Kurukshetra University, Kurukshetra

(Established by the State Legislature Act-XII of 1956)
("A++" Grade, NAAC Accredited)

Syllabus of the Programme
for
Post Graduate Programme

M.Sc. ZOOLOGY

as per NEP 2020
Curriculum and Credit Framework for Postgraduate Programme

With Multiple Entry-Exit, Internship and CBCS-LOCF
With effect from the session 2024-25 (in phased manner)

DEPARTMENT OF ZOOLOGY
FACULTY OF LIFE SCIENCES

KURUKSHETRA UNIVERSITY, KURUKSHETRA -136119

HARYANA, INDIA

29/5/2024
Chairperson
Deptt. of Zoology
K.U. Kurukshetra

Session: 2024-25	
Part A – Introduction	
Name of Programme	**M.Sc. Zoology**
Semester	**1**
Name of the Course	**Cell Biology**
Course Code	**M24-ZOO-101**
Course Type	**CC-1**
Level of the course	**400-499**
Pre-requisite for the course (if any)	**Zoology as a Subject at UG Level**
Course Learning Outcomes (CLO)	CLO 1: This core course will make students able to understand how the cell functions as a unit of life. CLO 2: Through this course, students will be able to appreciate the importance of various cell function and structures in the evolution of multicellular organisms. CLO 3: The studies will make the students reveal elegance, dynamics and economy in the living cell and a gratifying unity in the principles by which a cell functions. CLO 4: The students will know about the basic cellular and molecular approaches for cancer development and treatment.

Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	**1. Biomembranes** 1.1 Molecular composition and arrangement, functional consequences 1.2 Cellular Transport – Recapitulation of the plasma membrane; diffusion, active transport and pumps, uniports, symports and antiports. 1.3 Donnan equilibrium; ion movements and cell function: acidification of cell organelles 1.4 Maintenance of cellular pH; cell excitation; bulk transport; Receptor mediated endocytosis 1.5 Transepithelial transport **2. Cytoskeleton and cell movement** 2.1 Introduction to cytoskeleton and its role 2.2 Molecular structure of Actin, myosin and their organisation 2.3 Structure and dynamic organizations of microtubules and microfilaments 2.4 Microtubule motors and movement 2.5 Intermediate filaments 2.6 Role of Centrioles and basal bodies 2.7 Structure and functions of Cilia and flagella	15
II	3 **The Extra Cellular Matrix and Cell interactions** 3.1 Cell walls 3.2 The ECM and cell-matrix interactions 3.3 Cell-cell interactions: adhesion junctions, tight junctions, gap junctions, plasmodesmata 3.4 Ca^{++} dependent and Ca^{++} independent Homophilic cell-cell adhesion 4 **Cell matrix adhesion** 4.1 Integrins 4.2 Collagen 4.3 Non-collagen components	15

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	4.4 Auxin and cell expansion 4.5 Cellulose fibril synthesis and orientation 5 **Protein sorting and transport** 5.1 Protein uptake into the ER 5.2 Membrane proteins and Golgi sorting 5.3 Mechanism of vesicular transport 5.4 Lysosomes 5.5 Molecular mechanism of secretory pathway	
III	6 **Cell cycle** 6.1 Eukaryotic cell cycle 6.2 Regulators of cell cycle progression 6.3 Role of Meiosis in Genetic Variation 7 **Cell – Cell signaling** 7.1 Signaling molecules and their receptors 7.2 Pathways of intracellular signal transduction 8 **Biology of Cancer** 8.1 The development and causes of cancer 8.2 Oncogenes 8.3 Tumor suppressor genes 8.4 Molecular approaches to cancer treatment	15
IV	9 **Genome organization** 9.1 Chromosomal organization of genes 9.2 Transposons in prokaryotes and eukaryotes 9.3 Morphological and functional elements of eukaryotic chromosomes 10 **Cell Death** 10.1 Necrosis and Programmed cell death 10.2 Molecular Mechanism 10.3 Applications and Significance 11 **Biology of Ageing** 11.1 Morphological, Physiological and Functional changes during Ageing 11.2 Telomeres and Ageing 11.3 Theories of Ageing	15
	Total Contact Hours	60

Suggested Evaluation Methods			
Internal Assessment: 30		**End Term Examination: 70**	
➢ **Theory**	**30**	➢ **Theory:**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Molecular Cell, Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc., USA.
2. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson. Garland Publishing Inc., New York.
3. Cell and molecular biology Phillip Sheeler, Donald E. Bianchi Wiley, 1987
4. Life: The Science of Biology by David Sadava
5. Cell and Molecular Biology by De Robertis
6. Cell Biology by A.K. Berry, EMKAY Publlications
7. Molecular Cell Biology, Lodishet al., W.H. Freeman and Company (8th Ed. 2016)
8. Molecular Biology, Weaver R. F., McGraw-Hill Education (5th Ed. 2011)

