M.Sc. Zoology Semester- I

Major Zoology Course -I

Effective from June 2024

Course Code	**PS01MAZOO01[T]**	**Title of the Course**	**Systematics, Structural and Functional Anatomy of Invertebrates**
Total Credits of the Course	**04**	**Hours per Week**	**04**

Course Objectives:	To make students familiar with: 1. Through this course student get insight about how in the taxonomic hierarchy formed according increases in the complexity of structure and function of the eukaryotes. 2. This course makes a detailed comparison of the anatomy and physiology of the different taxa of non-chordates. 3. The course thus gives an overview of the intricate life processes and adaptive radiations in non-chordates.

Course Content

Unit	Description	Weightage* (%)
1.	**Principles & methods of taxonomy:** • Concepts of species, hierarchical taxa, Zoological nomenclature and its type. • Outline classification of animals: Important criteria used for classification in each taxon. • Classification of animals (Protozoa to Hemichordata). • Evolutionary relationships among taxa, Coelom- origin and functions. Protostomia and Deuterostomia.	25%
2.	**Nutrition and Digestion:** • Patterns of feeding and digestion in Cnidarians; • Filter feeding in Polychaeta, Mollusca and Echinodermata. **Respiration**: • Structure and functions of respiratory organs and mechanism in phylum Annelida, Arthropoda and Mollusca.	25%

3.	**Excretion:** • Structure and functions of excretory organs in phylum Helminthes, Annelida, Arthropoda and Mollusca. **Nervous system:** • Study of Nervous system from Cnidaria to Echinodermata. **Reproduction**: • Different types of reproduction in Invertebrates.	25%
4.	**Invertebrate Larvae:** • Larval forms of invertebrates and its evolutionary significance. **Minor Phyla:** • Structural organization and general characters of Phylum Entoprocta, Nemertinea, Rotifera, Brachipoda and Phoronida.	25%

Teaching-Learning Methodology	• Class room interactions • By chalk –duster method • By using OHP- Powerpoint presentation • By Giving project work • By giving Students seminar, unit test, assignment • Question bank circulation • Arranging guest talk

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Marks-Exam Pattern: Class test-15marks(30%), Quiz-15marks(30%), Seminar (active learning)-10marks(20%), Home assignment-5marks(10%), Attendance-5marks(10%)	50% (50 Marks)
2.	External Marks (10marks MCQs [from all 4 units] + 10marks descriptive Questions From each 4- unit)	50% (50 Marks)

Course Outcomes:	
1.	To develop an understanding of the characters used to classify or differentiate the organisms belonging to different taxa.
2.	Understand the relative position of individual organs and organ systems through anatomical diagrams of the invertebrate representatives.
3.	Realize that proximity in structure and physiology occurred diverse organisms.
4	Undertake research in any aspect of animal physiology in future. To help students in understanding the concepts of Zoology.

Sr. No.	Reference Books:
1.	Modern Text book of Zoology – Invertebrate by R.L.Kotpal
2.	Invertebrate Zoology by- Jordan & Verma
3	A Text Book of Zoology by P. S. Dhami and J. K. Dhami
4	Text Book of Zoology by S.N. Prasad
5	Comparative Animal Physiology by C.LADD PROSSER AND FRANK A. BROWN

On-lineResources :
https://epgp.inflibnet.ac.in
e-PATHSHALA (https://epathshala.nic.in/)

M.Sc. Zoology Semester I

MajorZoology Course-II

PS01MAZOO02 (T)

Effective from June 2024

Course Code	**PS01MAZOO02[T]**	**Title of the Course**	**Aquaculture & Fisheries Techniques**
Total Credits of the Course	**04**	**Hours per Week**	**04**

Course Objectives:	• Types of aquatic habitats. • Physical & chemical properties of water. • Aquatic adaptations of various animal groups. • Economic importance of aquatic animals. • Classification of fishes • Anatomy of fishes. • Fish disease.

