis of gene expression at RNA and protein level, large scale expression such as micro array based techniques. Molecular markers - RFLP, RAPD and AFLP techniques. Blotting techniques Sothern, Western, Northern and Dot Blot. Labelling of Nucleic acids. New Trends in Gene modification:- CRISPER/CAS System.

MODULE IV: Plant Biotechnology- Defining scope and impact of biotechnology- an overview. Plant tissue culture techniques: Choice of explant, culture media and culture conditions, hormonal regulation of growth and differentiation, micropropagation; shoot tip, nodal segment, meristem cultures: callus culture, callus mediated organogenesis, cell suspension culture, cell line selection, Somaclonal and Gametoclonal variations. Genetic basis. Applications. Somatic embryogenesis. Artificial seeds. Applications. Protoplast culture, Somatic hybridization and its impact on plant breeding. Use of protoplasts in genetic transformations. Haploid production: anther and ovule culture. Dihaploids and polyhaploids. Applications. Production of secondary metabolites. Cell immobilization. Bioreactor technology. Cryopreservation Technology- In-vitro strategies for conservation of germplasm.

MODULE V: Genetic engineering: Methods and applications. Applications of gene cloning techniques in plants. Gene targeting and sequence tags. Methods of gene transfer in plants. Agrobacterium and CMV mediated gene transfer; direct gene transfer using PEG, microinjection, electroporation, microprojectile (biolistics) method, liposome mediated DNA delivery, Transposons as vectors. Application of Plant Biotechnology: - Transgenic plants -Traits for improved crop production. Field testing of transgenic plants. Herbicide Resistance, Vaccines for Plants, Genetic Pesticides, Pathogen resistance Molecular farming of antibodies in plants and Enhanced Nutrition. Technique and Controversy of Terminator Gene Technology Genetically modified organisms and foods (GMO/GMF) - Social and ethical considerations. IPR issues. Patents. Biopiracy

MODULE VI: Animal Biotechnology-Objectives of gene transfer in animals Gene constructs. Transfection methods- calcium phosphate precipitation, DEAE-Dextran mediated transfection, microinjection, stem cell mediated gene transfer- Embryonic stem cell transfer, targeted gene transfer, trans gene integration, recovery of genes transferred into animals cell, expression of cloned proteins in animal cells, detection of transgene function. Current status of transgenic animal production-Applications in the pharmaceutical industry, targeted production of pharmaceutical proteins, drug production, specific proteins- insulin, somatotropin,vaccines, genetically engineered hormones, to increase milk yield, meat production; genetic engineering of livestock and developing animals specially created for use in xenografting. Bioethics: Animal welfare and ethics.

PRACTICALS

1. Isolation and purification of genomic DNA.
2. Demonstration of electrophoresis – Horizontal and Vertical
3. Isolation of total RNA (Demonstration only).
4. Isolation and Partial Purification of Proteins.
5. Preparation of culture medium (MS, N&N, SH, B5), sterilization and inoculation.
6. Shoot multiplication, Callus culture and organogenesis of important crops/medicinal plants/ornamentals.
7. Isolation and estimation of genomic DNA, Primer design, PCR, cDNA synthesis
8. Demonstration of Agarose gel electrophoresis.
9. Encapsulation of seeds/embryos in calcium alginate

REFERENCES

LEARNING RESOURCES:

- Abdin M.K., Kiran U. Kamaluddin & Ali, A. (2017). Plant Biotechnology: Principles and Applications. Springer.
- Alberts, B. (2018). Molecular biology of the cell.
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1. www.moef.nic.in
2. bch.cbd.int/database
3. www.ncbi.nlm.nih.gov
4. www.csu.edu.au
5. http://www2.le.ac.uk
6. https://swayam.gov.in
7. http://www.protocol-online.org
8. http://www.bioethics.net/
9. https://www.microbes.info/

Model Question Paper

DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc (CSS 3) Biodiversity Conservation Examination
BDC-CC-534 Molecular Biology and Biotechnology

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. What is PCR?
2. What do you mean by *invitro* mutagenesis?
3. Define micropropagation?
4. What is somatic embryogenesis?
5. Mention significance of xenografting?
6. What do you mean by microinjection?
7. Name an *invitro* strategy for conservation of germplasm
8. What are restriction endonucleases?
9. What do you mean by gene knock out?
10. Name two *invitro* culture techniques for the production of secondary metabolites

(10X1= 10 marks)