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Session: 2024-25			
Part A – Introduction			
Name of Programme	**M.Sc. Zoology**		
Semester	**1**		
Name of the Course	**Biochemistry and Bio-techniques**		
Course Code	**M24-ZOO-102**		
Course Type	**CC-2**		
Level of the course	**400-499**		
Pre-requisite for the course (if any)	**Zoology as a Subject at UG Level**		
Course Learning Outcomes (CLO)	CLO 1: It will provide the students a basic appreciation of the underlying principles and practical strategy of the analytical and preparative techniques that are fundamental to study and understanding of life processes. CLO 2: It will make the students to understand the general reactions of various metabolic pathways. CLO 3: Students will be able to explain the principle, working, materials used and applications of various biological techniques that are used to study the basic biological processes. CLO 4: Students will be able to describe the structure and classification of biomolecules.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1.0 **General Principles of Biochemistry and chemical composition of life** 1.1 General Introduction to Biomolecules 2.0 **Protein Biology:** 2.1 Primary, Secondary, tertiary and quaternary structure of proteins: i) Domain, ii) Ramachandran plot and its significance 3.0 **Enzyme:** 3.1 Classification and nomenclature, 3.2 Co-enzymes and Cofactors 3.3 Induced fit and Molecular Mechanism of Enzyme action, 3.4 Enzyme feedback mechanism, Isozymes. 4.0 **Nucleic acids: Structure and Functions** 4.1 DNA structure and functions 4.2 RNA structure and functions, 4.3 DNA choreography 4.4 Qualitative and quantitative estimation of DNA	15
II	5.0 **Metabolism:** 5.1 Glycolysis, citric acid cycles its regulation and role as metabolic hub. 5.2 Hexose monophosphate pathway its regulation and significance. 5.3 Cholesterol biosynthesis, its metabolism and steroidogenesis. 5.4 Bile acids and their metabolism 5.5 Saturated and unsaturated fatty acid and their metabolism.	15
III	6.0 Chemical and Biological assays (*in vitro* and *in vivo* assays). 7.0 Principles and uses of analytical instruments: 7.1Microscopes and imaging 7.2 Spectrophotometers, 7.3 NMR spectrophotometer 8.0 Microbiological and cell culture Techniques	15

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	8.1Setting of microbiological laboratory, 8.2Sterilization and Media preparation techniques 8.3 Inoculation and growth monitoring (Standard plate count technique), 8.4Isolation of a microbial colony and slant preparation. 8.5Design and functioning of tissue culture laboratory, 8.6Basics of cell/tissue culture, Culture media preparation, 8.7Cell proliferation measurements 8.8Cell viability testing and Cell harvesting methods. 8.9 Biosafety and levels 9.0 **Cryotechniques** : 9.1Cryopreservation for cells, tissue, organisms, 9.2Cryotechniques for microscopy.	
IV	10.0 **Separation techniques in biology**. 10.1 Molecular separations by chromatography, electrophoresis, precipitation etc. 10.2 Organelle separation by centrifugation. Density gradient centrifugation, Ultra Centrifugation, unit gravity centrifugation, affinity adsorption, anchorage based techniques etc. 10.3Cell separation by flow cytometery and FACS 11.0 **Radioisotope and mass isotope techniques in biology:** 11.1 Carbon dating and radioactive counting 11.2 Autoradiography 11.3 Biosensors 12.0 DNA fingerprinting	15
	Total Contact Hours	60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
➢ **Theory**	**30**	➢ **Theory:**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Animal Cell Culture – A practical approach, Ed. John R.W. Masters, IRL Press.
2. Introduction to Instrumental analysis, Robert Braun, McGraw Hill International editions
3. A Biologists guide to Principles and Techniques of Practical Biochemistry, K. Wilson and K.H. Goulding, ELBS Edn.
4. Lehninger AL, Nelson DL & Cox MM (1993) Principles of Biochemistry, 2nd edn. New York: Worth.
5. Stryer L (1995) Biochemistry, 4th edn. New York: WH Freeman.
6. Voet D, Voet JG & Pratt CW (1999) Fundamentals of Biochemistry. New York: Wiley.

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Session: 2024-25			
Part A – Introduction			
Name of Programme	**M.Sc. Zoology**		
Semester	**1**		
Name of the Course	**Biosystematics and Biostatistics**		
Course Code	**M24-ZOO-103**		
Course Type	**CC-3**		
Level of the course	**400-499**		
Pre-requisite for the course (if any)	**Zoology as a Subject at UG Level**		
Course Learning Outcomes (CLO)	CLO 1: Knowledge of Taxonomy helps in classifying and identifying biodiversity and biologist study the well understood relationships by making phylogenetic trees. CLO 2: It will help to understand the overall biodiversity of the world and their application in all the fields of biological sciences. CLO 3: Biostatistics helps to generate a hypothesis from a set of observation and then design experiment to test the hypothesis. CLO 4: Able to acquire, analyse and understand the significance of data.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1.0 Biosystematics and taxonomy: Definition and perspectives, 2.0 Historical resume, Importance and applications of systematics in biology. Concepts of newer aspects of biosystematics: Chemotaxonomy, Cytotaxonomy, Molecular taxonomy. 3.0 Dimensions of speciation and taxonomic characters: 3.1 Different Species concepts – species category 3.2Sub-species and other intra-specific categories. 4.0 Theories of biological classification, hierarchy of categories. 5.0 Taxonomic characters – different kinds, weighing of characters	15
II	6.0 **Methodology:** 6.1 Taxonomic collections, preservation, curetting process and identification. 6.2 Taxonomic keys-different kinds of taxonomic keys, their merits and demerits. 7.0 **Systematic publications:** 7.1 Different kinds of publications. 7.2 International code of Zoological Nomenclature (ICZN): principles, objectives and rules: Stability, Priority, Concept of availability, formation of names, synonymy, homonymy, the type method, kinds of type specimen, type-designation. 8.0 Principles of Bioethics in Biodiversity	15
III	9.0 **Measures of central value:** 9.1 Arithmetic mean, mode and median, Definition, calculation and its properties. 10.0 **Measures of Dispersion: Range,** 10.1 Interquartile range, 10.2 Quartile deviation. 10.3 Mean deviation and standard deviation, 10.4 Standard error 11.0 **Correlation:** 11.1Types and Methods studying correlation – Scatter diagram method, Graphic	15

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	method, Karl Pearson coefficient of correlation, Rank correlation. 12.0 Regression analysis (Regression lines and regression equation) 13.0 Chi-square analysis	
IV	14.0 **Concept of sampling and sampling methods:** 14.1 Definition and law of sampling, 14.2 Judgment sampling, Random sampling, stratified sampling, systematic sampling, multi-stages sampling and quota sampling. 15.0 Test of significance for large samples and small samples (student t-test, F- test; ANOVA). 16.0 Probability and law of probability, Theoretical probability distribution: Binomial distribution, Poison distribution, Normal distribution. 17.0 Components of computers, Basic functioning of computers, Use of Statistical Software in Biology	15
	Total Contact Hours	60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
➢ **Theory**	**30**	➢ **Theory:**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. M. Kato. The Biology of Biodiversity, Springer.
2. E.O. Wilson, Biodiversity, Academic Press, Washington.
3. G.G. Simpson, Principle of animal taxonomy, Oxford ISH Publishing Company.
4. E. Mayer, Elements of Taxonomy.
5. E.O. Wilson, The Diversity of Life (The College Edition), W.W. Northerm & Co.
6. S.K. Tikadar, Threatened Animals of India, ZSI Publication, Calcutta.

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Session: 2024-25			
Part A – Introduction			
Name of Programme	**M.Sc. Zoology**		
Semester	**1**		
Name of the Course	**Biology of Invertebrates**		
Course Code	**M24-ZOO-104**		
Course Type	**CC-4**		
Level of the course	**400-499**		
Pre-requisite for the course (if any)	**Zoology as a Subject at UG Level**		
Course Learning Outcomes (CLO)	CLO 1: The study of invertebrates reveals progressive evolutionary history and adaptations together which forms the basis of huge complex and diverse life forms. CLO 2: Students will acquire a clear understanding about organization of minor phyla and their relationship with other animal phyla CLO 3: Students will be able to know the structure and significance of various systems of Invertebrates CLO 4: Will have detail understanding of adaptations and significance of Invertebrates		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1.0 Introduction to invertebrates with their general characters, Basic body plan, Concept of Invertebrata v/s Vertebrata and Non-Chordata v/s Chordata 2.0 Organization of coelom 2.1 Concept and structure of Acoelomate, Pseudocoelomates and Coelomates. 2.2 Protostomia and Deuterostomia 2.3 Metamerism in Annelida, Pseudometamerism. 3.0 **Minor Phyla:** 3.1 Concept and significance 3.2 Organization and general characters of Acoelomate, Pseudocoelomates and Coelomates minor phyla (with special emphasis on Ctenophora, Rotifera, Endoprocta, Ectoprocta, Phoronida, Sipunculida and Echiuroidea).	15
II	4.0 **Locomotion** 4.1 Flagella and ciliary movement in Protozoa 4.2 Hydrostatic movement in Coelenterata, Annelida and Echinodermata 5.0 **Nutrition and Digestion** 5.1 Patterns of feeding and digestion in lower metazoa 5.2 Filter-feeding in Polychaeta, Mollusca and Echinodermata 6.0 **Respiration** 6.1 Organs of respiration: Gills, lungs, trachea,skin,Cloacal chamber, Buccopharyangeal area etc. 6.2 Respiratory pigments 6.3 Mechanism of respiration	15
III	7.0 **Excretion** 7.1 Organs of excretion: Coelom, coelomoducts, Nephridia and Malpighian tubules. 7.2 Mechanism of excretion and osmoregulation	15

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	8.0	**Nervous system** 8.1 Primitive nervous system: Coelenterata and Echinodermata 8.2 Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda). 8.3 Trends in neural evolution.	
	9.0	Social life in insects, Social life in Isoptera and Hymenoptera	
IV	10.0	**Invertebrate larvae** 10.1 Larval forms of free living invertebrates 10.2 Strategies and Evolutionary significance of larval forms 10.3 Conservation of invertebrates.	15
	11.0	**Introduction to insects** 11.1 Mouthparts of Insects 11.2 Mechanism of insect flight and hovering 11.3 Metamorphosis in insects 11.4 Hormonal control of moulting.	
	12.0	Economic importance of Invertebrates; Various Adaptations in Invertebrates	
		Total Contact Hours	60

Suggested Evaluation Methods			
Internal Assessment: 30		**End Term Examination: 70**	
➢ **Theory**	**30**	➢ **Theory:**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Hyman, L.H. The invertebrates, Vol. I. Protozoa through Ctenophora, McGraw Hill Co., New York.
2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltr J. London.
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
4. Barnes, R.D. Invertebrate Zoology, IIIrd edition. W.B. Saundrs Co., Philadelphia.
5. Russel-Hunter, W.D. A Biology of higher invertebrates, the Macmillin Co. Ltd. London.
6. Hyman, L.H. the Invertebrates smaller coelomate groups, Vol. V. McGraw Hill Co., New York
7. Read, C.P. Animal Parasitism. Prentice Hall Inc., New Jersey.
8. Sedgwick, A.A. Student text book of Zoology. Vol. I, II and III Central Book Depot, Allahabad
9. Parker, T.J., Haswell, W.A. Text book of Zoology, McMillan Co., London.