Course Content		
Unit	Description	Weightage* (%)
1.	* Introduction, Definition, Scope. and Importance of Fisheries * Origin and Evolution of Teleosti Fishes. Classification and general characters of Fishes and Prawns. Taxonomic identification of Fresh Water fishes by the Morphometric Method. * Ecology of Lentic and Lotic water bodies. Classification of Fresh water bodies - Rivers, Lakes, and Ponds. * Physical & Chemical (Temperature, Light, Hardness, pH, Chlorides, Dissolved Oxygen Alkalinity and Acidity) and biological characteristics of water bodies.	25%
2.	* Culture practices: Indian major carps and exotic carps; Shrimps and prawns * Induced Breeding: Hormonal regulation of gonadal development, Activity of Gonadotropin releasing hormone, application of hormones in aquaculture. * Induction of maturation and spawning.	25%

	* Methods of fishing: Crafts and Gear technology. * Migration in fishes	
3.	* Structure and Management of Culture ponds. * Mono culture, Polyculture and Composite fish culture. * Induced Breeding and its relevance. * Plankton and its significance in Aquaculture * Aquafeed: Nutrition, Feed formulation, Feed additives, Alternative feed ingredients. * Fish products and byproducts, fish processing production of fish sauce by lactic acid fermentation.	25%
4.	* Determination of Health Condition in Fishes and Ectoparasites of Fishes * Types of Diseases- viral, Bacterial, fungal, protozoan, and other parasitic diseases, Diagnosis, Control measures, Role of Bio-pesticides, Drug resistance * Recent developments in marine biotechnology. * Jellyfish Green Fluorescent Proteins and their applications.	25%

Teaching-Learning Methodology	• Class room interactions • By chalk –duster method • By using OHP- Power point presentation • By Giving project work • By giving Students seminar, unit test, assignment • Question bank circulation • Arranging guest talk

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Marks-Exam Pattern: Class test-15 marks (30%), Quiz-15marks (30%), Seminar (active learning)-10marks (20%), Home assignment-5marks (10%), Attendance-5marks (10%)	50% (50 Marks)
2.	External Marks (10marks MCQs[from all 4 units] + 10marks	50%

	descriptive Questions From each 4- unit)	(50 Marks)

Course Outcomes:	
1.	Student will be able to- Explain the types of aquatic habitats.
2.	Interpret importance of physical & chemical properties of water for aquatic life.
3.	Compare various adaptations in aquatic animals.
4.	Explore the importance of aquatic animals for economic development.
5.	Classify the fishes based upon their characters. Explain the anatomy of fishes.
6.	Identify the fish diseases based on symptoms.

Sr. No.	Reference Books:
1.	C.B.L. Srivastava. 2008. A Textbook of Fishery Science and Indian Fisheries ISBN: 81-225-0029-3
2.	T. V. R. Pillay. 1993. Aquaculture - Principles and Practices. Fishing News Bcok.ISBN-13. 978-0852382028
3	Pandey & Shukla. 2007. Fish & Fisheries ISBN: 81-7133-800-3
4	Jhingran V. G. (1997). Fish and Fisheries of India. Hindustan Publishing. ISBN: 9788170750178
5	Jayaram K. C. 1981. The fresh water fishes of India, Pakistan, Bangladesh, Burmaand Sri Lanka.OCLC Number:10369165

6	Kurian, C. V. and Sebastian, V.O. 1986. Prawns and Prawn fisheries of India. Hindustan Publishing Corporation. ISBN-13. 978-9997035660
7	Lakra W.S., Abidi SAH, Mukherjee S C and Ayyappan S. 2004. Fisheries Biotechnology. Narendra Publishing House. ISBN: 8185375860

On-line Resources :
https://epgp.inflibnet.ac.in
SWAYAM (https:/ /swayam.gov.in/)
NPTEL (https://nptel.ac.in/)
DIKSHA (https: //dikshagov.in/)
e-PATHSHALA (https://epathshala.nic.in/)

M.Sc. Zoology Semester I

Major Zoology-III

PS01MAZOO03 (T)

Effective from June 2024

Course Code	**PS01MAZOO03[T]**	**Title of the Course**	**Bioinstrumentation**
Total Credits of the Course	**04**	**Hours per Week**	**04**
Course Objectives:	• The course will enable the students to understand the principle and working of visualization techniques, separation techniques, spectroscopic techniques for analysis of the samples and principles and applications of tracer techniques in biology. • Principles and applications of different types of microscopy,		

	principle & application of cytophotometry and flow cytometry, centrifugation, electrophoresis chromatography, spectroscopy, radioactivity, radiation counters, x-ray diffraction will be known to the students.

Course Content		
Unit	Description	Weightage* (%)
1.	**Separation Techniques:** **Centrifugation:** Basic principle and application of analytical and preparative centrifugation, types of rotor, sedimentation coefficient, relative centrifugal force (RCF) differential, density and ultracentrifugation. **Electrophoresis:** Principle and applications agarose and 2D gel electrophoresis. Capillary electrophoresis and its applications. Native-PAGE, SDS-PAGE **Chromatography:** Principle, methodology and applications of gel–filtration, ion–exchange and affinity chromatography; Thin layer and High Performance Thin Layer Chromatography. Gas chromatography, High performance liquid chromatography (HPLC)	25%
2.	**Microscopy:** Principle, structure and applications of different types ofbright field & dark field microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy, scanning and transmission electron microscopy, Principle and applications of cytophotometry and flow cytometry.	25%
3.	**Spectroscopy** Basic principle of electromagnetic radiation, instrumentation and applications of UV, Visible, IR (including FTIR and ATR), AAS, NMR, Mass, MALDI-TOF spectroscopy. **Volumetric/ Titrations:** Measurements of pH, Buffer system, Conductivity, EDTA, Acid Base and Dichromate titrations.	25%

4.	**Molecular techniques**: Isolation and purification of RNA, DNA (genomic and plasmid) and proteins. **Blotting techniques** – Southern (DNA), Northern (RNA), Dot blotting and Western (proteins). Protein and DNA sequencing methods, strategies of genome sequencing, microarrays. DNA fingerprinting, PCR principle, DNA polymerases RFLP, RAPD and AFLP techniques.	25%

Teaching-Learning Methodology	• Class room interactions • By chalk –duster method • By using OHP- Power point presentation • By Giving project work • By giving Students seminar, unit test, assignment • Question bank circulation • Arranging guest talk

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Marks-Exam Pattern: Class test-15 marks (30%), Quiz-15marks (30%), Seminar (active learning)-10marks (20%), Home assignment-5marks (10%), Attendance-5marks (10%)	50% (50 Marks)
2.	External Marks (10marks MCQs[from all 4 units] + 10marks descriptive Questions From each 4- unit)	50% (50 Marks)

Course Outcomes:	
1.	On the Completion of this course, students will able to: Enrich the concept and application for separation of molecules by different types of centrifugation techniques. Knowledge of separation by horizontal and vertical gel electrophoresis is also anticipated. The separation of molecules by different types of chromatographic techniques will be learnt.

2.	Deals with the knowledge of different types of microscopes such as Light microscope, Compound microscope, Dark field, Bright field, Stereo microscope, Confocal, Phase contrast microscope, Fluorescent microscope, Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM). It also deals with the principle and application of cytophotometry and flow cytometry.
3.	Explore the consideration of principle and analysis of samples by different spectroscopic techniques such as UV, Visible, IR (including FTIR and ATR), AAS, NMR, Mass, MALDI-TOF, fluorescence, CD spectroscopy etc. will be learnt.
4.	Gather the concept of radioactivity autoradiography, different types of counters used to trace the radiation will be studied. The principle and application of x-ray diffraction methods to study the structure of biopolymer will be known.

Sr. No.	Reference Books:
1.	Modern Text book of Zoology – Invertebrate by R.L.Kotpal
2.	Invertebrate Zoology by- Jordan & Verma
3	A Text Book of Zoology by P. S. Dhami and J. K. Dhami
4	Text Book of Zoology by S.N. Prasad

On-line Resources :
https://www.biologydiscussion.com/zoology/
e-PATHSHALA (https://epathshala.nic.in/)
https://epgp.inflibnet.ac.in

M.Sc. Zoology semester –I
Zoology Practical
PS01MAZOO04,

Effective from June 2024

Course Code	PS01MAZOO04(P)	Title of the Course	Zoology Practical
Total Credits of the Course	04	Hours per Week	[4+4]=08

Course Objectives:	To make students familiar with: 1. To understand the Zoological concepts of Animal with particular emphasis on their experimental outcomes. 2.To understand the basic concepts of types of Invertebrates. The unit also introduces understanding of general aspects of Invertebrate Phyla and Animals. 3.To understand about Fisheries and their techniques.

