

Rayat Shikshan Sanstha's

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA

(An Autonomous College)

Reaccredited by NAAC with 'A+' Grade

Choice Based Credit System with Multiple Entry and Multiple Exit Option

(NEP-2020)

Syllabus For

Master of Science

Part - I

Zoology

Semester I and II

(Syllabus to be implemented from Academic Year 2022-23)

1. TITLE: Zoology

2. YEAR OF IMPLEMENTATION: 2022 – 20203

3. PREAMBLE:

M. Sc. Zoology course under autonomy has been prepared keeping in view the unique requirements of M. Sc. Zoology students. The prominence of the contents is to provide students the latest information along with due weightage to the concepts of traditional zoology so that they are able to understand and appreciate the current interdisciplinary approaches in the study of animal sciences and its role in societal and environmental development. The course content also advanced practical exercises so the students gets a hands on experience of the newest techniques that are currently in use. Project curriculum covering over the two years of the course which is designed in a way that, to give the students first hand research experience as it consists of writing of synopsis, literature review along with actual laboratory work and handling laboratory instruments. The course will also encourage students to hunt higher studies and research in life sciences, for becoming an entrepreneur and enable students to get employed in research institutes.

4. GENERAL OBJECTIVES OF THE COURSE:

- To impart the knowledge of animal science is the basic objective of the course.
- To develop scientific attitude among the students and to make the students open minded, enthusiastic, critical and curious so that they enter research field with a positive approach.
- To develop skill in practical work, experiments and handling laboratory instruments.
- To understand scientific terms, concepts, facts, phenomenon and their relationships.
- To make the students aware of natural resource, diversity, environment up to cell biology.
- To enable the students to acquire knowledge of animal cells and different molecules as well as genetics for the wellbeing of human.
- Enrichment of basic knowledge of techniques in zoology, bioinformatics and genetics.

5. DURATION:02 year

6. PATTERN:CBCS Semester

7. MEDIUM OF INSTRUCTION:English

Course Structure M.Sc. For M.Sc-I

Level	Semester	Course Code	Course Category	No. of Lectures Per Week	Credits	
8	I	MZT 101	Theory	4	4	
		MZT 102	Theory	4	4	
		MZT 103	Theory	4	4	
		CCS (Elective : Any one among two)				
		MZT 104: E ₁	Theory	4	4	
		MZT 104: E ₂	Theory	4	4	
		MZP 105	Practical	4	4	
		MZP 106	Practical	4	4	
		AECC- I		2	2	
		SEC - I		2	2	
Total					28	

Level	Semester	Course Code	Course Category	No. of Lectures Per Week	Credits	
8	II	MZT 201	Theory	4	4	
		MZT 202	Theory	4	4	
		MZT 203	Theory	4	4	
		CCS (Elective : Any one among two)				
		MZT 204: E ₁	Theory	4	4	
		MZT 204: E ₂	Theory	4	4	
		MZP 205	Practical	4	4	
		MZP 206	Practical	4	4	
		AECC- II		2	2	
		SEC - II		2	2	
Total					28	

[M : M.Sc., Z : Zoology, T : Theory, P : Practical,

AECC: Ability Enhancement Core Course (English), SEC : Skill Enhancement Course (Information Technology)]

Course Structure M.Sc. II

Level	Semester	Course Code	Course Category	No. of Lectures Per Week	Credits		
9	III	MZT 301	Theory	4	4		
		MZT 302	Theory	4	4		
		MZT 303	Theory	4	4		
		MZT 304	Theory	4	4		
		DSC (Elective : Any one among two)					
		MZP 305	Practical	4	4		
		MZP 306	Practical	4	4		
		SEC- III		2	2		
		SEC - IV		1	1		
		Research Training (20 to 40 Working Days)			1		
Total					28		

SEC – III: Start-Ups and Entrepreneurship: An approach for Sustainable Economy

Level	Semester	Course Code	Course Category	No. of Lectures Per Week	Credits
9	IV	MZT 401	Theory	4	4
		MZT 402	Theory	4	4
		MZT 403	Theory	4	4
		MZT 404 (Elective : Any one among two)	Theory	4	4
		MZP 405	Practical	4	4
		MZP 406	Practical	4	4
		SEC – V (C-III)		2	2
		SEC-VI Internship / Industrial Training (30 to 60 Working Days)			1
		MOOCs / SWYAM / NPTEL			1
Total					28

Class	M.Sc.I	M.Sc.II	Total
Credits	56	56	112

SEMESTER I

MZT 101: Biosystematics and Biodiversity

Course Objectives: Student will be able to;

1. To define taxonomy, and various tasks of taxonomists.
2. To summarize the different concept of species for taxonomic identification of the species.
3. To understand the concepts of hotspot diversity and roles to conserve that diversity.
4. To know the roles played by NGOs, and different communities in conserving the biodiversity.

Credits=4	SEMESTER I MZT 101 Biosystematics and Biodiversity	No. of hours per unit/ credits
Unit I	Unit I – Taxonomy	15
	<p>Introduction to taxonomy, Stages and importance of taxonomy; Problems, Aim and Tasks of Taxonomy.</p> <p>Modern Trends in Taxonomy: Morphological approach, immature stages and Embryological approach, Ecological, behavioral and Cytological approach.</p> <p>Methodologies in systematic : Molecular markers for detection/evaluation of polymorphism, RFLP, RAPD etc.</p>	
Unit II	Concept of species:	15
	<p>Introduction, Typological, Biological, Nominalistic, Evolutionary and recognition species concept with conclusions, taxonomic identification.</p> <p>Zoological nomenclature: Origin of the code, international code of Zoological nomenclatures rules of nomenclature. Species and their number, polytypic species, Subspecies, other intraspecific group, super species.</p>	
Unit III		15
	<p>Biodiversity Science: Evolution of biodiversity, Factors promoting high diversity, Endemism and Hotspots, Measures of Bio-diversity, Values of Biodiversity, Uses and Importance of Biodiversity.</p> <p>Evaluation of priorities for conservation of habitats and species: Selection criteria for protection of species–species quality, Hotspots, Conservation indices. Selection criteria for protection of species–species quality, Hotspots, Conservation indices.</p>	
Unit IV	Biodiversity Conservation:	15
	<p>Loss of biodiversity, listing of threatened biodiversity, Threats to biodiversity, Role of NGOs, Colleges and Universities.IUCN Guidelines for Red List categories and criteria (version 7.0), Red List of Indian Flora and Fauna.</p>	

Course outcomes: Student should be able to:

- 1) Student should be able to define taxonomy, and various tasks of taxonomists.
- 2) They can summarize the different concept of species for taxonomic identification of the species.
- 3) They can understand the concepts of hotspot diversity and roles to conserve that diversity.
- 4) They should know the roles played by NGOs, and different communities in conserving the biodiversity.

