

Shree Warana Vibhag Shikshan Mandal's

**WARANA UNIVERSITY,
WARANANAGAR**

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

॥ विद्या सर्वस्य भूषणम् ॥



Established: 2025

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

As Per National Education Policy - 2020

With Effect from Academic Year 2025-26 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. Course Code Table

A-1) M.Sc.-I: SEMESTER-I (TOTAL CREDITS-22)

COURSECATEGORY		COURSENAME	COURSECODE	CREDITS
DSC	DS-I	Molecular cell biology	2502PSZOMJ101	4
DSC	DS-I	Applied Entomology	2502PSZOMJ102	4
DSC	DS-I	Practical Laboratory (Molecular cell biology)	2502PSZOMN105	2
DSC	DS-I	Practical Laboratory (Applied & Basic Entomology)	2502PSZOMJ106	4
DSC	DS-I	Basic Entomology	2502PSZOMJ103	4
DSC	DS-I	Research Methodology	2502PSZORM104	4
CREDITS FOR M.Sc.-I,SEM-I:				22

A-2) M.Sc.-I: SEMESTER-II (TOTALCREDITS-22)

COURSECATEGORY		COURSENAME	COURSECODE	CREDITS
DSC	DS-II	Physiological Chemistry	2502PSZO MJ201	4
DSC	DS-II	Anatomy and Physiology	2502PSZO MJ202	4
DSC	DS-II	Practical Laboratory (Physiological chemistry)	2502PSZO MN205	2
DSC	DS-II	Practical Laboratory (Anatomy and physiology & Agricultural entomology)	2502PSZO MJ206	4
DSC	DS-II	Agricultural entomology	2502PSZO ME203	4
DSC	OJT/FP	OJT/Field Project	2502PSZO FP204	4
CREDITS FOR M.Sc.-I,SEM-II:				22

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 50 marks or 200 marks paper shall be converted to 100 marks.

Calculation of SGPA & CGPA

1. Semester Grade Point Average (SGPA)

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

2. Cumulative Grade Point Average (CGPA)

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

M. Sc. Zoology (Part I) (Semester I)
(NEP-2020)

(Introduced from Academic Year 2025-26)

Title of Course: Molecular Cell Biology

Course Code: 2502PSZOMJ101

Total Credits: 04

Course Outcomes: Upon successful completion of this course, the student will have in depth knowledge of:

CO 1: Functioning of the nucleus and its importance.

CO 2: Structure and various functions of membrane, intracellular transport and sorting.

CO 3: Functioning of various cell organelles at molecular level.

CO 4: Cytoskeletal elements, Cell signaling and cell division.

Module	Sub Module	Topic	Hour
Unit I	The Interphase Nucleus, Chromatin, and the Chromosome	The ultrastructure of interphase nucleus, nuclear envelope, and nuclear pore complex, Nuclear import and export, Nucleolus. The DNA structure, Histone proteins, Packaging of DNA into chromatin. Euchromatin and Heterochromatin, The C-value paradox, Fine structure and classification of chromosomes.	15 Hrs
Unit II	Membrane transport, protein sorting and vesicular trafficking	Biomembrane structure and functions. Transport of Ions and Small Molecules across the membrane. transcellular transport. Cell-cell junctions and their significance. Protein sorting and vesicular trafficking.	15 Hrs
Unit III	Cellular Respiration and Degradation	Mitochondria: Biogenesis, membrane differences, structure, and functions. Lysosomes: Origin, structural polymorphism and functions. Peroxisomes: Biogenesis, ultrastructure and functions. Endosomes: Late and early endosomes, assembly structure, and functions. Proteasomes: Types, assembly structure and functions.	15 Hrs
Unit IV	Cytoskeleton, Cell signaling and Cell division	Cytoskeletal elements: microtubules, microfilaments, intermediate filaments and associated motor proteins Cell signaling: Features of signal transduction, Molecular Mechanisms of Signal Transduction, Gated Ion Channels, Receptor Enzymes, G Protein-Coupled Receptors and Second Messengers, Regulation of Transcription by Steroid Hormones, Signaling by Mechanoreceptors, pain receptors, Taste receptors and olfactory receptors. Cell Division: Cell cycle regulation, cyclin dependent kinases and check point pathways, Extracellular and Intracellular Cues Regulating Entry into Meiosis.	15 Hrs

Reference books:

1. Molecular Biology of the Cell (7th Ed.) by Bruce Alberts, Rebecca Heald, Alexander Johnson, David Morgan, Martin Raff, Keith Roberts, Peter Walter, John Wilson, Tim Hunt, New York: Garland Science; 2022.

