



**Dnyanopasak Shikshan Mandal's**  
**College of Arts, Commerce and Science, Parbhani**

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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher: Mr. D.H. Pawar**

**Department: Zoology.**

**Program: M.Sc. F.Y.**  
**101**

**Subject: Zoology.**

**Course Code: ZOT-**

**Paper Title: Invertebrates: Structure and Function**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>1</b>	<b>I</b>	1. Organization of coelom : Acoelomates 2. Organization of coelom: Pseudocoelomates. 3. Organization of coelom : Protostomia and Dueterostomia 4. Locomotion : Flagellar and Ciliary movement in Protozoa 5. Locomotion : Hydrostatic movement in Coelenterata, Annelida, and Echinodermata	Define coelom, Explain Types of Coelom  Distinguish between protostomes and deuterostomes  Explain locomotion in invertebrates
<b>2</b>	<b>II</b>	1. Nutrition in Protozoa 2. Patterns of feeding and digestion in lower Metazoan 3. Filter feeding in Polychaeta, Mollusca and Echinodermata 4. Respiration: Organs of respiration: Gills, lungs and trachea 5. Respiratory pigments 6. Mechanism of respiration	Define nutrition, explain nutrition  Explain respiratory organs in various group of invertebrates
<b>3</b>	<b>III</b>	1. Organs of excretion: Coelom, Coelomoducts, Nephridia and Malphigian tubules 2. Mechanism of excretion	Define, explain ,mechanism of excretion in different species of

		3. Excretion and Osmoregulation 4. Primitive nervous system: Coelenterata and Echinodermata 5. Advanced nervous system: Annelida, Arthropoda, (Crustacea and Insecta) and Mollusca (Cephalopoda)	invertebrates
4	IV	1. Larval forms of invertebrates (Helminthes, Annelida, Arthropoda and Echinodermata) 2. Strategies and evolutionary significance of larval forms 3. Concept and significance of minor phyla 4. Organization and general characters of minor phyla 5. Hemichordata: Characters, Classification, Affinities and Economic importance.	Classify animals from different groups based on their features.

**Specify Course Outcome:** Classify animals from different groups based on their features.

**Specify Program Outcome:** Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endrinological & microscopic technique.

**Signature of Teacher**



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**Name of Teacher: Mr. D.H. Pawar**

**Department: Zoology**

**Program: M.Sc. F. Y.**  
101

**Subject: Zoology**

**Course Code:LCW-**

**Paper Title: LABORATORY COURSE WORK BASED ON THEORY PAPER-I**  
**Invertebrates: Structure and Function**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>1</b>	<b>I</b>	<ol style="list-style-type: none"><li>1. Demonstration of Digestive, Reproductive and Nervous system of crab, Earthworms, Cockroach.</li><li>2. Mounting of Nephridium &amp; Spermatheca of Earthworm: Trachea of Cockroach, Gills of Crab.</li><li>3. Mounting of larvae of insects and crustacea (Any five).</li><li>4. Museum specimens from invertebrate phyla: Salient characteristics, identification and classification of representative types of Invertebrate groups from Protozoa, Porifera, Coelenterata, Ctenophora, Platyhelminthes, Aschelminthes, Mollusca, Annelida, Arthropoda, Echinodermata and Hemichordata (Five specimens from each phylum).</li><li>5. Identification and study the larval forms all major phyla of Invertebrates.</li><li>6. Study of the following specimens to bring out their affinities; a. <i>Balanoglossus</i> b.</li></ol>	Identify, Classify, Demonstrate and mounting of different species of invertebrates

		<i>Cephalodiscus.</i> 7. Five permanent stained micro preparations prepared by the examinee are to be submitted at the time of practical examinations.	
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**Specify Course Outcome:** Identify, Classify, Demonstrate and mounting of different species of invertebrates

- **Specify Program Outcome:** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

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**Name of Teacher: Pathan N. I.**

**Department: Zoology**

**Program: M. Sc Ist year**

**Subject: Zoology**

**Course Code: Zoo-102**

**Paper Title: Paper II: Biosystematics, Taxonomy and Evolution**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	1. Definition and basic concepts of Biosystematics and Taxonomy. 1.1 Brief historical resume of systematic. 1.2 Importance and applications of Biosystematics in Biology. 2. Trends in Biosystematics: Chemotaxonomy, Cytotaxonomy, Molecular Taxonomy and Immunotaxonomy. 3. Dimensions of speciation. 3.1 Mechanism of speciation. 4. Species concepts: Species category, different species concepts, sub-species and other infra-specific categories. 5. Theories of Biological classification; Hierarchy of categorie	Classify animals from different groups based on their features. Describe different taxa and elaborate on their anatomical and morphological features.
<b>II</b>	1. Taxonomic characters: Different kinds, origin of reproductive isolation, biological mechanism of genetic incompatibility. 2. Taxonomic procedures: Taxonomic collections, preservation, curating, process of identification. 3. Taxonomic publications.	Identify and describe homologies between different groups of animals  Identify and access taxonomic information in different online

	4. Taxonomic keys: Different kinds of keys, their merits and demerits.	databases
<b>III</b>	1. International Code of Zoological Nomenclature (ICZN): operative principles, interpretation and application of important rules, formation of scientific names of various taxa. 2. Biodiversity- characterization, generation, maintenance and loss; magnitude and distribution of biodiversity, economic value, wildlife biology, conservation strategies.	Identify and access taxonomic information in different online databases
<b>IV</b>	2. Population genetics: Bottleneck Effect (Founder Effect), Hardy-Weinberg law of genetic equilibrium. Destabilizing forces, natural selection, mutation, genetic drift, migration. 3. Pattern of changes in nucleotide sequences. 4. Molecular Evolution, Gene evolution, Evolution of gene families.	Describe evolutionary relationship between different taxa. Explain about evolutionary distance between different taxa

**Specify Course Outcome:** Classify animals from different groups based on their features and Describe evolutionary relationship between different taxa.

**Specify Program Outcome:** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

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*Pro-forma for program and course outcomes (2.6.1)*

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**Name of Teacher: Pathan N.I**

**Department: Zoology**

**Program: M.Sc.F.Y**

**Subject: Zoology Course Code: LCW\_Zoo102**

**Paper Title: II: Biosystematics, Taxonomy and Evolution**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	<ol style="list-style-type: none"><li>1. Composition assessment of taxonomic diversity/Bio-diversity in habitat, e.g. Grassland, Wetland, forest etc.</li><li>2. Equipments and Specimen Collection Methods.</li><li>3. Collection of Insects, Spreading, Pinning and Studying of Insects.</li><li>4. Methods of collection, preservation and identification of plankton and representative forms of terrestrial and aquatic fauna.</li><li>5. Study of Local Fauna- Collection &amp; Preservation of Animals.</li><li>6. Systematic studies of Animals from Protozoa to Mammals (At least five Animals from each group.).</li><li>7. Museum preservation techniques of selected vertebrates and invertebrates.</li><li>8. Submission of Insects/Animals Collected (Compulsory.)</li></ol>	To perform identify, classify taxonomic diversity of different species of animals.

	9. Studies on fossils, connecting links like <i>Peripatus</i> , <i>Archaeopteryx</i> , <i>Limulus</i> . 10. Study of Homologous Organs and Analogous Organs. 11. Excursion/Study Tour Compulsory- Visit to ZSI and other places.	
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**Specify Course Outcome:** - To perform identify, classify taxonomic diversity of different species of animals.

