MBTCR8191T: Ecology and Evolution

Theory: [CIA: 20 Marks; End-Sem: 80 Marks]

No. of Credits	6
Theory/Composite	Theory
No. of periods assigned	6 Theory

Course description/objective:

The course is designed to

1. provide a comprehensive understanding of the ecological principles governing biotic-abiotic interactions and biodiversity, community structure and dynamism,
2. enable the students to gain an overview of the processes related to evolution, including speciation, co-evolution, life through geological ages and theories and evidences of evolution.
3. provide a comprehensive understanding of the ecological principles governing population biology, species interactions, and conservation biology.
4. enable the students to gain a firm grasp of the principles of evolutionary biology related to the origin of angiosperms, vertebrates and hominids.
5. develop an understanding of current environmental issues such as climate change and pollution.
6. provide a comprehensive understanding of molecular evolution and systematics.

Syllabus:

Module A: 27 marks (2 classes / week)

Unit I: Environment and Biodiversity: physical and biotic environment; biotic and abiotic interactions with model examples; alpha, beta and gamma biodiversity; ecads, ecotypes, ecospecies and coenospecies; biodiversity hotspots and terrestrial biomes

Unit II: Succession and Community ecology: Types; mechanisms; changes involved in succession; seral types; concept of climax; community structure and attributes; approaches for community study and statistical parameters: edges and ecotones

UNIT III: Evolutionary history and consequences: origin of universe and Hubble constant; frozen accident and evolution backward hypothesis; palynology and fossilization processes, dating of fossils, index fossil; form genus and reconstruction of fossil genera; evolutionary time scale and major events; evolution of seed habit and origin of angiosperms; Telome Theory

UNIT IV: Speciation: biological species concept, allopatric and sympatric species, quantum speciation, mechanisms of speciation, types of isolating mechanisms; co-evolution (including mimicry); adaptive radiation

UNIT V: Theories and evidences of evolution: Lamarckism, Darwinism and De Vries' theory – propositions and criticisms; embryological evidences including Haeckel's Biogenetic Law; missing links

Module B: 27 marks (2 classes / week)

UNIT VI: Population ecology: Characteristics of a population, survivorship and growth curves, r and K selection models, deme, Levin's model of metapopulation and relevant theories. Population regulation, role of density dependent, density independent, extrinsic and intrinsic factors, dominance diversity curves

UNIT VII: Species interactions & Conservation: Competition, predation, mutualism, detritivory. Principles and practice of conservation biology, IUCN and the Red Data Book, Project Tiger and conservation of Olive Ridley turtles as case studies, wetland management

UNIT VIII: Origin and Evolution of Life: Concept of Oparin, Miller's experiment, the first cell, RNA world, the evolution of metabolism, prokaryotes, eukaryotes and the origin of multicellular organisms. Extinction events: oxygen holocaust, Permo-Triassic and K-T extinctions

UNIT IX: Origin and Evolution of Vertebrates: Origin of vertebrates, reptilian evolution and dinosaur evolution timeline, mammalian evolution, origin and evolution of man, adaptive radiation

Module C: 26 marks (2 classes/week)

UNIT IX: Ecosystem and Conservation: (a) Ecosystem services, Ecosystem metabolism and Ecosystem dynamics (b) Types and models of food chain and food web (c) Concept of Apex Predator, keystone species, umbrella species, flagship species, Invasive species (d) Ecological limiting factors, ecological footprint, ecological pyramids (d) Ecologically sensitive areas, Corridors, Protected areas, Modern conservation approaches (in situ and ex situ strategy, etc.)

UNIT X: Habitat and Niche: (a) Concept of habitat and niche, Types of niche (b) Functional dynamics of niche (niche overlap, niche width, competitive exclusion principle, Resource partitioning, character displacement)

UNIT XII: Pollution and management: (a) Current issues of global climate change (b) Air quality management (b) Eutrophication, Arsenic pollution

UNIT XIII: Molecular Evolution and Systematics: (a) Concept of microevolution and macroevolution (b) Phylogenetic systematics, phylogenetic trees, cladistics and phenetics (c) Concept of molecular clocks, neutral theory of molecular evolution (d) Phylogeography, Paralogs and orthologs. (d) Neo Darwinism and modern synthetic theory

Texts & Reading/Reference Lists:

1) M.C. Dash. Fundamental of Ecology.
2) J.L. Chapman, M.J. Reiss. Ecology: Principles and Applications.
3) P.D. Sharma. Ecology and Environment.
4) P.S. Verma, V.K. Agarwal. Environmental Biology.
5) E.P. Odum. Ecology.
6) B.K. Hall, B. Hallgrimsson. Strickberger's Evolution.
7) D.J. Futuyma. Evolution.
8) M.P. Arora. Evolutionary Biology.
9) Relevant scientific literature.

Q.Paper Structure for End SemTheory

Module A (27 marks):
Compulsory Objective Questions: 1x 5 = 5 marks
Subjective Questions: Answer any 2 out of 3 questions (with subparts). 11 x 2 = 22 marks

Module B (27 marks):
Compulsory Objective Questions: 1x 5 = 5 marks
Subjective Questions: Answer any 2 out of 3 questions (with subparts). 11 x 2 = 22 marks

Module C (26 marks):
Subjective Questions:
Answer any 1 out of 2 questions. 6 x 1 = 6 marks
Answer any 2 out of 3 questions. 10 x 2 = 20 marks