

DISCIPLINE CENTRIC ELECTIVE COURSES

SEMESTER I

BR17104DCE: Cellular and Molecular Biology

Unit: I

Membrane structure: Structure and composition of biomembranes (Fluid Mosaic Model); Membrane fluidity, membrane rafts; Cell adhesion molecules (overview), tight junctions, gap junctions and plasmodesmata; Extracellular matrix; Cytoskeleton—microtubules, actin filaments, intermediate filaments.

Unit: II

Intracellular organelles: Structural organization of nucleus (nuclear membrane and nuclear pore complex), mitochondria, chloroplast, golgi bodies, endoplasmic reticulum, ribosome, lysosomes, peroxisomes, vacuoles; Genome organization in mitochondria and chloroplast.

Cell division and cell cycle: Mitosis and meiosis; Phases of cell cycle, cell cycle check points and control of cell cycle.

Unit: III

Nucleic acids: Structure of DNA double helix; Various forms of DNA (A, B, Z and H DNA); Packaging of genetic material (Nucleosome organization); DNA replication—enzymes, mechanism of DNA replication; RNA synthesis—promoters, transcription factors, mechanism of transcription; Structure of mRNA & tRNA.

Unit: IV

Protein synthesis: Genetic code; Aminoacylation of tRNA, initiation, elongation & termination of translation; Post translational modifications and protein trafficking.

Regulation of gene expression: Operon model in prokaryotes (lac operon, tryptophan operon and arabinose operon); Transcription attenuation; Regulation of transcription in eukaryotes—promoters and enhancers, activators and repressors, Role of chromatin in regulating gene expression; DNA methylation, miRNAs.

Practical Work:

- Microscopy in study of cell structure.
- Comparative study of Prokaryotic & eukaryotic cells and Plant & animal cell.
- Study Membrane stability Index.
- Centrifugation for separation of cell organelles.
- Study of stages of Meiosis and Mitosis.
- Study pollen mother cell meiosis.
- Study meiotic stages during gamete formation in grasshopper
- Study stages of mitosis from root tips.
- Extraction of Nuclear DNA.

BR17001GE: Microbial Resources

Unit: I

Microbial resources— historical perspective; Types of microbial resources (algal, fungal, bacterial, viral); Approaches for the assessment of microbial diversity (culture dependent and independent); Morphology and ultrastructure of bacteria and viruses (bacteriophages); Microbial growth and growth curve.

Unit: II

Role of microorganisms in food production and beverages (wine, beer, bread, cheese); Single Cell Proteins— production and utility; Microbes as sources of antibiotics and therapeutic agents; Major commercial microbial products (amino acids, enzymes, steroids and biopolymers).

Unit: III

Bioremediation; Role of microbes in bioremediation of soil and water; Role of microbes in waste water treatment (processes based on attached microbial growth, activated sludge process).

Unit: IV

Role of microbes in biogeochemical cycles (carbon, nitrogen, sulphur & phosphorus cycle); Microbes as bioindicators; Phycoviruses and algal blooms; Biodefence and bioterrorism.

SEMESTER I**BR15002GE: Algal Resources****Unit: I**

Algae: Introduction, habit and habitat, micro and macro-algae; Distribution in soil, freshwater and marine habitats; Contribution in primary productivity; Immobilized and inactivated algal biomass for metal and nutrient removal.

Unit: II

Algae as food and fodder: Algae as a source of vitamins, proteins, lipids, carbohydrates, minerals and iodine; Algae as fodder for cattle and poultry, seaweeds as animal feed; Agar agar, alginates and carrageenin.

Unit: III

Algae in pharmaceuticals: Algae as source of antimicrobials, antivirals and antifungals, neuroprotective proteins, therapeutic proteins and drugs; Use of algae in the light of modern research— as antioxidants and anticancer agents; Use of algae in forensic medicine research and HIV vaccine model.

Unit: IV

Algal biofuels and biofertilizers: Energy and chemicals; Biodiesel, hydrogen production-mechanism, progress and prospects; Mechanism of biological nitrogen fixation by cyanobacteria; Cyanobacteria as biofertilizers for paddy cultivation, reclamation of usar lands.

Tutorials: 1 hour/week

SEMESTER I**BR15001OE: Human Health and Plant Diet****Unit: I**

Introduction: Plants in the diet of hunter gatherers; Plants in modern western diet; Plants as sources of proteins, carbohydrates, fats, vitamins and minerals.

Unit: II

Good things from plants in the diet: Fibre, Antioxidants; Gut microbiotome; Role of phytonutrients in influencing gut microbiotome.

Unit: III

Plants as source of healthy diet: Natural health products; Algae and fungi as source of human food; Plant diet in pregnancy, lactation, infancy, childhood and adolescence.

Unit: IV

Plant diet and diseases: Impact of food matrix and phytonutrients against chronic diseases; Plant diet and disease management— diabetes, heart disease, cancer, obesity; Plants in nutrition fitness and sports; Food safety; Food poisoning.

Tutorials: 1 hour/week

SEMESTER II**BR15002DCE: Inheritance Biology****Unit: I**

Laws of inheritance: Dominance, segregation and independent assortment; Types of dominance; Lethal alleles; Multiple alleles; Test of allelism; Gene interaction— complementation, epistasis and pleiotropy.

Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes; Maternal inheritance.

Unit: II

Linkage and Recombination: Linkage, linkage maps, 3 point test cross; Homologous and non homologous recombination; Gene mapping in prokaryotes through transduction and conjugation; Sex-linked inheritance— sex limited and sex influenced traits; Mechanism of sex determination.

Quantitative inheritance: Genes and environment— heritability, penetrance and expressivity.

Unit: III

Mutations: Spontaneous and induced mutations, molecular mechanism of mutations (chemical mutagens and physical mutagens); Suppressor, missense, nonsense and silent mutations.

Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation; Auto- and allo-polyploidy and their genetic implications.

Unit: IV

Human genetics: Pedigree— gathering family history, construction of pedigree; Pedigrees of sex-linked, autosomal and mitochondrial traits; Genetic disorders (Klinefelter -, Turner-, Patau-, Down- & Edward's syndrome).

Population genetics: Gene pool; Hardy-Weinberg principle, factors affecting Hardy-Weinberg equilibrium (natural selection, migration and genetic drift); Molecular divergence and molecular clocks.

Tutorials: 3 hours/week

SEMESTER II**BR15003GE: Industrial Entomology****Unit: I**

Apiculture: Importance and scope; Bee species (biology, morphology, behaviour, and habitat); Bee keeping equipment, hives, bee pasturage and seasonal management; Honey extraction; Factors affecting honey yield; Properties and uses of honey; Granulation, fermentation and storage of honey; Uses of other bee products; Bee enemies including diseases and their control.

Unit: II

Sericulture: Silkworm species, systematic position and salient features; Rearing techniques of mulberry, muga, eri and tassar silkworms; Nutritional requirements of silkworms; Sericulture rearing house and appliances; Grainage technology and cocoon marketing; Enemies and diseases of silkworms and their management; By-products of sericulture.

Unit: III

Lac culture: Lac insect, biology and habitat; Host trees— pruning, inoculation, lac cropping techniques and harvesting; Enemies of lac insect and their control; Processing techniques of lac (traditional and modern); Physical and chemical characteristics of lac.

Unit: IV

Beneficial Insects: Insects as pollinators and biocontrol agents; Insects as soil fertility improving agents and scavengers; Use of insects and insect products in medicine; Use of insects in scientific investigations; Use of insects as food source.

Tutorials: 1 hour/week

SEMESTER II**BR15004GE: Bioresource Management****Unit: I**

Bioresource management: Exploitation of bioresources and sustainable development; Forest resource management (social forestry, agro forestry and NWFPs); Grassland management; Freshwater & marine bioresource management; Wildlife management.

Unit: II

Monitoring biodiversity: Methods for monitoring biodiversity trends; Mega biodiversity zones and global biodiversity hotspots; Threats to biodiversity, species extinction; IUCN threat categories, Red data book.

Unit: III

Conservation programmes: Principles and strategies of biodiversity conservation; *In situ* and *ex situ* conservation strategies; Role of remote sensing and geographical information system in biodiversity studies; Principles and methodologies for soil conservation and restoration; Biovillages.

Unit: IV

Acts and policies: Forest Conservation Act 1981; Environment (protection) Act 1986; Hazardous waste (Management and Handling) Rules 1989; Bio-Medical Waste (Management and Handling) Rules 1998; Environmental Impact Assessment (EIA); Environmental Management Plan (EMP) and Environmental Clearance for Establishing Industry (ECEI); National Biodiversity Action Plan National Biodiversity Act 2002.

Tutorials: 1 hour/week

SEMESTER II**BR15002OE: Organic Farming****Unit: I**

Organic agriculture: Principles of organic agriculture; Objectives and requirements of organic standards; Criteria for substances used in organic production and processing; Standard for organic production and processing; Organic certification; Organic farming and food security.

Unit: II

Organic crop production: Split production and parallel production; Crop production and conversion period; Diversity in crop production; Soil fertility and fertilization; Pest, disease and weed management; Breeding of organic varieties.

Unit: III

Organic animal husbandry: Animal management; Animal origin and conversion period; Breeds and breeding; Mutilations; Animal nutrition; Veterinary medicine; Transport and slaughter; Bee keeping.

Unit: IV

Vermiculture and vermicompositing: Species selection, environmental requirements; Vermicompositing—methods, materials and advantages; Role in soil fertility, plant growth promotion and disease management.

Tutorials: 1 hour/week

BR17002OE: Infectious Diseases and Human Health

Unit: I

Introduction to Infectious Diseases: Basic concepts in pathophysiology of infectious diseases, Outline of physiological mechanisms leading to diseased state, Infectious disease transmission, Infection and immunity, Acute and chronic Infections, Major infectious diseases of humans.

Unit: II

Bacterial Infections: Pathogenesis, mechanisms of pathogenesis; transmission, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major human infections (Tuberculosis, Cholera, Typhoid).

Unit: III

Viral Diseases: Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and anti-retroviral therapy of Human immunodeficiency virus (HIV/AIDS); Sexually transmitted diseases.

Unit: IV

Fungal and Protozoan Diseases:

Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major Fungal human pathogens: (Dermatophytes, Candida, Aspergillus); Protozoal human pathogens (Plasmodia and Trypanosoma).

SEMESTER III**BR15003DCE: Biological Interactions****Unit: I**

Plant interactions: Biotic community— structure and dynamics; Factors contributing to community stability (successional model and climax pattern model); Keystone species; Symbioses, mycorrhizal association; Plant defence and chemical warfare— plant-insect, plant-vertebrate and plant-plant interactions (brief concept); Parasitic and insectivorous plants; Pollination and seed dispersal by animals.

Unit: II

Social and community interactions of animals: Heritable basis of behaviour; Learned behaviour; Communication signals; Courtship, mating, parenting and individual reproductive success; Benefits and costs of living in a social group; Altruism; Migration and navigation; Factors affecting community structure— mutualism, commensalism, competitive interaction, predation, parasitic interactions; Co-evolution; Man animal conflict.

Unit: III

Biosignaling: General features of signal transduction pathways; Diversity of basic signaling cascades (brief idea) with emphasis on Protein kinases, Phosphoinositides, G-protein complex and Calcium mediated signaling; Two component sensor-regulator system in bacteria, plants and animals (one example each). Bacterial chemotaxis and quorum sensing.

Unit: IV

Applied Immunology: Immune system; antigens and antibodies; Types of immunoglobulins (overview); structure of antibody, Immune response system, antibody mediated responses; Allergic disorders (introduction, diagnosis and clinical manifestations); Aeroallergens (identification, isolation and impact on human health); Role of immunotherapy in allergic disorders.