**Specify Program Outcome:** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

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*Pro-forma for program and course outcomes (2.6.1)*

**Name of Teacher: Shewale .P.A**

**Department: Zoology**

**Program :M.Sc. F.Y**

**Subject: Zoology**

**Course Code: -Zoo-TH-303**

**Paper Title: Economic Zoology and Animal Behaviour**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>Unit- I</b>	1. Protozoan Parasites Pathogenic to man 1.1 Entamoeba histolytica, Trypanosoma, Binomics, prevention & control. 2. Zooparasitic Helminths – Structure, Life cycle, Pathogenicity and control. 2.1. Trematoda – Schistosoma haematobium. 2.2. Cestoda – Taenia solium and Taenia saginata. 2.3. Nematodes – Wuchereria bancrofti. 3. Mosquitoes as vector of Human diseases with special reference to - Malaria, Dengue, Filariasis, Chickengunya and control of Mosquitoes. 4. Introduction to Arthropods of Forensic importance.	<ul style="list-style-type: none"><li>• Economic Zoology and Animal Behavior.</li><li>• Evaluate and describe the economic impact of animals on human society.</li></ul>
<b>Unit- II</b>	1. Apiculture – Social Organization of Honey Bees, Life Cycle, Bee keeping and Economic Importance. 2. Sericulture - Types of Silk moth, Life cycle and rearing of Silk moth. 3. Fresh Water Fish Culture – 3.1 Indian major Carps. 3.2 Management of fish farm. 3.3 Breeding Pond, Hatching Pit, Nursery and Stocking Pond. 4. Pearl	<ul style="list-style-type: none"><li>• Describe different culture methods relevant to aquaculture.</li><li>• Identify and describe economically important fish and other animals.</li><li>• To learn the environmental</li></ul>

	<p>Culture 4.1 Pearl producing molluscs.  4.2 Pearl formation and pearl industries.  5. Vermiculture and Vermicomposting.  6. Poultry: Breeds, biology of fowl, methods of rearing and maintenance, diseases of poultry and their control measures.</p>	<p>requirement, culture, &amp; Application of vermiculture.</p>
<b>Unit-III</b>	<p>1. Introduction. 1.1 Concept of Ethology, its Branches and Scope. 1.2 Classification of behavioral patterns. a) Innate Behavior. b) Acquired Behavior. 1.3 Motivated Behaviour Goal Directed Behaviour Different Types of Biological Drives a) The Thirst Drive b) The Hunger Drive c) The Sleep Drive d) Heat and Cold Drive e) The Sexual Drive</p>	<ul style="list-style-type: none"> <li>Identify and explain different types of behavior patterns in animals.</li> </ul>
<b>Unit-IV</b>	<p>1. Perception of environment and Animal communication. 1.1 Chemical. 1.2 Olfactory. 1.3 Auditory. 1.4 Visual. 2. Ecological aspects of Behavior 2.1 Habitat selection – Optimal foraging theory, Anti predator defenses. 2.2 Role of Hormones in Behaviour a) Sexual Behaviour b) Aggressive Behaviour 2.3 Pheromones- Categories; Role of pheromones in animals. 2.4 Social Organization in Insects and Primates. 3. Reproductive Behavior – 3.1 Evolution of Sex and Reproductive Strategies. 3.2 Mating Systems. 3.3 Courtship. 3.4 Parental care in Animals – Fish and Amphibians.</p>	<ul style="list-style-type: none"> <li>Describe the importance of different behaviors in animal husbandry.</li> <li>Ethology refers to the natural capability of an animal to perform specific behaviours.</li> </ul>

**Specify Course Outcome:** Identify and describe economically important fish and other animals.

**Specify Program Outcome:** : Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

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**Name of Teacher: Shewale P.A**

**Department: zoology**

**Program: MSc .F.Y**

**Subject: Zoology**

**Course Code: LCW\_ 103-**

**Paper Tital :Economic Zoology and Animal Behavior III**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
	Economic Zoology	1. Study of Protozoan Parasites of Man – i) <i>Entamoeba histolytica</i> , ii) <i>Trypanosoma</i> iii) <i>Plasmodium</i> . 2. Study of Parasitic helminthes – i) <i>Schistosoma haematobium</i> . ii) <i>Taenia</i> <i>solium</i> . iii) <i>Taenia saginata</i> . iv) <i>Wuchereria</i> <i>bancrofti</i> . 3. Study of – i) Social organization of bees; ii) Life cycle of Honey bee; iii) Hive iv) Mosquitoes- Life cycle. 4. Identification of Food Fishes and Molluscsi) <i>Labeo rohita</i> ; ii) <i>Catla catla</i> ; iii) <i>Cirrhina</i> <i>mrigala</i> ; iv) <i>Channa</i> ; v) <i>Perna indica</i> ; vi) <i>Crassostrea</i> . 5. Visit to Fish breeding Farm.	To learn about Pathogenic diseases in humans.

		<p>6. Study of life cycle of Silk moth. 7. Study of Vermiculture</p>	<p>To study history scope &amp; economic importance of earthworms .</p> <p>To perform the harvesting of vermicompost for culture media.</p>
	<p>Animal Behavior</p>	<p>8. Study of Positive and negative phototrophism. 9. To study the habituation to light stimulus in the earthworm <i>Pheritima</i>. 10. To study the distribution of light stimuli in the earthworm <i>Pheritima</i> 11. To demonstrate photo tactic and geotactic responses of the animal provided (House fly <i>Musca domestica</i>) 12. Study of Positive and Negative Chemotactic Response with suitable examples. 13. Righting response in crab or any other animal. 14. Communication – Examples from invertebrates and vertebrates (Terrestrial, Aerial, Aquatic habitats) 15. Ecological aspects – Food selection, optimal foraging, prey and predator, Host-Parasite relationship. 16. Social behaviour – Aggregations – Examples from fishes, birds and mammals, social organization – insects 17. Reproductive behaviour – mating systems, sexual selection, parental care in animals.</p>	<p>Various species of birds learn &amp; practice song,</p>

**Specify Course Outcome:** To Study the economically important animals and animal husbandry.

**Specify Program Outcome:** Identify and classify animals based on morphological, and anatomical features of animal species, fish culturing, management and practice cytological, genetical, endrinological & microscopic technique.

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**Name of Teacher:** A. S. Hasekar

**Department:** Zoology

**Program:** MSc F.Y      **Subject:** Zoology

**Course Code:** ZOO-104

**Paper Title:** Paper IV (Elective): Conservation Biology

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>Unit I</b>	1. Concept of Biodiversity 2. Components of Biodiversity (Ecological, Genetic and Species diversity) 3. Value of Biodiversity 4. Biodiversity at global and national level- a comparative account. 5. Measures of species diversity: Species richness indices- Menhinick's index, Margalef's index, Species abundance indices- Simpson's index, Shannon index.	Interpreting the concept of biodiversity and recalling the Indian hotspot region.