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Session: 2024-25			
Part A – Introduction			
Name of the Programme	**M.Sc. Zoology**		
Semester	**1**		
Name of the Course	**Practical based on Papers M24-ZOO-101 & M24-ZOO-102**		
Course Code	**M24-ZOO-105**		
Course Type	**PC-1**		
Level of the course	**400-499**		
Pre-requisite for the course (if any)	**Zoology as a Subject at UG Level**		
Course Learning Outcomes (CLO)	CLO1: Students will develop skills in basic laboratory techniques and understand the principles in Biology. CLO2: Able to apply the scientific method to the process of experimentation. CLO3: This course will make students able to understand the regulation of chemical reactions in living cells. CLO4: Students will be able to conduct the morphomatric analysis of chromosomes and demonstrate cell division		
Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	0	4 hours	

Part B- Contents of the Course

	Practicals	Contact Hours
Course Contents	1. Preparation of mitotic chromosomes from onion root tips 2. Preparation of meiotic chromosomes from grasshopper testes. 3. Preparation of karyotypes from micrographs. 4. Calculation of morphometric data and preparations of idiogram. 5. Determination of chiasma frequency and terminalization coefficient. 6. Study of permanent slides of different stages of meiosis and mitosis. 7. Preparation of polytene chromosomes (Chironomous/mosquito) and mapping. 8. Preparation of Solutions- Standard solution, Molar, Molal and Normal solution. 9. Proteins: Quantitative estimation of proteins by Biuret method and Lowry's method. 10. Carbohydrates: quantitative estimation of total carbohydrates and glucose 11. Analysis of Fats/ Oils: iodine number, saponification value, acid value quantitative estimation of total lipids. 12. Preparation of Standard curve for the estimation and extraction of nucleic acids (DNA and RNA). 13. Paper chromatography: amino acids and carbohydrates. 14. Thin layer chromatography: neutral and phospholipids. 15. Tools: demonstration of parts and working of the following tools: PCR, GLC, Spectrophotometers, various kinds of microscopes, pH meter, Electrophoresis, Centrifuges, Tissue culture unit, Incubators 16. Microbiological media preparation, sterilization, dilution, inoculation and standard plate count.	120

Suggested Evaluation Methods

Internal Assessment: 30		End Term Examination: 70	
➢ **Practicum**	**30**	➢ **Practicum**	**70**
• Class Participation:	5	Lab record, Viva-Voce, write-up and execution of the practical	
• Seminar/Demonstration/Viva-voce/Lab records etc.:	10		

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• Mid-Term Exam:	15	

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Sharma R K, Sangha S P S (2009). Basic Techniques in Biochemistry and Molecular Biology, I.K. International Publishing House Pvt. Ltd. New Delhi
2. Podder T, Mukhopadhyay S, Das S K (2003). An Advanced Laboratory Manual Of Zoology Published by Rajiv Beri for Macmillan India Limited, Rajkamal Electric Press, Delhi
3. Sadasivam S, Manickam A (1997). Biochemical Methods, Ed. 2 nd , New Age International Publishers, New Delhi
4. David T. Plummer(1987). An Introduction to Practical Biochemistry. Ed. , 3 rd , McGraw-Hill Publisher, Rajkamal Electric Press, Delhi
5. Rajgopal G, Toora B D (2022). Practical Biochemistry. Ed. 5 th , Ahuja Publishing House, New Delhi

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Session: 2024-25			
Part A – Introduction			
Name of the Programme		**M.Sc. Zoology**	
Semester		**1**	
Name of the Course		**Practical based on Papers M24-ZOO-103 & M24-ZOO-104**	
Course Code		**M24-ZOO-106**	
Course Type		**PC-2**	
Level of the course		**400-499**	
Pre-requisite for the course (if any)		**Zoology as a Subject at UG Level**	
Course Learning Outcomes (CLO)	CLO1: Students will able to understand the processes involved in the recognition of key groups of invertebrates CLO2: Students will be able to prepare permanent mounts of different mouthparts of insects to study the details of their structure. CLO3: Students will able to identify and classify the specimens of available invertebrate phyla. CLO4: Able to elaborate the different systems of invertebrates such as Earthworm, Cockroach, Prawn, Starfish etc.		
Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	0	4 hours	

Part B- Contents of the Course

Practicals	Contact Hours
1. Slides and Museum specimens of following phyla: (a) PROTOZOA (b) PORIFERA (c) CNIDARIA (d) ANNELIDA (e) ARTHROPODA (f) MOLLUSCA (f) ECHINODERMATA (h) HEMICHORDATA 2. Study of mouth parts of Cockroach, Honey Bee, Red cotton bug and House fly 3. Mounting: Obelia, Tubularia, Bougainvillea, Trachea of Cockroach, Crustacean Larva, *Cyclops, Nauplius, Daphnia* 4. Demonstration of Digestive system, reproductive system and nervous system of Earthworm, Cockroach, Prawn, Loligo and Star fish. 5. Preparation and use of different types of taxonomic keys. 6. Statistical analysis of data using manual and computer software methods a. Mean, mode & Median b. Standard deviation and S.E. c. Coefficient of correlation **d.** Diversity Indices **e.** Test of Significance (Student's t - test)	120

Suggested Evaluation Methods

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Internal Assessment: 30		End Term Examination: 70	
➢ **Practicum**	**30**	➢ **Practicum**	**70**
• Class Participation:	5	Lab record, Viva-Voce, write-up and execution of the practical	
• Seminar/Demonstration/Viva-voce/Lab records etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. P S Verma (2010). A Manual of Practical Zoology: INVERTEBRATES, S Chand and Company Limited, New Delhi
2. S.S. Lal (1980). A Textbook of Practical Zoology: Invertebrate. Edition, 4. Publisher, Rastogi Publications
3. S.C. Agarwal (2019). Practical Invertebrate Zoology, Publisher: Pragati Prakashan
4. V Benerjee (2021) . A Textbook of Invertebrate Practical Zoology, Bharti Bhawan Publishers, Noida, UP
5. Robert L. Wallace, Walter K. Taylor (2002). Invertebrate Zoology Lab Manual, 6th edition, Publisher: Pearson

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Session: 2024-25	
Name of the Programme	**M.Sc. Zoology**
Semester	**1**
Name of the Course	Seminar
Course Code	**M24-ZOO-107**
Course Type: (CC/DEC/PC/Seminar/CHM/OEC/EEC)	Seminar
Level of the course	400-499
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO1: To enhance the communication skill of students to express the subject effectively during academic and professional discourse and to improve their ability to comprehend, and integrate academic text.
Credits	Seminar
	2
Teaching Hours per week	2
Max. Marks	50
Internal Assessment Marks	0
End Term Exam Marks	50
Examination Time	1 hour
Instructions for Examiner: Evaluation of the seminar will be done by the internal examiner(s) on the parameters a decided by staff council of the department. There will be no external examination/viva-voce examination.	