Tutorials: 3 hours/week

SEMESTER III**BR15006GE: Biomedicine and Bioprospecting****Unit: I**

Biomedicine: Introduction, present scenario & future prospectus; Sources of drugs (plants, animals, microorganism, drugs from organic synthesis); Historical development and present status of Chinese/ Amchi, Ayurvedic, Unani Sidha and Homeopathic systems of medicine.

Unit: II

Ethnobotany: Concept; Ethnobotanical and medicinal importance of some important medicinal plants of Kashmir viz. *Arnebia benthamii*, *Aconitum heterophyllum*, *Atropa acuminata*, *Podophyllum hexandrum*, *Saussurea costus*, *Rheum emodi*, *Digitalis purpurea*, *Valeriana jatamansii*, *Viola odorata*, *Picrorhiza kurroa*, *Dioscorea deltoidea* and *Hippophae rhamnoides*.

Unit: III

Herbal crude medicines: Classification, collection and processing; Various separation techniques for extraction of crude medicine, advantages and limitations; Plant drug standardization; Quality control and quality assurance of herbal drugs; Drug acts and rules.

Unit: IV

Bioprospecting: Concept and methods of bioprospecting; Role of traditional knowledge in bioprospecting; Biopiracy, case studies of biopiracy (Basmati, Neem, Turmeric, Periwinkle, Enola bean); Traditional Knowledge Digital Library (TKDL)— concept and importance.

Tutorials: 1 hour/week

SEMESTER III**BR15006GE: Biocontrol and Crop Management****Unit: I**

Biocontrol: Importance and scope; Biological control agents— predators, parasitoids and pathogens; Classical biological control— principles and procedures; Conservation biological control— conservation, habitat management and augmentation; Mass multiplication methods and effective evaluation techniques of biocontrol agents.

Unit: II

Plant disease management: Principles of plant disease management; Organic amendments and botanicals to control plant disease; Disease resistance and molecular approach for disease management; Fungicides, bactericides and antibiotics in disease management; Nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals.

Unit: III

Post harvest diseases: Concept of post harvest diseases; Importance with reference to environment and health; Postharvest management; Cultural practices in perpetuation of pathogens; Phytoextracts in controlling post-harvest diseases and improving the shelf life of produce.

Unit: IV

Integrated Pest Management (IPM): History, concept and principles; Components of IPM— host plant resistance, agronomic manipulations, mechanical, physical, chemical, biological, genetic and behavioural control methods; Economic Threshold Levels (ETL), Economic Injury Levels (EIL) and their determination.

Tutorials: 1 hour/week

SEMESTER III**BR15003OE: Biocosmetics****Unit: I**

Biocosmetics: History of biocosmetics; Importance of plant and animal resources in biocosmetics; Global market of biocosmetics; Manufacture and import of biocosmetics; Labelling, packaging and standardization of biocosmetics; Scope of biocosmetics industry in Jammu and Kashmir.

Unit: II

Skin cosmetics: Skin and hand creams; Facial skin care; Body lotions and bath time herbs; Sun screen products, skin tonics and anti-acne creams; Botanicals in skin care.

Unit: III

Hair cosmetics: Formulation of shampoos, surfactants and conditioners; Types of shampoos with emphasis on herbal shampoos; Hair colourants, fixers, sprays and gels; Botanicals in hair care.

Unit: IV

Perfumes and fragrances: Selection of fragrance; Raw material used in the preparation of fragrance; Fragrance and allergenicity, water soluble fragrances; Aromatherapy (Historical perspective, essential oils, aromatherapy for stress relief, weight loss and beauty aid).

Tutorials: 1 hour/week

DISCIPLINE CENTRIC ELECTIVE COURSES

SEMESTER IV

BR17404DCE: Bioinformatics

Unit: I

Bioinformatics databases: Bioinformatics— concept and application; Types of databases- Genome (NCBI, EBI, TIGR, SANGER), Nucleic acid (EMBL, GeneBank, DDBJ), Protein (SwissProt, TrEMBL, PIR) databases; Structural classification of proteins (SCOP, CATH).

Unit: II

Sequencing: Conventional and next generation sequencing; Basic Concept of sequence similarity, identity and homology; Sequence based database searches (blast, fasta, gcg, msf, nbrf-pir etc.); Homologues, orthologues, paralogues; Sequence alignment (pair-wise and multiple); Gene finding and genome annotation; **Transcriptomics:** DNA Microarray, Serial analysis of gene expression, Qualitative RT PCR.

Unit: III

Emerging areas of bioinformatics: Computational systems biology, semantic web; Bioontologies (types, application, softwares), annotations; Proteomics— separation, identification of proteins, MS-MS, protein microarray, protein expression profiling, protein- protein interaction mapping; Metabolomics, cheminformatics, phenomics.

Unit: IV

Phylogenetics: Morphological & molecular phylogeny; Representation of molecular phylogeny; Methods of phylogeny— maximum parsimony, likelihood and Bayesian method; Distance methods (UPGMA, NJ); Softwares (PHYLIP, Tree base, Mesquite, NTSY SPC).

Practical Work:

- Role of NCBI, EBI, TIGR and SANGER in maintaining sequence data.
- Demonstration of BLAST and FASTA.
- Study Pairwise and Multiple sequence alignments.
- Demonstration of MSA.
- Construction of Phylogenetic trees using morphological and molecular data.
- Tools for obtaining information about primary structure of proteins.

Practical Work:

- Role of NCBI, EBI, TIGR and SANGER in maintaining sequence data.
- Demonstration of BLAST and FASTA.
- Study Pairwise and Multiple sequence alignments.
- Demonstration of MSA.
- Construction of Phylogenetic trees using morphological and molecular data.
- Tools for obtaining information about primary structure of proteins.

SEMESTER IV**BR15007GE: Wood Resource Utilization****Unit: I**

Wood growth: Formation of wood cambium and its derivatives, growth rings, secondary xylem.

Wood anatomy: Soft wood and hard wood, sap wood and heartwood, knots; Reaction wood.

Unit: II

Physical properties of wood: Colour, luster, odour, weight, and density; Variation in density of early and late wood constituents, effect of growth rings on density.

Chemical properties of wood: Cellulose & hemi-cellulose— structure, chemical properties, effect of acids and bases; Lignin— structure and chemical properties; Wood extractives.

Unit: III

Wood deterioration and preservation: Wood boring insects— termites and carpenter ants; Wood destroying fungi; Wood preservation processes — non pressure and pressure processes; Wood preservative.

Wood seasoning: Concept & importance; Air seasoning— air drying, accelerated air drying; Special seasoning methods— drying by boiling in oily liquids and vacuum drying.

Unit: IV

Commercially important wood species in Kashmir: Description, habitat, type of wood and uses of pine, deodar, silver fir, willow, poplar and walnut; Wood as fuel; Saw dust and its uses, wood pellet technology.

Tutorials: 1 hour/week

SEMESTER IV**BR15008GE: Bioindustries****Unit: I**

Industrial revolution: Causes and consequences; Industrial economic sectors: Primary, Secondary, Tertiary and Quaternary Sectors; Small scale industries and their importance; Entrepreneurship— concept, entrepreneurial skills; Self employment.

Unit: II

Bioindustries: Concept and scope; Role of natural resources in economic development.

Bioindustries in India: Status and scope of agriculture, fisheries, sericulture, forest and dairy industry.

Unit: III

Fruit industry in J & K: Status and scope; Fresh and dry fruits—harvest, processing & storage and marketing.

Potential bioindustries in J & K: Apiculture, tannery, pisciculture, ornamental horticulture and herbal drug industry.

Unit: IV

Sustainable development: Concept, indicators of sustainable development; Quality assurance and quality control; Policies responsible for development of bioindustries. Intellectual Property Rights— concept and importance.

Tutorials: 1 hour/week

SEMESTER IV**BR15004OE: Green Technology****Unit: I**

Environmental Health: Concept of environment, ecosystem, components of ecosystem; Environmental problems— global warming, ozone depletion and acid rain, water pollution and soil erosion.

Unit: II

Green energy: Solar, wind, geothermal, tidal, hydroelectric energy and biobased energy; Biofuels (concept and types); Alternative energy sources and their environmental impact.

Unit: III

Green concept in Biotechnology: Bioremediation— concept and types; Bioreactors; Biorefinery; Biopharmaceuticals; Bioplastics; White biotechnology.

Unit: IV

Green Building: Green construction and sustainable building, biomimetrics; Choice of building material and location of building; Green walls (vertical gardens); Carbon sequestration at landscape level; Greenwashing; Eco-labelling (concept and examples).

Tutorials: 1 hour/week

Course No:	BT-17206 -DCE	Maximum marks	75
Course title:	Laboratory Course II		
Credits:	Three		

1. Media Preparation
2. Isolation of Genomic DNA and RNA.
3. Agarose Gel electrophoresis and Quantification of DNA and RNA.
4. Immunoprecipitation (IP).
5. SDS-PAGE and Western Blotting.
6. Assay of Enzyme activity.
7. Effect of temperature and pH on enzyme activity.
8. Determination of Kinetic constants K_m and V_{max} .
9. Preparation of plant tissue culture media.
10. Plant Tissue Culture

Course Descriptions 1st Semester

CORE COURSES

ENS17101CR: Fundamentals of Environmental Science (04 credits)

Unit I: Components of environment

- 1.1. Definition, principle and scope of environmental science
- 1.2. Atmosphere: Structure and composition
- 1.3. Hydrosphere and cryosphere: Hydrological cycle
- 1.4. Lithosphere: Structure and composition
- 1.5. Biosphere: Components

Unit II: Ecosystem dynamics

- 1.1. Structure and function of ecosystems
- 1.2. Ecosystem resilience
- 1.3. Primary productivity
- 1.4. Secondary productivity
- 1.5. Energy flow, energy models and energy relations in ecosystems

Unit III: Population and community ecology

- 1.1. Characteristics of population
- 1.2. Population growth and population interactions
- 1.3. Population regulation: Density dependent and density independent
- 1.4. Concept and characteristics of communities
- 1.5. Ecological succession, primary and secondary processes in successions, climax community and types of climax

Unit IV: Meteorology

- 1.1. Meteorological parameters: Atmospheric pressure, temperature, precipitation, humidity and wind
- 1.2. Radiation and heat budget
- 1.3. Atmospheric stability
- 1.4. Temperature inversions
- 1.5. Wind roses

ENS17102CR: Environmental Chemistry (04 credits)

Unit I: Analytical chemistry

- 1.1. Stoichiometry
- 1.2. Titrimetry and gravimetry
- 1.3. Potentiometry (pH and conductivity)
- 1.4. UV-visible and flame photometry
- 1.5. Atomic absorption spectrophotometry

Unit II: Atmosphere chemistry

- 1.1. Formation and evolution of earth's atmosphere
- 1.2. Ions, radicals and particulates in the atmosphere

- 1.3. Formation of inorganic and organic particulate matter
- 1.4. Thermo-chemical and photochemical reactions in the atmosphere
- 1.5. Chemistry of green house gasses

Unit III: Water chemistry

- 1.1. Physico-chemical characteristics of water
- 1.2. Solubility of gases in water; dissolved gases in water - CO₂, O₂, H₂S, CH₄ and NH₃
- 1.3. Biochemical oxygen demand and chemical oxygen demand
- 1.4. Carbonate-bicarbonate system
- 1.5. Redox potential

Unit IV: Soil chemistry

- 1.1. Soil profile and pedogenesis
- 1.2. Inorganic and organic components of soil
- 1.3. Physico- chemical properties of soils
- 1.4. Biochemical properties of soil
- 1.5. Soil classification and types

ENS17103CR: Laboratory Course

(04 credits)