	6. Biodiversity Hotspots in India- Himalayas, Indo-Burma, Sundalands and Western Ghats.	
<b>Unit II</b>	<p>1. Threats to Biodiversity: Ecological-competition, predation, climate; and anthropogenic habitat Destruction, Human population growth, pollution, land use patterns.</p> <p>2. Representative wild species of India.</p> <p>3. Endemic Species of India- Marine species, Vertebrate and Invertebrate species.</p> <p>4. Exotic and Invasive species, their effect on native species.</p> <p>5. Endangered species of India; IUCN Red List Categories, Red Data Book and Threatened Animals of India.</p> <p>6. Conservation of Biodiversity- In-situ conservation; Ex-situ conservation, Techniques used in In-situ &amp; Ex-situ conservation.</p>	Analysing the factor are responsible for biodiversity depletion and different type of species.
<b>Unit III</b>	<p>1. Basic concept of wildlife</p> <p>2. Biological Importance and Necessity for wild life conservation</p> <p>3. Economic and other benefits of wild life</p> <p>4. Causes for wildlife depletion</p> <p>5. Aims and objective of wildlife conservation</p> <p>6. Different approaches of wild life conservation</p> <p>7. Modes and methods of wildlife conservation</p> <p>8. National and International Organizations involved in wildlife conservation</p> <p>9. Sanctuaries, National parks &amp; Biosphere reserves in India.</p>	Interpreting and evaluating the concept of wildlife and applying its conservation methods.
<b>Unit IV</b>	<p>1. Conservation tools- Geographical Information System (GIS); Remote Sensing; Geographic Positioning System (GPS) in brief.</p> <p>2. Wildlife Health: Diseases of wild animals and their management- A brief account</p> <p>3. Legislative and Administrative measures for conservation of wildlife: Wildlife (Protection) Act of India (1972); International Union for Conservation of Nature (IUCN); World wildlife Fund (WWF)</p> <p>4. Present status of wildlife in India.</p> <p>5. Challenges in wildlife conservation and management in India-</p> <p>6. Role of Educational institutes, NGO's and Government organizations in wildlife conservation.</p>	Applying methods and tools used for wildlife conservation in India.

**Specify Course Outcome:** Defining, comparing and analysing the concept of biodiversity and basic concept of wildlife.

**Specify Program Outcome:** : Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

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**Name of Teacher: Hasekar A. S.**

**Department: Zoology**

**Program: MSc FY**

**Subject: Zoology**

**Course Code: Laboratory Course Work-II**

**Paper Title: Laboratory Course Work-II: IV (Elective): Conservation Biology**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	<ol style="list-style-type: none"><li>1. Collection and preservation of fauna.</li><li>2. Sampling Techniques (Transect and quadrat method).</li><li>3. Identification and use of keys – reference specimen.</li><li>4. Wildlife photography and documentation of locally occurring wild species of animals.</li><li>5. Remote sensing GIS and their modules for conservation.</li><li>6. IUCN Red List Exercise, VORTEX and SIS.</li><li>7. Statistical analysis – Shannon Weiner Index, Simpson's index, Species richness and evenness.</li><li>8. Museum study of Vertebrate Endangered Species or Threatened Wild Animals on the Basis of Charts/ models/ photographs (Any Five).</li><li>9. Survey/Study of local/nearby natural habitat and reporting of its biodiversity and health status.</li><li>10. Submission of local biodiversity album (soft copy in ppt or pdf format).</li><li>11. Field Visit to wild life sanctuaries and National parks( Tour report submission)</li></ol>	Perform and demonstrate the tools and techniques which are used for conservation of Biodiversity.

**Specify Course Outcome:** To explain the use various methods, tools and techniques for conservation of Biodiversity.

**Specify Program Outcome:** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

**Signature of Teacher**





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**Name of Teacher: Mr. D.H. Pawar**

**Department: Zoology.**

**Program: M.Sc. F.Y.**

**Subject: Zoology.**

**Course Code: ZOOTH-201**

**Paper Title: Animal Ecology, Toxicology and Environmental Pollution(P-VI)**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>1</b>	<b>I</b>	<b>UNIT -I</b> 1. Ecology- Basic Concept. 2. Nature of Ecosystem- 2.1 Abiotic and Biotic Factors. 2.2 Energy Flow in Ecosystem. 3. The Abiotic Environment 3.1 Temperature, Water and Soil as an Ecological Factors. 4. Minimums, Tolerances and the Medium. 4.1 Liebig's Law of Minimum. 4.2 Law of Limiting Factors. 4.3 Shelford's Law of Tolerance. 5. Ecological Adaptations 5.1 Volant Adaptations 5.2 Aquatic Adaptations 5.3 Desert Adaptations	Explain Interactions of organisms with their environments and consequences of these interactions on ecosystem dynamics.  Inspect structural adaptations; conservation and management of natural resources
<b>2</b>	<b>II</b>	<b>UNIT -II</b> 1. Biogeochemical Cycles and Ecosystem 1.1 Carbon Cycle 1.2 Nitrogen Cycle 1.3 Sulphur Cycle 1.4 Phosphorous Cycle	Illustrate inter-relationship between individuals in population and communities

		<p>1.5 Water Cycle</p> <p>2. Population Ecology</p> <p>2.1 Characteristics of Population</p> <p>2.2 Population Growth</p> <p>2.3 Population Fluctuations and Equilibrium</p> <p>2.4 Population Regulation</p>	
3	III	<p><b>UNIT -III</b></p> <p>1. Introduction to Toxicology and Pollution</p> <p>2. Environmental Toxicology</p> <p>2.1 Common Toxic Manifestations</p> <p>2.2 Toxic Metal Pollutants</p> <p>2.3 Toxic Gaseous Pollutants</p> <p>2.4 Toxic Inorganic and Organic Compounds</p> <p>2.5 Environmental Carcinogens</p> <p>3. Air Pollution</p> <p>3.1 Introduction</p> <p>3.2 Composition of the Atmosphere</p> <p>3.3 Sources of Air Pollution</p> <p>3.4 Effects of Air Pollution</p> <p>3.5 Air Pollution Monitoring and Control.</p> <p>4. Global Warming- Consequences and Effects.</p> <p>5. Soil pollution sources, effect and control</p>	Define , explain and importance of toxicology
4	IV	<p>1. Water Pollution</p> <p>1.1 Sources &amp; effects of Water Pollution</p> <p>1.2 Physical and Chemical Examinations of Water</p> <p>1.3 Water Pollution and Diseases</p> <p>1.4 Waste Water Treatment Processes</p> <p>a) Chemical Treatment and Biological Treatments</p> <p>2. Noise Pollution – Sources, Effects and Control of Noise Pollution</p> <p>3. Pollution by Solid Wastes.</p> <p>3.1 Sources and Effects</p> <p>4. Introduction to Indian legislations for pollution control</p>	Explain of the current environmental issues with ecological concepts involved.

**Specify Course Outcome:** Explain, illustrate and inspect ecological systems, pollution, resource management and their relationship and impact on life forms.