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. How can you ditinguish plasmids from cosmids?
12. Describe the synthesis of artificial seeds.
13. Critically analyse the significance of terminator gene technology
14. "Somaclonal variations have advantages and disadvantages" Explain?
15. What is cell suspension culture?
16. What do you mean by next generation sequencing?
17. Distinguish between AFLP and RFLP **(5X2= 10 marks)**

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Give an account on CRISPER/CAS System.?
19. Describe the methods used for gene transfer in animals
20. Describe the methods and applications of blotting technique
21. What are the applications of haploid culture? Explain how haploid plants can be produced?
22. Describe the procedure for the construction of genomic library
23. Describe the significance of Somatic hybridization in plant breeding **(4X3= 12 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

24. Describe the scope and applications of Plant biotechnology
25. Enlist and explain the methods for the analysis of gene expression at RNA and protein levels

(1X8= 8 marks)

SEMESTER III	Course Code: BDC- DE- 535	Credits: 2

NAME OF THE COURSE: REMOTE SENSING APPLICATIONS AND GIS

Course Outcomes (CO)

CO1: Gain knowledge in various remote sensing signals, processes and sensors.

CO2: Analyse spectral characteristics and data

CO3: Discuss digital data processing and GIS

CO4: The students get introduced with various GIS software, analysis and get an insight on application of GIS in various fields for the welfare of human.

COURSE CONTENT

MODULE I: Fundamentals of Remote Sensing- Definition, Electromagnetic spectrum, Interaction with atmosphere-Reflection and scattering of EM radiation, Sensing- Visible, near infrared, thermal & microwave sensors- Multispectral scanner, Thematic mapper, Spectral bands, High resolution Visible Imaging System, Linear imaging self-scanning system.

MODULE II: Space Platform for remote sensing- Ground based platforms, airborne platforms, Space borne platforms, geostationary satellites, and Sun synchronous satellites, Instantaneous Field of View, Spatial, Spectral, and Radiometric& Temporal Resolution. Satellites-Polar & geostationary, Sensors & Resolution, Indian Satellites, Spectral characteristics, Present satellites- atmospheric and terrestrial studies- data acquisition from satellites, preprocess.

MODULE III: Remote sensors- Classification of Sensors- on the basis of source of energy used,on the basis of function of sensors,on the basis of technical components of the system.Function of remote sensing.

MODULE IV: Image Processing- Fundamentals of Digital Image Processing, Processing Techniques- Structure of a digital image, Image display processor. Data preprocessing-digital techniques, restoration, enhancement, band rationing, stretching, convolution and rotation, contrast enhancement, thresholding-different output formats, Image enhancement techniques. Pattern recognition for remote sensing, Spatial information system.

MODULE V: Geographical information system- Development of GIS, Components of geographical information system, GIS software modules, Geographical data, Representation of topographical data, Comparison between vector & raster methods, Function of GIS.

MODULE VI: Remote Sensing Application to Forestry & Environment- Introduction, Loss of biological diversity, Biosphere reserves, The present issues on environment, Ecologically Hot Spot

Areas, Marine environment, Wetland environment, Degradation of Ecosystems, Forestry-Forest cover mapping & Surveillance, Forest Type Mapping, Identification and Mapping of Major Forest Plantations, Forest Stock Mapping, Monitoring of Deforestation and Afforestation, Grassland Mapping. Coastal vegetation, Wildlife habitat Assessment, Wastelands, Desertification. Use of space technology in Disaster Warning/Mitigation, Geosphere-Biosphere studies.

LEARNING RESOURCES:

REFERENCES

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ONLINE RESOURSES:

- htpp://chesapeke,/towson.edu/vermiz?priciples asp
- http://rst.gsfc.nasa.gov
- http://www.eduspace.esa.in.educ.com
- http://www.star.nesdid.noaa.giov/smcd/opdb/tutorial/into.html
- http:www.colorado edu/geography/gcraft/notes

Model Question Paper

DEPARTMENT OF BOTANY

UNIVERSITY OF KERALA

M.Sc. (CSS3) Biodiversity Conservation Examination

BDC-DE-535 Remote Sensing Applications (Elective)

