Syllabus template

Semester: 8	
Course : Major	
Paper Title: Ecology and Evolution	
Paper code: C4BT230821T	**Credits: 4**
Hours/week : 4	
Category: Core/MDC/SEC/VAC : Core	
Theory / Practical / Composite : Theory	
No of Modules : 2	

Course Overview:

1. To provide an overview of the theories and processes related to evolution, including natural selection, co-evolution, fossilization and evolution and extinction through geological ages.
2. To analyse the mechanisms of evolution including speciation and origin and evolution of various life forms.
3. To examine the ecology and structure of populations and communities, including factors influencing population growth, community organization and ecological succession.
4. To provide an advanced exploration of ecological principles and dynamics, including ecosystem management policies and modern conservation strategies.
5. To provide a comprehensive understanding of global environmental challenges, including pollution dynamics.
6. To provide a comprehensive exploration of the basic evolutionary relationships and taxonomic diversities of animals, and modern evolutionary perspectives including evo-devo principles.

Course Outcome:

Module A

1. Outline the fundamental concepts of theories and foundations of evolution, speciation and the evolutionary history of life and population and community ecology.
2. Describe and explain the mechanisms of evolutionary processes such as natural selection, speciation and adaptive radiation, major evolutionary transitions, population regulation and population characteristics, community structure and succession.
3. Apply the principles of evolutionary biology to interpret evolutionary adaptations, patterns of speciation and the evolutionary relationships and use ecological principles to interpret population growth patterns and community structure.
4. Analyze evolutionary processes and events leading to the origin and diversification of cells and organisms by integrating theories and evidence from evolutionary biology and examine the ecological significance of population and community dynamics.
5. Evaluate the significance of hypothesis and evidences of evolution and ecological consequences of factors regulating population growth and community stability.
6. Develop a comprehensive overview of theories and foundations of evolution, speciation and the evolutionary history of life and population and community ecology.

Module B

1. Identify and recognize key concepts of ecology and evolution, encompassing ecological species classification, niche ecology, ecosystem conservation, pollution biology, and principles of systematics and evolutionary architecture.

2. Explain and understand ecosystem dynamics, niche behaviours, conservation and pollution dynamics, and molecular evolution mechanisms.
3. Apply ecological and evolutionary principles to interpret sustainability, conservation approaches and animal diversity.
4. Analyze integrations in ecological and evolutionary strategies to address ecosystem stability and global environmental crises and evolutionary body plan architectures.
5. Evaluate the impact of conservation strategies and underlying ecological principles as well as evolutionary strategies on human and animal world.
6. Develop a comprehensive overview of the modern principles of ecology and evolution and design integrated strategic frameworks for global sustainability.

Prerequisites: ***Basic knowledge about animal and plant diversity, animal behaviour, environment, ecology and genetics.***

SYLLABUS

UNIT/Module	**CONTENT**	**HOURS or NUMBER OF CLASSES**	**CO Mapping**	**COGNITIVE LEVEL**
Module A	**Unit I: Foundations of Evolution:** Theories of evolution (Darwin's theory of Natural Selection, Modern Synthesis), natural selection, coevolution, evolutionary time scale, fossilization and dating of fossils, mass extinction events. **Unit II: Speciation and the Evolutionary History of Life:** Biological species concept, modes of speciation, isolating mechanisms, adaptive radiation. Origin of life, and evolution of cells and multicellular organisms, origin of vertebrates, reptilian evolution, origin and evolution of humans. **Unit III: Population and Community Ecology:** Population characteristics and growth, r and K selection, role of density-dependent and density-independent factors in population regulation. Community structure, ecological succession, ecotones and edge effects.	2 classes per week	CO1-CO6	K1-K6
Module B	**UNIT IV: Ecosystem Function and Species Dynamics:** (a) Ecosystem dynamics, ecosystem metabolism (b) Concept of apex predator, keystone species, umbrella species, flagship species, invasive species (c) Niche ecology (types, functional dynamics of niche).	2 classes per week	CO1-CO6	K1-K6

	UNIT V: Applied Environmental Ecology and Sustainability: (a) Ecosystem services, ecological footprint, ecosystem stressors (b) Ecological corridors, protected areas, modern conservation approaches (c) Current issues of global climate change (d) Eutrophication, Arsenic pollution. **UNIT VI: Integrative Evolutionary Biology:** (a) Basic principles of phylogenetic systematics (b) Concept of molecular evolution, paralogs and orthologs, neutral theory of molecular evolution (c) Bauplan concept (d) Micro- and macro-evolutionary trends in animal diversity.			

Text Books and Suggested readings

Module A

1. B.K. Hall, B. Hallgrimsson. Strickberger's Evolution.
2. D.J. Futuyma. Evolution.
3. J.L. Chapman, M.J. Reiss. Ecology: Principles and Applications.
4. M.C. Dash. Fundamentals of Ecology.
5. Relevant scientific literature.

Module B

6. M.C. Dash. Fundamentals of Ecology.
7. J.L. Chapman, M.J. Reiss. Ecology: Principles and Applications.
8. P.D. Sharma. Ecology and Environment.
9. P.S. Verma, V.K. Agarwal. Environmental Biology.
10. E.P. Odum. Ecology.
11. B.K. Hall, B. Hallgrimsson. Strickberger's Evolution.
12. D.J. Futuyma. Evolution.
13. M.P. Arora. Evolutionary Biology.
14. Begon, M., Townsend, C.R., and Harper, J.L. Ecology: From Individuals to Ecosystems.
15. Relevant scientific literature.

Evaluation: Theory: CIA: 30 marks; Semester Exam: 70 marks

Paper Structure for Theory Semester Exam Module:

Module A (35 marks)

Answer any five out of seven questions, each of 7 marks with subparts.
[No sub-part will be less than 2 marks or more than 5 marks]

Module B (35 Marks)

Subjective Questions: Answer any five out of seven questions, each of 7 marks with subparts.
[No sub-part will be less than 2 marks or more than 5 marks]

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
	Module A	
CO1	Outline the fundamental concepts of theories and foundations of evolution, speciation and the evolutionary history of life and population and community ecology.	K1
CO2	Describe and explain the mechanisms of evolutionary processes such as natural selection, speciation and adaptive radiation, major evolutionary transitions, population regulation and population characteristics, community structure and succession.	K2
CO3	Apply the principles of evolutionary biology to interpret evolutionary adaptations, patterns of speciation and the evolutionary relationships and use ecological principles to interpret population growth patterns and community structure.	K3
CO4	Analyze evolutionary processes and events leading to the origin and diversification of cells and organisms by integrating theories and evidence from evolutionary biology and examine the ecological significance of population and community dynamics.	K4
CO5	Evaluate the significance of hypothesis and evidences of evolution and ecological consequences of factors regulating population growth and community stability.	K5
CO6	Develop a comprehensive overview of theories and foundations of evolution, speciation and the evolutionary history of life and population and community ecology.	K6
	Module B	
CO1	Identify and recognize key concepts of ecology and evolution, encompassing ecological species classification, niche ecology, ecosystem conservation, pollution biology, and principles of systematics and evolutionary architecture.	K1
CO2	Explain and understand ecosystem dynamics, niche behaviours, conservation and pollution dynamics, and molecular evolution mechanisms.	K2
CO3	Apply ecological and evolutionary principles to interpret sustainability, conservation approaches and animal diversity.	K3
CO4	Analyze integrations in ecological and evolutionary strategies to address ecosystem stability and global environmental crises and evolutionary body plan architectures.	K4
CO5	Evaluate the impact of conservation strategies and underlying ecological principles as well as evolutionary strategies on human and animal world.	K5
CO6	Develop a comprehensive overview of the modern principles of ecology and evolution and design integrated strategic frameworks for global sustainability.	K6