**Specify Program Outcome:** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

**Signature of Teacher**



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**Name of Teacher: Mr. D.H. Pawar**

**Department: Zoology**

**Program: M.Sc. F. Y.**

**Subject: Zoology**

**Course Code:LCW-201**

**Paper Title: LABORATORY COURSE WORK BASED ON THEORY PAPER:-VI  
Animal Ecology, Toxicology and Environmental Pollution -VI**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>1</b>	<b>I</b>	1. Estimation of pH, Dissolved oxygen, Carbon di-oxide, Salinity and Carbonates and	To Estimate different water sample and soil

	<p>Bicarbonates in water samples.</p> <p>2. Study of Population Growth by model assumption and problems.</p> <p>3. Estimation of Carbonate or Nitrate from the soil sample.</p> <p>4. Estimation of Sulphate or Phosphate in the water sample.</p> <p>5. Animal Association - parasitism, mutualism and commensalisms.</p> <p>6. Ecological Adaptations (Any two examples from each to be studied)</p> <p>a) Volant Adaptations; b) Aquatic Animals (from fresh water and marine environment); c) Desert Animals.</p> <p>7. To study the effect of pollutant on heart beat on given animal (Crab/Fish/ Daphnia).</p> <p>8. Estimation of Chlorides/Salinity/Hardness from given water sample.</p> <p>9. Determination of LC<sub>50</sub> in relation to any toxicant in given aquatic animal.</p> <p>10. Study of rate of oxygen consumption by aquatic animals under environmental stresses.</p> <p>11. Visit to treatment Plants- a) Drinking water treatment plant. b) Effluent Treatment. c) Sewage treatment</p>	<p>sample</p> <p>Study of pollution</p> <p>Determine toxicant</p> <p>Examine water quality</p>
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**Specify Course Outcome:** to estimate ,determine , examine water and soil sample and its quality

**Specify Program Outcome:** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

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**Name of Teacher: Pathan N.I**

**Department: Zoology**

**Program: M.Sc. FY**

**Subject: Zoology**

**Course Code: Zoo202**

**Paper Title: VII: Gamete Biology and Animal Development**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	1) Spermatogenesis 1.1. Ultra structure of mammalian sperm. 1.2. Different phases of spermatogenesis. 1.3. Factors Controlling Spermatogenesis. 2) Oogenesis: 2.1. Morphology of generalized mature ovum. 2.2. Different phases of Oogenesis 3) Fertilization 3.1 Pre fertilization events 3.2 Post fertilization events 3.3 Biochemistry of fertilization 4) Biochemistry of semen: 4.1. Semen composition and formation in human. 4.2. Assessment of sperm function. 4.3 Semen related disabilities.	Explain and simplify the process of gamete formation and fertilization .
<b>II</b>	1) Ovarian follicular growth & differentiation	Define ovarian follicular growth and make use of different

	<p>1.1 Morphology 1.2 Endocrinology 1.3 Molecular biology 1.4 Ovulation and ovum transport in mammals . 2) Multiple ovulation and Embryo transfer technology (MOET) 3.1 Invitro Oocyte maturation 3.2 Super ovulation 3.3 Invitro fertilization (IVF) 3.4 Care and breeding of experimental animals including bioethics. 4) Assisted reproductive technologies 4.1 Embryo sexing and cloning 4.2 Screening for genetic disorders 4.3 ICSI, ZIFT, GIFT etc. 4.4 Cloning of animals by nuclear transfer 5) Embryonic stem cells, renewal by stem cells, stem cell disorders: Brief Account.</p>	techniques in fertilization
<b>III</b>	<p>1) Chick embryology 1.1 Structure of egg of hen. 1.2 Fertilization 1.3 Cleavage 1.4 Blastulation 1.5 Gastrulation 1.6 Foetal Membranes in chick</p>	Recalling the stages in chick embryology or developmental stages
<b>IV</b>	<p>1. Metamorphosis 1.1 Metamorphosis in amphibians &amp; its hormonal control. 1.2 Metamorphosis in insects &amp; its hormonal control. 2. Regeneration : 2.1 Regeneration in invertebrate &amp; vertebrate animals.</p>	Compare metamorphosis in amphibians and insect and regeneration process in different animals

**Specify Course Outcome:** Define, identify process of gamete formation in animals and there developmental stages .

**Specify Program Outcome:** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

**Signature of Teacher**



**Dnyanopasak Shikshan Mandal's**  
**College of Arts, Commerce and Science, Parbhani**

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*Pro-forma for program and course outcomes (2.6.1)*

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**Name of Teacher: Pathan N.I**

**Department: Zoology**

**Program: M.Sc. F.Y**

**Subject: Zoology**

**Course Code: Zoo202 Lab Course**

**Paper Title: VII: Gamete Biology and Animal Developments**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	<ol style="list-style-type: none"><li>1. Histological study of different stages of Gametogenesis.</li><li>2. Physical and chemical examination of semen</li><li>3. Microscopic examination of semen</li><li>4. Histological study of gonads of Frog/ Rat.</li><li>5. Demonstration of Reproductive system of Leech and Rat.</li><li>6. Study of types of eggs .</li><li>7. Estimation of calcium in egg shell by EDTA method</li><li>8. Mounting of Chick embryos of different hours (whole mount).</li><li>9. Study of permanent whole mount slides of Chick embryos of different</li></ol>	To performing identification and various developmental stages in animal

	hours. 10. Study of L.S/ T.S. of chick embryo through head and heart regions. 11. Study of Development of Frog/Embryology of Frog. 12. Studies on metamorphosis of Insect. 13. Experiments in regeneration in Hydra or Planaria.	
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**Specify Course Outcome:** Performing identifying , and study of various developmental stages in animal

**Specify Program Outcome: :** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

**Signature of Teacher**





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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher: Shewale P.A.**

**Department: Zoology**

**Program: MSc .F.Y**

**Subject: Zoology**

**Course Code:Paper-203**

**Title Paper: Biochemistry and Immunology VIII**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>Unit-I</b>	Biomolecules	1.1. Classification, Structure and Properties of Carbohydrates. 1.2. Classification, Structure and Properties of Lipids. 1.3. Classification, Structure and Properties of Proteins. 2. Metabolism- Carbohydrate Metabolism 2.1 Steps of Glycolysis (EMP Pathway). 2.2 Energy and Electron balance sheet. 2.3 Regulation of Glycolysis. 2.4 Glycogenesis, Glycogenolysis and Glyconeogenesis. 3. Citric Acid Cycle- 3.1 Pyruvate oxidation. 3.2 Various steps in citric acid cycle. 3.3 Enzymes of citric acid cycle. 3.4 Energetics of citric acid cycle. 4. Pentose Phosphate Pathway (HMP shunt).	Describe The Classification & Structural Organization of Biomolecules.
<b>Unit -II</b>	Lipid	1.1 The Oxidation pathway. 1.2 Energy yield from fatty acid	Study of biochemical