Time: Three hour **Maximum marks: 60**

I. Answer all questions in one word or sentence

1. Define remote sensing
2. Which region of the EMR spectrum is absorbed by the chlorophyll in green vegetation?
3. What is signature?
4. Which is the major wavelength range used for remote sensing?
5. What is radiance?
6. Name one Indian satellite.
7. What is GIS?
8. What is a platform?
9. Name a biosphere reserve in India.
10. Expand SPOT. **(10X1= 10 marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Write a short note on multi spectral remote sensing.
12. Explain briefly on non-imaging sensors.
13. What are different types of remote sensing based on function of sensors?
14. Differentiate between thermal infrared remote sensing (3 -100 µm) and visible and near infrared (0.4 – 2.5 µm) based remote sensing.
15. Give an account on ecological hotspot.
16. What is geometric restoration?
17. Distinguish between microwaves and UV waves. **(5X3= 15 marks)**

III. Answer any *five* of the following. Each answer not exceeding 150 words

18. What are the platforms used for remote sensing? Explain.
19. Briefly explain geostationary orbit.
20. Comment on the present issues on environment.
21. How is passive remote sensing different from active remote sensing?Giveexample.
22. Describe the purpose of principle componentsanalysis.
23. What are the different image enhancement techniques? Explain.

(5X5=25 marks)

IV.Answer any *one* of the following, not exceeding 350 words

24. Explain how is remote sensing applicable in forestry?
25. Write a note on image transformation in digital image processing.

(1X10= 10 marks)

SEMESTER III	Course Code: BDC- DE- 536	Credits: 2

NAME OF THE COURSE : CLIMATE CHANGE AND CROP ADAPTATIONS

Course Outcomes (CO)

CO1: Gain knowledge in the basics of climate change and its impact

CO2: Familiarize the environmental issues related to climate change

CO3: Analyse the socio-economic impact of climate change

CO4: Assess different crop management strategies that mitigate the impact of climate change

COURSE CONTENT

MODULE I: Introduction to Climate Change- Greenhouse gases and alteration of climate. Abiotic changes and its consequences. Effects on biotic interactions: Responses of populations, species and ecosystems to climate change, the ozone layer and climate change.

MODULE II: Environmental issues of climate change- Effects of Global warming on aquatic and terrestrial ecosystem of India with particular reference to Western Ghats. Action plans to reverse the Climate Change**.**

MODULE III: Socio-economic aspects of climate change impacts: Environmental pollution and associated hazards to animals and humans

MODULE IV: Ecology and its Relevance-Physical and social environment as factors of crop distribution and production. Agro ecology- cropping pattern as indicators of environment.

MODULE V:. Impact of Climate Change in Agriculture-Impact on soil-soil microbial activity, soil moisture availability and soil degradation. Impact of climate change on soil productivity-increase in temperature, increase in CO_2.Effects of extreme climatic events on yield crops. Impacts of climate change on insects and pests.

MODULE VI: Impacts of Climate Change and Crop Management-Design of crop simulation models, Development of econometric models, Simulation studies for determining the need of agronomic practices in crop production. Role of Genetic engineering in raising stress tolerant crops as part of climate mitigation strategies. Crop ecosystem response to climate change with examples: Rice, Coconut, Tapioca, Cashew, Pulses, Rubber, Spices, Tea & Coffee.

LEARNING RESOURCES:

REFERENCE

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Model Question Paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.Sc. (CSS 3) Biodiversity Conservation Examination
BDC-DE-536 Climate Change & Crop Adaptation (Elective)

Time: Three hours **Maximum marks: 60**

I. Answer all questions in one word or sentence

1. Define ecosystem.
2. What is climate?
3. What is greenhouse effect?
4. What is global warming?
5. What is an aerosol?
6. How do clouds affect the Earth's climate?
7. What is agroecology?
8. What is a biological pump?
9. Define electromagnetic spectrum.
10. Expand CFC

(10x1=10 marks)

II.Answer any *five* questions. Each answers not exceeding 50 words.

11. Explain briefly the use of genetic engineering to develop stress resistant cultivar.
12. Enlist greenhouse gases and explain its effects.
13. What are the main indicators of climate change?
14. Describe the effects of global warming in the aquatic ecosystem
15. What are the components in the climate system?
16. Write a note on biotic interaction of global warming.
17. How is climate change related to soil productivity?

(5X3= 15 marks)

III. Answer any *five* of the following. Each answer not exceeding 150 words

18. What are the remedial measures to reduce the harmful effects of climate change?
19. Briefly explain socio-economic aspects of climate change.
20. Describe briefly the components included in crop simulation studies.
21. Explain the impact of climate change in crop ecosystem response.
22. How do humans have a major impact on the climate change?
23. What is climate –smart agriculture?.
24. 'Climate change will have some good effects', Comment. **(5X5=25 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

25. Write an essay on natural resources, their sustainable management and conservation?
26. Comment on environmental pollution and associated hazards to crops. Suggest some control measures to override the detrimental effects of pollution.