References:

1. Alston, R.E. and B.L. Turner (1963): Biochemical systematics Prentices Hall Inc. Englewood Cliffs, N.J. 404 pp.
2. Avise, J.C. (1974): Systematic value of Electrophoretic data. *Syst. Zool.* 23 (4): 465 – 481.
3. Benazzi, M. (1973): Cytotaxonomy and evolution, General remarks vertebrate evolution. Ed.
4. A.B. Chiarelli and Campus Academic Press, London and N.Y. pp. 1-3.
5. Blomback, B and M. Blomback (1968): Primary structure of animal proteins as a guide in taxonomic studies. In *chemitaxonomy and serotaxonomy* (ed.) Hawkers pp. 3 – 20.
6. Camp, W.H. (1951): *Biosystematics Britania* 7: 113 – 127.
7. Chamberlin, W.J. (1952): *Entomological Nomenclature and Literature* 3rd edition Dubuvelowa William C. Brown Co.
8. Cole, A.J. (1969): Numerical taxonomy proceedings of the colloqui in numerical taxonomy held in the University of St. Andrews Sept. 1968. Academic Press, N.Y 324 pp.
9. Hennig, W. (1966): *Phylogenetic systematics Univ. Illinois Press* III, 263 pp.
10. Heywood, V.H. (1973): *Taxonomy and Ecology Systematics Association special Vol. 5 Academic Press, London, and New York* 370 pp.
11. Huxley, J.S. (ed.) *The New Systematics Oxford Univ. Press London* 538 pp.

MZT 102: Ecology and Environmental Pollution

Course objectives: Student will be able to:

1. Describe behavioral and physiological mechanisms by which organisms interact with other organisms and with their physical environment.
2. Explain the importance of biodiversity to ecosystems, energy flow.
3. Understand the role and sources of pollutants.
4. Get to know about the sources of pollution and their pollutants along with their control measures.

Credits=4	SEMESTER I MZT 102 Ecology and Environmental Pollution	No. of hours per unit/ credits
Unit I	<p>1 Habitat and Niche: Concept and types of habitat, Ecological niche, Niche width and overlap.</p> <p>2 Species interaction: Types of interactions, interspecific competition, Symbiosis.</p> <p>3 Community ecology: Types and nature of communities, Structure of community, Community dominance, edge and ecotones.</p>	15
Unit II	<p>1. Ecological Succession: Types and Patterns of succession, Climax.</p> <p>2. Ecosystem: Structure and Functions of ecosystem, Primary production.</p> <p>3. Environmental Impact Assessment: Definition and scope, characteristics, objectives, components, methodology, procedure for obtaining EIA clearance, preparation of EIA document.</p> <p>4. Biogeochemical Cycles</p>	15
Unit III	<p>1. Concept, Scope and Definitions of Environmental Pollution - Types of pollutants- based on physical properties, forms, causes of environmental pollution, pollution in relation to public health (Air, water, pesticide and radiation pollution).</p> <p>2. Air pollution -Definition, sources, principle air pollutants, effects of air pollutants. Smog - Classical smog and industrial pollution, photochemical smog and vehicular emission. Prevention and control of air pollutants.</p> <p>3. Environmental Legislation: Central and state boards for the prevention and control of environmental pollution, powers and functions of pollution control boards, penalties and procedure, duties and responsibilities of citizens for environmental protection, Wildlife Protection Act 1972.</p>	15

Unit IV	<p>Water pollution- Definition, Sources of water pollution, Types of water pollutants and their effects, BOD, COD water pollution control, Sewage treatment.</p> <p>Soil pollution- Sources, effects of soil pollutants and remedial measures.</p> <p>Radioactive pollution - Types, sources and effects of radiation.</p> <p>Agricultural pollution- Farm animal waste, Soil erosion plants residues, agrochemical- fertilizers and pesticides.</p>	15
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Course outcomes: Student should be able to:

1. Students should be able to describe behavioral and physiological mechanisms by which organisms interact with other organisms and with their physical environment.
2. They should explain the importance of biodiversity to ecosystems, energy flow.
3. They should understand the role and sources of pollutants.
4. They should get to know about the sources of pollution and their pollutants along with their control measures.

References:

1. Fundamentals of Ecology- Dash and Dash.
2. Basic Ecology- Odum E. P
3. Fundamentals of Ecology- Odum E.P
4. Modern concepts of ecology- K. D.Kumar.
5. Concepts of Ecology- H. D. Kumar.
6. Ecology - P. D.Sharma.
7. Environmental pollution Half, Rinehart and Winston, New York (1977)- LaurentHodges.
8. PandeyKamleshwar.,ShuklarJ.P.andTrivediS.P.(2005):Fundamentalof Toxicology.New Central book agency PVT. LTD.Kolkata

MZT 103: Cell and Molecular Biology

Course objectives: Student will be able to:

1. Explain the models of membrane structure and diffusion of molecules passing through it.
2. Give original example of pattern of protein secretion and its intracellular transport through vesicles.
3. Demonstrate the structure and function of cell organelles.
4. Criticize importance of cell cycle, checkpoints and signal transduction pathway.

Credits=4	SEMESTER I MZT 103: Cell and Molecular Biology	No. of hours per unit/ credits
Unit I	<p style="text-align: center;">Membrane Structure and Function</p> <ol style="list-style-type: none"> 1. Structure of model membrane, lipid bilayer and membrane protein diffusion, 2. Osmosis, ion channels, active transport, membrane pump Cell-cell adherence, Gap junction, ECM, Integrin 	15
Unit II	<p style="text-align: center;">Secretary Pathway:</p> <ol style="list-style-type: none"> 1. ER-structure (SER, RER), transport. 2. Ribosomes, polysomes, free ribosomes, membrane associated ribosomes and secretary pathway. 3. Vesicles involved in intracellular transport. 	15
Unit III	<p style="text-align: center;">Cellular respiration & degradation:</p> <ol style="list-style-type: none"> 1. Peroxisomes – structure and functions. 2. Endosomes – late and early – structure, formation, assembly & components. 3. Lysosomes – structure & polymorphism. 4. Proteasomes – types structures, assembly & functions. 5. Mitochondria -structure, assembly components. 6. Role of cyt.p.450 in detoxification (Xenobiotic Transformation) 	15
Unit IV	<p style="text-align: center;">Nuclear Components:</p> <ol style="list-style-type: none"> 1. Nucleus – EM. Structure. 2. Nuclear envelope – structure & function. 3. Chromosomes – Packaging of genome, genetic maps and nucleolus. 4. Heterochromatin. <p style="text-align: center;">Cell cycle division and signal transduction:</p> <ol style="list-style-type: none"> 1. Cell cycle – cyclins & cyclin dependent kinases & checkpoints. 2. Cytoskeleton & intracellular movement – microtubule, MTOC. 3. Micro filaments & intermediate filaments. 4. G protein and G protein coupled Signal transduction pathway. 	15

Course outcomes: Student should be able to:

1. Explain the models of membrane structure and diffusion of molecules passing through it.
2. Give original example of pattern of protein secretion and its intracellular transport through vesicles.
3. Demonstrate the structure and function of cell organelles.
4. Criticize importance of cell cycle, checkpoints and signal transduction pathway.

References:

1. Molecular biology of the Cell –Bruce Albert Pub. By Garland Pub. Inc.New York &London.
2. Molecular Cell biology – LodishBerk, Matsudaira, Kaiser, Krleger(2004) pub. By W.,H. Freeman & Company, NewYork.
3. Molecular cell biology – Gerald carp (2005) pu. By John Wiley&Sons.
4. Avers C.J. (1986)/ latest edition) Molecular Cell Biology, Addison-Westey, Reading inMassachusettes.
5. Baserga, R (1985)/ latest edition) The Biology of CellReproduction. Harward University Press Cambridge,Massachuselts
6. Beck, F. and J.B. Lloyd (eds) (1974) The Cell in Medical Science,Academic Press,London.
7. Callan, H.G (1986)/ latest edition) Lampbrush Chromosomes Springer –verlag NewYork.
8. Chambliss, G(ed)(1980)/latest edition) Ribosanes – Structure, Function& Genetics University of Park Press,Baltimore.
9. Edmunds, L.N. 1984 / latest edition- Cell Cycle Clock, Marcel Dekker, NewYork.
10. Edmunds, L.N. 1987/ latest edition. Cellular & Molecular Basis ofBiological Clocks Springer – VerlagBerlin.
11. Gomperts, B.D.(latest edition) PlusmaMembrane Academic press, NewYork.
12. Henning, W (ed) 1987/ latest edition Structure & Functionof Eukaryotic Chromosanes Springer – Verlag,Berlin.
13. Moens, P.B. (ed) 1987/ latest edition Meiosis Academic Press,Orlands, Florida, USA.
14. Nomura, M.A./Tissiers&P. Lengyel (eds). 1974 Latest edition –Ribosomes Cold Spring Harber Laboratory Press, New York.

MZT 104:E₁ Applied Entomology

Course objectives: Student will be able to:

1. Recite the anatomy of insects, its biology and control measures of insect pests.
2. Morphological characters, life cycle, damage and control of pests.
3. A model of lac culture, sericulture and apiculture cultivation and products used for economic purpose.
4. Criticize the various methods of pest control utilized in an IPM program.

Credits=4	SEMESTER-I MZT 104:E ₁ Applied Entomology	No. of hours per unit/ credits
Unit I	<p>1.Study of generalized insect: Grass hopper (Morphology and Anatomy Brief Account) Identification, Characteristics, Biology, Damage and Control of following insect pests.</p> <p>2.House hold pests: Cockroach, Ant, Cricket, Clothes Moth, Carpet beetle, Furniture beetle, Cigarette beetle, House hold hairy caterpillar, Silverfish, Book louse, Wasp.</p> <p>3.Medicinal Pests: Mosquitoes, Housefly, Bedbug, Sand fly, Human lice, Tse Tse fly, Rat flea, Hippobosca.</p>	15
Unit II	<p>1. Veterinary pests: Mosquitoes, Sand fly, Horsefly, Blowfly, Stable fly, Warble fly, Crew worm fly, Flea.</p> <p>2.Forest Pests: Termites, <i>Eutectonamacheearalis</i>, <i>Hybleapuera</i>, <i>Sahyadrassusmalabaricus</i>, <i>Batoceraru fumacualata</i>, Shishamde foliater <i>Plecopterare flexa</i>, Deodar defoliater Oak bark weevil, Sal bostrichid beetle.</p>	15
Unit III	<p>1.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 and pests of Mulberry.</p> <p>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.</p> <p>3.Apiculture: The honey bees, Social organization of honey bees, Life history of honey bees, Methods of bee keeping.</p>	15
Unit IV	<p>Principles and methods of pest management in residential places and public buildings, insecticides for domestic use and their safety, Organic methods of domestic pest management.</p>	15

Course outcomes: Student should be able to:

1. Recite the anatomy of insects, its biology and control measures of insect pests.
2. Explain morphological characters, life cycle, damage and control of pests.
3. Make a model of lac culture, sericulture and apiculture cultivation and products used for economic purpose.
4. Criticize the various methods of pest control utilized in an IPM program.

References:

1. A text book of Applied Entomology, vol.2 - K. P. Srivastava,1996.
2. Elements of Entomology- Rajendrasingh.
3. A text book of Forest Entomology – T.V. Sathe,2009.
4. Sericulture and Pest Management – T.V. Sathe and A.D. Jadhav,2001.
5. Sericultural crop protection – T.V Sathe,1998.
6. Agricultural Pests of India and South East Asia – A.S. Atwal,1993.
7. Crickets and Household pests – T.V. Sathe and M.R. Awate,2009.
8. Beekeeping in the tropics – G.S. Smit,1960.
9. Beekeeping in India, ICAR, New Delhi, S. Singh,1975.
10. A handbook of practical Sericulture, CSB, Ullal and Narsimhanna,1981.
11. A text book of applied entomology- K. P.Srivastava.

MZT 104:E₂ Histology and Histochemistry

Course objectives: Student will be able to:

1. Describe the instrumentation required in histology.
2. Explain techniques and stains used in histology.
3. Criticize structure of cell and tissue.
4. Demonstrate glycosaaminoglycans in histochemical techniques.

Credits=4	SEMESTER-I MZT 104:E₂ Histology and Histochemistry	No. of hours per unit/ credits
Unit I	Tools in histology: Principles, design and functioning of microtomes, Automated microtomes, Ultra microtome, Cryostat, Problems and troubleshooting	15
Unit II	Techniques in histology: Sample preparation, obtaining tissue samples, handling reagents. Fixatives (types of fixatives and effect on tissue), processing of fixed samples, Dehydration (procedure and significance), Embedding, block making, staining (staining methods histochemical and immunohistological methods), Dyes and dye binding reactive groups, Mordants and mordanting, Temporary and permanent preparations, Whole mount preparation	15
Unit III	Fundamentals of histology in vertebrate: Epithelial, connective, muscular, nervous and other specialized tissues in mammal (Rat/mice). Composite illustration of a cell, its cytoplasm and its organelles. Internal and external morphologies of ciliated and non ciliated epithelium. Junctional complex between epithelial cells. Basal regions of epithelial cells. Basal region of an ion-transporting cell. Cilia and microvilli.	15
Unit IV	Fundamentals of histochemical techniques: principle and practice, Detection of glycogen, Neutral and acid mucopolysaccharides, Detection of basic proteins, Detection of specific and nonspecific lipids, Detection of nonspecific esterases, Detection of acid /alkaline phosphatase.	15

Course outcomes: Student should be able to:

1. Describe instrumentation required in histology.
2. Explain techniques and stains used in histology.
3. Criticize structure of cell and tissue.
4. Demonstrate glycosaaminoglycans in histochemical techniques.

References:

1. Text book of Histology Roland lesson DL. WB Saunders Company, Tokyo.
2. Histology: Roland lesson and Thomas Leesan WB Saunders company Co., Canada
3. Histochemistry Vol. I II III A G E pearse Churchill Livingstone NY ZY 404 –
Histology and histochemistry (i) Enzyme detection: acid phosphatase, alkaline phosphatase, esterases (ii) Nucleic acid staining: methyl green, pyronine, feulgen stain (iii). Study of different types of tissue with help of permanent slides (iv) Effect of fixatives, fixation of tissues (v) Block preparation and sectioning (vi) Mucopolysaccharide staining, AB pH 1.5, 2.5
4. (vii) Proteins (basic mellrg) and lipid staining by sudan black ,(viii) Comparative study of effect of fixative on a given tissue, (ix) Effect of fixatives on tissue sections- liver
5. DiFiore's Atlas of histology with functional correlation, Victor P. Eroschenko 12th edition,351 West Camden Baltimore, MD 21201

MZP 105 (Practical based on paper – MZT 101 and 102)

Course objective: Student will be able to:

1. Classify specimens from different classes or phylum.
2. Describe morphological peculiarities of animals.
3. Explain methods of collection and preservation of animals
4. Analyze different physicochemical parameter of water.

Credits=2	MZP 105: (Practical based on paper – MZT 101 and 102)	No. of hours per unit/ credits
	<ol style="list-style-type: none"> 1. Study of museum specimens and slides invertebrate's phyla (one representative from each class) for biosystematics & biodiversity. 2. Study of museum specimens of chordates phylum (one representative from each class) for biosystematics and biodiversity. 3. Identification of insects/ molluscs with the help of keys up to orders. 4. Identification of insects/ molluscs with the help of keys up to families. 5. Identification of animals with the help of keys up to families (fish/amphibian with the help of preserved specimens / models / pictures). 6. Methods of collection and preservation of animals. 7. Visit to ZSI/fields. 8. Study of inter relationships parasitism, symbiosis, commensalisms(2-3 examples from each). 9. Study of endangered species. (Models, pictures, charts.). 10. Study of adaptations in animals from Pisces, amphibian, reptilian, birds & mammals (2-3 examples from each). 11. Visits to sanctuaries and National parks to study wild life management. 12. Study biodiversity of platue by Quadrate & transect method, Shannon index and Simpsons index 13. Detection of heavy metal by Atomic absorption Spectrophotometer 14. Use of software for identification of plants & animals. 15. Assessing existing data base on www. 16. Harnessing information through Internet regarding 	

	<p>Biodiversity.</p> <p>17. Clinical test for Phenylketonuria by Guthrie test /Ferric chloride test</p> <p>18. Preparation of culture media isolation of DNA from plants & animals.</p> <p>19. Study of microbes isolation, culture and staining from soil & water.</p> <p>20. Identification of planktons from different water samples.</p> <p>21. Determination of DO, CO₂ Hardness, Chloride, Alkalinity of fresh water and sewage water. (Physicochemical parameters)</p> <p>22. Determination of COD of sewage water.</p> <p>23. Determination of BOD of sewage water.</p> <p>24. Estimation of inorganic phosphate and nitrate from water sample.</p> <p>25. Qualitative and quantitative estimation of Zooplanktons.</p> <p>26. Detection of heavy metal from the water sample.</p> <p>27. Practicals set on the network – internet, protein information, Genome & Chromosome database set by teacher.</p> <p>28. Any other experiment set by the concerned teacher</p>	
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Course outcomes: Student should be able to:

1. By the end of this course student should be able to classify specimens from different classes or phylum.
2. Describe morphological peculiarities of animals.
3. Explain methods of collection and preservation of animals
4. Analyze different physicochemical parameter of water.

MZP 106 (Practical based on paper – MZT 103 and MZT 104: E₁)

Course objective: Student will be able to:

1. Identify various types of nucleus from WBCs and liver
2. Demonstrate different types of glycosaminoglycans from tissue.
3. Categorize different types of pests.
4. Compare between harmful and useful, beneficial insects.
5. Analyze histological structure of tissues
6. Justify the histochemical staining intensities of the different cells.

Credits=2	MZP 106 (Practical based on paper – MZT 103)	No. of hours per unit/credits
	<ol style="list-style-type: none"> 1. Demonstration of extracellular material <ol style="list-style-type: none"> a. Collagen, b. Elastin 2. Demonstration of Glycosaminoglycans in the extracellular material using <ol style="list-style-type: none"> a. AB-1 b. AB-2.5 c. PAS d. AF +AB 2.5 (Sialic Acid) e. MgCl₂ influence on alcinopolia. 3. Study of cell Organelles. <ol style="list-style-type: none"> a. Nucleus demonstration by <ol style="list-style-type: none"> 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. Effect of tonicity of solutions on plasma membrane – Isotonic, Hypotonic, Hypertonic b) Fragility test of RBC & Osmotic Resistance. 	
Credits=2	MZP 106 (Practical based on paper – MZT 103 and 104: E ₁)	No. of hours per unit/credits
	<ol style="list-style-type: none"> 1. Study of generalized insect. Identification economic importance of following insect pests (6-8 pests from each category) 2. Pests of stored gains. 3. House hold pests. 	

	<ol style="list-style-type: none"> 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. 	
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Credits=2	MZP 106 (Practical based on paper – MZT 103 and 104: E₂)	No. of hours per unit/ credits
	<ol style="list-style-type: none"> 1. Demonstration of different types of microtomes. 2. Handling and cleaning of light microscope with camera and microphotography of Histological Slides 3. Sectioning and staining of tissues for histological and histochemical Studies (Fish/Rat/Mice) 4. Interpretation histological slides of tissues: (salivary gland, spleen, thymus, adrenal gland, thyroid gland, pituitary gland, pancreas, blood cells, liver, intestine, kidney, testes, ovaries, uterus –any five tissues) 5. Histochemical detection of proteins by mercury bromophenol blue. 6. Histochemical detection of lipids by Sudan Black B. 7. Histochemical detection of carbohydrates by periodic acid Schiff's reagent 8. Histochemical detection of DNA in tissues by Feulgen. 9. Histochemical detection of Neutral and acidic mucosubstances by sequential staining (AB pH 2.5- PAS). 10. Histochemical detection of sialomucins by sequential staining (AB pH 2.5- AF). 11. Any other practical / experiment set by teacher /department. 	

Course outcomes: Student should be able to:

1. By the end of this course student should be able to identify various types of nucleus from WBCs and liver
2. Demonstrate different types of glycosaminoglycans from tissue.
3. Categorize different types of pests.
4. Differentiate between harmful and useful, beneficial insects.
5. Determine histological deformities in cell and tissues
6. Interpret the histochemical staining intensities of the different cells and quantitative analysis of biochemical composition of cell.

SEMESTER-II

MZT 201: Physiological chemistry

Course Objectives: Student will be able:

1. Understand biochemistry of carbohydrates, protein and lipid.
2. To introduce structure, function and organization of various bio-molecules present in the living cells.
3. Students know the structure and properties of macromolecules that act together to maintain and perpetuate the living systems.
4. Understand the structure and function of nucleic acid

Credits=4	SEMESTER-II MZT 201:Physiological chemistry	No. of hours per unit /credits
Unit-1	Principles of Biological chemistry-	15
	Principles of biophysical chemistry (pH, buffer, reaction kinetics dissociation and association constants) Physical constants, Structure of atoms, molecules and chemical bonds, Vander Waal's electrostatic, Hydrogen bonding and hydrophobic interactions. Thermodynamics, Concept of free energy, Enthalpy, Entropy, Water: Structure and physicochemical properties, Energy rich bonds. Basics of solution preparation: Molarity, Molality, Normality, W/V, % solution, ppm, Stock dilution.	
Unit-2	Carbohydrates –	15
	Structure, classification and function, Carbohydrate metabolism: Glycolysis, TCA cycle, Electron transfer and ATP generation, Bioenergetics of ATP cycle, glycogenesis, glycogenolysis, gluconeogenesis and Pentose phosphate pathway.	
Unit-3	Proteins-	15

	<p>Proteins – structure, classification and function, Biosynthesis and Oxidation of amino acids. Primary structure of proteins and nucleic acids, Conformation of proteins and, Reverse turn and Ramachandran plot.</p> <p>Nucleic acids: DNA, RNA structure, functions and Biosynthesis of nucleotides.</p>	
Unit-4	<p>Lipids- structure, classification and function, Catabolism of fatty acid – Beta oxidation, significance of beta oxidation, Biosynthesis of saturated and unsaturated fatty acids, Biosynthesis of triglyceride, biosynthesis of membrane phospholipids, Biosynthesis of cholesterol, Steroidal hormones- structure and functions.</p>	15

Course Outcomes: Students should able to:

1. Knowledge on the structure and function of different biomolecules would enable the students to consolidate their focus on understanding various metabolic pathways crucial for the sustenance of living systems.
2. Understand the how to form proteins and how to work at molecular level.
3. Understand the metabolic pathways and their role in human bodies.
4. Get knowledge of micro and macromolecules and their concern diseases.
5. Acquired knowledge and importance of water for living system.

References:

1. Arthur Anderson, Essentials of physiological chemistry, (New York, Wiley, London: Chapman & Hall, 1947) 395 pp.
2. Harold Harper, Review of physiological chemistry. (Appleton & Lange, 1979).
3. Peter Karlson- Introduction to Modern biochemistry, New York and London, Academic Press, 1965) 403 pp.
4. Mahler H and Cordes E – Biochemical chemistry
5. David Nelson and Michel Cox, Lehninger's Principles of Biochemistry: 6th edition, (W. H. Freeman Publisher, 2013) 1158 pp.
6. Francis Reithel, Concepts in Biochemistry, McGraw-Hill, 1967) 414 pp.
7. George Bell, J Norman Davidson and D Emsile Smith- Text book of physiology and biochemistry, Edinburgh: E & S. Livingstone Ltd. 1952) 1160 pp.
8. Mitlon and Toporely- Essentials of biochemistry

MZT 202 - Quantitative Biology and Tools and Techniques in Biology

Course Objectives: Student will be able to:

1. Understand about the terms Central tendency, correlations, regression and analysis of variance.
2. Understand how to apply testing hypothesis, Probability distribution, student t-test and Chi-square test.
3. Understand how to separate molecules by using different techniques
4. Understand analytical instruments and their applications in biology.

Credits= 4	SEMESTER-II MZT 202 - Quantitative Biology and Tools and Techniques in Biology	No. of hours per unit/credits
Unit-1	1. Introduction, Application in Biology. 2. Measurement of Central tendency. 3. Measures of dispersion. 4. Correlation- Types and methods of correlation. 5. Regression- Regression lines and coefficients. 6. Analysis of Variance (ANOVA).	15
Unit-2	1. Probability- Introduction, addition and multiplication theory. 2. Probability distribution- Binomial, Poisson and Normal. 3. Testing of hypothesis. 3.1 Tests of Significance. 3.2 Null hypothesis. 3.3 Alternative hypothesis. 3.4 Level of significance. 4. Student t- test. 5. Chi- square test (X ²). 6. Confidence integral.	15
Unit-3	Separation techniques: 2. Chromatographic techniques – Chromatography theory & practices, Molecular Sieve chromatography, affinity chromatography, ion exchange chromatography, HPLC, GLC, Thin layer chromatography. 3. Electrophoretic techniques – General principles, support media, electrophoresis of proteins and nucleic acids, Isoelectric focusing. 4. Density gradient centrifugation and its application	15

Unit-4	<p>(A) Analytical instruments and their applications in Biology: 1. Spectroscopy (Spectrophotometry, Spectrofluometry, NMR, ESR).</p> <p>(B) Microscopy, Radiometry &Immunochemical techniques. 1. Light microscope, phase contrast microscope, fluorescence microscope, Electron Microscope (SEM & TEM). 2. Immunoprecipitation, Labelling antibodies, immunoblotting, immunoassays and immunohisto /cytochemistry.</p>	15
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Course Outcomes: Students should able to:

1. Identify analyses appropriate for diverse types of data, and explain their theoretical fundamentals.
2. Describe, present, and critically evaluate analytical methods, models and theories used in published research, and identify, where relevant, more appropriate alternatives.
3. Apply and extend analytical methods, models and theories to biological datasets.
4. Acquire skills of separation technique, analytical instrumentation and their applications.

References:

1. Fundamentals of Statistics- Gupta S. C.
2. Basic Biostatistics and its applications- Datta A. K
3. Biostatistics and Biometry- Parihar and Parihar.
4. An Introduction to statistical Methods- C. B. Gupta.
5. Practical Biochemistry By Wilson and Walker
6. Cell : A molecular approach By Cooper
7. Molecular Biology of the Cell by Lodish et al.
9. Basic Biostatistics and its applications- Datta A. K
10. Biostatistics and Biometry- Parihar and Parihar.
11. An Introduction to statistical Methods- C. B. Gupta.

MZT 203 - Elements of physiology

Course Objectives: Student will be able;

1. Understand Physical concepts of homeostasis and control mechanisms and to study the functions of body system.
2. Understanding of the physiology and basic regulatory concepts related to the functioning of life processes.
3. Understand physiology of gastro intestine, respiration, circulation and excretion.
4. Understand the use of the scientific method and quantitative reasoning to field of physiology.

Credits=4	SEMESTER-II MZT 203: Elements of physiology	No. of hours per unit/credits
Unit-1	Gastrointestinal Physiology	15
	<ol style="list-style-type: none"> 1. Functional anatomy of gastrointestinal tract 2. Gastrointestinal tract associated glands (Liver, Pancreas and salivary gland) with their control mechanism 3. Digestion and absorption in gastrointestinal tract 4. Dietary balance, regulation of feeding, obesity and starvation, BMR, Vitamins and their role in metabolism 	
Unit-2	Physiology of Respiration:	15
	<ol style="list-style-type: none"> 2.1 Mechanism of breathing and pulmonary ventilation 2.2 Pulmonary volumes and capacities 2.3 Physiology of gas exchange 2.4 Regulation of respiration 	
Unit-3	Physiology of Circulation:	15
	<ol style="list-style-type: none"> 3.1 Body fluids, blood coagulation and homeostasis 3.2 Blood groups and blood transfusion 3.3 Cardiac muscles and cardiac cycle 3.4 Control of excitation and conduction in heart 3.5 Normal electrocardiogram 	
Unit-4	Physiology of Excretion:	15
	<ol style="list-style-type: none"> 4.1 Functional anatomy of the kidneys and Mechanism of urine formation 4.2 Regulation of urine formation, 4.3 process of micturition and diuretics 4.4 Cerebrospinal fluid and brain metabolism. 	

	4.5 Conduction of nerve impulse and synaptic transmission 4.6 Pituitary, Thyroid and Parathyroid Structure and functions, Bone marrow and erythropoiesis	
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Course Outcomes: Students should be able to:

1. Understand the functions of important physiological systems including the cardio-respiratory, renal and metabolic systems;
3. Understand how these separate systems interrelate to yield integrated physiological responses to challenges such as exercise, fasting and ascent to high altitude, and how they can sometimes fail.
4. Perform, analyse and report on experiments and observations in physiology;
5. Understand Pituitary, Thyroid and Parathyroid glands and their pathophysiology

References:

1. Gordon Shepherd, Neuro Biology, (New York Oxford University Press 1987) 774 pp.
3. J. Willis Hurst, et al (eds), The Heart, 7th ed. New York McGraw- Hill Book Co. 1990) 2274pp.
4. Eugene Renkin and Charles, Michel Hand Book of Physiology Vols. Circulation. (Oxford University Press, 1988) 1124pp.
5. Arthur Gayton et al., Circulation Overall regulation, (Annual Review Physiology, 1972) 34:13.
6. Arthur Gayton, Arterial pressure & Hypertension (Philadelphia, 1980).
7. Norman Kaplan et al, The Kidney in Hypertension (Perspectives in hypertension vol.2) (New York. Raven Press, 1989). Pages 46-51.
8. Arthur Gayton et al, Dynamics & Control of the Body fluids Philadelphia, (W.B. Saunders, Co., 1975).
9. Barry Brenner et al., The kidney 3rd ed. Philadelphia, (W.B. Saunders Co., 2006) 2080 pp.
10. Vernon Brooks, The neural Basis of motor control New York, (Oxford University Press, 1986).
11. Leonard Johnson, et al, Physiology of the gastro intestine tract, (New York Raven press, 2006) 2080 pp.
12. James Thompson et al (eds) Gastrointestinal Endocrinology. (New York McGraw Hill bookco., 1987).
13. Kritchevsky, Dvaid, Nair, Padmanabhan, Setchell, eds, The Bile Acids (New York Plenum Pub. Corp 1988) 604 pp.
14. Helen Guthrie, Introductory Nutrition 7th ed. Times Mirror/ Mosby College Publishing, StLouis, 1989) 289-331.

MZT 204:E₁ Biology of Parasites

Course Objectives: Student will be able;

1. Understand animal association, types, types of host and interrelationship between host and parasite
2. Understand the term vectors and arthropod vector of medical and veterinary importance.
3. Understand protozoan parasite and their diseases
4. Understand the life cycle, mode of transmission and control measures of different parasite.

Credits=4	SEMESTER-II MZT 204: E₁ Biology of Parasites	No. of hours per unit/credits
Unit-1	Animal association, Types of Parasites, Types of Hosts, Interrelationship between host and parasite responses and hosts to parasitic infection, Mode of transmission of parasite, Host specificity and parasitic adaptation	15
Unit-2	Vectors, i) Definition, types, Epidemiological consideration, Relationship of vertebrate pathogen to vector immunology, Physiology of vector, Population studies and effectiveness of vector. ii) Arthropod vector of Medical and veterinary importance Human louse, Triatominae bugs, Black flies, Sand flies, Mosquitoes, and Rat flea, ticks, mites and Vector control. Horse fly, House fly, Tsetse fly, Stable fly	15
Unit-3	Study of parasites from protozoa & cestoda 1. Trypanosoma and leishmania of humans. 2. Intestinal flagellates Giardia, Trichomonas, Gregarina. 3. General life cycle of cestodes: Taenia, Diphylobothrium, Diphylidium, Echinococcus.	15
Unit-4	Unit IV Study of parasites from Trematoda & Nematoda: <i>Schistosoma</i> , <i>Fasciola</i> , <i>Nematodes: Wuchereria, Ancylostoma, Strongyloides, Entrobium</i> . Plant nematodes. Biology, epidemiology and control of waterborne and food borne parasites. Ecological changes & emerging diseases. General pattern of parasitic transmission. Parasitic zoonosis.	15

Course Outcomes: Students should be able to:

1. Understand the vectors and disease and control measures by the vectors.
2. Animal associations for living in nature.
3. Understand the knowledge of cestodes, trematodes, nematodes and their life cycle.
4. Understand intestinal parasites and disease caused by them.