	Metabolism	<p>oxidation.</p> <p>1.3 Oxidation of unsaturated fatty acids.</p> <p>1.4 Control of fatty acid oxidation.</p> <p>1.5 Ketosis, Ketolysis and Ketogenesis.</p> <p>2. Fatty Acid Biosynthesis-</p> <p>2.1 Biosynthesis of Palmitate from acetyl Co A.</p> <p>2.2 Control of fatty acid synthesis.</p> <p>3. Nitrogen Metabolism-</p> <p>3.1 Amino acid degradation</p> <p>3.2 Transamination, deamination and decarboxylation reactions of amino acids.</p> <p>3.3 Disposal of Ammonia Krebs-Henseleit Urea Cycle</p>	pathway.
<b>Unit -III</b>	Immunology	<p>1. Innate (Non-specific) Immunity.</p> <p>2. Adaptive or Acquired (Specific) Immunity-</p> <p>2.1 Passive &amp; Active Acquired Immunity.</p> <p>3. Cells &amp; Organs of Immune System-</p> <p>3.1 T- cell &amp; T- cell receptor.</p> <p>3.2 T- cell maturation, activation &amp; differentiation.</p> <p>3.3 B-Cell, B-cell generation, activation and differentiation.</p> <p>4. Immunoglobulin:</p> <p>4.1 Introduction</p> <p>4.2 Structure of Antibody</p> <p>4.3 Classification, Structure and Functions of Immunoglobulin.</p> <p>5. Nature of antigen &amp; super antigens-</p> <p>5.1 Epitopes &amp; haptens.</p> <p>5.2 Antigenicity &amp; immunogenicity.</p> <p>5.3 Factors influencing immunogenicity.</p> <p>5.4 Antigen- antibody interaction &amp; their applications</p>	Study of immune system of man.
<b>Unit -IV</b>	Hypersensitivity & Cytokines	<p>2.1 Properties of cytokines.</p> <p>2.2 General structure of cytokines, functions of cytokines.</p> <p>3. Complement System-</p> <p>3.1 Complement components.</p>	Explain immunodeficiency disorder in man.

		3.2 Classical & alternative pathway. 3.3 Significance of complement system. 4. Hybridoma Technology- 4.1 Monoclonal antibodies- production & clinical uses. 4.2 Polyclonal antibodies. 5. Immunodeficiency Disorders- Reticular Dysgenesis, AIDS. Autoimmune Diseases- Haemolytic anaemia, Myasthenia gravis and Lupus erythromatosis	
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**Specify Course Outcome:** To understand the significance of Biochemistry and immunology.

**Specify Program Outcome:** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

**Signature of Teacher**



**Dnyanopasak Shikshan Mandal's**  
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*Pro-forma for program and course outcomes (2.6.1)*

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**Name of Teacher: Hasekar A. S.**

**Department: Zoology**

**Program: M.Sc F Y      Subject: Zoology**

**Course Code: ZOO-204**

**Paper Title: Paper IX: (Elective) Tools and Techniques for Biology**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	1. Distillation units 2. Incubators and Ovens 3. Digital Balances 4. Heating equipment- Water bath, Heating mantle, Hot plate. 5. Handling and cleaning of Laboratory glassware.	Identify and describe the different equipment and tools used in a biology laboratory
<b>II</b>	1. Importance of Tools and Techniques for Biology. 2. Principles, Working Mechanisms and Uses of Analytical Instruments – Balances, pH Meter, Colorimeter, Spectrophotometer, Ultracentrifuge, Spectrofluorometer, Radioactive Counters	Outline for importance and principle of various tools and techniques used in a biology laboratory.
<b>III</b>	1. Microscopy: Principles and Application of Light, Phase Contrast, Fluorescence, Scanning and Transmission Electron Microscopy. Operation and maintenance of simple and compound microscopes. 2. Microtomy: Types and applications; Collection & Preservation of animal tissue – Fixation, Embedding, Section Cutting, Staining and Mounting. 3. Staining Techniques for different histochemical studies. 4. Cryotechniques: History and applications of Cryotechniques	To Demonstrate various techniques used for biology laboratory.
<b>IV</b>	1. Importance of Separation Techniques in Biology 2. Separation by Chromatography- Paper, Thin Layer, Column, Affinity chromatography and HPLC. 3. Electrophoresis- Agarose Gel Electrophoresis, PAGE, Iso-electric focusing.	To perform separation techniques of various biomolecules .

	4. Centrifugation- Ultra centrifugation, Density Gradient Centrifugation 5. Cell Separation- Flow Cytometry	
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**Specify Course Outcome:** Properly operate laboratory equipment and used various techniques for separation of biomolecules.

**Specify Program Outcome: :** Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

**Signature of Teacher**



**Dnyanopasak Shikshan Mandal's**

**College of Arts, Commerce and Science, Parbhani**

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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher:** Hasekar A. S.

**Department:** Zoology

**Program:** MSc F.Y.      **Subject:** Zoology      **Course Code:** Laboratory Course Work-IV

**Paper Title:** Lab Course – IX (Elective): Tools and Techniques for Biology

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	1. Cleaning and overhauling a microscope. 2. Operation of any three different types of microscopes. 3. Fixing, embedding and block preparation of given tissue.	Demonstrate various tools and techniques used in biology

	4. Section cutting of given tissue blocks using a microtome. 5. Staining and mounting of given tissue sections. 6. Operation of distillation plant. 7. Operation of oven and incubator. 8. Separation of pigments by paper chromatography. 9. Separation of Amino Acids from tissue extracts by chromatography. 10. Separation of Proteins using Gel Electrophoresis. 11. Principles, Uses and Working Mechanism of High Performance Liquid Chromatography (HPLC). 12. Centrifugation of given sample using a laboratory centrifuge. 13. Colorimetric estimation of Protein / Glucose from given tissue sample	laboratory for separation of various biomolecules.
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**Specify Course Outcome:** Demonstrate various tools and techniques used in biology laboratory for separation of biomolecules.

**Specify Program Outcome:** : Explain, taxonomically classification and economical uses of animals and biodiversity of animals and their conservation methods and animal ecology and developmental biology and study of biomolecules and cell signalling in animals and various instrument use in biological laboratory.

**Signature of Teacher**



**Dnyanopasak Shikshan Mandal's**

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*Pro-forma for program and course outcomes (2.6.1)*

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**Name of Teacher: Mr. D.H. Pawar**

**Department: Zoology.**

**Program: M.Sc. S.Y.  
301**

**Subject: Zoology.**

**Course Code: ZOOL-**

**Paper Title: Vertebrates: Structure and Function( ZOOL- 301)**

Unit Number	Unit Name	Topics	Unit-wise Outcome
1	I	<b>1 Origin and concept of Protochordates</b> 1.1 Affinities of Protochordates <b>2 Origin and classification of vertebrates up to order level.</b> 2.1 Origin of vertebrates. 2.2 Classification of vertebrates	Learn anatomical relationship between different vertebrate classes.
2	II	<b>3 Vertebrate integument and its derivatives</b> 3.1 Development, General structure and function of skin and its derivatives 3.2 Glands, Scales, horns, claws, Nails, Hoofs, feathers and hairs <b>4 General plan of circulation in various Groups</b> 4.1 Blood-composition and function 4.2 Evolution of heart 4.3 Evolution of aortic arches 4.4 Blood circulation in various vertebrate groups: Single circulation and Double	Identify and classify anatomical structures of vertebrate organs.
3	III	<b>5 Respiratory system</b> 5.1 Characters of respiratory tissue 5.2 Internal and External respiration 5.3 Comparative account of respiratory organs. <b>6 Skeletal system</b> 6.1 Comparative account of jaw suspensorium, vertebral column 6.2 Comparative account of Limbs and girdles.	Study and Compare of respiratory organs in vertebrates
4	IV	<b>7 Urinogenital system</b> 7.1 Evolution of urinogenital system in vertebrates. <b>8 Nervous system</b> 8.1 Comparative anatomy of the Brain and spinal cord, Central nervous system. 8.2 Peripheral and autonomic nervous	Comparative study of different system in various group of vertebrates

		system. <b>9 Sense Organs</b> 9.1 Mechanoreceptors 9.2 Photoreceptors 9.3 Phonoreceptors	
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**Specify Course Outcome:** Identify and classify , coparative anatomy ,physiology study of vertebrates

**Specify Program Outcome: :** Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endrinological & microscopic technique.