(1X10= 10 marks)

SEMESTER 1V	Course Code: BDC- CC - 541	Credits: 4

NAME OF THE COURSE : ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND AUDITING

Course Outcomes (CO)

CO1: Get knowledge about EI Assessment and analysis

CO2: Familiarize activities of EIA in India

CO3: Identify types of disasters and methods for disaster management

CO4: Get awareness about environmental risk analysis and auditing

COURSE CONTENT

MODULE I: Environmental Impact Assessment (EIA): Definition, purpose and characteristics of EIA; global evolution of EIA; participants in EIA process, stages of EIA and types of EIA. Environmental inventory. Baseline data on EIA- environmental data, project data and project alternative data. Measurement of impact– physical, social, economic, natural; Public participation in environmental decision making; Framework of Environmental Assessment; Description of environmental setting; environmental impact factors and area consideration. Environmental Impact Statement (EIS) and Environmental Management Plan (EMP).

MODULE II: Environmental Impact Analysis: Impact identification and methods of impact identification- adhoc method, checklist, matrix, network, overlay and index methods; impact prediction and predictive methodologies, impact evaluation (assessment) and impact mitigation. Basic steps for the impact identification, prediction and assessment of air, water, noise, vegetation and wildlife environment with case studies.

MODULE III: EIA in India: An overview of history, current procedures, practices and guidelines. EIA of water resource projects, industries, mining and quarrying, highway construction, tourism developments. Basic Concept of Disaster- Definition of hazard, vulnerability, risk, disaster. Causative factors of disaster. Classification of disasters. Hazard Mitigation: Identification of hazard prone belts, hazard zonation and risk assessment; risk reduction in vulnerable areas, developing warning systems, forecasting, emergency preparedness, education and training activities, planning for rescue and relief works.

MODULE IV: Disaster Management: Definition of disaster management; components of disaster management cycle- crisis management & risk management. Crisis management- quick response & relief, recovery, development. Risk management- risk identification and risk assessment, risk reduction- preparedness, prevention and mitigation, risk transfer. Disaster management- act and policy. Important sectors in disaster management- health and medical care, communications, insurance, social work, NGO's, media, fire services, police and paramilitary services, armed forces etc. Levels of disasters in India.

MODULE V: Environmental, Methods, Risk Analysis -: Definition of Environment Audit & its importance for industries. Requirements of Rule 14 for Environmental Audit under Environmental protection Act 1986. Definitions of a. Signatory, b. Consumption Audit, c. Pollution audit, d. Hazardous audit, d. Solid waste audit, e. Disposal audit, f. Cost audit, g. Investment audit, h. Voluntary audit. Need & Definition of Risk Analysis, Identification of risk due to project activities, Cost of alleviation of risk and impact on project cost.

MODULE VI: The areas an environmental audit -Design specification and layout: Resource management: Pollution control systems and procedures: Emergency plans and response/safety system: Confirmation to regulatory requirement: Scope-Types of environmental audits-Objective-based types-(i) Liabilities audit: (ii) Management audit: (iii) Activities audit:- Client-driven types-(i) Regulatory external audit: (ii) Independent external audit: (iii) Internal environmental audit: (iv) Third party audits. General audit methodology-Basic structure of EA-Waste audits and pollution prevention assessments, EA in industrial projects

PRACTICALS

1. Submit a report on the study of impact of quarry/sand mining/hydroelectric project
2. Submit a report on the energy audit in the campus

LEARNING RESOURCES:

REFERENCES.

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Model Question Paper

DEPARTMENT OF BOTANY

UNIVERSITY OF KERALA

M.SC. Degree (CSS4) Biodiversity Conservation

BDC-CC-541 Environmental Impact Assessment and Auditing

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. What is the purpose of EIA?
2. What is hazard zone belt?
3. Define the term matrix
4. What is hazard zonation.
5. Name two methods of environment impact identification
6. Name two types of environmental audit.
7. What is cost audit?
8. What is environmental impact statement?
9. Define the risk analysis
10. Enlsit types warning systems in hazard mitigation **(10x1=10 marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. What are the different sectors in disaster management?
12. What is the difference between crisis management and risk management?
13. Explain the method of matrix in the impact identification?
14. Explain Environmental protection Act 1986..
15. Give an account on environmental inventory
16. What is pollution audit?
17. Discuss the importance of Public participation in environmental decision making

(5X2= 10 marks)