Course Content

	Description	Weightage* (%)
	PART-I Classification of kingdom Protista • Classification of Porifera and coelentera, • Classification of Platyhelminthes and Nematoda • Classification of Annelida and Arthropoda, • Classification of Mollusca, Echinodermata and Hemichordata • Study of feeding mechanism in invertebrates. • Study of respiratory organs of invertebrates. • Study of excretory organs of invertebrates. • Study of reproduction in invertebrates. • Study of Invertebrate Larva. • On field study the diversity of animals. **PART-II** • Classification of Fishes	100%

	• Morphometric and Meristic data of Fishes (At least 3 types). • Collection, Identification and Screening of fish for Ecto and Endo parasites • Collection, Preservation, and Identification of plankton. • Identification of Fry and Fingerlings of Indian Major Carps. • Estimation of PH, Temperature, Chlorides, Dissolved Oxygen from water samples. • Locating and Extracting the Pituitary gland from local Fish. • Layout and design of fish pond. • Layout and design of prawn and shrimp hatcheries. • Visit to local Fish Breeding Centre	

Teaching-Learning Methodology	• Using student's Microscope • Observation of specimens • Using certain chemicals for test • Learn through chart /Model/ Video/ ppt • Field visit, Project submission • Preparing journal through various diagrams & description

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination evaluation includes Lab Work Assessment-20 marks (40%), Viva-voce/Lab Quiz-20 marks (40%) Attendance-10marks (20%) which makes total 50 Marks.	50%
2.	External Examination Evalution includes Lab work Assignment-40 marks (80%), Viva-voce/Lab Quiz-10 marks (20%),which makes total 50 Marks.	50%

Course Outcomes:

1.	To improve the scientific awareness of animals among the students.
2.	To make students to understand the role of animals and their importance in life.
3.	To improve scientific attitude and to give emphasis on the development of

	practical skills, data analysis, calculations, and also on the limitations of the experimental method and Scientific data as well as results obtained.
4	To help students in understanding the concepts of fisheries and their various techniques.

Suggested Reference Books:	
Sr. No.	Reference Books
1.	A Manual of Practical Zoology- Invertebrate by P.S.VERMA
2.	Practical Zoology Invertebrate by S.S. LAL
3	Pandey & Shukla. 2007. Fish & Fisheries ISBN: 81-7133-800-3
4	Hand book of methods in environmental studies by S. K. MAITI
5	Practical Physiology, Anatomy & Biochemistry by SHAH, PATEL& GOEL T. V. R. Pillay. 1993. Aquaculture - Principles and Practices. Fishing News Bcok.ISBN-13. 978-0852382028

On-line resources :
https://epgp.inflibnet.ac.in
SWAYAM (https:/ /swayam.gov.in/)

M.Sc. Zoology Semester I
MINOR ZOOLOGY
PS01MIZOO01 (T)
Effective from June 2024

Course Code	PS01MIZOO01 (T)	Title of the Course	WILD LIFE AND TECHNIQUES
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	To make students familiar with: 1. To understand the Zoological concepts of Animal with particular emphasis on their Fields outcomes. 2. To understand the basic concepts of wildlife and there studies. The students will also learn about importance and Techniques of the Wildlife.

Course Content		
Unit	Description	Weightage* (%)
1.	Introduction ● Types of forest & habitat ● National park & sanctuary ● Biodiversity Hotspots ● Fauna of India (red listed species) ● Seasonal changes Scope & Significances Field Methodology ● Altmann's methodology ● Lab techniques ● Statistical (Quadrate & Transect), ● Site Selection	50%
2.	Tools & Equipment's ● Binoculars ● Spotting scops ● Camera ● Camera trapping Equipment for fisheries & snake rescue	50%

Teaching-Learning Methodology	• Class room interactions • By chalk –duster method • By using OHP- Powerpoint presentation • By Giving project work • By giving Students seminar, unit test, assignment • Question bank circulation

	• Arranging guest talk

Evaluation Pattern		
Sr. No.	Details of the Evaluation Internal and/or External Examination Evaluation	Weightage
1.	Internal Examination Evaluation includes Class test-10 marks(40%), Quiz -5 marks(20%), Home assignment-5 marks (20%), Attendance-5 marks(10%) which makes **total 25 marks**	50%
2.	External Examination [5 MCQs (5marks from all units) + Descriptive Questions(10 marks from each unit) **total -25marks**	50%

Course Outcomes:	
1.	To improve the scientific awareness among the students.
2.	To make students to understand the role and contribution of Wild lifeZoology in the developmentof science**.**
3.	To improve scientific attitude and to give emphasis on the development of experimental skills, data analysis, calculations, and also on the limitations of the experimental method and Scientific data as well as results obtained.
4	To help students in understanding the concepts of wild life Zoology