**Signature of Teacher**





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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher: Mr. D.H. Pawar**

**Department: Zoology**

**Program: M.Sc. S. Y.**  
301

**Subject: Zoology**

**Course Code: LCW-**

**Paper Title: LABORATORY COURSE WORK BASED ON THEORY PAPER-:**  
**Vertebrates: Structure and Function( ZOOL 301)**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>1</b>	<b>I</b>	<b>1 Dissection of scoliodon</b> i) Afferent and efferent arteries ii) Cranial nerves iii) Membranous labyrinth. iv) Brain of Scoliodon. <b>2 Dissection of Rat</b> i) Arterial system ii) Venous system iii) Neck nerves iv) Urinogenital system <b>3 Museum Study:</b> <b>i) Protochordates:</b> Balanoglossus, salpa, Doliolum, Herdmania, Amphioxus <b>ii) Pisces:</b> Zygaena, pristis, ophiocephalus, Mastacembalus, Catla-catla, Exocoetus, Hippocampus, Syngnathus, Diodon, Notopterus. <b>iii) Amphibia:</b> Ichthyophis, Rhacophorus, Rana, Necturus, Ambystoma. <b>iv) Reptilia</b> Chameleon, phrynosoma, varanus, crocodilus, cobra.	Identify, classify, Dissect in vertebrate species

		<p><b>v) Aves:</b> Bubo, Duck, Vulture, Psittacula, Pigeon.</p> <p><b>vi) Mammalia:</b> Loris, Bat, Pangolin, Funambulus, Shrew.</p> <p><b>4 Osteology/Skeleton:</b></p> <p>i) Skull of fowl, Dog,/Rabbit.</p> <p>ii) Vertebral column: Atlas vertebra, Axis vertebra, Trunk, lumbar, caudal.</p> <p>iii) Pelvic Girdle</p> <p>iv) Pectoral girdle</p>	
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**Specify Course Outcome:** Identify, classify, Dissect in vertebrate species

**Specify Program Outcome: :** Identify and classify animals based on morphological, and anatomical features of animal species, fish culturing, management and practice cytological, genetical, endrinological & microscopic technique.

**Signature of Teacher**



**Dnyanopasak Shikshan Mandal's**  
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*Pro-forma for program and course outcomes (2.6.1)*

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**Name of Teacher: Kadam P.P.**

**Department: Zoology**

**Program: MSc SY**

**Subject: Zoology**

**Course Code: ZOOL-302.**

**Paper Title: MOLECULAR CELL BIOLOGY**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	<b>Introduction to Molecular Biology</b>	1.1 Structure of Pro and Eukaryotic cells, Plasma membrane- structure and composition, Fluid Mosaic Model, Functions of cell membrane- Active and Passive Transport, Osmosis. 1.2 Intracellular compartments, protein sorting – secretory and endocytic pathways. 1.3 Cytoskeleton: a) Microtubule – structure and composition, Microtubule-associated proteins (MAPs), Microtubule Organizing Centers (MTOCs), Functions of microtubules, b) Intermediate Filaments – Types and Functions, Microfilaments – Myosin, Actin, Muscle contraction – Sliding Filament Model. 1.4 Nucleus, structure and functions, cell cycle, structure and organization of	To study and interpret structure and function of prokaryotic cell and eukaryotic cell.

		chromatin	
<b>II</b>	<b>Structure of gene and nature of genome</b>	<p>2.1 Fine structure of gene-eukaryotic genome organization (structure of chromatin, coding and non-coding sequences, satellite DNA), DNA damage and repair, DNA amplification and rearrangements.</p> <p>2.2 Regulation of gene expression in eukaryotes, Attenuation and anti-termination</p> <p>2.3 Oparon concept, DNA methylation, Heterochromatization</p> <p>Transposition</p>	Explain information of genome organization, DNA and regulation of gene expression in eukaryotes.
<b>III</b>	<b>Organization of transcriptional units</b>	<p>3.1 Mechanism of transcription of prokaryotes and eukaryotic, RNA processing (capping, polyadenylation, splicing, introns and exons)</p> <p>3.2 Ribonucleoproteins, structure of mRNA, genetics code and protein synthesis</p> <p>3.3 The law of DNA constancy, C-value and C-value paradox.</p> <p>3.4 Molecular basis of spontaneous and induced mutations and their role in evolution.</p> <p>Environmental mutagenesis and toxicity testing, population genetics</p>	To illustrate organization of transcriptional units.
<b>IV</b>	<b>Biochemistry and molecular biology of cancer</b>	<p>4.1 Definition, Types, Characteristics and Mechanism of cancer.</p> <p>4.2 Oncogenes, chemical carcinogenesis, genetic and metabolic disorders</p> <p>4.3 Signal Transduction – Extra cellular messengers, coupled receptors and their second</p>	To study and awareness of cancer and second messengers.

		<p>messengers.</p> <p>4.4 Second messengers and their role in signal transduction</p> <p>a) Cyclic Adenosine Monophosphate (CAMP) 12</p> <p>b) Cyclic Adenosine Diphosphate (CGMP)</p> <p>c) Di-Acyl Glycerol (DAG)</p> <p>d) Calcium (Ca<sup>2+</sup>), Signaling by insulin receptor.</p> <p>4.5 Convergence, Divergence – Crosstalk among different and signaling pathways, Role of (Nitric Oxide) NO and Carbon Monoxide (CO) cellular messengers.</p> <p>4.6 Apoptosis (Programmed cell death). 13</p>	
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**Specify Course Outcome:** Defining, understanding concept of molecular biology.

**Specify Program Outcome:** Identify and classify animals based on morphological and anatomical features of animal species, fish culturing, management and practice cytological, genetical, endocrinological & microscopic technique.

**Signature of Teacher**



**Dnyanopasak Shikshan Mandal's**  
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*Pro-forma for program and course outcomes (2.6.1)*

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**Name of Teacher: Ms. Kadam P. P.**

**Department: zoology**

**Program: MSc SY**

**Subject: zoology**

**Course Code: LCW 302**

**Paper Title: LABORATORY COURSE WORK BASED ON THEORY PAPER-II**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	<ol style="list-style-type: none"><li>1) Extraction of DNA from suitable tissue.</li><li>2) Extraction of RNA from suitable tissue.</li><li>3) Estimation of DNA from sample.</li><li>4) Estimation of RNA from sample.</li><li>5) Preparation of slide for different mitotic stages in onion root tips.</li><li>6) Preparation of meiotic stages and study of meiosis using suitable material.</li><li>7) Detection of Proteins, Carbohydrates and lipids in animal tissues sections using Histochemical staining techniques.</li><li>8) Dissection of salivary glands from chironomous larvae and observation of giant chromosomes.</li><li>9) Study of sex chromatin from mammalian buccal epithelium or hair root cells or lymphocytes.</li><li>10) Study of cancer cell histology (observation of slides of different cancer types).</li><li>11) Separation of DNA fragments by agarose gel electrophoresis.</li><li>12) Separation of cell proteins by electrophoresis.</li><li>13) Study of effect of pH on protein solubility in water.</li><li>14) Study of globular and filamentous proteins by electrophoresis.</li><li>15) Northern blotting , Western blotting. (Demonstration only)</li></ol>	Identification, understanding of various cell stages using suitable material and Experiment with DNA, RNA, proteins etc .