II. Answer any *four* of the following. Each answer not exceeding 150 words

18. Discuss the level of disasters in India
19. Explain the physical method for the measurement of environment impact
20. Write an account on the disaster management act and policy
21. Briefly explain the waste audits and pollution prevention assessments
22. Give an account on pollution control systems and procedures
23. Discuss the framework of environmental assessment. **(4X3= 12 marks)**

IV. Answer any *one* of the following, not exceeding 350 words

24. Give an account on the different types of environment audit and analyze its impact.
25. Explain the steps involved in the impact identification, prediction and assessment

(1X8= 8 marks)

SEMESTER IV	Course Code: BDC- CC- 542	Credits: 4

NAME OF THE COURSE : AGRO BIODIVERSITY AND WETLAND MANAGEMENT

Course Outcomes (CO)

CO1: Familiarize the importance of conservation and management of agro biodiversity and wetlands.

CO2: Discuss the improved agricultural practices for agro biodiversity conservation

CO3: Identify biodiversity in wetlands

CO4: Gain knowledge about Legislation and Policies for wetland management and conservation

COURSE CONTENT

MODULE. I: Agrobiodiversity- definition, agrobiodiversity and food security, key processes influencing agrobiodiversity, needs for agrobiodiversity capacity, global context for agrobiodiversity management- global change and agrobiodiversity, impact of climate change on agrobiodiversity, policies for agrobiodiversity conservation and use, institutional aspects of managing agrobiodiversity, biodiversity today, importance of biodiversity, types of biodiversity, genetic conservation, gene banks, cryo preservation, Loss of biodiversity- threatened, endangered and extinct species. El-nino sensitivity, resource endowment and socio economic characteristics

MODULE II: Genetic resources for food and agriculture, status and trends of agrobiodiversity, agrobiodiversity and livelihoods, traditional knowledge and agrobiodiversity, agrobiodiversity and in situ conservation in ethnic minority communities, environmental services, sustainable management of agrobiodiversity, agrobiodiversity conservation and economic development, strategies for conservation- insitu and ex situ, consequence of technologies and production for the economic and environmental performance of rice based farming system in Kerala

MODULE III: International Food Policy Research Institute (IFPRI), role of FAO to modernize and improve agricultural practices, Seed exchange networks for agrobiodiversity conservation, GM crops pros and cons, diversity of underutilised crops, potential for underutilized crops to improve security of food production, crops for the future, cultivated agrobiodiversity, plant breeding and agrobiodiversity, methods of crop improvement- selection, hybridization, plant breeding, plant introduction, tissue culture, biofortification, bio pesticides, commensalism, predation, scavenging, parasitism, symbiosis, biotic stability, ecological adaptations

MODULE IV: Wetland management: introduction,basic concepts on wetland ecology, definition and classification of wetlands: wetlands as ecosystems and part of river basin, distribution and typology, wetland habitat and ecology, physico-chemical parameters-hydrology and soils. Unusual and extreme

habitats. biodiversity in wetland systems- aquatic organisms- microbes, phyto and zooplanktons, plants, invertebrates and vertebrates. Wetland functions and values, ecosystem services. nutrient cycling in aquatic systems. productivity, trophic states and eutrophication. Freshwater ecosystems management techniques and the conservation of rare species, global wetland outlook: state of the world's wetlands and their services to people.

MODULE V: Wetland protection and legislation, wetlands (Conservation and Management) **r**ules**,** the economics of ecosystems and biodiversity for water and wetlands, wetlands for disaster risk reduction: effective choices for resilient communities, assessing, quantifying and valuing the ecosystem services of coastal lagoons, coastal wetland resilience and vulnerability to sea-level rise, issue of wetlands conservation and management, threat analysis and management Planning: natural and human impacts; major threats to wetlands;. Setting management objectives and priorities. Orders of the Supreme Court and National Green Tribunal regarding wetland conservation in India, wetlands conservation: methods, functions, uses and values.

MODULE VI: Wetland ecology: wetland ecosystem service and restoration, wetlands and people, Lake and watershed management National Wetland Conservation Programme (NWCP), Management of aquatic weeds, monitoring of wetlands, managing hydrology; control of siltation and pollution. Involvement of local communities in conservation of wetlands, wetland conservation: issues and applications, climate-change impacts on natural resources, Wetlands in India: ramsar significance and sites in India, special type wetlands: Myristica swamps, , importance of conservation biology. Wetland policy: National Wetland Rules, Wetland related institutional arrangements: Functioning of Lake Development Authorities. Major Wetlands of the World:Ramsar Convention; Wetland conservation vis a vis other conventions (CBD, CMS. CITES, UNFCCC). Conservation issues of major wetlands of the World.