2. Molecular Cell Biology, 9th Ed. Harvey Lodish; Arnold Berk; Chris A. Kaiser; Monty Krieger; Anthony Bretscher; Hidde Ploegh; Kelsey C. Martin; Michael Yaffe; Angelika Amon, **W H Freeman & Co.** New York, US.
3. The cell: A molecular approach - Cooper
3. Molecular cell biology – Gerald carp

M. Sc. Zoology (Part I) (Semester I)
(NEP-2020)
(Introduced from Academic Year 2025-26)

Title of Course: Applied Entomology

Course Code: 2502PSZOMJ102

Total Credits: 04

Course Outcomes: Upon successful completion of this course, Students will be able to

CO1: Demonstrate morphology and anatomy of insects.

CO2: Recognize various types of insect pests.

CO3: Work in Sericulture, apiculture and lac culture,

CO4: Appreciate the forensic entomology and nutritional entomology.

Module	Topic	Hour
Unit I	1. Study of generalized insect: Grasshopper (Morphology and Anatomy, brief Account). 2. Types of Insect pests: Definition with suitable examples. 3. Types of Forest pests: Defoliators, Sapsuckers, Borers of trees, spike disease of Sandal, Soil insects damaging forest trees, control methods of forest pests.	15 Hrs
Unit II	1. Stored grain pests: Rice weevil, Rice moth, Khapra beetle, Pulse beetle, Rust red floor beetle, Angoumois grain moth. 2. Veterinary entomology: Farm animal pests- Horse fly, Blowfly, Stable fly, Louse fly, Warble fly, Screw worm, Cattle louse, bird louse, Flea	15 Hrs
Unit III	Sericulture: History of Sericulture, Life cycles of Mulberry and Non-mulberry Silkworms, Rearing technology of mulberry silkworm, Diseases and pests of Mulberry silkworm, Moriculture and cultural practices, Diseases and pests of Mulberry.	15 Hrs
Unit IV	1. Apiculture: The honey bees, Social organization of honey bees, Life history of honey bees, Methods of bee keeping. 2. Lac culture: Lac insect- Taxonomy, distribution and life history, Host plants and lac insects, Strains of lac insect and their propagation, Cultivation practices, Lac extraction and uses. 3. Forensic entomology: History, Corpse associated arthropod classes, Role of arthropods in forensic entomology, Examples. 4. Nutritional entomology: Advantages of eating insects (Entomophagy), Examples of insects generally consumed, Nutritional value, Entomophagy as a source of income.	15 Hrs

Suggested Readings:

- Ambrose, D.P. (2015). The Insects. Structure, Function and Biodiversity. Kalyani publishers, New Delhi. 626pp.
- Herms W. B. (1961). Medical Entomology. The Macmillan Company, New York And Brett-Macmillan Limited, Galt, Ontario. pp. 616.

3. Srivastava K. P. (1996). A Textbook of Applied Entomology, Volume- II. Kalyani Publishers, New Delhi. pp. 487.
4. David B. V. and Ramamurthy V. V. ((2015). Elements of Economic Entomology. Brillion Publishing, New Delhi. pp. 398.
5. Shukla G. S. and Upadhayay V. B. (2011) Economic Zoology. Rastogi Publications, Meerut, India. pp. 487.
6. Tembhare, D. B (2013). Modern Entomology. Himalaya Publishing House, India. pp 502.

M. Sc. Zoology (Part I) (Semester I)
(NEP-2020)
(Introduced from Academic Year 2025-26)

Title of Course: Basic Entomology

Course Code: 2502PSZOMJ103

Total Credits: 04

Course Outcomes: Upon successful completion of this course ...

CO1: Students will gain knowledge about how insects originated and evolved, the distribution and diversity of insects, and why insects continue to dominate the world.

CO2: Students will get an in-depth knowledge of the structure of the head, thorax, and abdomen of insects and their various appendages which are very important for insect identification.

CO3: Students get a detailed study of the historical background of insect classification, the types and components of insect classification, and an explanation of which insects belong to the different orders within the classification of insects.

Module	Sub Module	Topic	Hour
Unit I	Introduction To Insects And Body Plan	1. Insects 1.1. Origin and evolution of insects. 1.2. Distribution and Diversity of Insects. 1.3. Dominance of insects. Body Segmentation 2.1 Tagmosis 2.2 Modification 3. Head 3.1 Types and segmentation 3.2 Cranium 3.3 Tentorium 3.4 Cephalic appendages 4. Cervix	15 Hrs
Unit II	Insect Body Plan	1. Thorax 1.1 Skeleton 1.2 Segmental regions – Tergum, Sternum and Pleuron 1.3 Thoracic appendages- Legs and Wings 2. Abdomen 2.1 Typical Abdomen 2.2 Skeleton 2.3 Abdominal appendages- Pregenital, Genital and post-genital.	15 Hrs
Unit III	Systematics	1. Insect Classification 1.1 Historical background 1.2 Types of Classification	15 Hrs