**Specify Course Outcome:** Identify, demonstrate, and evaluate the concept of molecular biology including various techniques and instruments.

**Specify Program Outcome: :** Identify and classify animals based on morphological and anatomical features of animal species, fish culturing, management and practice cytological, genetical, endocrinological & microscopic technique.

**Signature of Teacher:**



**Dnyanopasak Shikshan Mandal's**  
**College of Arts, Commerce and Science, Parbhani**

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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher: Pathan.N.I**

**Department: Zoology**

**Program: MSc S.Y.      Subject: Zoology**

**Course Code: Zoo303B**

**Paper Title: FISH MORPHOLOGY, ANATOMY AND PHYSIOLOGY - I**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	1.1. Scope and Significance of Fishery Science. 1.2. Classification of fishes. 1.3. General characters of: 1.2.1 Elasmobranchii 1.2.2 Teleostomi: Actinopterygii, Crossopterygii. 1.4. Integument and Exoskeleton: 1.4.1 Fish skin and functions 1.4.2 Exoskeleton - Different types of scales	To study of analysing and importance of fishery science, and classify different species of the fishes Explain the integument and derivatives of different species in fishes and categorize fish scale
<b>II</b>	2.1. Endoskeleton of typical cartilaginous and Bony fishes 2.1.1. Skull 2.1.2. Vertebral column 2.1.3. Appendicular skeleton 2.2. Colouration in fishes 2.2.1 Chromatophores 2.2.2 Morphological Colour changes 2.2.3 Physiological Colour changes 2.2.4 Biological Significance	Analyse Endoskeleton ,of typical cartilaginous and bony fishes and explain morphology and physiology of in different species of fishes



	of colouration 2.3. Food, feeding habits and digestion 2.3.1. Feeding habit of Teleosts 2.3.2. Alimentary canal and its modification 2.3.3. Physiology of digestion	
<b>III</b>	3.1. Respiration 3.1.1 Organs of respiration in fishes 3.1.2 Types and structure of gills 3.1.3 Mechanism of gaseous exchange 3.1.4 Accessory respiratory organs 3.2. Circulation <sup>21</sup> 3.2.1 Structure and working of teleostean heart 3.2.2 Afferent and efferent branchial vessels in Teleosts	Comparing respiration and circulation in different species of fishes
<b>IV</b>	4.1. Excretion and Osmoregulation in fish 4.1.1 Structure of kidney 4.1.2 Nitrogenous waste excretion 4.1.3 Osmoregulation: Water and Salt balance in Freshwater and Marine fish.	Explaining excretion and osmoregulation in different species of fishes

**Specify Course Outcome:** Explain and compare fish morphology, anatomy and physiology

**Specify Program Outcome:** : Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endocrinological & microscopic technique.

**Signature of Teacher**



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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher: Pathan N.I**

**Department: Zoology**

**Program: M.Sc.SY**

**Subject: Zoology Course Code: LCW:-303 B**

**Paper Title: FISH MORPHOLOGY, ANATOMY AND PHYSIOLOGY – I**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	1) Identification of any two specimens from following groups: i) Elasmobranchs. ii) Placoderms. iii) Holocephali. iv) Dipnoi. v) Actinopterygii. vi) Crosspterygii. 2) Identification of Caudal fins in Fishes. 3) Mounting of Placoid, Cycloid and Ctenoid scales. 4) Identification of Skull, Vertebrae and Girdles in Bony and Cartilaginous Fishes. 5) Aggregation and Dispersion phenomena of Chromatophores in Fishes. 6) Dissections: i) Digestive system of Herbivorous and Carnivorous Fishes; Study of Gut contents. ii) Heart, Ventral aorta and Afferent arteries of	To perform identify and classify different specimens in the fishes mounting of different scales in the fishes. to dissect in fishes

	Cartilagenous and bony Fishes. iii) Accessory respiratory organs in Clarius, Channa, Anabas, Heteropneustus fossils.	
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**Specify Course Outcome:-** To perform identify, classify and dissect in the different species in fishes

**Specify Program Outcome: :** Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endrinological & microscopic technique.

**Signature of Teacher**



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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher: Shewale P.A**

**Department: zoology**

**Program: MSc .SY**

**Subject: zoology**

**Course Code: Zoo-304 B**

**Paper Title: FISH MORPHOLOGY, ANATOMY AND PHYSIOLOGY – II**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	1.1 Nervous System 1.1.1 Structure and function of Brain 1.1.2 Lateral Line Canal System 1.2 Reproduction 1.2.1 Organs of reproduction 1.2.2 Maturation and spawning 1.2.3 Seasonal changes in gonads 1.2.4 Fecundity & Spawning periodicity	To study of analysing the Nervous systemif fish, and Explain reproduction in fishes.
<b>II</b>	2.1. Migration of Fishes 2.1.1 Types of migration 2.1.2 Patterns of migration 2.1.3 Causes of migration 2.1.4 Advantages of migration 2.1.5 Factors influencing migration 2.2. Age and growth in Fishes 2.2.1 Methods for determining age and growth- Tagging, marking, scale and otolith method 2.2.2 Factors influencing growth of fish	Analyse migration in fishes and explain morphometric charecter of fishes.
<b>III</b>	3.1 Swim bladder and its modifications 3.1.1 Structure of the swim bladder	To study the modification of organs in

	3.1.2 Structural modifications 3.1.3 Function of the swim bladder 3.2 Electric Organs 3.2.1 Structure of the electric organs in various fishes 3.2.3 Mechanism of electric discharge 3.2.4 Function of electric organs 24 3.3 Bioluminescence and Sound Production 3.3.1 Luminiscent organs in fishes 3.3.2 Physiology of light production 3.3.3 Sound producing organs in fishes 3.3.4 Significance of Sound production	fishes according to there environment.
<b>IV</b>	1 Pituitary gland : Structure and Histophysiology of pituitary gland 2 Thyroid gland: Structure and functions of Thyroid gland 3 Adrenal gland: Structure and functions of Adrenal gland Parental Care in Fishes Fish Venoms and poisons Venom apparatus in Stingray, Scorpion Fische and Weavers 4.3.2 Dangerous Fishes – Puffer fish, Lion fish, Candiru, Stonefish	Explaining the different endocrine gland in fishes.

**Specify Course Outcome:** Explain and compare fish morphology, anatomy and physiology.

**Specify Program Outcome:** Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endrinological & microscopic technique.

**Signature of Teacher**



**Dnyanopasak Shikshan Mandal's  
College of Arts, Commerce and Science, Parbhani**

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*Pro-forma for program and course outcomes (2.6.1)*

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**Name of Teacher: Mr. Shaikh Ubaid S. K. Masood.**

**Department: Zoology**

**Program: M.Sc. S.Y**

**Subject: Zoology**

**Course Code: Lab course: 304-B**

**Paper Title: FISH MORPHOLOGY, ANATOMY AND PHYSIOLOGY – II**

Unit Number	Topics	Unit-wise Outcome
	1. Estimation of Fecundity 2. Determination of Age of given Fish by Scale method 3. Dissection: i. Brain, Membranous Labyrinth, Cranial nerves in Bony and Cartilagenous Fishes. ii. Reproductive system in Bony and Cartilagenous Fishes. iii. Weberian ossicles, Air bladder in Fishes. 4. Identification of Migratory Fishes, Electric Fishes and Poisonous Fishes. 5. Identification of Parental Care observing Fishes. 6. Identification of Pituitary, Thyroid, Adrenal gland in Fishes (Permanent slide) 7. Study of relationship between length and weight of fishes.	Identify and classify different fishes also practice mounting and dissections of fishes.