PRACTICALS

1. Basics on taxonomy and enumeration of Phyto and Zooplanktons.
2. Field study on revival and restoration of Wetlands: Field visit to a Wetland in India (Any Ramsar site) to study restoration and revival efforts. Submission of the report.
3. Germplasm collection of major agricultural crops (minimum two from each categories)
   a) Cereals: Rice, Wheat
   b) Pulses: Green gram, Black gram, Horse gram, Sword bean
   c) Vegetables: Capsicum, Ladies finger
   d) Underutilised crops: wild edible fruits, vegetables
   e) Oil seeds: Sesame, Sunflower, Castor
4. Wetland Ecosystem - spot identification
5. Hybridization in any crop species

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LEARNING RESOURCES:

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Model Question Paper
UNIVERSITY OF KERALA
DEPARTMENT OF BOTANY
M.SC. Degree (CSS4) Biodiversity Conservation
BDC-CC- 542. AGROBIODIVERSITY & WETLAND MANAGEMENT

Time: 3 Hrs. **Maximum: 40 Marks**

I. Answer all questions in one word or sentences

1. Define agrobiodiversity
2. What is IFPRI?
3. How to define a wetland?
4. Mention any two GM crops
5. What are genebanks?
6. What is NWCP?
7. What is El-nino sensitivity?
8. Point out causes of eutrophication?
9. What is biofortification?
10. Name two major wetlands in India **(10X1=10marks)**

III. Answer any five questions. Each answer not exceeding 50 words

11. Brief account on the key process involved in agrobiodiversity conservation
12. Explain the role of ethnic communities in agrobiodiversity conservation
13. Differentiate commensalism and predation
14. Brief account on the basic concepts of wetland ecology
15. Mention the ecosystem services of coastal lagoons
16. What are the important functions of Indian Lake Development Authorities?
17. Briefly explain the National wetland rules **(2X5=10marks)**

III. Answer any four of the following. Each answer not exceeding 150 words

18. Explain the impact of aquatic weeds in water shed management. Point out possible mitigation strategies
19. Explain the values of wetlands in biodiversity conservation
20. Write an account on world wetland outlook. Give your opinion on how legislation help to protect wetland.
21. Explain the importance of underutilised crops in agrobiodiversity and design a strategy for the sustainable utilization
22. Write an account on conservation strategies and crop production
23. Explain the impact of climate change on agrobiodiversity **(3X4=12marks)**

IV.Answer any one of the following. Each answer not exceeding 350 words

24. Write an essay on plant breeding and agrobiodiversity. Develop a solution for protection of Agribiodiversity
25. Describe the major issues for the conservation of global wetlands and explain the importance of ramsar and other conventions in wetland conservation **(8X1=8marks)**

SEMESTER IV	Course Code: BDC- CC- 543	Credits: 4

NAME OF THE COURSE : COASTAL AND MARINE DIVERSITY AND CONSERVATION

Course Outcomes (CO)

CO1: Know about the coastal and marine ecosystem, and importance of conservation

CO2: Identify the threats of marine biodiversity and provide conservation and management strategies

CO3: Use legislation for the protection of biodiversity

CO4: Develop skill for identification of coastal and marine organisms

COURSE CONTENT

MODULE I: Coastal Zone Diversity and Conservation - Coastal resources management programme - Integrated Coastal Zone Management - need, scope, potentials and constraints for ICZM. Coastal settlements - human impacts on the coastal zones with special emphasis on artisanal fishing, coastal aquaculture and coastal tourism. Coastal vulnerability - mangroves, wetlands, sand dunes, sea-grasses, lagoons and enclosed seas, islands, coral reefs and other protected areas, , mangroves-distribution, ecological features, importance and uses of mangroves. Coastal ecosystem monitoring. Effect of port activities and coastal pollution on mangroves, corals and beaches. Role of national and international agencies for coastal and Ocean management. GIS and remote sensing for ICZM. Coastal information management & communication - Basic Principles.

MODULE II: Introduction To Marine Biodiversity- Sea and Oceans - Physcio chemical properties and biogeochemical interactions. Understanding the marine biodiversity and conservation, divisions of biodiversity, keystone species, Umbrella species, indicator species, flagship species, values of biodiversity, ecosystem functioning, world's marine biological diversity, marine hot spots-cold seeps, hydrothermal hotspots, marine biosphere reserves and their importance in India and abroad.