References:

1. Ramnik Sood, Parasitology, (C.B.S. Publisher, New Delhi –2019) 344 pp.
2. Krishnadhan Chatterjee, Parasitology Protozoology and Helminthology, 13th Edition (C.B.S. Publisher, New Delhi 2019) 304 pp.
3. Leslie Chapell, Physiology of parasites, (John, Willey & Sons N.Y.1979).
4. Elmer Noble and Glenn Noble, The Biology of Animal Parasites, 2nd Ed. (Lea & Febieger U.S.A., 1982).
5. Clark Read, Parasitism & Symbiology, (Ronald Press New York, 1970).
6. Gerald Schmidt, Larry Robert, Foundation of Parasitology, 8th Ed. (McGraw Hill Companies, 2009) 683 pp.
7. Derek Smyth, Introduction Animal Parasitology, 2nd Ed. (Johns Willey Sons New York 1997).
8. The Biology of parasitism and introduction to the study of associate organism- by White field, P.J. (1977) University Parks Press Baltimore.
9. Animal Parasitism – by Read C.P. Prenters Hall of India Pvt. Ltd., New Delhi.
10. Helminths, Arthropods & Protozoo of domesticated Animals. By E.J.L. souls by, ELBSpublishation London Ed. 1969 ed.
11. Parasitology – by Chandler and Chands, A Text book of Parasitology by S.S. Kelkar and Rohini S. Kelkar, Bombay popular prakashan.

MZT 204:E₂ - General Endocrinology

Course Objectives: Student will be able-

1. Understand invertebrate endocrinology.
2. Understand the various endocrine glands and their secretion.
3. Understand hormonal regulation of endocrine glands.
4. Understand the pathophysiology of hormones in mammals.

Credits=4	SEMESTER-II MZT 204: E₁ General Endocrinology	No. of hours per unit/credits
Unit-1	Invertebrate endocrine systems:	15
	Insect- Anatomical organization, structure and chemistry of hormones. Neuroendocrine control of metamorphosis Endocrine Control of reproduction Endocrine Control of diapause Pheromones in insects.	
Unit-2	Vertebrate endocrine systems(Human):	15
	Autocrine, paracrine and endocrine secretions - an overview of mammalian endocrine system. a) Hypothalamus- structure and functions, hypothalamohypophysial portal system, regulation of hypophysial secretions. b) Pituitary gland (Hypophysis)-structure and functions. Functional cell types and its hormones. c) Anatomical organization and hormone synthesis of endocrine glands- thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland and gonads.	
Unit-3	Mechanism of hormone action in mammals (Human):	15
	Types of hormone receptors (membrane bound cytoplasmic and nuclear receptors) regulation of receptor number, signal transduction- secondary messengers, cyclic AMP, prostaglandin, Cadmodulin mediated pathways, genomic mechanism of hormone action- thyroid and steroid hormones,	

	termination of hormone action.	
Unit-4	Pathophysiology of hormones in mammals (Human):	15
	Pituitary gland- Hyperpituitarism (Gigantism, Acromegaly, Cushing's Syndrome) Hypopituitarism (Sheehan's and Simmonds Disease, Dwarfism, Diabetes insipidus) Thyroid gland – Hyperthyroidism (Grave's disease, Goiter) Hypothyroidism- Cretinism, Myxoedema) Adrenal gland- Hyperadrenalism (Cushing's syndrome, Conn's syndrome) Hypoadrenalism (Addison's disease, hypoadosteronism)	

Course Outcomes: Students should able to:

1. Understand the invertebrate endocrinology.
2. Enlist the various endocrine glands and their secretion.
3. Understand mechanism of hormone action in mammals (Human).
4. Understand the pathophysiology of hormones in mammals and hormones causing diseases.

References:

1. Bentley, P.J. 1994: Comparative vertebrate endocrinology -III Ed. Cambridge Univ. Press (NY)
2. Chandra. S. Nagi : Introduction to Endocrinology PHI (New Delhi)
3. Degroot. L.J. and Neill, J.D. 2001: Endocrinology-IV Ed, Vol. I-III. W.B. Saunders company (Ed)
4. Modern entomology: D. B. Tembare 2nd revised edition, Himalay publication
5. Highman and Hill 1972: Comparative Endocrinology of Invertebrates
6. Human physiology- Guyton and Hall.
7. Mandal. A. 1994: Handbook of Neuroendocrinology, EMKAY publications
8. Nelson. R.J. 1995: An Introduction to behavioural endocrinology Sinauer Associates, Inc.
9. Nooris. D.O. 1996 :Vertebrate endocrinology IIIrd Ed., Academic Pres
10. Pickford G.E & Atz W.J. 1957: The Physiology of Pituitary gland of fishes (Zoological Survey; New Delhi)
11. Turner. C.D. and Bugnara. J.T 1976: General Endocrinology., W.B. Saunder
12. Zarrow M.X and McCarthy. J.L 1964: Experimental endocrinology (Academic Press; New York).
13. Textbook of Pathology., 2013 Harsh Mohan, 7th Edition

MZP-205 (Practical based on paper – MZT 201 and 202)

Course Objectives: Student will be able;

1. Understand human system physiology, building on knowledge of basic physiological principles.
2. Understanding practical biological skills in physiology of organisms.
3. Acquire skills in conducting collaborative research in the field of physiology and allied sciences.
4. Understand how to apply testing hypothesis, Probability distribution, student t-test, ANOVA and Chi-square test with examples.

