

SEMESTER - II

Core Course (CC- 5): Environmental Science

Full Marks - 70

Time : 3 hrs

Questions to be set in three parts representing all the five units. Part A will consist of 10 objective questions of 2 marks each. Part B will consist of five short questions (Four to be answered), 15 marks each. Part C will consist of five long questions (three to be answered) of 10 marks each.

Unit I: Concept and Dynamics of ecosystem

1.1 Abiotic factors and Biotic factors.

1.2 Energy flow

(a) Lindeman's rule of trophic dynamics

(b) Energy flow models

1.3 Biogeochemical cycles: Nitrogen, Carbon, Sulphur and Phosphorus cycle

1.4 Hydrological cycles.

Unit II: Principles pertaining to limiting factors

2.1 Liebig's Law of minimum, Shelford's Law of tolerance

2.2 Concept & Law of limiting factors

2.3 Factors compensation and ecology

Unit III: Population Growth, Predation and Competition

3.1 Demography: Life tables, Generation time, Net reproductive rate, Reproductive value

3.2 Population growth: Exponential growth, Verhulst-Pearl logistic growth model,

3.3 Population regulation: extrinsic and intrinsic mechanisms

3.4 Concept of niche, niche width and overlap, fundamental and realized niche, resource partitioning character displacement

Unit IV: Global Environmental Science

4.1 Climate Change

4.2 Carbon Footprint

4.3 Water quality: conservation of surface and ground water

4.4 Wildlife conservation

(a) Causes of extinction

(b) National and International efforts for conservation (CITES, IUCN, CBD)

(c) National parks and sanctuaries

(d) Biosphere reserves

(e) Wildlife protection Acts

Unit V: Pollution Biology

5.1 Pollutants, their sources and classification

5.2 Causes, effects and control of Water and Air Pollution

5.3 Eutrophication and Intropication

5.4 Environmental Radioactive pollution

5.5 Emerging pollutants: POPs, Pharmaceuticals

5.6 Bio-indicators as index of pollution and their significance

SEMESTER – II

Core Course (CC-6) Bio-Instrumentation & Biostatistics

Full Marks – 70

Time – 3 hrs

Questions to be set in three parts representing all the five units. Part A will consist of 10 objective questions of 2 marks each. Part B will consist of five short questions/Four to be answered of 3 marks each. Part C will consist of five long questions (three to be answered) of 10 marks each.

Unit – I

- 1.1 Principles and uses of analytical instruments – pH meter, colorimeter, Spectrophotometer, Ultra-centrifuge
- 1.2 Microscopy – Principles of light, Transmission Electron, Scanning Electron, Fluorescence, Phase-contrast and Confocal Microscopes Photomicrography

Unit – II

- (A) Separation techniques
1. Electrophoresis: SDS PAGE, Agarose gel electrophoresis
 2. Chromatography: Column, GLC, HPLC
 3. Organic separation by centrifugation
 4. Cell separation by flow cytometry and density gradient centrifugation
- (B) Immunological techniques
1. Radio-immunoassay (RIA)
 2. Enzyme-linked immunosorbent assay (ELISA)

Unit – III

- 4.1 Basic concepts in Biostatistics (sampling design, data collection and scaling techniques)
- 4.2 Mean: Arithmetic, Geometric, Harmonic Mean
- 4.3 Standard Deviation
- 4.4 Standard Error
- 4.4 Analysis of Variance (ANOVA)

Unit-IV

1. Correlation (SPL, Pearson and Rank's correlation)
2. Regression

Unit – V

- 1.1 Rules of probability
- 1.2 Binomial probability distribution
- 1.3 Poisson probability distribution
- 1.4 Normal probability distributions
- 1.5 Test of Significance
 - (a) Chi-square test
 - (b) Student's t-test

SEMESTER – II

Core Course (CC- 7): Biochemistry

Full Marks – 70

Time : 3 hrs

Questions to be set in three parts representing all the five units. Part A will consist of 10 objective questions of 2 marks each. Part B will consist of five short questions (four to be answered) of 2 marks each. Part C will consist of five long questions (three to be answered) of 10 marks each.