Course Contents

1. Estimation of volume of a water body: Pond, pool, lake
2. Determination of the soil texture in different terrestrial habitats
3. Estimation of meteorological parameters (temperature, precipitation, humidity, wind)
4. Determination of latitude, longitude and altitude of a place
5. Demonstration of major rock types
6. Determination of light intensity in different habitats
7. Standardization of reagents – titrants (acids, bases)
8. Determination of pH, conductivity, alkalinity and acidity of water samples
9. Estimation of pH, conductivity and alkalinity of soil samples
10. Estimation of free carbon dioxide content in water samples
11. Estimation of chloride content in different water and soil samples
12. Estimation of cations (calcium, magnesium, sodium, potassium) in water samples
13. Estimation of cations (calcium, magnesium, sodium, potassium) in soil samples
14. Experimental verification of Beer-Lambert's law
15. Determination of primary productivity aquatic habitats
16. Determination of primary productivity in terrestrial habitats
17. Study of dose – effect relationships in important toxicants/pollutants
18. Study of leaf pigment by paper chromatography and TLC methods
19. Estimation of protein and carbohydrate content in biological samples
20. Collection and identification of the fish fauna of different aquatic habitats

CLB15103CR: Lab course-I

- Biochemical calculations
- Concept of pH and buffers
- Qualitative analysis of carbohydrates
- Qualitative analysis of amino acids
- Qualitative analysis of lipids
- TLC and paper chromatography amino acids and sugars
- Quantitative Estimation of proteins using Lowry's/ Biurett method
- Quantitative Estimation of glucose by Nelson Somogy's method
- Quantitative Estimation of cholesterol by Zlatki's Method
- Titrimetric estimation of ascorbic acid
- Sterilization techniques
- Preparation of culture media, pure culture techniques
- Study of bacterial growth by turbidimetry/ spectrophotometry and serial dilution methods
- Extraction and Assay of Enzymes

CLB15203CR: Lab Course-II

- Isolation of bacterial genomic DNA
- Isolation of Plasmid DNA
- Preparation of genomic DNA from Plant tissue by CTAB method
- Isolation of DNA from blood samples by Phenol-Chloroform method
- Qualitative and quantitative determination of DNA
- Absorption spectra of Nucleic Acids and Determination of melting temperature of calf thymus DNA.
- Denaturation of DNA and UV absorption studies.
- Agarose gel electrophoresis
- Polyacrylamide gel electrophoresis (PAGE) and SDS- PAGE
- Amplification of DNA segment by PCR

CLB15303CR: Lab Course-III

- Estimation of serum albumin and determination of albumin/globulin ratio.
- Estimation of serum triglycerides, total cholesterol, HDL cholesterol, LDL cholesterol.
- Estimation of serum bilirubin
- Estimation of serum acid phosphate, alkaline phosphate, ALT and AST and their clinical use
- Estimation of serum urea and creatinine
- Urine analysis – Routine and microscopic examination
- Sub Cellular fractionation and marker enzymes activity
- Estimation of serum of normal and sickle hemoglobin
- Estimation of T3, T4, and TSH by ELISA/RIA
- Estimation of antinuclear antibodies and C reactive protein
- Separation of mononuclear cells by Ficoll-Hypaque.
- TLC/ DLC
- Estimation of non-protein nitrogen, urea, urate, creatine and creatinine.
- Tests for urinary proteins
- Tests for lipids and lipoproteins
- Estimation of cholesterol
- Estimation of Na^+ , K^+ and Cl^-
- Estimation of Ca^{++} , Mg^{++} and P
- Estimation of Fe^{+2} , Cu^{+2} and Zn^{+2}
- Estimation of porphyrins and hemoglobin
- Tests for gastric function, occult blood
- Tests for liver and billiary tract diseases
- Tests for renal diseases

SEMESTER IV

CLB15401CR: Internship Dissertation

Internship represents a cross-over point between university and career. The experience one gets during an internship will indicate how he/she should structure future studies, particularly when it comes to deciding what aspects one should focus on. Students carry their internship program outside the parent department wherein project work will be carried out, based on research and actual bench work under the guidance of their respective supervisor at the place of internship. The department facilitates the students for placement for their internship. During the program the students are in close touch with their respective teachers in the department. The students are expected to put at least six working hours daily for a maximum period of six months. At the end of the internship, the internship dissertation will be submitted in the parent department and evaluated.

CLB15402CR: Host Institute Grading

During the internship, the students will be critically evaluated by the supervisors and will be graded by them based on their attendance in the lab, daily experimental work, writing and communication skills and other criteria related to routine lab work.

CLB15403CR: Internship Assessment

This will include an openers enation, defending their dissertation work to be evaluated by an external examiner (to be nominated by Head of the Department) and all the faculty members. The presentation will be followed by the viva of the students to be carried out by the external examiner.

Course Descriptions 1st Semester

CORE COURSES

ENS17101CR: Fundamentals of Environmental Science (04 credits)

Unit I: Components of environment

- 1.1. Definition, principle and scope of environmental science
- 1.2. Atmosphere: Structure and composition
- 1.3. Hydrosphere and cryosphere: Hydrological cycle
- 1.4. Lithosphere: Structure and composition
- 1.5. Biosphere: Components

Unit II: Ecosystem dynamics

- 1.1. Structure and function of ecosystems
- 1.2. Ecosystem resilience
- 1.3. Primary productivity
- 1.4. Secondary productivity
- 1.5. Energy flow, energy models and energy relations in ecosystems

Unit III: Population and community ecology

- 1.1. Characteristics of population
- 1.2. Population growth and population interactions
- 1.3. Population regulation: Density dependent and density independent
- 1.4. Concept and characteristics of communities
- 1.5. Ecological succession, primary and secondary processes in successions, climax community and types of climax

Unit IV: Meteorology

- 1.1. Meteorological parameters: Atmospheric pressure, temperature, precipitation, humidity and wind
- 1.2. Radiation and heat budget
- 1.3. Atmospheric stability
- 1.4. Temperature inversions
- 1.5. Wind roses

ENS17102CR: Environmental Chemistry (04 credits)

Unit I: Analytical chemistry

- 1.1. Stoichiometry
- 1.2. Titrimetry and gravimetry
- 1.3. Potentiometry (pH and conductivity)
- 1.4. UV-visible and flame photometry
- 1.5. Atomic absorption spectrophotometry

Unit II: Atmosphere chemistry

- 1.1. Formation and evolution of earth's atmosphere
- 1.2. Ions, radicals and particulates in the atmosphere

- 1.3. Formation of inorganic and organic particulate matter
- 1.4. Thermo-chemical and photochemical reactions in the atmosphere
- 1.5. Chemistry of green house gasses

Unit III: Water chemistry

- 1.1. Physico-chemical characteristics of water
- 1.2. Solubility of gases in water; dissolved gases in water - CO₂, O₂, H₂S, CH₄ and NH₃
- 1.3. Biochemical oxygen demand and chemical oxygen demand
- 1.4. Carbonate-bicarbonate system
- 1.5. Redox potential

Unit IV: Soil chemistry

- 1.1. Soil profile and pedogenesis
- 1.2. Inorganic and organic components of soil
- 1.3. Physico- chemical properties of soils
- 1.4. Biochemical properties of soil
- 1.5. Soil classification and types

ENS17103CR: Laboratory Course

(04 credits)

Course Contents

1. Estimation of volume of a water body: Pond, pool, lake
2. Determination of the soil texture in different terrestrial habitats
3. Estimation of meteorological parameters (temperature, precipitation, humidity, wind)
4. Determination of latitude, longitude and altitude of a place
5. Demonstration of major rock types
6. Determination of light intensity in different habitats
7. Standardization of reagents – titrants (acids, bases)
8. Determination of pH, conductivity, alkalinity and acidity of water samples
9. Estimation of pH, conductivity and alkalinity of soil samples
10. Estimation of free carbon dioxide content in water samples
11. Estimation of chloride content in different water and soil samples
12. Estimation of cations (calcium, magnesium, sodium, potassium) in water samples
13. Estimation of cations (calcium, magnesium, sodium, potassium) in soil samples
14. Experimental verification of Beer-Lambert's law
15. Determination of primary productivity aquatic habitats
16. Determination of primary productivity in terrestrial habitats
17. Study of dose – effect relationships in important toxicants/pollutants
18. Study of leaf pigment by paper chromatography and TLC methods
19. Estimation of protein and carbohydrate content in biological samples
20. Collection and identification of the fish fauna of different aquatic habitats

- 1.3. Formation of inorganic and organic particulate matter
- 1.4. Thermo-chemical and photochemical reactions in the atmosphere
- 1.5. Chemistry of green house gasses

Unit III: Water chemistry

- 1.1. Physico-chemical characteristics of water
- 1.2. Solubility of gases in water; dissolved gases in water - CO₂, O₂, H₂S, CH₄ and NH₃
- 1.3. Biochemical oxygen demand and chemical oxygen demand
- 1.4. Carbonate-bicarbonate system
- 1.5. Redox potential

Unit IV: Soil chemistry

- 1.1. Soil profile and pedogenesis
- 1.2. Inorganic and organic components of soil
- 1.3. Physico- chemical properties of soils
- 1.4. Biochemical properties of soil
- 1.5. Soil classification and types

ENS17103CR: Laboratory Course

(04 credits)

Course Contents

1. Estimation of volume of a water body: Pond, pool, lake
2. Determination of the soil texture in different terrestrial habitats
3. Estimation of meteorological parameters (temperature, precipitation, humidity, wind)
4. Determination of latitude, longitude and altitude of a place
5. Demonstration of major rock types
6. Determination of light intensity in different habitats
7. Standardization of reagents – titrants (acids, bases)
8. Determination of pH, conductivity, alkalinity and acidity of water samples
9. Estimation of pH, conductivity and alkalinity of soil samples
10. Estimation of free carbon dioxide content in water samples
11. Estimation of chloride content in different water and soil samples
12. Estimation of cations (calcium, magnesium, sodium, potassium) in water samples
13. Estimation of cations (calcium, magnesium, sodium, potassium) in soil samples
14. Experimental verification of Beer-Lambert's law
15. Determination of primary productivity aquatic habitats
16. Determination of primary productivity in terrestrial habitats
17. Study of dose – effect relationships in important toxicants/pollutants
18. Study of leaf pigment by paper chromatography and TLC methods
19. Estimation of protein and carbohydrate content in biological samples
20. Collection and identification of the fish fauna of different aquatic habitats

DISCIPLINE CENTRIC ELECTIVE

ENS17104DCE: Environmental Geoscience

(04 credits)

Unit I: Earth science

- 1.1. Origin and evolution of earth
- 1.2. Geological time scale
- 1.3. Earth surface processes
- 1.4. Geomagnetism: Magnetic and gravitational fields of the earth
- 1.5. Continental drift: Plate tectonics and Neo-tectonics

Unit II: Natural hazards and disaster management

- 1.1. Concept and classification of natural hazards
- 1.2. Causes and environmental consequences of
 - a. Earth quakes and Tsunami
 - b. Floods and droughts.
 - c. Landslides
- 1.3. Risk assessment and vulnerability analysis
- 1.4. Disaster management: preparedness, response, rehabilitation and failures (case studies)
- 1.5. National disaster management policy

Unit III: Marine systems

- 1.1. Marine zones
- 1.2. Composition of seawater
- 1.3. Marine resources and their recycling
- 1.4. Ice sheets and fluctuations of seawater
- 1.5. Ocean conveyor belt

Unit IV: Geochemistry

- 1.1. Geochemical classification and distribution of elements in earth
- 1.2. Mobility of trace elements
- 1.3. Concept of rare earth elements
- 1.4. Geochemical cycles - C, N, P, S
- 1.5. Concept of residence time and rate of natural cycles

ENS17105DCE: Environmental Toxicology

(04 credits)

Unit I: Principles of toxicology

- 1.1. Definition, scope, goals and divisions of toxicology
- 1.2. Factors influencing toxicity, toxicity of chemical mixtures
- 1.3. Factors affecting environmental concentration of toxicants,
- 1.4. Dose - response relationship
- 1.5. Toxicity testing methods (single & multi species, acute, sub-acute and chronic toxicity)

Unit II: Biotransformation of xenobiotics

- 1.1. Membranous barriers, binding, storage and absorption of xenobiotics
- 1.2. Excretion of xenobiotics
- 1.3. Biotransformation: General principles and types of biotransformation
- 1.4. Cytochrome P 450, its variants and their role
- 1.5. Glutathione – S- transferase, its variants and their role

Unit III: Bio-magnification of xenobiotics

- 1.1. Bioaccumulation, bioconcentration and biomagnification - study methods (microcosm)
- 1.2. Compartment models
- 1.3. Bioassay and its applications in toxicology
- 1.4. Antidotal procedures in toxicology
- 1.5. Chemical safety evaluation

Unit IV: Toxicants as public health hazard

- 1.1. Pesticides and heavy metals.
- 1.2. Radioactive substances and food additives
- 1.3. Automobile emissions.
- 1.4. Occupational diseases: Principles and methods of occupational health.
- 1.5. Evaluation and control of occupational health hazards.