MODULE III: Benthic Floral Components- Seaweeds-classification, occurrence, economic importance, sea grass and salt marshes distribution, their role in coastal ecosystems, algal blooms: Nekton oceanography: Nektonic crustaceans, cephalopods, marine reptiles, seabirds, marine mammals-cetaceans, sirenians, pinnipedes, importance of marine mammals, Benthic Faunal Community Zonations-rocky shores, sandy shores, estuaries and kelp forest, marine sponges-their types and importance, Cnidarians-classification, coral reefs-structure, distribution and limiting factors

MODULE IV : THREATS TO MARINE BIODIVERSITY : Threats to Biodiversity in special ecosystems with reference to mangroves and coral reefs. Species extinction, vulnerability to extinction, habitat destruction- in coral reefs and mangroves, habitat degradation, habitat fragmentation, maximum sustainable yield (MSY), alien species, diseases, global climate change and

impact on marine biodiversity-coral bleaching, ocean acidification. Marine Pollutants: Types, sources and ecological effects on marine environment – Sewage, heavy metal, pesticide, oil, nuclear, thermal and plastic pollution. Ecological impact of pollutants on marine organisms. Effect of mining and dredging operation on marine environment.

MODULE V : Conservation Strategies- Importance of conservation, IUCN and their importance, various conservation strategies- germplasm banks, cryopreservation, marine protected areas, sea ranching, mesh size regulation, TED, fishing holidays, conservation and development at national and international level. Coastal and ocean resource management - endangered coastal biota, marine biosphere reserves and marine parks

MODULE VI: Conservation Policies And Legislations- Various legislations and regulations in conservation of marine biodiversity-the role of MoEn & F in conservation, Ministry of Environment Forest and Climate change in conservation, MOES and COMAPS, remote sensing and GIS for Ocean management, NGO's involvement in conservation and various case studies related to coastal marine conservation science and policy with reference to Indian maritime states. United Nations Convention on the Law of the Sea (UNCLOS), International Convention for the Prevention of Pollution from Ships (MARPOL).

PRACTICALS:

Phytoplankton- identification of common forms
Identification of common zooplankton
Collection and identification of locally available seaweeds, seagrasses, mangroves and preparation of herbarium
Seaweeds-identification of commercially valuable groups
Mangroves-identification of common species
Coral reef and associated organisms
Field visit to intertidal environments/ estuaries and Mangroves/ Marine Biosphere Reserve/ coastal zones.

REFERENCES:

LEARNING RESOURCES:

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Model question paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
M.SC. Degree (CSS4) Biodiversity Conservation
BDC-CC- 543 Coastal and Marine Diversity and Management

Time: Three hours **Maximum marks: 40**

I. Answer all questions in one word or sentence

1. What are keystone species?
2. Mention importance of sand dunes
3. What are lagoons?
4. Write about Umbrella species
5. What are the causes of coral bleaching?
6. Define threatened species
7. List our significance of Marine parks
8. Explain MARPOL
9. Explain ICZM
10. 'Hydrothermal hotspots**'.** Mention the significance **(10X1= 10 marks)**

II. Answer any *five* questions. Each answers not exceeding 50 words.

11.Explain marine hotspots with an example
12.Explain divisions of biodiversity
13. Write about Nektonic crustaceans
14 Write a note on effect of mining on ocean ecosystem
15.Write about UNCLOS
16.Write an account on endangered coastal biota
17.Explain ecosystem functioning **(5X2= 10 marks)**

III. Answer any *four* of the following. Each answer not exceeding 150 words

18.Oceans have critical role in biogeochemical cycles. Substantiate.
19.Write a note on marine biosphere reserve citing examples.
20.Explain impact of pollution in ocean ecosystem. Give recommendations to reduce pollution
21.Write about importance of coastal zone regulation
22.Explain importance of coral reefs. Hy they are called as keystone species.
23.Mention importance of GIS and remote sensing in ocean management

(4X3= 12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24.Explain conservation strategies to be adopted for protection of coastal ecosytem
25.Write about Benthic flora with the characteristic features **(1X8= 8 marks)**

SEMESTER IV	Course Code: BDC- D- 544	Credits: 4

NAME OF THE COURSE : DISSERTATION

Course Outcomes (CO)

CO1: Develop the skill for identification of research problems and design suitable experiments

CO2: Gain the capability to observe, analyse and interpret the results obtained and conclude.