Credits=2	SEMESTER-II MZP 205 (Practical based on paper – MZT 201 and 202)	No. of hours per unit/credits
	<ol style="list-style-type: none"> 1. Estimation of glycogen. 2. Estimation of lipids & phospholipids. 3. Estimation of Vitamin C. 4. Estimation of Cholesterol. 5. Estimation of alpha-amino nitrogen by formol titration. 6. To find saponification value for a given fat. 7. To prepare solution of given concentration change in normality/Molarity Prepare phosphate buffer of known pH and molarity- pH measurement, measurement of pH of lemon juice, urine and serum. 8. To find absorption spectrum of hemoglobin, bovine serum albumin, tyrosine and (uv-visible). 9. To estimate free amino acids by Ninhydrin method. 10. To estimate protein content by Biuret method/ Lowry et.al./ Bradford method. 11. To estimate the sugar by Nelson-Somogyi method and glucose. 12. Separation of sugars by TLC. 13. Spot test of amino acids. 14. Serum cholesterol, Calcium estimation 15. Examples based on different population genetical principles (Based on theory). 16. To isolate proteins by salting out or by adjusting 	

	isoelectric point. 17. To estimate tyrosine content by Folin-phenol method. 18. To estimate the purity of ATP. 19. Examples based on Chi-square test & student t-test. 20. Examples based on regression. 21. Examples based on Correlation coefficient. 23. Examples based on Coefficient of variance. 24. Examples based on ANOVA. 24. Examples based on Probability. 25. Any other practical set by the concerned teacher.	
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Course Outcomes: Students should able to:

1. Estimate total amount of protein, lipid, glycogen, cholesterol and vitamin C from sample.
2. Apply the knowledge of biostatistics in routine life.
3. Separate out molecules from the sample by using different techniques
4. Acquire skills of analytical instrumentation and their applications

References:

1. Ramesh Gupta and S. Bhargava, Practical Biochemistry, Fifth Edition, (CBS Publishers & Distributors, 2013).
2. John Walker and Keith Wilson, Practical Biochemistry: Principles and Techniques, (Cambridge University Press., 2005) 807 pp.
3. David Plummer, An Introduction to Practical Biochemistry, Third Edition, (McGraw Hill Education Pvt Limited, 2017).
4. Dnyaneshwar Tembhare, Techniques in Life Sciences, First Edition, (Himalaya Publishing House Pvt. Ltd. 2010) 463 pp.
5. B. Antonisamy, Prasanna Premkumar and Solomon Christopher, Principles and practice of Biostatistics, (Elsevier India, 2017) 390 pp.

MZP 206 (Practical based on paper – MZT 203 and 204: E₁)

Course Objectives: Student will be able-

1. Understand Physiological concepts of homeostasis and control mechanisms and to study the functions of body systems.
2. Understanding of the physiology and basic regulatory concepts related to the functioning of life processes.
3. Understand physiology of gastro intestine, respiration, circulation and excretion.
4. Understand the identification and Preservation of different parasites.

Credits=2	MZP 206 Practical based on paper – MZT 203 and 204: E₁	No. of hours per unit/credits
	<ul style="list-style-type: none"> • Determination of bleeding time • Determination of clotting time • Estimation of Haemoglobin (Hb) concentration and oxygen carrying capacity • Enumeration of Red blood corpuscles (R.B.C) • Enumeration of white blood corpuscles (W.B.C) • Differential count of W.B.C. • Erythrocyte sedimentation rate (E.S.R) • Detections of digestive enzymes • Microanatomy of Endocrine glands • To estimate amylase from saliva • To study normal constituents of urine • Measurement of breathing rate, heart beat and study of heart sound • Collection of parasites: Protozoans/ Nematodes/ Helminthes/ Insects. • Preservation and Identification of parasites: Protozoans • Preservation and Identification of parasites: Nematodes • Preservation and Identification of parasites: Helminthes • Preservation and Identification of parasites: Insects 	

	<ul style="list-style-type: none"> • Lifecycle studies of parasites: Protozoans • Lifecycle studies of parasites: Nematodes • Lifecycle studies of parasites: Helminthes • Lifecycle studies of parasites: Insects • Any other practical set by concern teachers. 	
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Course Outcomes: Students should able to:

1. Understand different physiological techniques for identified disease.
2. Estimate different enzymes from saliva.
3. Acquired the knowledge of life cycle of different Protozoans, Nematodes, Helminths.
4. Acquire Knowledge of Endocrine gland and their role in Physiology.

References:

1. Dnyaneshwar Tembhare, Techniques in Life Sciences, First Edition, (Himalaya Publishing House Pvt. Ltd. 2010) 463 pp.
2. Ramnik Sood, Parasitology, (C.B.S. Publisher, New Delhi –2019) 344 pp.
3. Krishnadhan Chatterjee, Parasitology, Medical Publisher Calcutta, 1987.
4. Leslie Chapell, Physiology of parasites, (John, Willey & Sons N.Y.1979).
5. Elmer Noble and Glenn Noble, The Biology of Animal Parasites, 2nd Ed. (Lea & Febieger U.S.A., 1982).
6. Clark Read, Parasitism & Symbiology, (Ronald Press New York, 1970). Gerald Schmidt, Larry Robert, Foundation of Parasitology, 8th Ed. (McGraw Hill Companies, 2009) 683 pp.
7. Derek Smyth, Introduction Animal Parasitology, 2nd Ed. (Johns Willey Sons New York 1997).
8. Krishnadhan Chatterjee, Parasitology Protozoology and Helminthology, 13th Edition (C.B.S. Publisher, New Delhi 2019) 304 pp.

MZP 206

Practical based on paper – MZT 203 and 204: E₂

Course Objectives: Student will be able to;

1. Understand the various endocrine glands from invertebrate.
2. Prepare the permanent slide of various endocrine glands using different staining methods.
3. Identify different syndromes related to endocrine system.
4. Understand biochemical estimation of protein and blood sugar.

Credits =2	MZP 206 Practical based on paper – MZT 203 and 204: E ₂	No. of hours per unit/credits
	<ol style="list-style-type: none">1. Study of endocrine glands from invertebrates: insects2. Demonstration of endocrine glands from vertebrates (Rat/Mice) -pituitary, thyroid, thymus, pineal, parathyroid, pancreas & adrenal glands.4. Permanent slide preparations of above endocrine glands using different staining methods.5. Study of estrous cycle in rat- vaginal smear method6. Demonstration of following technique in a suitable animal (rat/mice).<ol style="list-style-type: none">a) Adrenalectomyb) Gonadectomy7. Identification of different syndromes and diseases related to endocrine system (photographs).8. Estimation of protein in control and diabetic rat/mice by Lowry's method.9. Detection of blood sugar level in control and diabetic rat/mice.10. Any other practical / experiment set by teacher /department.	

Course Outcomes: Students should be able to:

1. They should able to understand the various endocrine glands from invertebrate.
2. They should able to To prepare the permanent slide of various endocrine glands using different staining methods.

3. They should be able to identify different syndromes related to the endocrine system.
4. They should be able to understand the different demonstration techniques in animals (rat/mice).
5. They should be able to understand the biochemical estimation of protein and blood sugar.

References:

1. Dr. Mofidul Islam and Dr. Biplab Kumar Das: Endocrinology with practical; Mahaveer publication.
2. Norman Lavin: Manual of endocrinology and metabolism; 5th edition
3. Prakash S. Lohar: Endocrinology hormones and human health.