

Shree Warana Vibhag Shikshan Mandal's

**WARANA UNIVERSITY,
WARANANAGAR**

(A State Public University established under Section 3 (6) of MPUA,
2016)

॥ विद्या सर्वस्य भूषणम् ॥



Warana University

Established: 2025

**Structure & Syllabus For
Master of Science-M.Sc. in Zoology
UNDER
Faculty of Science & Technology
M.Sc. Part -II (Semester- III and IV)**

As Per National Education Policy - 2020

With Effect from Academic Year 2026-27 Onwards

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Preamble – M.Sc. Zoology Program

The Department of Zoology, Warana University started in the year 2025 under. It offers M.Sc. and Ph.D. Programmed in Zoology. While designing this syllabus, emphasis was given to cover the syllabus of NET and SET examinations so that students will help students to qualify these exams.

The syllabus is framed according to the guidelines of National Education Policy 2020 (NEP 2020), where students get an opportunity to select an elective course of his/her choice from the first semester of M.Sc. like Cell Biology, Animal Physiology, Entomology, Aquaculture and Fisheries, and Sericulture. Appropriate number of hours is allotted for the lab Courses to offer skill development. During M.Sc. I, the lab courses are based on theory papers Viz. Molecular Cell Biology, Applied Entomology, and Research Methodology in Zoology, Physiological Chemistry, Anatomy and Physiology. In Research Methodology, students will gain the knowledge of bioinstrumentation and biostatistics along with basics of Animal systematics.

The syllabus offers opportunity of on job training or Field project to get an experience outside the walls of the classroom.. The M.Sc. program in Zoology will help the students to understand the complex life processes at cellular and molecular level, the functioning of cells, tissues, organs and systems, develop technical skills in Entomology, Aquaculture and Fisheries and Sericulture. The students will be able to analyze a situation critically and make decisions in the areas of their specialization.

A) General Objectives of Zoology

1. To Understand Animal Diversity

Recognize the wide variety of animal life, including classification, taxonomy, and evolutionary relationships among different groups.

2. To Learn Animal Structure and Function

Study the anatomy (structure) and physiology (function) of animals, from single-celled organisms to complex vertebrates.

3. To Explore Evolutionary Relationships

Understand how animals have evolved over time and how natural selection, adaptation, and speciation have shaped life on Earth.

4. To Study Animal Behavior and Ecology

Examine how animals interact with each other and their environment, including behavioral patterns, ecological roles, and life cycles.

5. To Understand Developmental Biology

Learn how animals develop from fertilized egg to adult, including embryology and reproductive strategies.

6. To Gain Skills in Scientific Inquiry and Research

Develop the ability to observe, analyze, and interpret biological data through laboratory experiments and field studies.

7. To Appreciate the Role of Animals in Ecosystems and Human Life

Understand the ecological, economic, and cultural importance of animals, and the impact of human activity on animal life.

8. To Promote Conservation Awareness

Learn the significance of biodiversity conservation and sustainable management of animal resources.

9. To Prepare for Careers in Biological Sciences

Provide foundational knowledge and skills necessary for careers or advanced study in medicine, veterinary science, wildlife biology, research, and more.

10. To Foster Critical Thinking and Problem Solving

Encourage analytical thinking to address biological questions and environmental challenges.

Programme Outcomes (POs)

- 1. PO1: Apply the knowledge of Zoology in day today life.**
- 2. PO2: Understand animals from their sub-cellular to ecosystem level.**
- 3. PO3: Gain the knowledge of agro based entrepreneurship like Sericulture, aquaculture,**
- 4. Apiculture and lac culture for providing lab-to-land benefits to Society.**
- 5. PO4: Able to frame hypothesis, design experiment, analyze data & generate conclusions.**
- 6. PO5: Able to work in different fields of biological sciences like animal cell culture, toxicology, enzymology, bioinstrumentation etc.**
- 7. PO6: Students are able to address societal issues like pollution, health awareness, pest-parasite management, taxonomy and biodiversity conservation. Entrepreneurship and Employability**

Program Specific Outcomes (PSOs)

PSO 1: The students will learn about animal diversity, cell biology, genetics, ecology, ethology, evolution, and entomology.

PSO 2: The students will understand various basic concepts and be able to describe them.

PSO 3: The students can apply their knowledge to classify, distribute, and organize the animals.

PSO 4: The students can solve the problems related to patterns of heredity, pedigree analysis, etc.

PSO 5: The students will acquire skills like sketching the diagrams, karyotype analysis, dissection, and other practical skills.

2. Duration- The course is full time and of two years duration.

3. Eligibility- for Admission B. Sc. Zoology from any recognized Institutions.

4. Medium of Instruction:English

1. Determination of CZPA, Grading and Declaration of result

University has adopted 10-point Grading System as follows:

- In each semester, marks obtained in each course (Paper) are converted to grade points: If the total marks of course are 100 and passing criteria is 40%, then use the following Table for the conversion.

1. GradationChart:

Table

Marks Obtained	Numerical Grade(Grade Point)		CGPA	LetterGrade
Absent	0 (zero)		-	Ab:Absent
0–39	0to 4		0.0– 4.99	F:Fail
40– 49	5		5.00–5.49	C:Average
50– 54	6		5.50–6.49	B:AboveAverage
55– 64	7		6.50–7.49	B+:Good
65– 74	8		7.50–8.49	A:VeryGood
75– 84	9		8.50–9.49	A+:Excellent
85– 100	10		9.50–10.0	O :Outstanding

Note:

1. Marks obtained ≥ 0.5 shall be rounded off to next higher digit.
2. The SGPA&CGPA shall be rounded off to 2 decimal points.
3. Marks obtained in 50marks or 200 marks paper shall be converted to 100 marks.

Calculation of SGPA &CGPA

1.SemesterGradePointAverage(SGPA)

$$= \frac{\sum(\text{Coursecredits} \times \text{Grade points obtained}) \text{ of a semester}}{\sum(\text{Coursecredits}) \text{ of respective semester}} \text{ SGPA}$$

2.CumulativeGradePointAverage(CGPA)

$$\text{CGPA} = \frac{\sum(\text{Total credits of a semester} \times \text{SGPA of respective semester}) \text{ of all semesters}}{\sum(\text{Total course credits}) \text{ of all semesters}}$$

2. NATURE OF QUESTION PAPER AND SCHEME OF MARKING:

For 4 Credits 60:40

For 2 Credits 30:20

NOTE: As per Science Subject Pattern

3. Internal Evaluation Scheme

As per university rules

4. Duration of Examination

- | | | | |
|------|---------------------------------------|-----------|---------|
| i. | Duration of Examination for | 60 marks- | 2 Hours |
| ii. | Duration of Examination for | 30 marks- | 1 Hours |
| iii. | Duration of Practical Examination for | 50 marks- | 2 Hours |

5. Course Wise Syllabus (Paper)

- | | | | |
|------|------------|----------------|---------|
| i. | COs | | |
| ii. | Module | Teaching Hours | Credits |
| iii. | References | | |

M.Sc. Zoology

SEMESTER–III

Course Name - **BIOLOGY OF PARASITES**

Course code:

Total Credits:04

Course Outcomes –

CO1: Understand basic concepts, origin, evolution, types, and adaptations of parasites.

CO2: Explain host–parasite interactions, transmission, host range, and ecological importance.

CO3: Describe classification, morphology, life cycle, pathogenicity, and prevention of protozoan parasites.

CO4: Explain morphology, life cycle, diseases, and control of trematode and cestode parasites.

CO5: Understand features, life cycle, pathogenicity, and prevention of nematode parasites.

Unit 1- Parasitism

15 hrs

1.1 Introduction, origin and evolution of parasitism, paleoparasitology and its significance, Parasitic adaptation, parasites and their types.

1.2 Host parasitic interaction and host ranges, ecological importance of parasites and their transmission.

Unit 2- Protozoa

15 hrs

2.1 Classification with important characteristics, reproduction, morphology, lifecycle, pathogenicity and prophylaxis of Leishmaniasis; Trypanosome sp., Plasmodium sp., Giardia sp.

Unit -3 Platyhelminthes trematode parasites

15 hrs

3.1 General characters and geographical distribution, morphology, life cycle, pathogenicity and prophylaxis of trematode parasites, Fasciola sp., Fasciolopsis sp., Dicrocoelium sp., Echinostoma sp., Schistosoma sp., Polystoma sp.

3.2 Platyhelminthes cestode parasites

General characters and geographical distribution morphology, life cycle, pathogenicity & prophylaxis of cestode parasites; Taenia sp., Echinococcus, Hymenolepis sp., Dipylidium sp.

Unit 4 - Nematode parasites

15 hrs

4.1 General characters and geographical distribution, morphology, life cycle, pathogenicity and prophylaxis of - Ascaris sp., Trichinella sp., Enterobius sp., Ancylostoma sp., Wuchereria sp.

Suggested Readings:

- Cheng, T.C. General parasitology Academic Press, Inc. (1986)
- Noble, E.R. and Noble, G.A: Parasitology, The biology of Animal parasites Lea and Fabiger
- Andeson, D.R.: Comparative Protozoology, Cambridge Uni. Press.
- Chandler, A.C. and Read, C.P.; Introduction of Parasitology, Willy Eastern,
- Belding, D.A. A text book of Prasitology, Meredith pub. Co.
- Baker, J.R. Parasitic Protozoa, Academic Press
- Grell, K.G. Protozoology, Springer Verlag

Practical

1. Study of the protozoan parasites through slides: Study of malaria- infected blood smear of mouse with Plasmodium sp. signet ring stage, trophozoite stage, Schizont stage and Study of permanent slides-Giardia, Nyctotherus, Balantidium, Opalina, Entamoebahistolytica, Leishmania promastigotes.
2. Study of permanent slides of cestodes parasites- Taeniascolex, mature proglottids, cysticercus larva, T.S. of mature proglottid to demonstrate tegument, Echinococcusgranulosus W.M., Hydatid cyst, Diphylobothriumlatum mature proglottid, Dipylidiumcaninumscolex, mature proglottids, Monieziaexpansa, Amphilinafoliacea
3. Detailed morphological studies of Taenia sp.: Dissect and expose the digestive and reproductive system
4. Study of permanent slides of trematodes parasides- Fasciola hepatica W.M., Echinostoma W.M., Fasciolopsisbuski W.M., T.S of Fasciola sp. to demonstrate tegument, larval forms of Fasciolasporocyst, redia, cercaria, Polystomaintegerrimum
5. Study permanent slides of nematodes i.e Trichurisglobulosa. Oxyuris, Ancylostoma male & female, Wuchereriafemale. Trichinella sp., Trichuris sp., Enterobius sp., Stronglyoides sp., Necator sp., Ancylostomia sp., Wuchereria sp. Dracunculusmedinensis
6. Detailed morphological of Ascaris: Dissect and expose the digestive, male and

female reproductive system and study the permanent slides-T. S. Ascaris male, T.S. Ascaris female.

7. Detailed morphological of Whipworm and Pinworm: Dissect and expose the digestive and reproductive system of parasite.

8. Collection and identification of indigenous ectoparasites and end parasites

9. Preparation of temporary slides of the collected identified samples of parasites.

M.Sc.II Zoology Sem-III Paper no. VII

Course Name - INSECT ECOLOGY

Course code –

Total Credits-04

Course Outcomes –

CO1: Understand ecological concepts, insect abundance, distribution, and abiotic factors.

CO2: Explain population growth models, life tables, and insect population dynamics.

CO3: Describe food, nutrition, and interspecific interactions affecting insects.

CO4: Understand competition, predator–prey interactions, and survival strategies.

CO5: Explain community ecology, biodiversity, and applications in pest management.

UNIT I-

15 hrs

1.1 History and Definition, Basic Concepts. Organisation of the Biological world. Plato's Natural Balance vs Ecological Dynamics as the modern view. Abundance and diversity of insects, Study of abundance, distribution and relation between the two.

1.2 Basic principles of abiotic factors and their generalised action on insects. Implications for abundance and distribution of organisms including insects.

UNIT II

15 hrs

2.1 Basic concepts of abundance- Model vs Real world. Population growth basic models – Exponential vs Logistic models. Discrete vs Continuous growth models. Concepts of Carrying capacity, Environmental Resistance and Optimal yield. Vital Statistics- Life Tables and their application to insect biology. Survivorship curves. Case studies of insect life tables.

2.2 Population dynamics- Factors affecting abundance- Environmental factors, dispersal and migration, Seasonality in insects. Classification and mechanisms of achieving different seasonality- Diapause (Quiescence) - aestivation, hibernation.

UNIT III

15 hrs

3.1 Biotic factors- Food as a limiting factor for distribution and abundance, Nutritional Ecology. Food chain- web and ecological succession. Interspecific interactions- Basic factors governing the interspecific interactions- Classification of interspecific interactions - The argument of cost-benefit ratios.

3.2 Competition- Lotka-Volterra model, Concept of niche ecological homologues, competitive exclusion. Prey-predator interactions Basic model- Lotka-Volterra Model, Volterra's principle. Functional and numerical response. Defense mechanisms against predators/parasitoids

Evolution of mimicry, colouration, concept of predator satiation; evolution of life history strategies.

UNIT IV

15 hrs

4.1 Community ecology- Concept of guild, Organisation of communities Hutchinson Ratio, May's d/w, Relation between the two and their association with Dyar's Law and Przibram's law.

4.2 Relative distribution of organisms, Concept of diversity- the Wallacian view. Assessment of diversity. Diversity- stability debate, relevance to pest management. Pest management as applied ecology.

Practical

1. Types of distributions of organisms.
2. Study of insect life table.
3. Pest survey and surveillance.
4. Methods of sampling insects, estimation of densities of insects and understanding the distribution parameters
5. Determination of optimal sample size.
6. Learning to fit basic population growth models.
7. Testing the goodness of fit for insect population.
8. To study interactions with Lotka -Volterra model.
9. To study on Assessing and describing ecological niche.
10. Field visit to study biodiversity in agro- forest ecosystem.

Suggested Readings

Chapman JL & Reiss MJ. 2006. Ecology: Principles & Applications. 2nd Ed. Cambridge Univ. Press, Cambridge.

Gotelli NJ & Ellison AM. 2004. A Primer of Ecological Statistics. Sinauer Associates, Inc., Sunderland, MA.

Gotelli NJ. 2001. A Primer of Ecology. 3rd Ed. Sinauer Associates, Inc., Sunderland, MA

Gupta RK. 2004. Advances in Insect Biodiversity. Agrobios, Jodhpur.

- Krebs CJ. 1998. Ecological Methodology. 2nd Ed. Benjamin-Cummings Publ. Co., New York.
- Krebs CJ. 2001. Ecology: The Experimental Analysis of Distribution and Abundance. 5th Ed. Benjamin-Cummings Publ. Co., New York.
- Magurran AE. 1988. Ecological Diversity and its Measurement. Princeton Univ. Press, Princeton.
- Price PW. 1997. Insect Ecology. 3rd Ed. John Wiley, New York.
- Real LA & Brown JH. (Eds). 1991. Foundations of Ecology: Classic Papers with Commentaries. University of Chicago Press, Chicago.
- Southwood TRE & Henderson PA. 2000. Ecological Methods. 3rd Ed. Methuen & Co. Ltd., London.
- Speight MR, Hunt MD & Watt AD. 2006. Ecology of Insects: Concepts and Application. Elsevier Science Publ., The Netherlands.
- Wilson EO & William H Bossert WH. 1971. A Primer of Population Biology. Harvard University, USA.
- Wratten SD & Fry GLA. 1980. Field and Laboratory Exercises in Ecology. Arnold, London.

M.Sc. Zoology Sem-III

Title of course: Animal behaviour

Course code:

Total Credits:04

Course Outcomes:

CO1: Explain basic concepts of animal behaviour and communication.

CO2: Describe how environmental factors influence animal behaviour.

CO3: Discuss social behaviour and group interactions in animals.

CO4: Explain reproductive behaviour and mating strategies in animals.

CO5: Understand the role of hormones and pheromones in controlling behaviour.

Unit 1: Behaviour

1.1 Definition - Innate behaviour, learning, reasoning, motivation, conflict and sexual behaviour.

1.2 Migration and homing with special reference to birds.

1.3 Communication in animals: Visual, olfactory, auditory and tactile.

1.4 Camouflage and Mimicry - types of mimicry

Unit :2 Ecological Aspects of Behaviour

2.1 Habitat selection, food selection and optimal foraging theory.

2.2 Anti-predator defense mechanisms, aggression, territoriality and dispersal.

Unit 3: Social behaviour

3.1 Social Behaviour: Aggregations - Schooling in fishes, flocking in birds, herding in Mammals.

3.2 Group selection, kin selection, altruism, inclusive fitness, and social organization in insects and primates.

Unit :4 Reproductive behaviour

4.1 Reproductive Behaviour: Evolution of sex, reproductive strategies, mating systems, courtship, sperm behaviour competition, sexual selection and parental care.

4.2 Hormones and behaviour, pheromones and behaviour.

Practical-

1. Tools, techniques and methods used in studying animal behavior.
2. To study nests and nesting behaviour of the birds and social insects.
3. To study Social life behaviour in animals.
4. To study courtship behaviour in animals.
5. To study the parental behaviour in animals.
6. To study different types of animal behaviour such as habituation, camouflage, mimicry & reproductive.
7. Prepare shortvideos/movieson any two behaviour.
8. Visit to Forest/Wild life Sanctuary/Biodiversity Park/Zoological Park to study and record the behavioural activities of animals and prepare a short report.

Suggestive readings

1. John Alcock, (2013) Animal Behaviour, Xth Edition, Sinauer Associates Inc., USA.
2. Manning, A. and Dawkins, M. S, (2012) An Introduction to Animal Behaviour, VI th Edition, Cambridge University Press, UK.
3. McFarland, D. (1985) Animal Behaviour, Pitman Publishing Limited, London, UK.
4. Rubenstein, D. (2022) Animal Behavior, XIIth Edition, Sinauer Associates, Oxford University Press, UK.
5. Gadagkar, R. (2021) Experiments in Animal Behaviour: Cutting-Edge Research at Trifling Cost, Indian Academy of Sciences. David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.

M.Sc. Zoology Sem-IV

Title of course: Evolution and Natural selection

Course code:

Total Credits:04

Course Outcomes:At the end of the course the students will be able to:

CO1: Acquire enhanced knowledge about the mechanism of natural selection

CO2: Describe the mechanism of natural selection and the evolutionary mechanisms

CO3: Comprehend concepts regarding Neutral theory of evolution

Unit 1: (15 hrs.)

1.1. Concepts of variation, adaptation, struggle, fitness, and natural selection - Spontaneity of mutation and the evolutionary synthesis.

1.2. Origin of life. Concept of Haldane and Oparin, Miller experiment (1953). The RNA world, the first cell and Evolution of prokaryote.

Unit 2: (15 hrs.)

2.1. Origin of eukaryotes, anaerobic metabolism - Origin of photosynthesis and aerobic metabolism and Evolution of unicellular eukaryote. Contributions of Lynn Margulis (Endosymbiotic theory.).

2.2. Palaeontological evidences of vertebrate evolution - Important fossil evidences of fishes, amphibia, reptiles and birds (brief and general account only).

Unit 3: (15 hrs.)

3.1 Natural Selection :Types (stabilizing, directional, disruptive), artificial selection, group selection, and sexual selection

3.2 Mutation:Types of Mutations: Point mutations (substitution, insertion, deletion), frame-shift mutations, and large-scale chromosomal aberrations (deletion, duplication, inversion, translocation).Causes of Mutation.

Unit 4 – (15 hrs.)

4.1 Genetic Drift -Definition &Evolutionary Significance: Acts as a major mechanism of microevolution alongside natural selection and mutation.

4.2 Mechanisms of Genetic DriftBottleneck Effect, Founder Effect

Suggested Readings:

1. Bergstrom, C. T. and L. A. Dugatkin. 2012. Evolution, Second MEDIA Edition. W.W. Norton & Company, International Student Edition, pp-756.
2. Jobling, M., E. Hollox, M. Hurles, T. Kivisild and C. T. Tyler Smith. 2014. Human Evolutionary Genetics. Second Edition. Garland Sciences, London, pp-650.
3. Veer Bala Rostogi, 2018. Organic Evolution (Evolutionary Biology), Thirteenth Edition Vinoth Kumar Jain, Scientific International (Pvt.) Ltd, New Delhi, pp-590.
4. <https://www.flipkart.com/books/evolution~contributor/pr?sid=bks>
5. <http://www.evolution-textbook.org/>
6. <https://onlinelibrary.wiley.com/journal/15585646>
7. <http://darwin-online.org.uk/>

Recommended texts

1. Strickberger. M. W. 2000. Evolution. Third Edition, Jones Bartlett Publishers, pp-722.
2. Hall B. K. and B. Hallgrimsson. 2014. Strickberger's Evolution. Fifth Edition, Bartlett Learning, An Ascend Learning Company, pp-642.
3. Barton, N.H., D. Briggs, J.A. Eisen David, D.B. Goldstein and N.H. Patel. 2007. Evolution. Cold Spring Harbor Laboratory Press, pp-833.

Practicals :

1. Study of plant and animal fossils (Stromatolites, Rhynia, Lepidodendron, Trilobite, Ammonite, Glomerula, Colombia forbesi)
2. Study of plant and animal connecting links (Archaeopterix, Lungfish, Platypus, Gnetum, Seed ferns, Euglena)
3. Study of animal hybrids (grizzly, mule, wholphin, liger, zorse, dzo)
4. Making of fossils using shadu clay
5. Identify animals with super senses (Octopus, Bat, Mantis Shrimp, Jewel beetles, Honey Bees)
6. Study of homologous and analogous animal parts.
7. Visit to a museum/science center
8. Identify and comment upon the spots of evolutionary significance
 - (a) Archaeopteryx

- (b) Darwin's finches
- (c) Serial homology in cephalothoracic appendages in prawn
- (d) Homology vs Analogy
- (e) Adaptive radiation in beaks of bird

Title of course: Animal behaviour

Course code:

Total Credits:04

Course Outcomes:

CO1: Explain basic concepts of animal behaviour and communication.

CO2: Describe how environmental factors influence animal behaviour.

CO3: Discuss social behaviour and group interactions in animals.

CO4: Explain reproductive behaviour and mating strategies in animals.

CO5: Understand the role of hormones and pheromones in controlling behaviour.

Unit 1: Behaviour

1.1 Definition - Innate behaviour, learning, reasoning, motivation, conflict and sexual behaviour.

1.2 Migration and homing with special reference to birds.

1.3 Communication in animals: Visual, olfactory, auditory and tactile.

1.4 Camouflage and Mimicry - types of mimicry

Unit :2 Ecological Aspects of Behaviour

2.1 Habitat selection, food selection and optimal foraging theory.

2.2 Anti-predator defense mechanisms, aggression, territoriality and dispersal.

Unit3: Social behaviour

3.1 Social Behaviour: Aggregations - Schooling in fishes, flocking in birds, herding in Mammals.

3.2 Group selection, kin selection, altruism, inclusive fitness, and social organization in insects and primates.

Unit :4 Reproductive behaviour

4.1 Reproductive Behaviour: Evolution of sex, reproductive strategies, mating systems, courtship, sperm behaviour competition, sexual selection and parental care.

4.2 Hormones and behaviour, pheromones and behaviour.

Practical-

1. Tools, techniques and methods used in studying animal behavior.
2. To study nests and nesting behaviour of the birds and social insects.
3. To study Social life behaviour in animals.
4. To study courtship behaviour in animals.
5. To study the parental behaviour in animals.
6. To study different types of animal behaviour such as habituation, camouflage, mimicry & reproductive.
7. Prepare shortvideos/movieson any two behaviour.
8. Visit to Forest/Wild life Sanctuary/Biodiversity Park/Zoological Park to study and record the behavioural activities of animals and prepare a short report.

Suggestive readings

1. John Alcock, (2013) Animal Behaviour, Xth Edition, Sinauer Associates Inc., USA.
2. Manning, A. and Dawkins, M. S, (2012) An Introduction to Animal Behaviour, VI th Edition, Cambridge University Press, UK.
3. McFarland, D. (1985) Animal Behaviour, Pitman Publishing Limited, London, UK.
4. Rubenstein, D. (2022) Animal Behavior, XIIth Edition, Sinauer Associates, Oxford University Press, UK.
5. Gadagkar, R. (2021) Experiments in Animal Behaviour: Cutting-Edge Research at Trifling Cost, Indian Academy of Sciences. David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.

M.Sc. Zoology Sem-IV

Title of course: Ecology, Ethology and Biodiversity Conservation

Course code:

COURSE OUTCOME

At the end of the course the students will be able to:

CO1: Understand the components of ecosystem, concepts of ecosystem energetics, and types of succession

CO2: Acquire in depth knowledge in the concepts of habitat, niche, guild, and species interactions

CO3: Analyze the complex animal behavior patterns, fundamentals and different factors regulating the animal behavior

CO4: Understand the types of learning process and the neural mechanism of learning and memory

CO5: Generate interest in biodiversity among the learns and understand the conservation strategies in India

CO6: Analyze the importance of international conventions, treaties for the conservation of global biodiversity

COURSE CONTENT

Part A: Ecology (30 hrs.)

Module 1. Ecological Energetics, Transition and Stability in Communities (15 hrs.)

1.1 Solar energy. Solar irradiance – Chemosynthesis. Energy flow - Unidirectional model. Mention Y-shaped

energy flow model.

1.2 Ecological succession: Types (Primary succession, Secondary succession), Causes of succession

(Autogenic succession, Allogenic succession).

1.3 Mechanisms of succession - (Nudation, Migration, Ecesis, Competition, Reaction, Stabilisation). Seral

communities. Changes in animal life. Micro-succession. Climax community – Characteristics, types of

climax. Monoclimax and polyclimax theory. Examples of succession – (Succession in an aquatic

ecosystem, succession in a terrestrial ecosystem)

Module 2. Concepts of Habitat, Niche, Guild and Species Interactions (15 hrs.)

2.1 Habitat, microhabitat and niche. Different types of niches: Grinnellian niche, Eltonian niche,

Hutchinsonian niche. Contemporary niche theory. Niche overlap. Gaia hypothesis.

2.2 Competitive exclusion principle, resource partitioning, compression hypothesis, concept of guild,

character displacement, ecological equivalents.

2.3 Intra and interspecific interactions: Types of Interspecific interactions– (Positive, Negative and Neutral),

Positive interactions (commensalism, proto-cooperation, mutualism and pollination).
Negative

interactions (competition, parasitism, amensalism, predation, herbivory, carnivory).

2.4 Co-evolution: Mutualism (Insects and insect-pollinated flowers, Birds and bird-pollinated flowers,

Acacia ants and Acacias, Hosts and parasites, Mention Antagonistic coevolution, Mention Geographic

ART C: Biodiversity Conservation (40hrs.)

Module 5. Biodiversity & Conservation Biology (30hrs.)

5.1 Diversity indices: Alpha diversity, Beta diversity and Gamma diversity. Species diversity and ecosystem

stability.

5.2 Biodiversity in India: Major biogeographic zones of India; India as a mega diversity nation; hot spots

biodiversity – characteristics; an outline of the features and biodiversity of hot spots in India (Western

Ghats and Eastern Himalaya). Terrestrial ecosystems of India: Forests- characteristic features,

biodiversity, ecosystem services, degradation, and management strategies; Grasslands- characteristic

features, biodiversity, ecosystem services, degradation, conservation; Deserts- characteristic features,

climate, and biodiversity). Freshwater ecosystems - characteristic features, types-lentic and lotic,

biodiversity, threats, climate change. Marine ecosystems - characteristic features, biodiversity,

ecosystem services and threats and conservation strategies. Estuaries – types, salinity variation,

biodiversity, human impact.

5.3 Depletion of biodiversity: Current estimates of species loss, causes of biodiversity loss, impacts of

biodiversity loss, Strategic species concepts: keystone species, indicator species, umbrella species,

flagship species.

5.4 Strategies of biodiversity conservation: in situ and ex situ conservation, Gene Banks, establishment of

protected areas, habitat conservation, public awareness and other relevant measures. Restoration

ecology, need and uses. Karanji lake restoration in India (Brief account only).

5.5 Project tiger, Project elephant. World Conservation Strategy (1980), National Biodiversity Action Plan

2008 (Brief account only).