		1.3 Components of classification 1.4 Type specimen 2. Apterygote Orders 2.1 Entognathus: Collembola 2.2 Ectognathus: Thysanura 3. Pterygote Orders 3.1 Odonata, Embidina, Phasmida, Orthoptera , Isoptera, Blattaria, Anopleura.	
Unit IV	Systematics	1. Pterygote Orders 1.1 Hemiptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera. While describing Insect orders, details of the Habitat, External Morphology, Internal anatomy and Classification upto families with examples are expected.	15 Hrs

Suggested Reading Material:

1. Ambrose, D.P., 2015. The Insects. Structure, Function and Biodiversity. Kalyani publishers, New Delhi. 626pp.
2. Chapman, R. F. (1998). The Insect structure and function, 4th Ed. Cambridge University Press, UK. PP 747.
3. Gillot, C. (1980). Entomology, 3rd Ed. Plenum Press, New York, pp 730.
4. Gullan, P. G. and Cranston, P. S., 2010. The insects. An outline of Entomology. Wiley Blackwell. pp. 565.
5. Mani, M. S. (1968). General Entomology. Oxford & IBH Publishing Co., pp 597.
6. Snodgrass, R. E. (1935). Principles of Insect Morphology, Tata Mc Graw -Hill, New York. pp 667.
7. Tembhare, D. B (2013). Modern Entomology. Himalaya Publishing House, India. pp 502.
8. Wigglesworth, V.B., 1939. The Principles of Insect Physiology. Sixth ed. Methuen and Co. Ltd., London. pp 741.

M. Sc. Zoology (Part I) (Semester I)
(NEP-2020)
(Introduced from Academic Year 2025-26)

Title of Course: Research Methodology

Course Code: 2502PSZORM104

Total Credits: 04

Course Outcomes: Upon successful completion of this course, students will be able to,

CO 1: Understand various separation techniques.

CO 2: Know in detail spectroscopy and principles and types of microscopes and immunological techniques

CO 3: Appreciate and apply various concepts of biosystematics.

CO 4: Apply various statistical methods in research

Module	Sub Module	Topic	Hour
Unit I	Separation Techniques	<p>1. Centrifugation techniques. Basic principles of sedimentation and centrifuges and their uses, differential centrifugation, density gradient centrifugation.</p> <p>2. Chromatographic techniques – Chromatography theory & practices, Molecular Sieve chromatography, affinity chromatography, ion exchange chromatography, HPLC, GLC, Thin layer chromatography.</p> <p>3. Electrophoretic techniques – General principles, support media, electrophoresis of proteins and nucleic acids, Isoelectric focusing.</p>	15 Hrs
Unit II	Techniques	<p>1. Spectroscopic techniques: UV and Visible light Spectroscopy, Spectrofluorimetry.</p> <p>2. Microscopy: Light microscope, phase contrast microscope, fluorescence microscope, Electron Microscope (SEM & TEM).</p> <p>3. Immunological techniques -Immunoprecipitation, Labelling antibodies, immunoblotting, immunoassays, immunohisto/cytochemistry.</p>	15 Hrs
Unit III	Biosystematics	<p>1. Taxonomy: Introduction to taxonomy, Stages and importance of taxonomy; Problems, Aim and Tasks of Taxonomy.</p> <p>2. Modern Trends in Taxonomy: Morphological approach, immature stages and Embryological approach, Ecological, behavioural and Cytological approach, Biochemical and Numerical taxonomy.</p> <p>3. Kinds of Classification</p>	15 Hrs
Unit IV	Biostatistics in research	<p>1. Application of statistics in Biology.</p> <p>2. Measures of Central tendency: Arithmetic mean, mode and median.</p> <p>3. Measures of dispersion: Range, quartile deviation, mean deviation, Standard deviation, coefficient of variation.</p> <p>4. Probability and Probability distribution - Introduction, addition and multiplication theory; Binomial, Poisson and Normal distribution.</p> <p>5. Correlation and Regression</p> <p>6. Hypothesis testing and test - Student t-test, Chi- square test</p>	15 Hrs

		(χ^2), Analysis of Variance.	
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References Books:

1. Principles and Techniques in Biochemistry and Molecular Biology by Wilson and Walker
2. Cell: A molecular approach By Cooper
3. Molecular Biology of the Cell by Lodish *et al.*
4. Fundamentals of Statistics- Gupta S. C., 2018
5. Basic Biostatistics and its applications- Datta A. K
6. Biostatistics and Biometry- Parihar and Parihar, 2018
7. An Introduction to statistical Methods, (23rd Edt.) by C. B. Gupta and Vijay Gupta, 2009.
8. Biostatistics by S. K. Pundir, 2022.
9. Introduction to Biostatistics by Larry Winner, Department of Statistics, University of Florida.
10. Camp, W.H. (1951): Biosystematics Britania 7: 113 – 127.
11. Huxley, J.S. (ed.) The New Systematics Oxford Univ. Press London 538 pp.
12. Jeffrey, C. (1977): Biological nomenclature Indian Ed. Oxford and IBH Pub. Co. New Delhi 72 pp.
13. Mayr, E. (1969): Principles of systematic in Zoology Mc. Graw Hill N.Y. 428 pp.
14. Mayr, E. and E.G. Linsley and R.L. Usinger (1953): Methods and Principles of systematic Zoology, Mc Graw Hill N.Y. 328 pp.

M. Sc. Zoology (Part I) (Semester I) (NEP-2020)

(Introduced from Academic Year 2025-26)

Title of Course: Practical Based on Molecular Cell Biology

Course Code: 2502PSZOMN105

Total Credits: 02

Course Outcomes: Upon successful completion of this course, students will be able to,

CO1: Demonstrate subcellular macromolecules by using histochemical techniques.

CO2: Demonstrate cell organelles with organelle specific cytochemical techniques.

Practical Based on Molecular Cell Biology

1. Demonstration of extracellular material
 - a. Collagen
 - b. Elastin
2. Demonstration of Glycosaminoglycans in the extracellular material using
 - a. AB-1
 - b. AB-2.5
 - c. PAS
3. Demonstration of Nucleus by
 - i) Basic Dyes: TB, HE, Methylene blue.
 - ii) Feulgen reaction: Effect of temperature,
4. Lysosome demonstration (Acid phosphatase and any other method)
5. Golgi bodies demonstration (Cajal Method)
6. Demonstration of mitochondria
7. Effect of tonicity of solutions on plasma membrane –
 - a) Isotonic, Hypotonic, Hypertonic
 - b) Fragility test of RBC & Osmotic Resistance.

Title of Course: Practical Based on Applied and Basic Entomology

Course Code: 2502PSZOMJ106

Total Credits: 04

Entomology:

Course Outcomes: Upon successful completion of this course students will be able to

CO1: Collect, preserve insect specimens and prepare microscopic slide for identification and record.

CO2: Mount different appendages of insects

CO3: Identify pest of stored grains, veterinary animals and human importance for their proper management.

CO4: Appreciate biology of economically important insects

Practical based on Applied Entomology:

1. Study of generalized insect. Identification economic importance of following insect pests (6-8 pests from each category)
2. Pests of stored grains.
3. Household pests.
4. Pests of medical importance.
5. Pests of veterinary importance.
6. Forest pests.
7. Types of silk moths.
8. Rearing appliances of mulberry silk worm and demonstration.
9. Study of forensic insects
10. Study of nutritional insects.
11. Life cycle and types of honey bees.
12. Lac insect economic importance.
13. Field visit for demonstration of pest damage.
14. Field visit for collection of insects.
15. Any other practical set by concern teacher

Practical based on Basic Entomology:

1. Collection and preservation of insects.
2. Study of mouth parts in insects.
3. Study of antennae in insects.
4. Mounting of tentorium.
5. Study of types of wings in insects.
6. Study of types of legs in insects.
7. Study of abdominal appendages in Cockroach and Grasshopper.
8. Study of locally available insect orders with examples.
9. Any other practical set by concerned teacher

M. Sc. Zoology (Part I) (Semester II)
(NEP-2020)

(Introduced from Academic Year 2025-26)

Title of Course: Physiological chemistry

Course Code: 2502PSZOMJ201

Total Credits: 04

Course Outcomes: Upon successful completion of this course, students will be able to,

CO1: Understand the basic principles of Physics and Chemistry applicable in biology.

CO2: Understand the Metabolism of carbohydrates and its energetics.

CO3: Understand the chemistry of amino acids, proteins and nucleic acids.

CO4: Understand metabolism of lipids and their physiological significance.

Module	Sub Module	Topic	Hour
Unit I	Chemical foundations of Biology	Structure of atom, Types of bonds, Van der Waal's electrostatic forces of attraction, hydrophobic interactions. Chemical structure and properties of water, pH, pKa, buffers, Thermodynamics in biological system: Enthalpy, Entropy and Gibb's free energy	15 Hrs
Unit II	Carbohydrate metabolism	Structure, classification and functions of carbohydrates, Glycolysis, regulation and energetics, TCA cycle, regulation and energetics, Electron transfer system structure and mechanism of action, oxidative phosphorylation and ATP generation, Glycogenesis, glycogenolysis and gluconeogenesis Pentose phosphate pathway and its significance	15 Hrs
Unit III	Amino acids, Proteins and nucleic acids	Amino acids: Classification of amino acids, biosynthesis and Oxidation of amino acids. Proteins: Protein structure and functions: Primary, secondary, tertiary and quaternary structure Nucleic acids: Structure of nucleotides. Structure of DNA and RNA, De novo and salvage pathway of synthesis of nucleotides	15 Hrs
Unit IV	Lipid metabolism	Lipids- structure, classification and functions, Steroidal hormones: structure and functions. Catabolism of fatty acid – Beta oxidation, Carnitine shuttle, Significance of beta oxidation. Bioenergetics of Beta oxidation Biosynthesis of saturated and unsaturated fatty acids. Biosynthesis of triglycerides, Biosynthesis of membrane phospholipids. Biosynthesis of cholesterol Biosynthesis of prostaglandins and leukotriene Lipoprotein metabolism	15 Hrs

Reference Books

1. Lehninger-Principles of Biochemistry: Nelson and Cox 25
2. Biochemistry:, Tymoczko, Berg, Stryer
3. Review of physiological chemistry: H. Harper

**M. Sc. Zoology (Part I) (Semester II)
(NEP-2020)**

(Introduced from Academic Year 2025-26)

Title of Course: Anatomy and Physiology

Course Code: 2502PSZOMJ202

Total Credits: 04

Course Outcomes: Upon successful completion of this course, students will be able to,

CO1: Learn about anatomy of digestive system and nutrition.

CO2: Understand various concepts of respiratory physiology.

CO3: Understand various aspects of circulatory physiology.

CO4: Illustrate anatomy and physiology of excretory and endocrine organs

Module	Sub Module	Topic	Hour
Unit I	Physiology of Digestive System	1.1 Anatomy and physiology of gastrointestinal tract, Salivary gland, Pancreas and Liver. 1.2 Digestion and absorption in gastrointestinal tract 1.3 Balanced diet, obesity and starvation. 1.4 Vitamins and their role in nutrition.	15 Hrs
Unit II	Physiology of Respiration	2.1 Anatomy and physiology, respiratory tract and pulmonary ventilation. 2.2 Pulmonary air volumes and capacities. 2.3 Exchange of Oxygen and carbon dioxide. 2.4 Control of respiration.	15 Hrs
Unit III	Physiology of Circulation	3.1 Blood, Composition of blood, blood coagulation. 3.2 Blood groups and blood transfusion. 3.3 Anatomy and physiology Heart and blood vessels, Heart blood supply. 3.4 Conduction system and pace maker. 3.5 Electrocardiogram, Cardiac Cycle and heart sound.	15 Hrs
Unit IV	Physiology of Excretion and Endocrine System	4.1 Anatomy and physiology of the kidneys, nephron and mechanism of urine formation. 4.2 Urinary bladder, process of micturition, Hemodialysis and Artificial kidney. 4.3 Anatomy and physiology of Pituitary gland and Adrenal gland. 4.4 Anatomy and physiology of Thyroid and Parathyroid gland.	15 Hrs

Reference:

1. Human Physiology – by A.C. Guyton. Saunders Company London, Toronto.
2. Shepherd G.M. Neuro Biology, New York Oxford University Press 1987.
3. Hurst J.W et al (eds) The Heart 7th ed. New York McGraw- Hill Book Co. 1990.
4. Hand Book of Physiology Vols. Circulation. Renkin, E.M. & Micbel, C.C. (eds) American Physiological Society, 1984.
5. Guyton A.C. et al. Circulation Overall regulation Annu Re. Physiol. 34: 13 1972.
6. Guyton A.C. 1980 Arterial pressure & Hypertension Philadelphia, W.B. Saunders Co- Cartiar output & its regulation 1973.
7. Kaplan N.M. et al 1989- The Kidney in Hypertension (Perspectives in hypertension vol.2) New York. Raven Press.
8. Guyton A.C. et al 1975 Dynamics & Control of the Body fluids Philadelphia, W.B. Saunders, Co., 1975.
9. Brenner B.M. & Rector, F.C. (Jr) 1986. The kidney 3rd ed. Philadelphia, W.B. Saunders Co., 1986.
10. Brooks V.B. 1986. The neural Basis of motor control New York, Oxford University press.
11. Johnson L.R. et al Physiology of the gastrointestinal tract 1987 New York Raven press.
12. Thompson J.C. et al (eds) Gastrointestinal Endocrinology. New York McGraw Hill book co., 1987.

13. Setchell K.D.R. et al eds 1988. The Bile Acids New York Plenum Pub. Corp.
14. Guthrie H.A. 1988. Introductory Nutrition 7th ed. St. Lonis C.V. Mosby Co.,
15. Felig P et al (eds) 1987. Endocrinology & Metabolism New Your Mac Graw- Hill Book Co.,
16. DeGroot L.J. et al 1989. Endocrinology 2nd ed. Philadelphia, W.B. Saunders Co. 1989.
17. Kannan, C.R. 1988. The adrenal gland New York Plenum Pub. Corp.

M. Sc. Zoology (Part I) (Semester II)
(NEP-2020)

(Introduced from Academic Year 2025-26)

Title of Course: Agricultural Entomology

Course Code: 2502PSZOME203

Total Credits: 04

Course Outcomes: Upon successful completion of this course, Students would,

CO1: Gain knowledge of pests on Cereals and Pulses.

CO2: Become familiar with important pests of fruits and fruit trees,

CO3: Get acquainted with important pests of sugar cane, fibre crops, and oilseed crops,

CO4: Acquire knowledge on important Pests of vegetable crops

Module	Topic	Hour
Unit I	<p>1. Definition of Pest, General characters, Habitats, Damage, Economic Threshold Level, Economic Injury Level, Causes for insect assuming pest status, Types of damage to plant by insects and their estimation. Identification, characteristics, biology, damage and Management of important agricultural pests</p> <p>2. Pests of Cereals: Paddy and Jowar stem borers, midge fly, aphid, Grasshopper, Paddy Leaf hoppers, armyworm, cutworm, and blister beetle.</p> <p>3. Pests of pulses: 1. Gram pod borer, Cutworms, Turplume moth, Turpod Bug, Turpod fly, Lentilpod borer, and Beanfly.</p>	15 Hrs
Unit II	<p>4. Pests of fruits and fruit trees (Temperate): Sanjose scale, apple wooly aphid, white fly, cherry stem borer, codling moth, apple stem borer, peach fruit fly and Almond weevil.</p> <p>5. Pests of fruits and fruit trees: Citrus caterpillar, citrus psylla, citrus white fly, citrus fruit</p>	15 Hrs

	moth, Mango stem borer. Mango jassid, Mango mealy bug, Mango stone weevil, Mango fruitfly, Grapevine mealy bug, grapevine thrips, Pomegranate (anar) butterfly, Banana weevil, papaya AK grasshopper	
Unit III	<p>6. Pests of sugar cane: Sugarcane woolly aphids, White grubs, borers, Pyrilla, Whitefly, Mealybug, Termites.</p> <p>7. Pests of fiber crops: Cotton pink boll worm, Spotted boll worms, American boll worm, Red cotton bug, Dusky cotton bug, cotton aphid, cotton leafroller, Bihar hairy caterpillar on jute and sun hemp capsid.</p> <p>8. Pests of Oilseed Crops: Mustard aphid, Mustard Sawfly, groundnut aphid, groundnut stem borer, cutworm, Bihar hairy caterpillar white grub, castor semilooper, castor capsule borer, Til hawkmoth, linseed gall midge, Sunflower head borer, safflower aphid.</p>	15 Hrs
Unit IV	<p>9. Pests of vegetable crops: Cabbage caterpillar, Diamond back moth, potato tuber moth, Onion thrips, Brinjal fruit & stem borer, Jassid, mealy bug, whitefly, Red pumpkin beetle and Hadda beetle.</p> <p>10. Pests of plantation crops: Coffee stem borer, coffee shoot hole borer, Tea mosquito bug, coconut weevil, and Rhinoceros beetle</p> <p>11. Pests of Spices and Narcotic: Chilli thrips, castor capsule borer, white grub, Bihar hairy caterpillar, Tobacco caterpillar, Tobacco aphid and Hesperid caterpillar.</p>	15 Hrs

Suggested Reading Material:

1. Ambrose, D.P. (2015). The Insects. Structure, Function and Biodiversity. Kalyani publishers, New Delhi. 626pp.
2. Atwal A.S. and Dhaliwal G.S. (2015). Agricultural pests of South Asia and their Management. Kalyani Publishers, New Delhi. pp 678.
3. Awasthi V. B. (2009). Introduction to General and Applied Entomology. Scientific Publishers, Jodhpur. pp. 499.
4. David B. V. and Ramamurthy V. V. (2015). Elements of Economic Entomology. Brillion Publishing, New Delhi. pp. 398.
5. Pruthvi H. S. (1969). Textbook on Agricultural Entomology. Job Press Private Limited, Kanpur. pp. 977.
6. Singh R. (2004). Elements of Entomology. Rastogi Publications, Meerut, India. pp. 564.
7. Shukla G. S. and Upadhayay V. B. (2011) Economic Zoology. Rastogi Publications, Meerut, India. pp. 487.
8. Srivastava K. P. (1996). A Textbook of Applied Entomology, Volume- II. Kalyani Publishers, New Delhi. pp. 487.
9. Tembhare, D. B (2013). Modern Entomology. Himalaya Publishing House, India. pp 502.