CO3: Understand the methodologies to be adopted for scientific research and publication

CO4: Develop creative ideas/ strategies for the conservation of natural resources/ biodiversity

CO5: Conserve and sustainably utilize natural resources

CO6: Disseminate the ideas of conservation to community and participate in biodiversity registry.

SEMESTER I- IV	Course Code: BDC- GC- 501	Credits: 2

NAME OF THE COURSE : GERMPLASM CONSERVATION

Course Outcomes (CO)

CO1: Identify the threats and conservation strategies of biodiversity

CO2: Assess the importance and conservation measures of sacred grooves and wetland ecosystem

CO3: Analyse ex situ and in situ germplasm conservation strategies.

COURSE CONTENT

MODULE I: Introduction, Definition, Genetic diversity, Species diversity, Ecosystem diversity: Structural and functional aspects. Bio-geographic classification of India. Basic concepts of conservation biology, history of conservation biology, the value of biodiversity and conservation

MODULE II: Threats to Biodiversity: Habitat loss, pollution, species introduction, global climate change, overexploitation, poaching of wildlife. Rare species, genetic diversity of rare species, habitat loss and fragmentation. Extinction: mass extinction, extinction process, ecosystem degradation, over exploitation, invasive species. Endangered and endemic species of India

MODULE III: Conservation strategies:- *In-situ* biodiversity conservation - conservation of species within their natural habitats. Wild sanctuaries, protected areas, national parks Biosphere reserve, Wild life sanctuaries in Kerala. Biosphere reserve and National parks in India.

MODULE IV: Sacred Grooves and Wetlands- Sacred groves- significance, important sacred groves in Kerala, Socio economic aspects of sacred groves. Wetlands and Ramsar sites. Important wet lands in India. Economic benefits of wetlands. Myristica swamps and its importance, myristica swamps in Kerala. Mangrove ecosystems and its economic importance.

MODULE V : Ex-Situ conservation methods- Zoo and Botanical garden, seed bank, in vitro bank, pollen bank. Captive breeding of animals and artificial propagation of plants, with possible reintroduction into the wild

MODULE VI: Germplasm Storage and Cryopreservation - Conservation of germplasm, *In vitro* strategies, short, medium and long term (cryopreservation) preservation, application, techniques of cryopreservation, choice of material, preculture, cryoprotection, freezing, thawing, reculture, vitrification, encapsulation, dehydration, determination of survival and viability, plant growth and regeneration, applications of cryopreservation, Cryopreservation of vegetative propagated and recalcitrant seed species, Large-scale utilization of cryopreservation for germplasm conservation, cryopreservation-progress and prospects.

LEARNING RESOURCES:

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Model Question Paper

DEPARTMENT OF BOTANY

UNIVERSITY OF KERALA

M.Sc. (CSS) Degree Examination

BDC-GC-501 Germplasm Conservation (Generic Course)

Time: Three hours **Maximum marks: 60**

Answer all questions in one word or sentence

1. Define species diversity
2. What do you mean by habitat loss?
3. What is vitrification?
4. What do you mean by invasive species?
5. Expand UNEP
6. Which National Park is famous for one- horned rhinoceros
7. Name an extinct plant species
8. What is seed bank?
9. Name a national park
10. What do you mean by recalcitrant species?

(10X1= 10 marks)

II.Answer any *five* questions. Each answers not exceeding 50 words.

11. What is the difference between rare and endangered species?
12. What do you mean by ecosystem degradation? How does it affect biodiversity
13. Write a note on in situ conservation
14. What is endemism? List any three endemic plant and animal species of India
15. Define biosphere reserve. Name the three zones of a biosphere reserve and the activities permitted in each.
16. Differentiate alpha, beta and gamma diversity?
17. Describe the significance of sacred groves in germplasm conservation

(5X3= 15 marks)

III. Answer any *five* of the following. Each answer not exceeding 150 words

18. Discuss the importance of myristica swamps
19. Give an account on the international organizations involved in the conservation of wildlife
20. Describe the various ex-situ methods for germplasm conservation
21. What do you mean by hot spots of biodiversity? What are the criteria for identifying hot spots ? Which are the biodiversity hotspots in India
22. Explain the measures taken for conservation of biodiversity in India
23. Describe the consumptive value of biodiversity as food, drugs & medicines, and fuel & fiber with suitable examples

(5X5=25 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. Discuss the applications of cryopreservation by explaining the methods adopted for germplasm conservation
25. What are the threats to biodiversity? Suggest measures to overcome its harmful effects

(1X10= 10 marks)