M.Sc. Zoology Semester IV

Title of Course : Medical Entomology

Course code:

Total Credits: 04

Course outcomes:

CO1 : Understand, classify, and identify insects of medical and veterinary importance.

CO2 : Incorporate the subject knowledge in designing innovative techniques of vector control.

CO3 : Better prepared to contribute to the field of public and community health.

CO4 : Understand molecular aspects of diseases of medical importance.

CO5 : Capable of joining the research areas pertinent to vector borne diseases.

Unit 1: Overview of Entomology. 15hrs

1.2. Classification of Class Insecta and Arachnida with special emphasis medically important Arthropods.

1.3. Insect Morphology: Exoskeleton, Head, thorax, and abdomen.

1.4. Insects Physiology: Digestive system, Excretory system, Circulatory system, Reproductive system, Nervous system, and Endocrine system.

1.5. Insect Development: Growth & development, Metamorphosis.

Unit 2: Biology of medically important Insects 15hrs

2.1. Diptera: Mosquitoes (Anopheles, Aedes, Culex), Housefly, Horsefly, Tsetse fly and Sand fly.

2.2. Hemiptera: Bed bugs.

2.3. Siphonaptera: Flea.

2.4. Siphunculata: Head louse, Body louse and pubic louse.

2.5. Dictyoptera: Cockroaches.

Unit 3: Insect Ecology & Behaviour 15hrs

3.1. Insects and climate: Temperature, Light, Rainfall, Wind and Influence of Climate change.

3.2. Insect population dynamics: Population functions and factors affecting population size.

3.3. Climate change and its influence on Malaria in India.

3.4. Community ecology: Classes of interaction, factors affecting interaction and consequences of interaction.

3.5. Insect behavior: mating, feeding and defensive strategies.

Unit 4: Arthropod-borne diseases

15hrs

4.1. Bacterial diseases - Plague, Rickettsiosis, Bartonellosis.

4.2. Viral disease – Dengue, Japanese Encephalitis, Chikungunya, Zika.

4.3. Protozoan diseases – Leishmaniasis, Malaria, Trypanosomiasis.

4.4. Helminthic diseases – Filariasis (Wuchereria, Brugia, Loa).

4.5. Direct injury, Annoyance, Allergies, toxins, myiasis and venomous arthropods.

Practical's:

1. Insect Collection and Preservation methods.
2. Collection of medically important Insects and identification up to genus level.
3. Maintenance and study the stages life cycle of Cockroach / house fly / mosquito.
4. Preparation of permanent mounts of mosquito respiratory siphon and trumpet.
5. Preparation of permanent mounts of Insect leg and antennae.
6. Preparation of permanent mounts of wings of Cockroach / house fly / mosquito.
7. Dissection, mounting and preparation of permanent slides of Insect mouth parts.
8. Dissection of salivary glands of Cockroach / house fly / mosquito.
9. Dissection of Digestive system, nervous system and reproductive system of Cockroach / housefly / mosquito.
10. Dissecting and mounting of male and female genitalia of Cockroach / house fly / mosquito.
11. Collection of venomous Arthropods and identification.
12. Maintenance of Insect / venomous arthropod collection box. (Submission of Insect / venomous arthropod collection box is must during the practical examination)

References:

1. Biology of Disease Vectors, 2nd Ed., William C. Marquardt, 2004, Elsevier Academic Press.
2. Medical and Veterinary Entomology, 2nd Ed., Gary Mullen & Lance Durden.
3. Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods, Revised Edition. by Bruce Eldridge & John Edman.

4. Medical Toxicology by Richard C. Dart. Pub: Lippincott Williams & Wilkin.
5. Manual of Medical Entomology by Deane P. Furman & Paul Catts.
6. Infectious Diseases of Arthropods by Goddard.
7. Medical Entomology for Students 5th edition by Mike Service.
8. General and Applied Entomology by David and Ananthakrishnan.
9. Destructive and Useful Insects by R. L. Metcalf.
10. Ecology of Insects by Martin R. Speight Pub: Wiley-Blackwell.
11. Insect ecology by Timothy D. Schowalter 3rd Edition. Pub: Elsevier, 2011.