Sr. No.	Reference Books
1.	Bird identification manual by Serhal & Chafic khatib
2.	Bird identification manual by GEER FOUNDATION
3.	A text book of zoogeographic by FRANK E. BEDDARD
4.	Research methodology by C.R.Kothari
5.	Fundamental of research methodology & statistic by Y.K.Singh

On-line resources
https://cdn-10.nikon-cdn.com/fileuploads/pdfs/sport-optics-imaging/Bino_Handbook.pdf
https://www.academia.edu/43821533/Research_Methodology_by_C_R_Kothari

M.Sc. FIRST SEMESTER
ZOOLOGY PRACTICAL
PS01MIZOO02, Practical
Effective from June 2024

Course Code	**US01MIZOO02(P)**	Title of the Course	**WILD LIFE & TECHNIQUES**
Total Credits of the Course	**02**	Hours per Week	**04**
Course Objectives:	To make students familiar with: 1. To understand the Zoological concepts of Animal with particular emphasis on their Experimental outcomes. 2. To understand the basic concepts of wildlife and there studies. The students will also learn about importance and Techniques of the Wildlife.		

Course Content		
	Practicals: • Quadrat and Transect methods. • Field visit : aquatic habitat • Field visit : Terrestrial habitat • On field precocious • Uses of Field Equipments :Binoculars, Spotting scoops, • How to use Camera in field. • Uses of Field Equipments : Camera trapping and its installment • Equipment for fisheries • Equipment for snake rescue	100%

	• Use of field guide books ▫ Birds of Indian Subcontinent by Richard Grimmette ▫ Mammals of Gujrat & India. ▫ Butterflies of India. ▫ Snakes of India.	

Teaching-Learning Methodology	• Using student's Microscope • Observation of specimens • Using certain chemicals for test • Learn through chart /Model/ Video/ ppt • Field visit, Project submission • Preparing journal through various diagrams & description

Evaluation Pattern

Sr.No.	Details of the Evaluation	Weightage
1.	Internal Examination Evaluation includes--Lab work Assignment-10marks (40%), Viva-voce/Lab quiz-10 marks(40%), Attendance-5marks (20%) which makes **total 25 marks**	50%
2.	External Examination Evaluation includes- --Lab work Assignment-20marks (80%), Viva-voce/Lab quiz-5 marks(20%) which makes **total 25 marks**	50%

Course Outcomes:

1.	To improve the scientific Skills and awareness among the students.
2.	To make students to understand the role and contribution of wildlife Zoology in the development of science.
3.	To improve scientific attitude and to give emphasis on the development of experimental skills, data analysis, calculations, and also on the limitations of the experimental method and Scientific data as well as results obtained. To help students in understanding the concepts of wild life Zoology

Suggested Reference Books:	
Sr. No.	Reference Books
1.	Bird identification manual by Serhal & Chafic khatib
2.	A text book of zoogeographic by FRANK E. BEDDARD
3.	Research methodology by C.R.Kothari

On-line resources
https://cdn-10.nikon-cdn.com/fileuploads/pdfs/sport-optics-imaging/Bino_Handbook.pdf
https://www.academia.edu/43821533/Research_Methodology_by_C_R_Kothari

Programme Structure for Master of Science in Zoology
(Syllabus with effect from June – 2024)

M.Sc. Zoology Semester – I

Course Type	Course Code	Name of Course	T/ P	Credit	Exam Hrs.	Internal [CEE]	External [SEE]	Total marks
MAJOR	PS01MAZOO01	Systematics, Structural and Functional Anatomy of Invertebrates	T	4	2:30hrs	50	50	100
MAJOR	PS01MAZOO02	Aquaculture and Fisheries Techniques	T	4	2:30hrs	50	50	100
MAJOR	PS01MAZOO03	Bioinstrumentation	T	4	2:30hrs	50	50	100
MAJOR	PS01MAZOO04	Zoology Practical	P	4	3:00hrs	50	50	100
MINOR	PS01MIZOO01	Wild life and Techniques	T	2	1:30hrs	25	25	50
MINOR	PS01MIZOO02	Zoology Practical	P	2	1:30hrs	25	25	50
TOTAL CREDITS				**20**		250	250	500