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) of 5 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) Lindemann's rule of trophic dynamics

(b) Energy flow models

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

1.4 Hydrological cycles

Unit II: Principles pertaining to limiting factors

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

2.2Concept & Law of limiting factors

2.3 Factors compensation and ecotypes

Unit III: Population Growth, Predation and Regulation

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

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

3.3Population regulation extrinsic and intrinsic mechanisms

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

Unit IV: Global Environmental Issues

4.1Climate Change

4.2Carbon Footprint

4.3Water Security – conservation of surface and ground water

4.4 wildlife consevation

(a) Causes of extinction

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

(c) National parks and sanctuaries

(d) Biosphere reserves

(e) Wildlife protection Acts

Unit V: Pollution Biology

5.1Pollutants, their sources and classification

5.2Causes, effects and control of Water and Air Pollution

5.3Biomagnification and Eutrophication

5.4Thermal and Radioactive pollution

5.5Emerging pollutants: POPs, Pharmaceuticals

5.6 Bio-indicators as index of pollution and their significance

12.6.18 12.6.18 12.6.18

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 5 marks each. Part C will consist of five long questions (three to be answered) of 10 marks each.

Unit – I

1.1Principles 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. Organelle 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

4.1Basic concepts in Biostatistics (sampling design, data collection and scaling techniques)

4.2Mean: Arithmetic, Geometric & Harmonic Mean

4.2Standard Deviation

4.3Standard Error

4.4 Analysis of Variance (ANOVA)

Unit-IV

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

Unit –V

1.1 Rules of probability

1.2 Binomial probability distribution

1.3 Poission probability distribution

1.4 Normal probability distributions

5.5Test of Significance

(a)Chi-square test

(b)Student's t-test

12.6.18 12/6/18 12.6.18

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 5 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

2.3Polysaccharides: Homopolysaccharide and Heteropolysaccharide

2.3 Glycolysis, HMP shunt, Glyconeogenesis 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-genetic 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

12.6.18 12.6.18 12.6.18

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 5 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, sub - species and other infra-specific categories, evolutionary relationship 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 : Chemo - taxonomy, cyto - 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
2. 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. Rates 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

12.6.18 12-6-18 12.6.18

SEMESTER - II

Core Course (CC- 9) Practical **Full Marks - 70**

First Sitting

1. Biochemical experiments (any one of the followings) 10
   (a) Determination of salivary amylase activity
   (b) Colorimetric estimation of glucose, urea, uric acid or albumen 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
   (a) Archaeopteryx
   (b)Darwin's finches
   (c) Serial homology in cephalothoracic appendages in prawn
   (d) Homology vs Analogy
   (e) Adaptive radiation in beaks of birds

3. Histochemistry; Histochemical demonstration involving the following reagents: 10
   PAS, Alcian Blue, Sudan Black B, Sudan III/IV, Feulgen, Methyl green- Pyronin, Mercury bromophenol or
   Preparation of temporary mount of any two of the specimens of planktons

Second Sitting

4. Environmental studies (any one of the following) 10
   (i) Measurement of pH
   (ii) Estimation of dissolved O_2
   (iii) Estimation of free CO_2
   (iv) Estimation of carbonate & bicarbonate alkalinity
   (v) Composition & assessment of the taxonomic diversity/biodiversity in a habitat (of grassland, arid & wetland)
   (vi) Estimation of the total hardness

5. Biostatistics: 10
   Standard deviation, standard error, correlation, regression, t-test

6. Class record 10

7. Viva-voce 10

12.6.18 12.6.18 12.6.18

SEMESTER – III

Core Course (CC- 10): Vertebrate Immunology 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 5 marks each. Part C will consist of five questions (three to be answered) of 10 marks each.

Unit I: Innate and Acquired Immunology

1. Cell types of innate and adaptive immunity, Lymphocyte trafficking
2. Phagocytosis and inflammation
3. Humoral immunity: β cell activation and differentiation, primary and secondary humoral response
4. Cell mediated immunity: T - cell development and T-cell activation, CTL and NK cell mediated immunity

Unit 2: (A) Nature of Antigens

1. Antigenicity and immunogenicity, and the factors influencing it.
2. Characteristics of β and T cell epitopes and haptens
3. Super antigen and its role in T cell activation
4. Antigen processing and presentation
5. MHC complex

(B) Structure and functions of Antibodies

(a) Gross and fine structure

(b) Classes and sub-classes

(c) Antibody mediated effector functions and monoclonal antibodies

Unit 3: (A) Antigen- antibody interaction and Complement system

1. Antibody affinity and antibody avidity
2. Precipitation reactions
3. Agglutination reactions
4. Complement System - activation pathway, biological function and complement deficiencies
5. ELISA

(B) Cytokines : Classification and function, Cytokines receptors.

Unit 4: Organization and expression of Ig genes

1. Organization of Ig genes
2. Generation of antibody diversity
3. BCR and Generation of T-cell receptor diversity

Unit 5: Immunology and Diseases

1. Hypersensitivity (Type I, II, II, IV).
2. Auto-immunity
3. Immune responses to infectious agents - bacterial, viral and parasitic infection (Protozoa and Helminth parasites).
4. Immunodeficiencies

12.6.18 12.6.18 12.6.18