ENS17106DCE: Mountain Ecology

(02 credits)

Unit I: Mountains ecology

- 1.1. Mountain ecosystem: Goods and services
- 1.2. Major mountains systems of the world: Himalayas, Alps, Andes
- 1.3. Ecological specializations in high altitude ecosystems
- 1.4. Impacts of climate change on mountain ecosystems
- 1.5. Mountain policy support: Land use dynamics, poverty and food security

Unit II: Himalayan resources

- 1.1. Glacier resources
- 1.2. Forests and forestry
- 1.3. Medicinal plants
- 1.4. Flora and fauna of Jammu & Kashmir
- 1.5. Energy resources of Jammu & Kashmir (Hydel and Solar)

ENS17107DCE: Human and Environment

(02 credits)

Unit I: Environmentalism

- 1.1. Environmentalism: Concept and history
- 1.2. Environmental organizations (WWF, UNEP, IUCN, WHO)
- 1.3. Environmental movements in India: Narmada dam, Tehri dam, Almatti dam and Chipko
- 1.4. The monetization frontier
- 1.5. Environmental politics

Unit II: Environmental education and psychology

- 1.1. Environmental education
- 1.2. Environmental protection and religious teachings
- 1.3. Public awareness and role of NGOs
- 1.4. Environmental psychology and current problems
- 1.5. Environmental ethics

Credit IV: Environmental economics**(16 hrs)**

- 1.1. Environmental economics: Definition and scope
- 1.2. Population, poverty and environment
- 1.3. Concept of intangibles and externalities
- 1.4. Environmental evaluation methods: Hedonic pricing, contingent evaluation and household production function
- 1.5. Carbon credits and trading

ENS14108EO: Plant morphogenesis, Cyto-genotoxicity & Herbal Medicine (04 credits)**Credit I: Plant morphogenesis and regeneration****(16 hrs)**

- 1.1. Initiation, nutrition and maintenance of plant cell and tissue culture
- 1.2. Cellular totipotency, initiation of callus cultures and its characteristics
- 1.3. Cell differentiation and organogenesis
- 1.4. Suspension culture
- 1.5. Tissue culture studies of some threatened medicinal plants of Kashmir Himalaya

Credit II: Herbal medicine and health care**(16 hrs)**

- 1.1. Traditional Herbal Medicines for Healthcare and Management of Human diseases
- 1.2. Medicinal and aromatic materials from plants
- 1.3. Benefits of Medicinal and aromatic plant materials
- 1.4. Industrial utilization of medicinal plants
- 1.5. Phytochemical and anti microbial studies of some medicinal plants

Credit III: Cyto-genotoxicity**(16 hrs)**

- 1.1. Necrosis, apoptosis and inflammation
- 1.2. Somatic and genetic risk of environmental pollutants.
- 1.3. Cancer latency, threshold and non-threshold model of cancer
- 1.4. Mechanism of chemical carcinogens (free radicals and alkylating agents)
- 1.5. Classification of carcinogens (physical, chemical and biological agent)

Credit IV: Toxicogenomics (Testing protocols)**(16 hrs)**

- 1.1. Ames test and micronucleus test
- 1.2. Chromatid and chromosome aberration
- 1.3. Screening, tier testing and test batteries for mutagenicity testing
- 1.4. FISH technique
- 1.5. Use of Comet assay in environmental toxicology

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- Concepts of Ecology. E.J. Kormondy
- Atmosphere, Weather & Climate. R.G. Barry & R.J. Chorley
- Environment: Principles & Applications. Chris Park.
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- Environmental Science - Physical Principles & Applications. Boeker & Grondelle
- Fundamentals of Physical Environment. Briggs, Smithson, Addison & Atkinson
- Atmosphere, Weather & Climate. R.G. Barry & R.J. Chorley
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- Introducing Physical Geography. Alan Starhler & Arthur Starhler
- Earths Dynamic Systems. W.K. Hamblin & E.H. Christiansen
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- Ecology with special reference to Animals and Man. S. Charles, Kendeigh
- Evolutionary Ecology. Eric R. Pianka
- A Primer of Ecology. Nicholas J. Gotelli
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- The Global Casino. Nick Middleton
- Natural Hazard Mitigation. Godschalk, Beatley, Berke, Brower & Kaiser
- Active Tectonics. E. Keller & N. Pinter
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- Environmental Economics-A Critical Overview. Alan Gilpin
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General Instructions for the Candidates

1. The first semester is of 24 credit weightage.
2. A candidate has compulsorily to opt for 12 credits from the core component.
3. A candidate has a choice to opt for any 12 credits (3 papers) out of minimum of 16 credits (4 papers) offered as Electives (Allied).
4. A candidate can earn more than the minimum required credits (i.e., more than 96 credits for four Semester programme) which shall be counted towards the final result of the candidate.

COURSE DESCRIPTIONS OPEN ELECTIVE

ENS17OE01: Environmental Ethics and Sociology (2 Credits)

Unit I

- 1.1. An introduction to environmental ethics and philosophy
- 1.2. Ethics in society
- 1.3. Responsibility for environmental degradation
- 1.4. Theories of environmental ethics and philosophy
- 1.5. Resource consumption patterns and the need for equitable utilization

Unit II

- 1.1. Role of agriculture in socio-economic development
- 1.2. Land reforms and Bhoodan movement in India
- 1.3. Community development projects
- 1.4. Rural social structure
- 1.5. Ecological theories of urbanization and urban social problem

ENS17OE02: Global Environmental Problems (02 Credits)

Unit I

- 1.1 Acid rain
- 1.2 Ozone depletion
- 1.3 Deforestation
- 1.4 Biodiversity loss
- 1.5 Global warming and climate change

Unit II

- 1.1. Role of an individual in conservation of natural resources
- 1.2. General idea about environmental laws
- 1.3. International conventions (Stockholm declaration)
- 1.4. Kyoto protocol and Montreal protocol
- 1.5. Earth summit

ENS17OE03: Environmental Protection (02 Credits)

Unit I

- 1.6. Role of an individual in conservation of natural resources
- 1.7. General idea about environmental laws
- 1.8. International conventions (Stockholm declaration)
- 1.9. Kyoto protocol and Montreal protocol
- 1.10. Earth summit

Unit II

- 1.1. Environment management
- 1.2. Control of soil, water and air pollution
- 1.3. Solid and hazardous waste management
- 1.4. Biodiversity conservation
- 1.5. Natural resource management

ENS17OE04: Sustainable Development (2 credits)

Unit I

- 1.1. Concept and strategies of sustainable development
- 1.2. Principles of ecological economics – scope and usefulness
- 1.3. Prey-predator and supply-demand cycles

ENS14201CR: Environmental Pollution and its Control - I
(Air, Noise and Radioactive Pollution)

(04 credits)

Credit I: Air pollution

(16 hrs)

- 1.1. Sources, classification and properties of primary and secondary air pollutants
- 1.2. Pollutant behaviour in atmosphere
- 1.3. Smog and acid rain
- 1.4. Ozone layer depletion
- 1.5. Global warming and climate change

Credit II: Control of air pollution

(16 hrs)

- 1.1. Indoor air pollution and its control: smoke, HCs, particulate matter, Radon
- 1.2. Air quality standards and Monitoring of air pollution: SO_x, NO_x, CO, SPM and hydrocarbon
- 1.3. Control of particulate, gaseous air pollution - SO_x, NO_x, CO and green house gases
- 1.4. Plume Rise and Design of Stack height
- 1.5. Bio-filters and control of air pollution

Credit III: Noise pollution and its control

(16 hrs)

- 1.1. Noise pollution: Definition and sources
- 1.2. Measurement of Noise and sound pressure level,
- 1.3. Equivalent sound pressure level (Leq), Noise pollution level (NPL), Sound exposure level (SEL), Traffic noise index (TNI), Day-Night level (DNL), noise criteria curves
- 1.4. Impact of noise on human health and environment
- 1.5. Noise control and abatement measures

Credit IV: Thermal and radioactive pollution and its control

(16 hrs)

- 1.1. Thermal pollution: causes and consequences
- 1.2. Control of thermal pollution
- 1.3. Radioactive pollution: causes and consequences
- 1.4. Types of radioactive pollutants and their sources
- 1.5. Radioactive waste management and control

ENS14202CR: Environmental Pollution and its Control - II
(Soil and Water Pollution)

(04 Credits)

Credit I: Land degradation and soil pollution

(16 hrs)

- 1.1. Causes and kinds of land degradation and Soil Pollution
- 1.2. Desertification: causes, consequences
- 1.3. Soil erosion: causes, assessment and environmental impacts
- 1.4. Fate of pesticides in soil
- 1.5. Industrial waste effluents and heavy metals and their interaction with soil components

Credit II: Control of land degradation and soil pollution

(16 hrs)

- 1.1. Control of soil pollution
- 1.3. Soil conservation and control of soil erosion

ENS14201CR: Environmental Pollution and its Control - I
(Air, Noise and Radioactive Pollution)

(04 credits)

Credit I: Air pollution

(16 hrs)

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- 1.2. Pollutant behaviour in atmosphere
- 1.3. Smog and acid rain
- 1.4. Ozone layer depletion
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Credit II: Control of air pollution

(16 hrs)

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- 1.5. Bio-filters and control of air pollution

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(16 hrs)

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(04 Credits)

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(16 hrs)

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- 1.3. Soil erosion: causes, assessment and environmental impacts
- 1.4. Fate of pesticides in soil
- 1.5. Industrial waste effluents and heavy metals and their interaction with soil components

Credit II: Control of land degradation and soil pollution

(16 hrs)

- 1.1. Control of soil pollution
- 1.3. Soil conservation and control of soil erosion

- 1.2. Waste lands and their reclamation
- 1.4. Sustainable agricultural practices
- 1.5. Integrated pest management

Credit III: Water pollution

(16 hrs)

- 1.1. Sources and types of water pollution
- 1.2. Lake eutrophication and stream pollution
- 1.3. Petroleum hydrocarbons and marine pollution
- 1.4. Ground water pollution
- 1.5. Biocides and Heavy metals and their impact on aquatic life

Credit IV: Control of water pollution

(16 hrs)

- 1.1. Water and waste water standards
- 1.2. Control of eutrophication and restoration of lakes
- 1.3. Wetland conservation
- 1.4. Role of aquatic plants in pollution abatement
- 1.5. Control of Stream pollution and Groundwater Management

ENS14203CR: Laboratory Course

(04 credits)

Course Contents

1. Determination of silt load of a stream / river
2. Estimation of total dissolved and suspended solids in water
3. Determination of rate of soil erosion in different ecosystems
4. Estimation of dissolved oxygen, BOD, COD and dissolved organic matter in different waters
5. Estimation of organic carbon and organic matter in different soils samples
6. Estimation of nitrogen (NH_3 , NO_2 and NO_3) and phosphorus (ortho- and total) in different waters
7. Estimation of phosphorus and nitrogen content in different soil samples
8. Estimation of dissolved silica and sulphate in different water bodies
9. Estimation of gaseous pollutants (SO_x , NO_x) and SPM in industrial emissions
10. Determination of SO_x , NO_x and SPM in ambient air
11. Qualitative and quantitative estimation of phytoplankton and periphyton community in different aquatic habitats
12. Qualitative and quantitative analysis of zooplankton in relation to eutrophication
13. Study of leaf pigment by paper chromatography and TLC methods
14. Comparative anatomical study of mesophytes, hydrophytes and xerophytes
15. Chemical characterization of ground water
16. Study of dose – effect relationships in important toxicants/pollutants
17. Estimation of protein and carbohydrate content in biological samples
18. Application of diversity indices in aquatic and terrestrial ecosystems
19. Spring and stream order classification
20. Biochemical tests for different enzymes

- 1.2. Waste lands and their reclamation
- 1.4. Sustainable agricultural practices
- 1.5. Integrated pest management

Credit III: Water pollution

(16 hrs)

- 1.1. Sources and types of water pollution
- 1.2. Lake eutrophication and stream pollution
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- 1.4. Ground water pollution
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(16 hrs)

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ENS14203CR: Laboratory Course

(04 credits)

Course Contents

1. Determination of silt load of a stream / river
2. Estimation of total dissolved and suspended solids in water
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4. Estimation of dissolved oxygen, BOD, COD and dissolved organic matter in different waters
5. Estimation of organic carbon and organic matter in different soils samples
6. Estimation of nitrogen (NH_3 , NO_2 and NO_3) and phosphorus (ortho- and total) in different waters
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9. Estimation of gaseous pollutants (SO_x , NO_x) and SPM in industrial emissions
10. Determination of SO_x , NO_x and SPM in ambient air
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12. Qualitative and quantitative analysis of zooplankton in relation to eutrophication
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15. Chemical characterization of ground water
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17. Estimation of protein and carbohydrate content in biological samples
18. Application of diversity indices in aquatic and terrestrial ecosystems
19. Spring and stream order classification
20. Biochemical tests for different enzymes

DISCIPLINE CENTRIC ELECTIVE

ENS17204DCE: Atmospheric Science

(04 credits)

Unit I: The atmosphere

- 1.1.Introduction to atmospheric science
- 1.2.Atmospheric dynamics
- 1.3.Basic structure and mechanism of atmospheric general circulation,
- 1.4. Monsoon systems, cyclones, anticyclones, jet streams, ENSO
- 1.5.Air-sea interactions

Unit II: Climatology

- 1.1.Fundamentals of climatology
- 1.2.Classification of climate: Koppen's and Trewartha
- 1.3.Climatic zones of India
- 1.4.Climate of J&K
- 1.5. Paleo-climatology and climate change

Unit III: Atmospheric aerosols

- 1.1.Introduction and types of aerosols
- 1.2.Sources, transformation, geographical distribution and atmospheric effects
- 1.3.Chemical composition of aerosols
- 1.4.Carbonaceous aerosols: Black carbon
- 1.5.Global cooling versus global warming

Unit IV: Atmospheric data analysis

- 1.1.Dry and wet atmospheric deposition
- 1.2.LIDARS, SODARS, weather RADARS
- 1.3.Remote-sensing techniques (WP-RASS)
- 1.4. Self recording instruments, radiosondes, radiometersondes, ozone sonde
- 1.5. Climate modeling

ENS17205DCE: Environmental Microbiology

(04 credits)

Unit I: Microbial ecology

- 1.1.History and scope of microbiology
- 1.2.General account of micro-organisms
 - a. Bacteria
 - b. Fungi, algae and viruses
 - c. Protozoa
- 1.3.Interactions between microbes and other organisms
- 1.4. Factors affecting growth of microorganisms
- 1.5. Brief introduction to thermophiles, barophiles, acidophiles, alkalophiles and psychrophiles

Unit II: Microbes and environment

- 1.1. Nature and function of micro-organisms in soil, water and air
- 1.2. Microbial spoilage of food and its preservation
- 1.3. Microbial activity in sewage disposal
- 1.4. Application of micro-organisms in the control of

- a. Oil pollution
- b. Chemical pollution - pesticides, synthetic polymers, and metals
- c. Bio-deterioration of materials
- 1.5. Role of microbes in fixation and solubilization / mineralization of nutrients: carbon, nitrogen, phosphorus, sulphur

Unit III: Microorganisms and human health

- 1.1. Human health and environment: MMR, IMR, Life expectancy, morbidity
- 1.2. Status of communicable diseases in India
- 1.3. Epidemiology (reservoir of infection, communicability and control)
 - a. Air borne diseases: tuberculosis, influenza viruses
 - b. Soil borne diseases: tetanus and gas-gangrene
 - c. Water and food borne diseases: cholera, typhoid, giardiasis, hepatitis
- 1.4. Allergic diseases
- 1.5. Insect vectors of human diseases like malaria, dengue, encephalitis, and their control

Unit IV: Industrial microbiology

- 1.1 Major products of industrial microbiology - Antibiotics, amino acids and biopolymers.
- 1.2 Fermentation technology and bioprocessing
- 1.3 Role of microbiology in metallurgy.
- 1.4 Basic techniques in molecular biology - PCR and electrophoresis
- 1.5 Biosafety levels in microbiology labs.

ENS17206DCE: Green Environment

(02 Credits)

Unit II: Ecotourism

- 1.1. Ecotourism: concept and significance
- 1.2. Tourism in National Parks, sanctuaries, wetlands and other landscapes
- 1.3. Concept of tourism carrying capacity
- 1.4. Tourism policy
- 1.5. Ecotourism potential in J&K

Unit IV: Green cities

- 1.1. Concept of green buildings and cities
- 1.2. Green belt
- 1.3. Consumer behavior
- 1.4. Sustainable urban traffic management
- 1.5. Green city: a case study

ENS17207DCE: Ecological Tour

(02 credits)

During 2nd semester, students are required to go for institutional visit to various academic and research institutions outside Jammu & Kashmir carrying 02 credits and will form a component of Elective Allied. One credit will be given for participation and one credit for Tour report and viva voce.

- a. Oil pollution
- b. Chemical pollution - pesticides, synthetic polymers, and metals
- c. Bio-deterioration of materials
- 1.5. Role of microbes in fixation and solubilization / mineralization of nutrients: carbon, nitrogen, phosphorus, sulphur

Unit III: Microorganisms and human health

- 1.1. Human health and environment: MMR, IMR, Life expectancy, morbidity
- 1.2. Status of communicable diseases in India
- 1.3. Epidemiology (reservoir of infection, communicability and control)
 - a. Air borne diseases: tuberculosis, influenza viruses
 - b. Soil borne diseases: tetanus and gas-gangrene
 - c. Water and food borne diseases: cholera, typhoid, giardiasis, hepatitis
- 1.4. Allergic diseases
- 1.5. Insect vectors of human diseases like malaria, dengue, encephalitis, and their control

Unit IV: Industrial microbiology

- 1.1 Major products of industrial microbiology - Antibiotics, amino acids and biopolymers.
- 1.2 Fermentation technology and bioprocessing
- 1.3 Role of microbiology in metallurgy.
- 1.4 Basic techniques in molecular biology - PCR and electrophoresis
- 1.5 Biosafety levels in microbiology labs.

ENS17206DCE: Green Environment

(02 Credits)

Unit II: Ecotourism

- 1.1. Ecotourism: concept and significance
- 1.2. Tourism in National Parks, sanctuaries, wetlands and other landscapes
- 1.3. Concept of tourism carrying capacity
- 1.4. Tourism policy
- 1.5. Ecotourism potential in J&K

Unit IV: Green cities

- 1.1. Concept of green buildings and cities
- 1.2. Green belt
- 1.3. Consumer behavior
- 1.4. Sustainable urban traffic management
- 1.5. Green city: a case study

ENS17207DCE: Ecological Tour

(02 credits)

During 2nd semester, students are required to go for institutional visit to various academic and research institutions outside Jammu & Kashmir carrying 02 credits and will form a component of Elective Allied. One credit will be given for participation and one credit for Tour report and viva voce.

COURSE DESCRIPTIONS GENERIC ELECTIVE

ENS17GE01: Basics of Ecology and Environment (2 credits)

Unit I

- 1.1 Importance of environment
- 1.2 Components of environment-Atmosphere, hydrosphere, lithosphere and biosphere
- 1.3 Human and environment relations
- 1.4 Environment and development
- 1.5 Tools for environmental management

Unit II

- 1.1 Structure and functions,
- 1.2 Natural and managed ecosystem
- 1.3 Ecosystem goods and services
- 1.4 Ecological Succession
- 1.5 Ecological Interactions

ENS17GE02: Biogeography (2 credits)

Unit 1

- 1.1. Biodiversity and its importance
- 1.2. Threats to biodiversity
- 1.3. Hotspots of Biodiversity
- 1.4. Major biomes of the world: Distribution and characteristic features
- 1.5. Biogeography: Processes and patterns

Unit II

- 1.1. Geographical classification and zones
- 1.2. Zoogeographic realms of the world: Palaearctic, Nearctic, Neotropical, Oriental, Australian and African
- 1.3. Dispersal: Means, modes and barrier
- 1.4. Migrations
- 1.5. Conservation Biogeography

ENS17GE03: Analytical Instrumentation (02 credits)

Unit I

- 1.1. Stoichiometry
- 1.2. Titrimetry and gravimetry
- 1.3. Visible and UV spectroscopy
- 1.4. Atomic absorption spectrophotometry
- 1.5. Principle and applications of microscopy

Unit II

- 1.1. Chromatography-Basic Principle and its classification
- 1.2. Ion-exchange Chromatography
- 1.3. Gas liquid Chromatography/GC-MS
- 1.4. HPTLC and HPLC
- 1.5. Spectro-fluorimetry

ENS17GE04: Environmental Issues (03 credits)

Unit I

- 1.1. History and nature of human population growth
- 1.2. Natural resources, current status and types of resources
- 1.3. Resource depletion

Course Descriptions 3rd SEMESTER

CORE COURSES

ENS17301CR: Natural Resources

(4 credits)

Unit I: Mineral resources

- 1.1. Classification of mineral resources
- 1.2. Metals and minerals from land and their global distribution
- 1.3. Metals and minerals from oceans and their global distribution
- 1.4. Metals and mineral deposits in India with special reference in J&K
- 1.5. Environmental consequences of mineral exploitation

Unit II: Water resources

- 1.1. Inventory of earth's water resources: Surface and groundwater
- 1.2. Water resources of India with special reference to Kashmir
- 1.3. Global water budget
- 1.4. Surface and ground water resources: Global consumption pattern
- 1.5. Water resource management

Unit III: Bio-resources

- 1.1. Animal resources: current status with special reference to India
- 1.2. Fishery resources of India with special reference to J&K
- 1.3. Plant resources
- 1.4. Forest resources of India: Timber and non timber
- 1.5. Rangelands

Unit IV: Energy resources

- 1.1. Renewable energy resources
- 1.2. Non-renewable energy Resources
- 1.3. Nuclear energy
- 1.4. Concept of green fuels
- 1.5. Hydrogen as a source of energy

ENS17302CR: Environmental Impact Assessment

(04 credits)

Unit I: Fundamentals of EIA

- 1.1. Environment impact assessment: Concept, objectives and approaches
- 1.2. Strategic environmental assessment
- 1.3. EIA guidelines 2006 and amendments
- 1.4. Protocol for environment impact statements
- 1.5. Public participation in environmental decision making

Unit II: EIA methodologies

- 1.1. EIA methods
- 1.2. Baseline data generation
- 1.3. Air and water quality assessment
- 1.4. Ecological assessment
- 1.5. Social impact assessment

Unit III: EIA Case studies

- 1.1. Hydro power, irrigation and drainage
- 1.2. Industrial estates and Parks
- 1.3. Highways and Railways
- 1.4. Thermal power projects
- 1.5. Cement and Chemical industries

Unit IV: Ecological modeling

- 1.1. Role of models in ecology
- 1.2. Components of a model
- 1.3. Classes of mathematical models
- 1.4. Models of population (growth and interaction) and pollutant dispersal
 - a. Lotka – Volterra model
 - b. Leslie’s matrix model
 - c. Gaussian plume model
- 1.5. Modeling of air quality, water quality and noise characteristics

ENS17303CR: Laboratory Course

(04 credits)

Course Contents

1. Case studies based on environmental laws
2. Survey of different residential areas for determining the prevalence of different air, water, soil and food borne diseases
3. EIA – Leopold Matrix method and case studies
4. Socio-economic studies – preparing of questionnaire and case studies
5. Computation of standard deviation, standard error and coefficient of variation
6. Computation of correlation and regression
7. One way and two way classification of ANOVA
8. Land use / land cover classification from satellite data
9. Delineation of drainage of a given area from satellite data
10. Delineation of point, line and polygon themes
11. Waste auditing of any institution/ organization
12. Working and design of treatment plants
13. Spring and stream order classification
14. Study of colonization potential of periphyton on artificial substrates
15. Study of morphogenetic response of explants on media
16. Collection and demonstration of the pharmacognostic characters of important medicinal plants
17. Comparative anatomical study of mesophytes, hydrophytes and xerophytes
18. Collection and identification of common aquatic macrophytes
19. Field trip to National park/wildlife sanctuary/industrial area
20. Study of insect fauna in different environments

Unit III: EIA Case studies

- 1.1. Hydro power, irrigation and drainage
- 1.2. Industrial estates and Parks
- 1.3. Highways and Railways
- 1.4. Thermal power projects
- 1.5. Cement and Chemical industries

Unit IV: Ecological modeling

- 1.1. Role of models in ecology
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- 1.3. Classes of mathematical models
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ENS17303CR: Laboratory Course

(04 credits)

Course Contents

1. Case studies based on environmental laws
2. Survey of different residential areas for determining the prevalence of different air, water, soil and food borne diseases
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19. Field trip to National park/wildlife sanctuary/industrial area
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DISCIPLINE CENTRIC ELECTIVE

ENS17304DCE: Environmental Laws

(04 credits)

Unit I: Environmental Protection

- 1.1. Environment protection: Provisions of constitution (article 21, 48A, 51A, and 253)
- 1.2. National efforts on environmental protection, laws and policy in India
- 1.3. International efforts for environment protection (Stockholm, Kyoto protocol)
- 1.4. CITES (1973)
- 1.5. Earth Summit

Unit II: National Laws-I

- 1.1. Indian forest act (1927), forest conservation Act (1980) and rules (1981)
- 1.2. Wildlife protection Act (1972) and amended (2002) and J & K wildlife (protection) Act (1978) as amended in (2002)
- 1.3. The Water (Prevention and Control of Pollution) Act (1974) as amended up to (1988) and rules (1975)
- 1.4. The Air (Prevention and Control of Pollution) Act as amended by amendment Act (1987) and rules (1982)
- 1.5. The Environmental (Protection) Act (1986)

Unit III: National Laws-II

- 1.1. Hazardous waste management and handling rules (1989)
- 1.2. Biomedical waste (management and handling) rules (1998)
- 1.3. Noise pollution (regulations and control) rules (2000)
- 1.4. Municipal solid wastes (management and handling) rules (2000)
- 1.5. The EPA rules (1986)

Unit IV: National Laws-III

- 1.1. Biological diversity Act (2002)
- 1.2. Public liability insurance act (1991)
- 1.3. Intellectual property rights and patent act (2005)
- 1.4. National environment tribunal act (1995)
- 1.5. National green tribunal act (2010)

ENS17305DCE: Environmental Biotechnology

(04 credits)

Unit I: Introduction to environmental biotechnology

- 1.1. Biotechnology
 - a. Concept and environmental relevance
 - b. Environmental risks
- 1.2. Elementary information of gene transfer, brief account of cloning vehicles
- 1.3. Recombinant DNA technology and its applications.
- 1.4. Environmental Genomics: A key to understanding biology, pathophysiology and disease
- 1.5. Molecular taxonomy: documenting biodiversity by DNA barcoding

Unit II: Eco-friendly role of animals

- 1.1. Vermiculture technology
 - a. Earth worms and soil productivity
 - b. Earthworm culture and vermi-composting

- 1.2. Aquaculture improvement through biotechnology
- 1.3. Fish farming through biological wastes
- 1.4. Stem cell and animal cloning
- 1.5. Biological control of insects -definition, principles and control mechanisms

Unit III: In-vitro storage of plants

- 1.1 Tissue culture: Concept and importance
- 1.2 Micropropagation: Techniques and application
- 1.3 Conservation: Short term, medium term and long term
- 1.4 Recent developments in cryopreservation
- 1.5 Biotechnology in biodiversity conservation: Germplasm conservation , Gene banks and DNA banks

Unit IV: Biotechnology in environmental management

- 1.1. Biosensors and bioindicators
- 1.2. Biotechnology in pollution control
- 1.3. Biodegradation and bioremediation
- 1.4. Emerging environmental biotechnological trends
- 1.5. Genetically modified organisms and bio-safety: a general account

ENS17306DCE: Remote Sensing and GIS

(02 credits)

Unit I: Remote-sensing

- 1.1. Concept and overview of remote sensing: Concept of resolution-spatial, spectral, radiometric and temporal
- 1.2. Remote Sensing satellites: LANDSAT & IRS satellite series
- 1.3. Electromagnetic spectrum: EMR sources-active & passive, radiation laws
- 1.4. Fundamentals of image interpretation and processing
- 1.5. Aerial photographs and their types on the basis of look angle

Unit II: Geographic information system

- 1.1. Global positioning system : Basic principles and functioning
- 1.2. Development of GIS, functional requirements of GIS: hardware configuration and software modules
- 1.3. Geographic data: Spatial and non-spatial, data models: raster and vector
- 1.4. Remote sensing and GIS integration
- 1.5. Application of remote sensing and GIS in:
 - a. Monitoring and management of biodiversity
 - b. Integrated watershed development and
 - c. Environmental impact assessment

ENS17307DCE: Ecological Tour to Ladakh

(02 credits)

During 3rd semester, students will be required to go for the field study tour within Jammu & Kashmir carrying 02 credits which will form a component of the elective allied. One credit will be given for participation and one credit for field collection, tour report and viva-voce.

- 1.2. Aquaculture improvement through biotechnology
- 1.3. Fish farming through biological wastes
- 1.4. Stem cell and animal cloning
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ENS17306DCE: Remote Sensing and GIS

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Unit II: Geographic information system

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- 1.2. Development of GIS, functional requirements of GIS: hardware configuration and software modules
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- 1.4. Remote sensing and GIS integration
- 1.5. Application of remote sensing and GIS in:
 - a. Monitoring and management of biodiversity
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ENS17307DCE: Ecological Tour to Ladakh

(02 credits)

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Course Descriptions 4th SEMESTER

CORE COURSES

ENS17401CR: Environmental Engineering

(04 credits)

Unit I: Fundamentals of environmental engineering

- 1.1. Environmental engineering: Introduction and scope
- 1.2. Sewage and storm water drainage
- 1.3. Planning of housing drainage
- 1.4. Environmental sanitation
- 1.5. Ventilation and air conditioning

Unit II: Drinking water treatment

- 1.1. Methods of water purification: flocculation, sedimentation, sedimentation with coagulation
- 1.2. Filtration: sand filters, pressure filters, horizontal filters
- 1.3. Disinfection and desalination of water
- 1.4. Chemical treatment: adsorption, gas stripping, ion exchange
- 1.5. Reverse osmosis and distillation

Unit III: Sewage treatment

- 1.1. Wastewater treatment plants: Concept, methods and design
 - a. Primary
 - b. Secondary
 - c. Tertiary
- 1.2. Sludge and its disposal techniques
- 1.3. Natural methods of sewage disposal
- 1.4. Biology of sewage treatment
- 1.5. Reclamation and reuse of industrial and domestic wastewater

Unit IV: Solid and hazardous waste management

- 1.1. Solid wastes: sources, generation and their characteristics
- 1.1. Hazardous waste: sources and generation and their characteristics
- 1.2. Disposal and management of solid, industrial and hazardous wastes,
- 1.3. Hospital waste management
- 1.4. Site remediation

ENS17402CR: Biodiversity and Resource Management

(04 credits)

Unit I: Biogeography

- 1.1. Geographical classification and zones
- 1.2. Major biomes of the world: Distribution and characteristic features
- 1.3. Zoogeographic realms of the world: Palaearctic, nearctic, neotropical, oriental, australian and african
- 1.4. Dispersal: Means, modes and barriers, island life
- 1.5. Migrations

Course Descriptions 4th SEMESTER

CORE COURSES

ENS17401CR: Environmental Engineering

(04 credits)

Unit I: Fundamentals of environmental engineering

- 1.1. Environmental engineering: Introduction and scope
- 1.2. Sewage and storm water drainage
- 1.3. Planning of housing drainage
- 1.4. Environmental sanitation
- 1.5. Ventilation and air conditioning

Unit II: Drinking water treatment

- 1.1. Methods of water purification: flocculation, sedimentation, sedimentation with coagulation
- 1.2. Filtration: sand filters, pressure filters, horizontal filters
- 1.3. Disinfection and desalination of water
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- 1.1. Wastewater treatment plants: Concept, methods and design
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- 1.4. Biology of sewage treatment
- 1.5. Reclamation and reuse of industrial and domestic wastewater

Unit IV: Solid and hazardous waste management

- 1.1. Solid wastes: sources, generation and their characteristics
- 1.1. Hazardous waste: sources and generation and their characteristics
- 1.2. Disposal and management of solid, industrial and hazardous wastes,
- 1.3. Hospital waste management
- 1.4. Site remediation

ENS17402CR: Biodiversity and Resource Management

(04 credits)

Unit I: Biogeography

- 1.1. Geographical classification and zones
- 1.2. Major biomes of the world: Distribution and characteristic features
- 1.3. Zoogeographic realms of the world: Palaearctic, nearctic, neotropical, oriental, australian and african
- 1.4. Dispersal: Means, modes and barriers, island life
- 1.5. Migrations

Unit II: Biodiversity

- 1.1. Biodiversity: Status and importance, India as a mega-diversity nation
- 1.2. Endemism: Factors controlling distribution of flora and fauna
- 1.3. Hot Spots and cold spots, concept of native and exotic species
- 1.4. Biodiversity decline: Drivers of change and pressures
- 1.5. Threatened species categories of IUCN; concept of extinction threshold and extinction debt

Unit III: Biodiversity Management

- 1.1. Forest conservation: social forestry and joint forest management
- 1.2. Management of rangelands
- 1.3. Fishery resource management
- 1.4. Monitoring and management of bio-diversity
- 1.5. Biodiversity Conservation
 - a. In-situ conservation: National parks, sanctuaries, biosphere reserves, Ramsar Sites
 - b. Ex-situ conservation: botanical gardens, zoological parks, zoos, seed banks, in-vitro conservation

Unit IV: Management of natural resources

- 1.1. Concept and strategies of sustainable development
- 1.2. Management of mineral resources
- 1.3. Management of fresh water resources
- 1.4. Energy crisis and conservation of energy resources
- 1.5. Concept of ecological footprint and carbon sequestration

ENS17403CR: Project Work

(04 credits)

The project work shall be of practical nature and the candidate has to carry out the project work related to environment under the supervision of concerned teacher.

The distribution should be as follows:

- **Part I:** Identification of problem area and general description
- **Part II:** Study of specific literature in detail pertaining to the statement of the problem
- **Part III:** Developing a solution, methodology or proposing a hypothesis to solve the problem
- **Part IV:** Experimental analysis, results, discussion, conclusion and recommendations

Each student has to submit the dissertation of the project work for evaluation. The student has to give seminar (internal) and viva voce (external) of the project work.

Unit II: Biodiversity

- 1.1. Biodiversity: Status and importance, India as a mega-diversity nation
- 1.2. Endemism: Factors controlling distribution of flora and fauna
- 1.3. Hot Spots and cold spots, concept of native and exotic species
- 1.4. Biodiversity decline: Drivers of change and pressures
- 1.5. Threatened species categories of IUCN; concept of extinction threshold and extinction debt

Unit III: Biodiversity Management

- 1.1. Forest conservation: social forestry and joint forest management
- 1.2. Management of rangelands
- 1.3. Fishery resource management
- 1.4. Monitoring and management of bio-diversity
- 1.5. Biodiversity Conservation
 - a. In-situ conservation: National parks, sanctuaries, biosphere reserves, Ramsar Sites
 - b. Ex-situ conservation: botanical gardens, zoological parks, zoos, seed banks, in-vitro conservation

Unit IV: Management of natural resources

- 1.1. Concept and strategies of sustainable development
- 1.2. Management of mineral resources
- 1.3. Management of fresh water resources
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ENS17403CR: Project Work

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- **Part III:** Developing a solution, methodology or proposing a hypothesis to solve the problem
- **Part IV:** Experimental analysis, results, discussion, conclusion and recommendations

Each student has to submit the dissertation of the project work for evaluation. The student has to give seminar (internal) and viva voce (external) of the project work.

- 1.2.Theory and practice of managing the establishment, composition, and development of the forest
- 1.3.Urban forest ecology
- 1.4. Agro-ecosystems: Concept, structural and functional components
- 1.5. Role of biodiversity in agro-ecosystems, Food security and agriculture

Unit IV: Desert and grassland ecology

- 1.1. Ecological complexity of the desert communities
- 1.2. fauna and flora of the deserts
- 1.3. Ladakh cold desert
- 1.4. Grasslands ecology: evolution and types
- 1.5. Biodiversity and conservation in grasslands

ENS17406DCE: Environmental Planning and Auditing

(02 credits)

Unit I

- 1.1.Environmental planning – importance and objectives
- 1.2.Land use planning
- 1.3.Urban development and environmental planning
- 1.4.Rural development and environmental planning
- 1.5. Role of ethics, aesthetics and science in environmental planning

Unit II

- 1.1.Principles and guidelines of environmental auditing
- 1.2.Preparation of environmental audit report
- 1.3.Waste audit procedures – sources, types and management of wastes
- 1.4.ISO 9001 and 9002
- 1.5.ISO 14000

ENS17407DCE: Restoration Ecology

(02 credits)

Unit I: Concepts in restoration ecology

- 1.1. The basic principles and concepts of restoration ecology
- 1.2. Characteristics of degraded and restored ecosystems
- 1.3. Ecological indicators in restoration
- 1.4. Theory and practice of restoring animal and plant diversity
- 1.5. Ecological principles of the restoration of native ecosystems

Unit II: Restoration planning

- 1.1. Goals and objectives
- 1.2. Adaptive management and monitoring
- 1.3. Ethics of restoration
- 1.4. Role of public-private partnership in restoration
- 1.5. Measuring progress and success of restoration programs

- 1.4. Environment and human health
- 1.5. Environmental degradation

Unit II

- 1.1 Air pollution
- 1.2 Water pollution
- 1.3 Soil Pollution
- 1.4 Noise pollution
- 1.5 Radioactive pollution

ENS17GE05: Crenobiology

(02 Credits)

Unit I

- 1.1.Springs as critical biotopes
- 1.2.Classification of springs
- 1.3.Spring discharge and biology of spring biotopes
- 1.4. Delineation of spring protection zones
- 1.5.Vulnerability assessment and mapping of spring waters

Unit II

- 1.1.Inventory and monitoring of springs
- 1.2.Spring water geochemistry and recharge
- 1.3.Springs as ecosystems
- 1.4. Case study of major springs
- 1.5.Conservation and management of spring ecosystems

ENS17GE06: Industrial Ecology

(02 credits)

Unit I

- 1.1. Basic principles of green chemistry
- 1.2. Application and need of green chemistry
- 1.3. Concept of green economy, green growth and low carbon development
- 1.4. Introduction to industrial ecology and its relation to the concept of sustainability
- 1.5. Principles and objectives of industrial ecology

Unit II

- 1.6. Industrial symbiosis, industrial ecosystems and eco industrial parks
- 1.7. Ecology and biomimicry
- 1.8. Future and challenges of industrial ecology
- 1.9. Concept of green technology
- 1.10. Ecomark scheme and eco-friendly products

ENS17GE07: Strategic Environmental Assessment

(02 credits)

Unit I:

- 1.1. Origin of EIA:
- 1.2. Concept and objectives of EIA
- 1.3. EIA process
- 1.4. Baseline data collection
- 1.5. EIA guidelines 2006

Unit II:

- 1.1 Protocol for environment impact statements
- 1.2 EIA methods
- 1.3 Strategic environmental assessment
- 1.4 SEA process
- 1.5 Case studies

Credit IV: Environmental economics**(16 hrs)**

- 1.1. Environmental economics: Definition and scope
- 1.2. Population, poverty and environment
- 1.3. Concept of intangibles and externalities
- 1.4. Environmental evaluation methods: Hedonic pricing, contingent evaluation and household production function
- 1.5. Carbon credits and trading

ENS14108EO: Plant morphogenesis, Cyto-genotoxicity & Herbal Medicine (04 credits)**Credit I: Plant morphogenesis and regeneration****(16 hrs)**

- 1.1. Initiation, nutrition and maintenance of plant cell and tissue culture
- 1.2. Cellular totipotency, initiation of callus cultures and its characteristics
- 1.3. Cell differentiation and organogenesis
- 1.4. Suspension culture
- 1.5. Tissue culture studies of some threatened medicinal plants of Kashmir Himalaya

Credit II: Herbal medicine and health care**(16 hrs)**

- 1.1. Traditional Herbal Medicines for Healthcare and Management of Human diseases
- 1.2. Medicinal and aromatic materials from plants
- 1.3. Benefits of Medicinal and aromatic plant materials
- 1.4. Industrial utilization of medicinal plants
- 1.5. Phytochemical and anti microbial studies of some medicinal plants

Credit III: Cyto-genotoxicity**(16 hrs)**

- 1.1. Necrosis, apoptosis and inflammation
- 1.2. Somatic and genetic risk of environmental pollutants.
- 1.3. Cancer latency, threshold and non-threshold model of cancer
- 1.4. Mechanism of chemical carcinogens (free radicals and alkylating agents)
- 1.5. Classification of carcinogens (physical, chemical and biological agent)

Credit IV: Toxicogenomics (Testing protocols)**(16 hrs)**

- 1.1. Ames test and micronucleus test
- 1.2. Chromatid and chromosome aberration
- 1.3. Screening, tier testing and test batteries for mutagenicity testing
- 1.4. FISH technique
- 1.5. Use of Comet assay in environmental toxicology

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- Environmental Science. Cunningham, Saigo
- Environmental Science. Jackson & Jackson

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- Essentials of Geology. Chernicoff, Fox, Venkatakrishnan
- Physical Geology. Monroe & Wicander
- Concepts of Ecology. E.J. Kormondy
- Atmosphere, Weather & Climate. R.G. Barry & R.J. Chorley
- Environment: Principles & Applications. Chris Park.
- Earth Systems. W.G. Ernst
- Environmental Science - Physical Principles & Applications. Boeker & Grondelle
- Fundamentals of Physical Environment. Briggs, Smithson, Addison & Atkinson
- Atmosphere, Weather & Climate. R.G. Barry & R.J. Chorley
- Geosystems: An Introduction to Physical Geography. Robert W. Christopherson
- Introducing Physical Geography. Alan Starhler & Arthur Starhler
- Earths Dynamic Systems. W.K. Hamblin & E.H. Christiansen
- Soils in our Environment. Miller and Gardiner
- Fundamentals of Soils. J. Gerrard
- Environmental Science. Enger and Smith
- Basics of Environmental Science. Michael Allaby
- Principles of Environmental Science. Cunningham and Cunningham
- Environmental Sciences (System and Solutions). Mckinney and Schoch
- Principles of atmospheric physics and chemistry. Goody
- Smoke, Dust and Haze. S K Friedlander
- General Climatology. H. J. Critchfield
- Environmental Chemistry. IAN Williams
- Environmental Chemistry. A. K. De
- Environmental Chemistry. Stanley E. Manahan
- An Introduction to Analytical Chemistry. S.A. Iqbal & M. Satake
- Chromatography of Environmental Hazards. Lawrence Fishbein
- Principles of Biochemistry. Wilson Walker
- Electron Spin Resonance. J.E. Wertz And J.R. Bolton
- Analytical Chemistry. D. Kealey And P.J. Haines
- Text Book of Quantitative Chemical Analysis. G.H. Jeffery, J. Basset, J. Mendham and R.C. Denney
- The Surface Chemistry of Soils. Garrison Sposito
- The Nature & Properties of Soils. Brady & Weil
- Soils in our Environment. Miller and Gardiner
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- Essentials of Geology. Chernicoff, Fox, Venkatakrishnan
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- A Treatise on Limnology (Vol I – III). G. E. Hutchinson
- Limnology. Goldman and Horne
- Limnology. P. S. Welch
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- Weathering (An introduction to scientific principles). Bland and Rolls
- Soil fertility and fertilizers. Havlin et al.
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- Soil science and management. Edward J Plaster
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- Environmental chemistry. Fritz Helmet
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- An introduction to environmental chemistry. Andrews et al.
- Stream ecology. Barness and Mishall
- Analytical mass spectrometry. Budde
- Primary Productivity of the Biosphere. Helmut Lieth & Robert H. Whittaker
- Tropical Ecosystems & Ecological Concepts. Patnick L. Osborne
- Concepts of Ecology. E.J. Kormondy
- Ecology & Environmental Management. C.C. Park
- Ecology of a Changing Planet. Mark B. Bush
- Ecology for Environmental Sciences: Biosphere, Ecosystems & Man. J. M. Anderson
- Fundamentals of Ecology. E.P. Odum
- Instant Notes in Ecology. Mackenzie, Ball & Virder
- Primer of Ecological Theory. Jonathan Roughgarden
- Ecology with special reference to Animals and Man. S. Charles, Kendeigh
- Evolutionary Ecology. Eric R. Pianka
- A Primer of Ecology. Nicholas J. Gotelli
- Ecology Theories and Applications. Peter Stiling
- Applied Ecology and Natural Resource Management. Guy R. Mcpherson and Stephen Destefano
- Population Ecology. Begon & Mortimer
- Geosystems: An Introduction to Physical Geography. Robert W. Christopherson
- Physical Geology. Plummer, Mc. Geary, Carlson
- Physical Geology. Monroe & Wicander
- Essentials of Geology. Chernicoff, Fox, Venkatakrishnan
- Earths Dynamic Systems. W.K. Hamblin & E.H. Christiansen
- Introducing ecology. Cotgreave and Forseth
- Community ecology. Diamond and Case
- Community ecology. R J Putman
- Biodiversity and conservation. Michael J Jeffries
- Environmental Geology: Principles & Practice. Fred G. Bell
- Physical Geology. Monroe & Wicander
- Economic Geography - A Study of Resources. Prithwish Roy
- Environmental Science. Cunningham, Saigo
- Fish & Fisheries of India. V.G. Jhingram
- Concepts of Ecology. E.J. Kormondy
- River Jhelum, Kashmir Valley. L. Nyman
- Natural Resources and Environmental Technology. Jasper S Lee
- Himalayan Glaciers. Naseerudin Ahmed, Sarwar Rais
- Wildlife Wilderness. G.A.Bhat
- Range ecology. Humphrey
- Flowers of the Himalaya. Adam Stainton
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- Microclimate - The Biological Environment, 2nd ed. Normal J. Rosenverg, Blaine L. Blad, Shashi B. Verma
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- Atmospheric, Weather and Climate. R.G. Barrey and R.J. Chorley
- Geosystems- An Introduction to Physical Geography. Robert W. Christopherson
- Physical Geology. Plummer, Mc. Greary, Carlson
- Essentials of Geology. Wicander & Monroe
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- The Global Casino. Nick Middleton
- Natural Hazard Mitigation. Godschalk, Beatley, Berke, Brower & Kaiser
- Active Tectonics. E. Keller & N. Pinter
- Environmental Chemistry. M. Satake & Y. Mido
- Earths Dynamic Systems. W.K. Hamblin & E.H. Christiansen
- Physical Geology. Wicander & Monroe
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- Our Geologic Environment. H. Blatt
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- Environmental Science. Botkin, D.B. and Keller, E.A.
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- Environmental Geography. Marsh, W.M. and Grossa, Jr. J.M.
- Environmental Oceanography. Abel, D.C. and Mc Connell, R.L.
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- Natural Hazards and Disasters. Hyndman, D. and Daudley, N. (Editors)
- Environmental Geochemistry. Eby, G.N.
- Environmental Hydrogeology. Soliman, M.M., LaMoreaux, P.E., Memon, B.A.,
- Mineralogy. Perkins, D. Assad, F.A. and LaMoreaux, J.W.
- Environmental Law, the Economy and Sustainable Development. Revesz, Sands and Stewart
- Higher Education in India. Mehraj-ud-Din
- Environmental Economics and Policy. Tietenberg
- Issues in Environmental Economics. Hanley and Roberts
- Importance of Wildlife Conservation from Islamic Perspective. H.S.A. Yahya
- Psychology. Jhon J. Seamon, Douglas and T. Kenrick
- Society in Focus – Introduction to Sociology. William E. Thompson and Joseph V. Hickey
- Clinical Approach to Rural Development. E.D. Setty
- Environmental psychology. Annete Bolger
- Environment and Society. Francis Moore
- Environmental Economics-A Critical Overview. Alan Gilpin
- The economics of the environment and natural resources. R.Quentin Graflon et al.