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Session: 2024-25			
Part A – Introduction			
Name of Programme		**M.Sc. Zoology**	
Semester		**2**	
Name of the Course		**Population and Community Ecology**	
Course Code		**M24-ZOO-201**	
Course Type		**CC-5**	
Level of the course		**400-499**	
Pre-requisite for the course (if any)		**Zoology as a Subject at UG Level**	
Course Learning Outcomes (CLO)	CLO1: Students will be able to understand and explain the need for intra- and interdisciplinary cooperation in researching different ecosystems. CLO2: Students will understand the all biotic and abiotic factors that are related to individual, population, community and ecosystem and defines the relationships between them. CLO3: Information provided will give an insight about the benefits of ecosystem and can be used in the management of natural resources for sustainable development in ways that leave the environment healthy. CLO4: Many specialties within ecology such as marine, vegetation and statistical ecology provides students information to better understand the environment around them.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1.0 Basic Concepts: Definition, Scope and Significance of Ecology, Concept of biosphere, atmosphere, lithosphere and hydrosphere. 2.0 Organizational level of ecological systems, Ecological aspects of abiotic, biotic and edaphic factors, limiting factors 3.0 **Ecosystem:** Concept, Kinds and components 4.0 **Ecological energetic and energy flow:** Food chains, food webs, trophic structure; concept of productivity: primary, secondary, gross and net, Energy flow models.	15
II	5.0 **Restoration Ecology** Ecology of Disturbed Ecosystems: disturbance and its impact on the structure and functioning of terrestrial and aquatic ecosystems. 6.0 **Population characteristics** 6.1 Introduction and concepts of population ecology 6.2 Attributes of populations 6.3 Population density, methods of population density measurement 6.4 Growth rate and growth forms 6.5 Natality, mortality, survivorship curves and life tables 6.6 Biotic potential – Generation time, net reproductive rate reproductive values 6.7 Population and distribution. 6.8 Population dispersion	15
III	7.0 **Population regulation and Interactions**	15

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	7.1 Extrinsic and intrinsic mechanisms 7.2 Concept of density dependent and density independent factors in population regulation. 7.3 Concept of intra specific and inter specific population interactions 7.4 Proto-cooperation, mutualism and commensalisms 7.5 Host-parasite interactions, Life history strategies – r and k selection. 8.0 **Competition and niche theory** 8.1 Intraspecific and inter specific interactions 8.2 History of niche concepts 8.3 Gause's theory of niche	
IV	9.0 **Predation** 9.1 Theory; predator-prey oscillations 9.2 Model of prey – predatory dynamics 9.3 Role of predation in nature 9.4 Parasitism 10.0 **Community characteristics** 10.1 Species diversity; Biodiversity indices: Diversity, dominance, Similarity& dissimilarity Index 10.2 Ecological Succession 10.3 Ecological dominance 10.4 Ecotones and Edge effect 11.0 Ecological Impact Assessment	15
	Total Contact Hours	60

Suggested Evaluation Methods			
Internal Assessment: 30		**End Term Examination: 70**	
➢ **Theory**	**30**	➢ **Theory:**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Understanding Evolution by Earl. D. Hanson, Oxford University Press, Oxford, New York.
2. Oxford Surveys in Evolutionary Biology Vol. I – Vol. VI, Oxford University Press, Walton, Street, Oxford.
3. Evolution by Theodose H. Eaton (Jr.) Thomes – Nolson & Sona Limited, London.
4. Evolutionary Theory: (The unfinished synthesis) by Robert G.B. Reid: Croom Helm: London & Sydney.
5. Dobzhansky, Th. Genetics and Origin of species. Columbia University Press.

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Session: 2024-25			
Part A – Introduction			
Name of Programme		**M.Sc. Zoology**	
Semester		**2**	
Name of the Course		**Comparative Physiology**	
Course Code		**M24-ZOO-202**	
Course Type		**CC-6**	
Level of the course		**400-499**	
Pre-requisite for the course (if any)		**Zoology as a Subject at UG Level**	
Course Learning Outcomes (CLO)	CLO1: An appropriate understanding of functioning of each system of different groups of animals with their comparison will be acquainted. CLO2: The students will able to explore all reasoning and queries that how animals work CLO3: The students will be able to learn that how the physiology of different groups of organisms is influenced by the different environments of their niches CLO4: Since this course also have some important practical component where interesting exercises will be conducted to perform experiment and answer various queries of animal physiology		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1.0 Digestion 1.1 Feeding mechanisms and regulation, 1.2 Comparative physiology of digestion and absorption in different animal groups 2.0 Respiration 2.1 Respiratory organs, Types of respiration, mechanism of breathing 2.2 Transport of respiratory gases 2.3 Respiratory pigments through different phylogenetic groups. 2.4 Physiological response to oxygen deficient stress. 3.0 Excretion 3.1 Patterns of nitrogen excretion among different animal groups 3.2 Functional anatomy of renal unit; mechanisms of ultrafiltration, Counter Current mechanism, Dialysis 4.0 Osmoregulation in different animal groups 4.1 Definition and basic classification of organisms on the basis of osmoregulation 4.2 Osmotic challenges of different environments 4.3 Mechanism of Osmoregulation in fresh water, Estaurine and Marine animals 4.4 Osmoregulation in migratory organisms, Control and regulation of osmoregulation	15
II	5.0 Thermoregulation 5.1 Homeothermic animals, Poikilotherms, Hibernation and Aestivation, 5.2 Physical, chemical, neural regulation, 5.3 Physiological adaptations acclimatization & acclimation in response to	15

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	high, low ambient temperature 6.0 Circulation of body fluids and their regulation among different animal groups 6.1 Systems of circulation, heart beat and blood pressure, 6.2 Cardiac cycle, Cardiac output and its regulation, 6.3 Lymphatic system 7.0 Receptor physiology – a comparative study of Mechanoreception, Photoreception, Chemoreception and Equilibrium reception 8.0 Muscle and Contractile physiology 8.1 Contractile elements, cells and tissues among different phylogenic groups; Muscle structure and function-correlation; 8.2 Electric organs and tissues	
III	9.0 Comparative testicular physiology in animals 9.1 Morphology, Differentiation, Function and its regulation 10.0 Comparative ovarian physiology and differentiation in vertebrates 10.1 Morphology, Endocrinolgy, Oogensis, vitellogensis 11.0 Neuronal physiology 11.1 Structure and classification of neurons and glial cells. 11.2 Synaptic action, dendritic properties and functional operation of spinal cord, Brain stem 11.3 Autonomic nervous system.	15
IV	12.0 Principles of synaptic transmission 12.1. Ca2+ and transmitter release; post synaptic transmission mechanism; 12.2. Diversity of neurotransmitters: acetylcholine, catecholamine, serotonin, GABA, glycine, histamine, peptides, NO, and opiods. 13.0 Physiological adaptations to different environments 13.1 Physiological adaptations acclimatization & acclimation in response to high, low ambient temperature, 13.2 Physiological adaptation at high altitude and in deep sea environment. 14.0 Stress Physiology Concept of Stress and Strain, Stress hormones and stress regulatory mechanisms.	15
	Total Contact Hours	60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
➢ **Theory**	**30**	➢ **Theory:**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. C.L. Prosser. Comparative Animal Physiology. W.B. Saunders & Company.
2. R. Eckert. Animal Physiology: Mechanisms and Adaptation. W.H. Freeman & Company.
3. W.S. Hoar. General and Comparative Animal Physiology
4. Schiemdt-Nielsen. Animal Physiology: Adaptation and Environment. Cambridge.
5. C.L. Prosser. Environment and Metabolic Physiology. Wiley-Liss, New York.
6. David Randall, Warren Burggren, Kathleen French: Eckert Animal Physiology
7. Guyton, A.X., Text Book of Medical Physiology, 7th edition, Saunders Company (1986).

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Session: 2024-25			
Part A – Introduction			
Name of Programme		**M.Sc. Zoology**	
Semester		**2**	
Name of the Course		**Population Genetics & Evolution**	
Course Code		**M24-ZOO-203**	
Course Type		**CC-7**	
Level of the course		**400-499**	
Pre-requisite for the course (if any)		**Zoology as a Subject at UG Level**	
Course Learning Outcomes (CLO)	CLO1: To provide students the basic insight about the mechanism of evolution and to make them able to relate different forms of life on our planet earth. It will also provide them in-depth knowledge about the changing frequency and distribution of alleles within the population. CLO2: Acquire a clear understanding about genetic equilibrium in natural populations CLO3: To know about genetics of quantitative traits in populations CLO4: Detail understanding of molecular phylogenetics and methods of construction of phylogenetic tree		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1.0 Concepts of evolution and theories of organic evolution with an emphasis on Darwinism. 2.0 Emergence of Neo-Darwinism-Neutral Hypothesis 3.0 **Neo Darwinism** 3.1 Hardy-Weinberg law of genetic equilibrium 3.2 A detailed account of destabilizing forces: (i) Natural selection (ii) Mutation (iii) Genetic drift (iv) Migration (v) Meiotic drive	15
II	4.0 **Quantifying genetic variability** 4.1 Genetic structure of natural populations 4.2 Phenotypic variations 4.3 Models explaining changes in genetic structure of populations 4.4 Factors affecting human disease frequency 5.0 **Molecular population genetics** 5.1 Patterns of change in nucleotide and amino acid sequences 5.2 Ecological significance of molecular variations 6.0 **Genetics of quantitative traits in populations** 6.1 Analysis of quantitative traits 6.2 Estimation of heritability 6.3 Genotype-environment interactions	15

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	6.4 Inbreeding depression and heterosis 6.5 Molecular analysis of quantitative traits 6.6 Phenotypic plasticity	
III	7.0 **Genetics of speciation** 7.1 Concept of species 7.2 Patterns and mechanisms of reproductive isolation 7.3 Modes of speciation (Allopatric, Sympatric, Parapatric, Peripatric) 8.0 **Molecular Evolution** 8.1 Gene Evolution 8.2 Evolution of gene families, Molecular drive 8.3 Assessment of molecular variations 9.0 **Origin of higher categories** 9.1 Phylogenetic gradualism and punctuated equilibrium 9.2 Major trends in 'the origin of higher categories 9.3 Micro-and Macro-evolution	15
IV	10.0 **Molecular phylogenetics** 10.1 Concept of phylogenetic trees. 10.2 Methods of construction of Phylogenetic trees. 11.0 **Population genetics and ecology** 11.1 Metapopulations 11.2 Monitoring Natural Populations 11.3 Populations size and extinction 11.4 Loss of genetic variations 11.5 Conservation of genetic resources in diverse texa	15
	Total Contact Hours	60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
➢ **Theory**	**30**	➢ **Theory:**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Dobzhansky, Th. Genetics and Origin of Species. Columbia University Press. Dobzhansky, Th., F.J. Ayala, G.L. Stebbines and J.M. Valentine. Evolution. Surjeet Publication, Delhi.
2. Futuyama, D.J. Evolutinary Biology, Suinuaer Associates, INC Publishers, Dunderland.
3. Hartl, D.L. A Primer of Population Genetics. Sinauer Associates, Inc, Massachusetts.
4. Jha, A.P. Genes and Evolution. John Publication, New Delhi.
5. King, M. Species Evolution-The role of chromosomal change. The Cambridge University Press, Cambridge.
6. Merrel, D.J. Evolution and Genetics. Holt, Rinehart and Winston, Inc.
7. Smith, J.M. Evolutinary Gentics. Oxford University Press, New York.
8. Strikberger, M.W. Evolution. Jones and Bartett Publishers, Boston London.

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Session: 2024-25			
Part A – Introduction			
Name of Programme	**M.Sc. Zoology**		
Semester	**2**		
Name of the Course	**Biology of Vertebrates**		
Course Code	**M24-ZOO-204**		
Course Type	**CC-8**		
Level of the course	**400-499**		
Pre-requisite for the course (if any)	**Zoology as a Subject at UG Level**		
Course Learning Outcomes (CLO)	CLO1: Students will be able to understand various biological functions, the evolution of life from most primitive to most advanced form with respect to their habit and habitat. CLO2: Students will have acquaintance with the basic concepts, external morphology and sexual dimorphism in chordates and understand the various systems, adaptation and dentition in chordates. CLO3: Students will also Understand the Classification various classes of phylum Chordate i.e., Pisces, Reptiles, Aves and Mammals. CLO4: This core course will make students familiarize with the vertebrate diversity around them		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1.0 **Introduction to Chordates with their general characters.** 1.1 Origin of Chordates 1.2 Concept of Protochordata or pre-vertebrates 1.3 Classification of Vertebrates upto orders 2.0 **Integument and its derivatives** 2.1 Development, general structure and functions of skin and its derivatives 2.2 Glands, scales, horns, claws, nails, hoofs, feathers and hair	15
II	3.0 **Skeletal system** 3.1 Form, function, body size and skeletal elements of the body 3.2 Comparative account of jaw suspensorium, Vertebral column 3.3 Limbs and girdles 4.1 **Digestive system** 4.1 Dentition, Stomach, Digestive Glands 4.2 Anatomy of gut in relation of to feeding habits- herbivores, carnivores and omnivores. 5.0 **Respiratory system** 5.1 Characters of respiratory tissue, Internal and External Respiration 5.2 Comparative account of respiratory organs	15
III	6.0 **General plan of circulation in various groups** 6.1 Components of Blood 6.2 General plan of circulation in reptiles, birds and mammals 6.3 Evolution of heart, aortic arches and Portal systems 7.0 **Evolution of Urinogenital system in vertebrate series** 7.1 Structure and functions of different types of kidney 7.2 Urino-genital ducts	15

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	8.0 Flight adaptation in birds, Migration in fish and Birds	
IV	8.0 **Nervous system** 8.1 Comparative anatomy of the brain in relation to its functions 8.2 Comparative anatomy of spinal cord 8.3 Nerves-Cranial, Peripheral and Autonomous nervous systems 9.0 **Sense organs** 9.1 Simple receptors 9.2 Organs of Olfaction and taste 9.3 Lateral line system 9.4 Electroreception	15
	Total Contact Hours	60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
➢ **Theory**	**30**	➢ **Theory:**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Barrington, E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd,Edinbourgh.
2. Bourne, G.H. The structure and functions of nervous tissue. Academic Press, New York.
3. Carter, G.S. Structure and habit in vertebrate evolution - Sedgwick and Jackson, London.
4. Kingsley, J.S. Outlines of Comparative Autonomy of Vertebrates. Central Book Depot,Allahabad.
5. Kent, C.G. Comparative anatomy of vertebrates.
6. Milton Hilderbrand. Analysis of vertebrate structure. IV. Ed. John Wiley and Sons Inc.,New York.
7. Sedgwick, A. A Students Text Book of Zoology, Vol. II.
8. Torrey, T.W. Morphogenesis of vertebrates. John Wiley and Sons Inc., New York and London.
9. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.

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Session: 2024-25			
Part A – Introduction			
Name of the Programme		**M.Sc. Zoology**	
Semester		**2**	
Name of the Course		**Practical based on Papers M24-ZOO-201 & M24-ZOO-202**	
Course Code		**M24-ZOO-205**	
Course Type		**PC-3**	
Level of the course		**400-499**	
Pre-requisite for the course (if any)		**Zoology as a Subject at UG Level**	
Course Learning Outcomes (CLO)	CLO1: Provide significant knowledge of biological research with safe lab practices. CLO2: Students will understand application of histological studies in clinical and medical sciences and will be able to prepare these slides CLO3: Students will be able to identify biodiversity around them and spread awareness about biodiversity conservation CLO4: This course will help the students to understand research based knowledge methods for the welfare of human.		

Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	0	4 hours	

Part B- Contents of the Course

	Practicals	**Contact Hours**
Course Contents	1. Study of various components of pond and grassland ecosystem. 2. Determination of Water quality characteristics viz: Dissolved oxygen, pH, free carbon dioxide, salinity, transparency, alkalinity, chloride and hardness. 3. Methods of population density measurements. 4. Estimation of biodiversity indices. 5. Field Visit to Aquatic, Forest and other ecosystems for identification of biota. 6. Preparation of tissues for microtomy and demonstration of cryo techniques 7. Histochemistry: Methods of fixation of different tissues. 8. Histochemical test: (a) Haemotoxylin-eosin (b) Toluidine Blue (c) Sudan Block-B (d) Mercury bromophenol blue (e) Methyl green-pyronin-Y (f) Periodic acid Schiff's (g) Acid phosphatase (h) Alkaline phosphatase 9. Demonstration of live gametes and their staining procedure. 10. Determination of optimum pH, temperature and concentration for optimum activity of salivary amylase, 11. To demonstrate that the optimum activity of trypsin enzyme is pH and temperature dependent. 12. Qualitative test of vitamins and Quantification of vitamin A and C. 13. Total RBC, WBC and Different WBC count 14. Estimation of Blood plasma	120

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
➢ **Practicum**	**30**	➢ **Practicum**	**70**
• Class Participation:	5	Lab record, Viva-Voce, write-up and execution of the practical	
• Seminar/Demonstration/Viva-voce/Lab records etc.:	10		

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• Mid-Term Exam:	15	

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Podder T, Mukhopadhyay S, Das S K (2003). An Advanced Laboratory Manual of Zoology Published by Rajiv Beri for Macmillan India Limited, Rajkamal Electric Press, Delhi
2. Garg S K, Bhatnagar A, Kalla A, Johal M S(2002). Experimental Ichthyology. Ed. 1 st , CBS Publishers and Distributors, New Delhi
3. Verma P S (2021). A Manual Of Practical Zoology Chordates, Ed. 11 th , S Chand Publisher, New Delhi
4. Balakrishna Shetty, Sweekritha H Poonja (2018). Histology Practical Manual, Jaypee Brothers Medical Publishers Pvt. Limited, New Delhi
5. APHA (2017). Standard methods for the examination of water and wastewater. American Public Health association, American water Works association and Water environment Federation. Ed. 23 rd , 1 Street, NW, Washington DC
6. Baker H and Frank O (1968). Clinical Vitaminology: Methods and Interpretation

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Session: 2024-25			
Part A – Introduction			
Name of the Programme	**M.Sc. Zoology**		
Semester	**2**		
Name of the Course	**Practical based on Papers M24-ZOO-203 & M24-ZOO-204**		
Course Code	**M24-ZOO-206**		
Course Type	**PC-4**		
Level of the course	**400-499**		
Pre-requisite for the course (if any)	**Zoology as a Subject at UG Level**		
Course Learning Outcomes (CLO)	CLO1: Students will able to understand the processes involved in the recognition of key groups of vertebrates CLO2: Students will be able to identify and classify the available specimens of vertebrate classes. CLO3: Students will have ability to prepare permanent mounts of different types of scales and hair to study the details of their structure and their role in the identification of specimens. CLO4: Will be able to elaborate the different systems of vertebrates such as fish, frog rat and pigeon.		
Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	0	4 hours	

Part B- Contents of the Course

Practicals	Contact Hours
Course Contents: 1. Demonstration of cranial nerves and aortic arches of Scoliodon, Degestive system, Nervous system, Arterial and venous system of frog, Lizard, Pigeon and rabbit. 2. Museum specimens and slides : (i) Protochordates (ii) Fishes (iii) Amphibians (iv) Reptiles (v) Birds (vi) Mammals 3. Comparative Osteology (i) Skull and lower jaw (ii) Vertebrae (iii) Girdles (iv) Limb bones 4. Temporary/Permanent mounts of Hair & Scales 5. Different types of Feathers, Scales & Hair 6. Construction of Phylogenetic tree	120

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Suggested Evaluation Methods			
Internal Assessment: 30		**End Term Examination: 70**	
➢ **Practicum**	**30**	➢ **Practicum**	**70**
• Class Participation:	5	Lab record, Viva-Voce, write-up and execution of the practical	
• Seminar/Demonstration/Viva-voce/Lab records etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. P S Verma (2021). A Manual Of Practical Zoology Chordates, Ed. 11 th , S Chand Publisher, New Delhi
2. S.S. Lal (2009). Practical Zoology: Vertebrate. Edition, 12. Publisher, Rastogi Publications, Delhi
3. Podder T, Mukhopadhyay S, Das S K (2003). An Advanced Laboratory Manual of Zoology Published by Rajiv Beri for Macmillan India Limited, Rajkamal Electric Press, Delhi

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Session: 2024-25			
Part A – Introduction			
Name of the Programme	**M.Sc. Zoology**		
Semester	**2**		
Name of the Course	**Constitutional, Human and Moral values, and IPR**		
Course Code	**M24-CHM-201**		
Course Type	**CHM**		
Level of the course (As per Annexure-I	**400-499**		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO 1: CLO 2: CLO 3: CLO 4:		
Credits	Theory	Practical	Total
	2	0	2
Teaching Hours per week	2	0	2
Internal Assessment Marks	15	0	15
End Term Exam Marks	35	0	35
Max. Marks	50	0	50
Examination Time	3 hours		

Part B- Contents of the Course (Will be available from common pool)

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	Syllabus will be provided by central pool	
II		
III		
IV		
	Total Contact Hours	30

Suggested Evaluation Methods

Internal Assessment: 15		**End Term Examination: 35**	
➢ **Theory**	**15**	➢ **Theory**	**35**
• Class Participation:	4	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	4		
• Mid-Term Exam:	7		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

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