Unit-I: Bioenergetics

- 1.1 Laws of thermodynamics, internal energy, enthalpy, entropy
- 1.2 Concept of free energy, redox potential, energy rich compounds
- 1.3 Mitochondrial electron transport chain and oxidative phosphorylation

Unit-II: Biochemistry of Carbohydrates

- 2.1 Monosaccharides and Disaccharides, Types and properties
- 2.2 Polysaccharides: Homopolysaccharide and Heteropolysaccharide
- 2.3 Glycolysis, HMP shunt, Glycogenogenesis and Glycogenolysis

Unit-III: Biochemistry of proteins and lipids

- 3.1 Primary, secondary, tertiary, quaternary and domain structures
- 3.2 Stabilizing forces in protein structure
- 3.3 Peptide conformation (Ramachandran plot, helices, turns and sheets)
- 3.4 Biosynthesis of Urea
- 3.5 Free fatty acids: Synthesis and importance
- 3.6 β -Oxidation of long chain fatty acids

Unit – IV: Enzyme Biochemistry

- 4.1 Enzyme: Classification and nomenclature
- 4.2 Mechanism of enzyme action
- 4.3 Kinetics of enzyme catalyzed reaction
- 4.4 Non-specific Regulation of enzyme activity:
 - (a) Feedback inhibition
 - (b) Allosteric inhibition
- 4.5 Free radicals, Antioxidants and detoxification

Unit – V: Principles of Histology and Histochemistry

- 5.1 General principles of fixation and types of fixatives
- 5.2 General principles of staining and types of dyes
- 5.3 General principles of histochemistry:
 - (a) Carbohydrate
 - (b) Protein
 - (c) Lipid
 - (d) Nucleic acids
 - (e) Enzymes

SEMESTER – II

Core Course (CC- 8): Biosystematics and Evolution

Full Marks – 70

Time : 3 hrs

Questions to be set in three parts representing all the five units. Part A will consist of 10 objective questions of 2 marks each. Part B will consist of five short questions (four to be answered) of 3 marks each. Part C will consist of five questions (three to be answered) of 10 marks each.

Unit 1: Biosystematic

1. Definition & basic concept of Biosystematics and taxonomy, its importance and application in biology.
2. Hierarchy of categories, outline of classification of animals, important criteria used for classification up to Classes in each phylum.
3. Species concept : Biological and phylogenetic, subspecies and other intra-specific categories, evolutionary relationships among taxa
4. International code of Zoological nomenclature (ICZN): operative principles, and important rules, Zoological nomenclature and scientific names of various taxa
1. Trends in taxonomy : Classical taxonomy, clad taxonomy and molecular taxonomy

Unit 2: Pattern of genetic variation and natural selection

1. Genetic polymorphisms, variation in chromosome structure, protein structure and nucleotide sequences
1. Concept of Natural Selection (Darwinian and neo-Darwinian), mode of its operation - stabilizing, directional and disruptive modes of Natural Selection

Unit 3: Molecular evolution

1. Variation in the evolution of protein and DNA sequences
2. Molecular phylogenies
3. Rate of molecular evolution and molecular clock
4. Neutral theory of molecular evolution
5. Origin of new genes and evolution of multi gene family

Unit 4: Mechanism of speciation

1. Patterns and mechanisms of reproductive isolation and its role in evolution
2. Models of speciation : sympatric and allopatric

Unit 5: Population genetics

1. Concept of Gene pool, allele frequency and genotype frequency
2. Hardy-Weinberg principle of genetic equilibrium and its mathematical derivation
3. Detailed account of destabilizing forces of genetic equilibrium: Natural selection, Mutation, Migration, Meiotic drive, and Genetic Drift

SEMESTER - II

Core Course (CC-9) Practical

First Sitting

Full Marks - 70, CIA - 30

1. Biochemical experiments (any one of the following)	10	05
(a) Determination of salivary amylase activity		
(b) Colorimetric estimation of glucose, urea, uric acid or albumin in a given sample		
(c) Separation of amino acids by paper chromatography		
(d) Biochemical detection of glucose, starch, protein or lipid in a given sample		
2. Identify and comment upon the spots of evolutionary significance (any one of the following)	10	05
(a) Archaeopteryx		
(b) Darwin's finches		
(c) Serial homology in cephalothoracic appendages in pecten		
(d) Homology in Anology		
(e) Adaptive radiation in beaks of birds		
3. Histochemistry; Histochemical demonstration involving the following reagents: PAS, Alvan Blue, Sudan Black B, Sudan III, Fe, Prussian, Mayer's cross- Pyronin, Mercuric hemophthal or Preparation of temporary mount of any two of the specimens of plankton	10	05
Second Sitting		
4. Environmental studies (any one of the following)	10	05
(i) Measurement of pH		
(ii) Estimation of dissolved O_2		
(iii) Estimation of free CO_2		
(iv) Estimation of carbonate & bicarbonate alkalinity		
(v) Sampling & assessment of the taxonomic diversity/biodiversity in a habitat of grassland, pond & wetland		
(vi) estimation of the total hardness		
5. Hypothesis testing, standard error, correlation, regression, t-test	10	05
6. Exam record	10	
7. Viva-voce	10	05

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