General Instructions for the Candidates

1. The first semester is of 24 credit weightage.
2. A candidate has compulsorily to opt for 12 credits from the core component.
3. A candidate has a choice to opt for any 12 credits (3 papers) out of minimum of 16 credits (4 papers) offered as Electives (Allied).
4. A candidate can earn more than the minimum required credits (i.e., more than 96 credits for four Semester programme) which shall be counted towards the final result of the candidate.

Women in Ancient India

HS17107GE

Unit-I

- A. **Historiography**-- women's issue as analysed in different historiographical discourses, viz. colonial, Nationalist, Marxist and recent trends.
- B. **Women in Scripture**: Epics and Puranas

Unit-II

- A. Women and Marriage: Different forms of Marriage
- B. Women and property
- C. Women and the institution of Sati

Selected Readings:

- Agarwal, Bina, *A Field of One's Own: Gender and Land Rights in South Asia*, CUP, 1994.
- Altekar, A.S., *The Position of Women in Hindu Civilisation*, second revised edition, chs. 8, 9.
- Aparna Basu and A. Taneja [eds] *Breaking out of Invisibility; Women in Indian History*, 2002
- Atre, Shubhangana, *The Archetypal Mother*, 1987.
- Barai, Kumudini, *Role of women in the History of Orissa; From the earliest times to 1568 A.D.*, 1994
- Bhattacharji, Sukumari, *Women and Society in Ancient India*, 1994
- Chakravarty, Uma, *Everyday Lives, Everyday Histories; Beyond the Kings and Brahmanas of Ancient India*, 2006
- Chakravarty, U. 'Whatever happened to the Vedic Dasi?: Orientalism, Nationalism and Script from the Past' in Sangari and Vaid [eds] *Recasting Women*, 1989
- Chitgopekar Nilima (ed), *Invoking Goddesses: Gender Politics in Indian Religion*, 2002
- Elamkulam P.N. Kunjan Pillai, 'Matriliny in Kerala' in *Studies in Kerala History*, 1969
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- Hildebrandt, A. and K. Erndl (eds), *Is the Goddess a Feminist: The Politics of South Asian*
- Hirschon, Renee, *Women and Property: Women as Property*, 1984.
- Jaini, Padmanabh, *Gender and Salvation*, 1992.

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- Joan Wallach Scott, *Gender and Politics of History*, 1986, Ch,1.2
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- Moore, Henrietta, *Feminism and Anthropology*, 1988.
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- Orr, Leslie, *Donors Devotees and Daughters of the God*, 2000
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- Rangachari, Devika, *Invisible Women, Visible Histories.: Society ,Gender And Polity in North India*.2009
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- Roy.K.*The emergence of Monarchy in north India 8-4 centuries B.C*,1994
- Sanday, *Female Power and Male Dominance: On the Origins Of Sexual Inequality*,Cup,1981
- Shah, Kirit K., *Problem of Identity: Women in Early Indian Inscriptions*, OUP, 2001
- Shah, Shalini, *Love, Eroticism and Female Sexuality in the Classical Sanskrit Literature 7-13th*
- Shah, Shalini, *Poetesses in the Classical Sanskrit Literature: 7th-13th Centuries*, *Indian Journal of*
- Shah, Shalini, *The Making of Womanhood: Gender Relations in the Mahabharata*,1995
- Sharma, R.S., *Light on Early Indian Society and Economy*, 1966.
- Shaw, Miranda, *Passionate Enlightenment*, 1994.
- Tyagi, Jaya, *Engendering the Early Household*, Orient Longman, Delhi, 2008.

Syllabus Choice Based Credit System (CBCS)
for M.A Persian 2017 onwards

SEMESTER I

(3 core courses, each course of 4 credits)

PER17101CR :-Classical Persian Literature Poetry (Ghazal & Rubai)

Critical Study of the poets and Translation and Explanation of the below mentioned text:

Credit - 1st

انتخاب از غزلیات سعدی شیرازی:

- ا- شب فراق که داند که تا سحر چندست -
- ب- مادرین شهر غریبیم و درین ملک فقیر -
- ج- شب است و شاهد شمع و شراب و شیرینی -
- د- من ندانستم از اول که تویی مهر و وفایی -

Credit - 2nd

انتخاب از غزلیات حافظ شیرازی:

- ا- صبحدم مرغ چمن با گل خواسته گفت -
- ب- دوش دیدم که ملائک در میخانه زدند -
- ج- ستاره ای بد زشید و ماه مجلس شد -
- د- بیا تا گل برافشانیم و می در ساغر اندازیم -

Credit - 3rd

انتخاب از غزلیات خواجو کرمانی:

- ا- اگر سرم برود در سرو فانی شام -
- ب- گویا عزم ندارد که شود روزا مشب -
- ج- دیشب درآمد از دم آن ماه چهره ست -
- د- در چمن دوش بوی تو گذر میکردم -

Credit - 4th

انتخاب از رباعیات عمر خیّام:

- ا- افسوس که نامه جوانی طی شد -
- ب- این قافله عمر عجب می گذرد -

- ج۔ درکار گاہ کوزہ رستم دوش۔
د۔ پیش ازمن و تو لیل و نہاری بوده است۔

Books Recommended For Study

- ۱۔ بوستان ادب از دکتر شمس الدین احمد۔
- ۲۔ دیوان حافظ۔ بہ تصحیح پرفیسر نذیر احمد قاسم غنی۔ و مقدمہ
- ۳۔ کلیات سعدی۔ چاپ فروغی۔
- ۴۔ رباعیات عمر خیام۔
- ۵۔ شعر الجم از شبلی نعمانی۔ ۵ جلد۔
- ۶۔ تاریخ تحول شعر فارسی۔ از زین العابدین مومتمن۔
- ۷۔ دی باخیام۔ از علی دشتی۔
- ۸۔ سخن و سخنوران۔ فروزانفر بدیع الزمان۔
- ۹۔ باکاروان حلہ۔ دکتر عبدالحسین زرین کوب۔
- ۱۰۔ گلستان عجم ترجمہ باکاروان حلہ مطبوعہ اسلام آباد۔
- ۱۱۔ جام جہان نما۔ محمد علی اسلامی ندوش۔
- ۱۲۔ در مکتب حافظ از زرین کوب۔
- ۱۳۔ صور خیال در شعر فارسی از دکتر شفیع کدکئی انتشارات نیل۔

PER17102CR:- Classical Persian Prose.

Critical study of the prescribed books, authors and translation of the text given below.

Credit - 1st

انتخاب از سیاست نامہ از نظام الملک طوسی
۱۔ فصل ہفتم: اندر بر رسیدن از حال عامل وقاضی..... و شرط سیاست

Credit - 2nd

انتخاب از چہار مقالہ (مجمع النوادر)۔ از نظامی عروضی سمرقندی

مقالہ دوم: در ماہیت علم شعر و صلاحیت شاعر۔ از ص ۱۶۸ تا ۱۸۰

Credit - 3rd

انتخاب از گلستان سعدی شیرازی
جدال سعدی بامدعی در بیان تو انگری و درویشی
حکایت اول دوم سوم چهارم

Credit - 4th

انتخاب از تاریخ مسعودی معروف به تاریخ بیهقی تألیف ابوالفضل محمد بن حسین بیهقی
آمدن رسول از بغداد به گاهای درگذشتن القادر بالله خلیفه عباسی

In the examination there will be four Credits in this course - with an alternative choice - and the students will be required to attempt all the four. The Credits will be designed to test students critical understanding of the thematic and formal aspects of prescribed text.

Books Recommended For Study

- ۱- ”بهار ادب“ انتخاب از نثر کلاسیک فارسی با هتنام دکتر شمس الدین احمد -
- ۲- گزیده های از نظم و نثر فارسی - نثر کهن - متن های تاریخی از انتشارات فرهنگ و هنر -
- ۳- سبک شناسی - از ملک اشعر ابهار -
- ۴- نور و ظلمت در تاریخ ادبیات ایران از میخائل - ترجمه از اسد پور پیرانفر -
- ۵- چهار مقاله تصحیح دکتر محمد معین (دیباچه) -
- ۶- دیداری با اهل قلم از شادروان دکتر غلام محسین یوسفی - ۲ جلد
- ۷- قلمرو سعدی - علی دشتی -
- ۸- گنجینه سخن - دکتر ذبیح الله صفا -
- ۹- گلستان سعدی به کوشش - نوالله ایزدپرست

PER17203CR:- Communication and Skills

Credit - 1st

To Learn the Persian Grammatic terms and their usage. Question answer, Fill in the blanks, word meaning & sentence from the prescribed book.

مهدی ضرغامیان ج ۳- از آموزش زبان فارسی

Credit - 2nd

Translation and study of 1st five chapters of the prescribed book.

آموزش زبان فارسی از مهدی ضرغامیان ج ۳-

Credit - 3rd

Translation and study last five chapters of the prescribed book.

آموزش زبان فارسی از مهدی ضرغامیان

Credit - 4th

Oral conversation in Persian Language & Viva Voce Test.

(Note):- The Viva Voce examination will be conducted by the external examiner, Head of the Department and concerned teacher.

PER17204DCE:- History of Persian Literature (Ghanavid & Saljok Period)

Credit - 1st:

۱- وضع نثر فارسی در دوره غزنویان

Credit - 2nd:

۲- وضع شعر فارسی در دوره غزنویان

Credit - 3rd:

۳- ترویج نثر فارسی در دوره سلجوقیان

Credit. 4th

۴- ترویج شعر فارسی در دوره سلجوقیان