- **Specify Course Outcome:** Identify and classify different fishes also practice mounting and dissections of fishes.
- **Specify Program Outcome:** Identify and classify animals based on morphological and anatomical features of animal species, fish culturing, management and practice cytological, genetical, endocrinological & microscopic technique.

**Signature of Teacher**



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**Name of Teacher: Mr. D.H. Pawar**

**Department: Zoology.**

**Program: M.Sc. S.Y.**  
**401**

**Subject: Zoology.**

**Course Code: ZOOL-**

**Paper Title: GENETICS AND GENETIC ENGINEERING ( ZOOL 401)**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>1</b>	<b>I</b>	1. Mendel's law of inheritance 1.1. Law of Dominance 1.2. Law of Segregation 1.3. Law of independent assortment 2. Interaction of genes and modifying genes 2.1. Complementary gene factors 2.2. Supplementary gene factors 2.3. Inhibitory factors 2.4. Lethal gene factors 2.5. Epitasis 3. Sex chromosomes and sex linked inheritance 3.1. Types of sex chromosomes and sex chromatin 3.2. Sex linkage in Drosophila 3.3. Sex linkage in man 3.4. Sex linked lethal genes 4. Chromosomal methods of sex determination 4.1. Heterogametic Males i. xx-xo type ii. xx-xy type 4.2 Heterogametic Females i. zo-zz system	Learn the basic of Mendel's Laws of inheritance by using the different examples cross and ratio.  Explain the Sex determination examples of Sex linked inheritance

		ii. zw–zz system	
<b>2</b>	<b>II</b>	<p>1. Linkage and crossing over</p> <p>1.1. Kinds of linkages and significance</p> <p>1.2. Mitotic and meiotic crossing over</p> <p>1.3. Mechanism of meiotic crossing over</p> <p>1.4. Kinds of crossing over</p> <p>2. Mutations</p> <p>2.1. Gene mutation</p> <p>2.2. Chromosome mutation – Autopolyploidy, Aneuployploidy</p> <p>2.3. Induced mutation &amp; CIB method</p> <p>2.4. Mutagenic agents</p> <p>3. Multiple Alleles and Inheritance</p> <p>3.1. Multiple allelism A–B–O blood groups</p> <p>3.2. Inheritance of A–B–O blood groups and medico–legal applications</p> <p>3.3. Rh–factor and Erythroblastosis foetalis</p>	Interpret the concept of Multiple Alleles Inheritance. Learn the Linkage and Crossing over.
<b>3</b>	<b>III</b>	<p><b>Human Genetics</b></p> <p>3. Numerical abnormalities of human chromosomes and related syndromes</p> <p>3.1. Non–disjunction, Aneuploidy</p> <p>3.2. Patau syndrome</p> <p>3.3. Down syndrome</p> <p>4. Sex chromosomes –</p> <p>2.1 Turner’s syndrome</p> <p>2.2 Klinefilter’s syndrome</p> <p>5. Structural abnormalities of human chromosomes and related syndromes</p> <p>3.1. Cri–du–chat syndrome</p> <p>3.2. Robert–sonian translocation</p> <p>3.3. Prader–Willi Syndrome</p> <p>3.4. William’s Syndrome</p> <p>6. Human metabolic disorder</p> <p>4.1. Phenylketouria</p> <p>4.2. Alcaptonuria, Tay–Sach’s disease</p> <p>4.3. Glucose–6–phosphate dehydrogenase deficiency, Emphysemia</p>	Extend the Human Genetics with respect to Inborn errors of metabolism. Outline of Nature and functions of genetic materials
<b>4</b>	<b>IV</b>	<p>1. Introduction to recombinant DNA technology</p> <p>2. Enzymes used in DNA technology</p> <p>3. Cloning vectors – Plasmids, Phages, Cosmids</p> <p>4. Cloning techniques – Isolation and purification of genomic and plasmid DNA and</p> <p>5. RNA, Gel electrophoresis of nucleic acids</p> <p>6. Gene transfer techniques –</p>	Learn and understand Recombinant DNA Technology and other techniques of Genetic Engineering. Extend the knowledge of Construction of rDNA and Transgenic animals.



		Electroporation and microinjection 7. Applications of recombinant DNA technology. Monitoring of gene expression in live 8. cells, crop and live stock improvement	
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**Specify Course Outcome:** Identify and classify animals based on morphological and anatomical.

**Specify Program Outcome:** Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endrinological & microscopic technique.

**Signature of Teacher**



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**Name of Teacher: Mr. D.H. Pawar**

**Department: Zoology**

**Program: M.Sc. S. Y.**

**Subject: Zoology**

**Course Code:LCW-401**

**Paper Title: LABORATORY COURSE WORK BASED ON THEORY PAPER-:  
GENETICS AND GENETIC ENGINEERING ( ZOOL 401)**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>1</b>	<b>I GENE-TICS</b>	1. Preparation of pedigree chart of some phenotypic characters of human 2. Study of sex–chromatic from buccal smear or hair root cells 3. Identification and preparation of human Karyotypes 4. DNA sequencing 5. Estimation of DNA by spectrophotometer 6. Study of mitosis using onion root tip cells 7. Study of meiosis in grasshopper testis 8. Study of polytene chromosomes in chironomous larval salivary glands 9. Study of blood sugar estimation in normal and diabetic patients 10. Study of monohybrid, dihybrid crosses and interaction of genes with suitable examples	Solve the problems based on Genetics and explain the various types of genetic diseases and Evolutionary study.
<b>2</b>	<b>II GENETIC ENGINEERING</b>	11. Gel electrophoresis of nucleic acids (DNA/RNA). Isolation and detection of DNA/RNA on agarose gel.	Learn, understanding and demonstrate isolation techniques in genetic -

		12. Isolation of DNA/RNA from blood 13. Plasmid isolation from bacterium 14. Transformation experiment 15. Restriction digestion of DNA	engineering
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**Specify Course Outcome:** Specify Course Outcome: Learn and describe basic embryonic and extra-embryonic development, developmental processes and assisted reproductive technologies.

**Specify Program Outcome:** : Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endrinological & microscopic technique.

**Signature of Teacher**



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*Pro-forma for program and course outcomes (2.6.1)*

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-----Name  
of Teacher: Ms. Kadam P. P. Department: Zoology

Program: MSc SY Subject: zoology Course Code: ZOOL-402

Paper Title: ENDOCRINOLOGY (With Reference to Mammal / Human)

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	<b>Introduction to Endocrinology</b>	1.1. Hypothalamo – Hypophysial portal system. 1.2. Pituitary gland – Structure and location. 1.3. Structure, histology and hormones of Adenohypaphysis. 1.4. Structure, histology and hormones of Neurohypophysis. 1.5. