



GATE Syllabus

Ecology and Evolution



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ECOLOGY AND EVOLUTION

Subject Code: /EY

Course Structure

Sections/Units	Topics
Section A	Ecology
Unit 1	Population Ecology
Unit 2	Species Interactions
Unit 3	Community Ecology
Unit 4	Ecosystem Structure, Function and Services
Section B	Evolution
Unit 1	Origin, Evolution and Diversification of Life
Unit 2	Types of Selection (Stabilizing, Directional etc.)
Unit 3	Life History Strategies
Unit 4	Origin of Genetic Variation
Unit 5	Molecular Evolution
Section C	Mathematics and Quantitative Ecology
Unit 1	Mathematics and Statistics In Ecology
Unit 2	Statistical Hypothesis Testing
Section D	Behavioural Ecology
Unit 1	Classical Ethology
Unit 2	Mating Systems

Course Syllabus

Section A: Ecology

Unit 1: Population Ecology

- Metapopulation dynamics:
 - Growth rates
 - Density independent growth
 - Density dependent growth
 - Niche concept

Unit 2: Species Interactions

- Plant-animal interactions:
 - Mutualism
 - Commensalism
 - Competition
 - Predation
- Trophic interactions:
 - Functional ecology
 - Ecophysiology
 - Behavioural ecology

Unit 3: Community Ecology

- Community assembly, organization and evolution
- Biodiversity:
 - Species richness
 - Evenness and diversity indices
 - Endemism
 - Species-area relationships

Unit 4: Ecosystem Structure, Function and Services

- Nutrient cycles
- Biomes
- Habitat ecology;
- Primary and secondary productivity
- Invasive species
- Global and climate change
- Applied ecology

Section B: Evolution

Unit 1: Origin, Evolution and Diversification of Life

- Natural selection
- Levels of selection

Unit 2: Types of selection (stabilizing, directional etc.)

- Sexual selection
- Genetic drift
- Gene flow
- Adaptation
- Convergence
- Species concepts

Unit 3: Life history strategies

- Adaptive radiation
- Biogeography and evolutionary ecology

Unit 4: Origin of genetic variation

- Mendelian genetics
- Polygenic traits, linkage and recombination
- Epistasis, gene-environment interaction
- Heritability
- Population genetics

Unit 5: Molecular evolution

- Molecular clocks
- Systems of classification:
 - Cladistics
 - Phenetics
- Molecular systematics
- Gene expression and evolution

Section C: Mathematics and Quantitative Ecology

Unit 1: Mathematics and Statistics in Ecology

- Simple functions (linear, quadratic, exponential, logarithmic, etc.)
- Concept of derivatives and slope of a function
- Permutations and combinations
- Basic probability (probability of random events
- Sequences of events, etc.)
- Frequency distributions and their descriptive statistics (mean, variance, coefficient of variation, correlation, etc.)

Unit 2: Statistical Hypothesis Testing

- Concept of p-value
- Type I and Type II error, test statistics like t-test and Chi-square test
- Basics of linear regression and ANOVA

Section D: Behavioural Ecology

Unit 1: Classical Ethology

- Neuroethology
- Evolutionary ethology
- Chemical
- Acoustic and visual signaling

Unit 2: Mating systems

- Sexual dimorphism
- Mate choice
- Parenting behaviour competition
- Aggression
- Foraging behavior
- Predator-prey interactions
- Sociobiology
- Kin selection, altruism, costs and benefits of group-living