M. Sc. Zoology (Part I) (Semester II)
(NEP-2020)
(Introduced from Academic Year 2025-26)

Title of Course: On Job Training/Field Project

Course Code: 2502PSZOFF204

Total Credits: 04

On Job Training:

On job training shall be of 100 marks for 4 credits. 70 marks will be for completion and submission of its report and 30 marks will be for presentation.

Field Project:

Field project shall be of 100 marks for 4 credits. 70 marks will be for completion and submission of its project report and 30 marks will be for presentation

M. Sc. Zoology (Part I) (Semester II)
(NEP-2020)
(Introduced from Academic Year 2025-26)

Title of Course: Practical Based on Physiological Chemistry

Course Code: 2502PSZOMN205

Total Credits: 02

Course Outcomes: Upon successful completion of this course, students will be able to,
CO1: Estimate biomolecules from biological materials.

Practical Based on Physiological Chemistry

1. Estimation of glycogen.
2. Estimation of lipids & phospholipids.
3. Estimation of Vitamin C.
4. Estimation of Cholesterol.
5. To find saponification value for a given fat.
6. Preparation of phosphate buffer pH measurement.
7. To estimate free amino acids by Ninhydrin method.
8. To estimate protein content by Biuret method/ Lowry et.al./ Bradford method.
9. Estimation of glucose.
10. Estimation of casein from milk.
11. Estimation of Uric acid
12. Extraction of Starch.
13. Extraction of Glycogen

M. Sc. Zoology (Part I) (Semester II)
(NEP-2020)
(Introduced from Academic Year 2025-26)

Title of Course: Practical Based on Anatomy & Physiology and Agricultural Entomology

Course Code: 2502PSZOMJ206

Total Credits: 04

Course Outcomes: Upon successful completion of this course, students will be able to,

CO1: Find out Bleeding time, clotting time, Hb%,

CO2: Determine physiologically important parameters such as breathing rate, heartbeat, heart sounds

CO3: Understand the histology of digestive organs and endocrine glands

CO4: Enable students to collect, preserve small insect specimens and prepare microscopic slide for identification and record.

CO5: Identify the pests of cereals, pulses, fiber crops

CO6: Identify the pests of fruits, fruit trees, oil seed crops and vegetable crops

CO7: Collect, preserve and identify various insect pests.

Practical Based on Anatomy & Physiology

1. Determination of Bleeding time
2. Determination of Clotting time
3. Estimation of Hemoglobin (Hb) concentration and oxygen carrying capacity
4. Enumeration of Red blood corpuscles (R.B.C)
5. Enumeration of white blood corpuscles (W.B.C)
6. Differential count of W.B.C.
7. Erythrocyte sedimentation rate (E.S.R)
8. Detections of digestive enzymes
9. Anatomy and histology of digestive and endocrine glands
10. To estimate amylase from saliva
11. To study normal constituents of urine
12. Measurement of breathing rate, heart beat and study of heart sound.
13. Any other practical set by the concerned teacher

Practical Based on Agricultural Entomology

1. Pests of cereals.
2. Pests of pulses.
3. Pests of fiber crops.
4. Pests of fruit and fruit trees.
5. Pests of Oil seed crops.
6. Pests of Vegetable crops.
7. Other agricultural important insect pests
8. Field visit to study nature pest damage.
9. Any practical set by the concerned teacher

EXAMINATION PATTERN FOR DSC ZOOLOGY

1) **PATTERN:** Theory and practical examinations will be conducted at the end of each semester. Internal examinations will be conducted after completing about half of the syllabus.

2) **MEDIUM OF INSTRUCTION:** The medium of instructions shall be in English.

3) **STRUCTURE OF COURSE:** M.Sc.I–Zoology theory and practical and Internal Assessments as per the Framework Set by the Warana University.

SEMESTER-I(Theory and Practical)

Sr. No.	Subject	Internal Exam	University Exam	Total	Credits
1	Molecular cell biology	40	60	100	4
2	Applied Entomology	40	60	100	4
3	Practical Laboratory (Molecular cell biology)	20	30	50	2
4	Practical Laboratory (Applied & Basic Entomology)	40	60	100	4
5	Basic Entomology	40	60	100	4
6	Research Methodology	40	60	100	4
Total =550					22

SEMESTER-II(Theory and Practical)

Sr. No.	Subject	Internal Exam	University Exam	Total	Credits
1	Physiological Chemistry	40	60	100	4
2	Anatomy and Physiology	40	60	100	4
3	Practical Laboratory (Physiological chemistry)	20	30	50	2
4	Practical Laboratory (Anatomy and physiology & Agricultural entomology)	40	60	100	4
5	Agricultural entomology	40	60	100	4
6	OJT/Field Project	40	60	100	4
Total =550					22

Minimum Marks required for passing

	Internal Exam	University Exam	Practical
Maximum marks	40	60	50
Minimum marks	16	24	20

SCHEME OF EXAMINATION

The question paper will be set on the entire syllabus and preferably covering each unit of syllabi.

