बिरसा मुंडा ट्रायबल युनिवर्सिटी
Birsa Munda Tribal University

राजपिपला, जि. नर्मदा Rajpipla, Dist. Narmada
Established by Tribal Development Department, Govt. of Gujarat

School of Science
B.Sc. (Zoology) Programme

Subject Code & Name: BS05MJZOO1 Structure and functions of Invertebrates

Teaching and Evaluation Scheme:

Teaching Scheme				Examination Scheme			
Credits				Component Weightage			
				CCE		SEE	
L	T	P	Total	TH	PWE	TH	PWE
4	-	-	4	50 %	-	50 %	-

Programme Name	B.Sc. Zoology
Semester	V
Course Code	BS05MJZOO1
Course Title	Structure and functions of Invertebrates
Course Content Type (Th./Pr.)	Theory
Course Credit	4
Sessions	4
Total Teaching/Lab. Hours	60 Theory Hours

Learning Objectives

- Define what an invertebrate is, identify key characteristics. Describe the body plans, skeletal types and structural adaptation that allow them to survive in diverse habitats.
- Students will describe the process of Metamorphosis in insects.
- Mastering insect biology, classification, ecology, anatomy and metamorphosis alongside identification and their roles in ecosystems.

Prerequisites (if any)

- Student must aware about specific terms used for animal organ and organ systems.
- Before studying in detail about Non-Chordates students should have profound understanding of Non-Chordates Animals.
- Students focus on entomology-specific topics: Insect taxonomy, systematics and metamorphosis.

Learning Outcomes

On the Completion of this course, students will able to:

- Students were able to learn about the general topics of different classes of animals.
- Students will learn about morphology and organ systems of primitive animal.
- Accurately identify insects up to family, order level using morphological keys and describe their diagnostic characters.

School of Science
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Detailed Contents		
UNIT	**TOPIC/SUB-TOPIC**	**TEACHING HOURS**
I	**General Topics and Type study:** **Protozoa: General Account** • Reproduction in Protozoa, Economic Importance **Porifera: General Account** • Canal system, Cellular organization **Coelenterata: General Account** • Alteration of Generation (polyp and Medusa), Kinds of Coral Reefs and Economic Importance **Platyhelminthes: General Account** • Types of Larvae - Liver fluke (Miracidium, Sporocyst, Redia, Cercaria and metacercaria) and Tapeworm (Onchosphere) **Aschelminthes: General Account** • Common Nematode parasites in Man (Ascaris, hookworm, Trichinella spiralis) **Types study: *Taenia Solium* (Tape Worm):** • External morphology, Body wall, Nervous system, Excretory, osmoregulatory system and Reproductive system	15
II	**Annelida: General Account** • Nephridia and Coelomoducts and Reproduction in Annelida **Type study: Nereis** • External morphology, Digestive system, Nervous system and Reproductive system **Arthropoda: General Account** • Larvae of Crustacea: Nauplius larva, Zoea larva, Megalopa larva, Alima larva **Type and study: *Preriplaneta Americana* (Cockroach):** • External morphology, Digestive system, Circulatory system, Respiratory system, Nervous system and Reproductive system	15
III	**Mollusca: General Account** • Foot in Mollusca • Torsion and Detorsion in Gastropoda **Type study: Apple Snail (*Pila globosa*)** • External Morphology, Digestive system, Excretory system, Nervous system, Sense organs and Reproductive system **General Account: Echinodermata** • Larval Forms in Echinodermata: Bipinaria larva, Ophiopluteus larva, Ophiopluteus larva **Type and study: Star Fish (Asterias)** • External Morphology, Digestive system, Circulatory system and Water Vascular system and Reproductive system	15

School of Science
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IV	**Basics of Entomology** **Introduction to Entomology** • Definition, scope, and significance of Entomology • Diagnostic characters and position of Class Insecta **Brief classification of insects up to orders with examples** • Distinguishing characters of major insect orders: Orthoptera, Hemiptera, Coleoptera, Lepidoptera, Diptera and Hymenoptera **External Morphology of Insects** • Body segmentation: Head, thorax, and abdomen • Structure and modifications of Mouthparts. **Growth, Development and Metamorphosis** • Moulting and ecdysis • Metamorphosis: Ametabolous, Hemimetabolous and Holometabolous	15

Text Book(s)

1. A Textbook of Invertebrate Zoology by R. L. Kotpal. Rastogi Publications, Meerut
2. Invertebrate Zoology by E. L. Jordan and P. S. Verma. S. Chand & Company Ltd., New Delhi
3. Invertebrate Zoology by P. S. Dhami and J. K. Dhami. R. Chand & Company, New Delhi
4. Modern Textbook of Zoology: Invertebrates by R. L. Kotpal, Rastogi Publications, Meerut
5. A Manual of Practical Zoology: Invertebrates by P. S. Verma. S. Chand, New Delhi
6. Elements of Zoology: Invertebrates by N. Arumugam. Saras Publication, Nagercoil
7. Nirav Collage Zoology – 201 for B.Sc. Students by Mihir Suthar and Haresh Patel
8. Nirav Collage Zoology – 204 for B.Sc. Students by Mihir Suthar and Haresh Patel
9. General Entomology by B.V. David and T.N. Ananthakrishnan – Tata McGraw Hill Education
10. A Textbook of Entomology by H.S. Pruthi – Kalyani Publishers
11. Applied Entomology by K.P. Srivastava – Kalyani Publishers
12. Fundamentals of Entomology by Richard J. Elzinga – Pearson Education

Reference Books

1. Invertebrate Zoology by Robert D. Barnes. Saunders College Publishing
2. Integrated Principles of Zoology by Cleveland P. Hickman Jr., Larry Roberts and Allan Larson. McGraw-Hill Education
3. The Invertebrates: Function and Form by E. J. W. Barrington, CBS Publishers & Distributors
4. Invertebrates by Richard C. Brusca, Wendy Moore and Stephen M. Shuster. Oxford University Press
5. Biology of the Invertebrates by Jan A. Pechenik. McGraw-Hill Higher Education
6. The Insects: Structure and Function by R.F. Chapman – Cambridge University Press
7. Principles of Insect Morphology by R.E. Snodgrass – Cornell University Press
8. Imms' General Textbook of Entomology by A.D. Imms *et al.*– Springer Nature
9. Medical Entomology for Students by Mike Service – Cambridge University Press

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Web Resources
• Animal Diversity Web – https://animaldiversity.org • National Geographic Animals – https://www.nationalgeographic.com/animals • NCBI Bookshelf – https://www.ncbi.nlm.nih.gov/books • Khan Academy Biology – https://www.khanacademy.org/science/biology • Biodiversity Heritage Library – https://www.biodiversitylibrary.org • IUCN Red List – https://www.iucnredlist.org • Entomological Society of India – www.entsocindia.org • Indian Council of Agricultural Research (ICAR) – www.icar.org.in • National Bureau of Agricultural Insect Resources (NBAIR) – www.nbair.res.in • National Centre for Integrated Pest Management (NCIPM) – www.ncipm.icar.gov.in • Food and Agriculture Organization – Insect Pest Management – www.fao.org • Encyclopedia of Life – Insects Database – www.eol.org

L:: Lecture, **T::** Tutorial , **P::**Practical

CCE:: Continuous and Comprehensive Evaluation
(CCE Theory includes Mid Semester Examination, Assignment, MCQ quizzes, Seminar, Reflective notes, class participation, case analysis and presentation, slip tests (announced/ surprised), attendance etc. or any combination of these)

PWE:: Practical Work Examination
(PWE includes Laboratory practical work, project work, viva simulation exercise work etc.)
SEE:: Semester End Evaluation