▪ COMMON NATURE OF QUESTION FOR THEORY PAPER:

SEMESTER–I

1. Molecular cell biology
2. Applied Entomology
3. Basic Entomology
4. Research Methodology

SEMESTER– II

1. Physiological Chemistry
2. Anatomy and Physiology
3. Agricultural entomology

Nature of Question paper (M.Sc. First Year)

Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus. Equal weight age should be provided to each unit.

Total Marks: 60

Instructions: 1.All the Questions are compulsory.

i. Theory examination of 4 credit course (Total Marks 60, Time: 2 Hours)

- | | |
|--|-----------|
| Q.1. Multiple Choice Questions
10 Questions | (10marks) |
| Q.2. Any One of the Following
a)
b) | (10marks) |
| Q.3. Any One of the Following
a)
b) | (10marks) |
| Q.4. Any One of the Following
a)
b) | (10marks) |
| Q.5. Any four of the Following
a)
b)
c)
d)
e)
f) | (20marks) |

Nature of Question paper for Practical Course

(Choose any one pattern of following)

Practical Course	Pattern	Q.1	Q.2	Q.3	Q.4	Total (Marks)
Zoology-I	I	20	20	10	10	60
	II	10	10	10	10	40

Practical Course	Pattern	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Total (Marks)
Zoology-II	I	20	10	05	05	05	05	50

B Question Paper Pattern for the Semester-end Examination (Practical)

i. Practical Examination of 4 Credit course (Total Marks: 60; Minimum 6 hours)

Q. 1. Major Experiment/ Question - 20 Marks

Q. 2. Major Experiment/ Question - 20 marks

Q. 3. Minor Experiment/ Question - 10 marks

Q. 4. Minor experiment/ Question/ Spotting/ etc.- 10 marks

Pattern-II Q.1 to Q.4 journal, Attendance, Oral viva-voce, Report/Seminar/, each having 10 marks

ii. Practical Examination of 2 Credit course (Total Marks: 30; Time: 3 to 4 hours)

Q. 1. Major Experiment/ Question- 20 marks

Q. 2. Minor Experiment/ Question- 10 marks

Q.3. to Q.6 journal, Attendance, Oral viva-voce, Report/Seminar/, each having 05 marks

Note: Journal writing with submission and oral/viva voce examination is considered as internal evaluation having 40% weightage, while experiments (1 and 2) are considered as external evaluation having 60% weightage.

ANNEXURE-I

M.Sc. Programme Structure for M.Sc.-I Semester I														
Teaching Scheme						Examination Scheme								
Sr. No.	Theory (TH) & Practical (P)					Semester-end Examination (SEE)			Internal Assessment (IA)			Practical		
	Course Type	No. of Lectures	Practical	Hours	Credits	Paper Hours	Max	Min	Internal	Max	Min	Paper Hours	Max	Min
1.	DSC-I	4		4	4	2	60	24	Assignment	40	16			
2.	DSC-I	4		4	4	2	60	24		40	16			
3.	DSC-I	4		4	4	2	60	24		40	16			
4.	DSC-I	4		4	4	2	60	24		40	16			
5.	DSC-I(P)	4	-	4	4					-	-	6	100	40
6.	DSC-I(P)	2		2	2					-	-	4	50	20
Total					22	[DSC (60 X 4) Total SEE = 240			DSC (40X4) Total IA = 160			Practical. = 250 Total Practical. = 150		
Total Semester –I = 550														

M.Sc. Programme Structure for M.Sc.-I Semester II														
Teaching Scheme						Examination Scheme								
Sr. No.	Theory (TH) & Practical (P)					Semester-end Examination (SEE)			Internal Assessment (IA)			Practical		
	Course Type	No. of Lectures	Practical	Hours	Credits	Paper Hours	Max	Min	Internal	Max	Min	Paper Hours	Max	Min
1.	DSC-II	4		4	4	2	60	24	Assignment	40	16			
2.	DSC-II	4		4	4	2	60	24		40	16			
3.	DSC-II	4		4	4	2	60	24		40	16			
4.	OJT/FP	1		4	4							6	100	40
5.	DSC-II(P)	4	-	4	4					-	-	6	100	40
6.	DSC-II(P)	2		2	2					-	-	4	50	20
Total					22	[DSC (60 X 3) Total SEE = 180			DSC (40X3) Total IA = 120			Practical. = 250 Total Practical. = 150		
Total Semester –I = 550														

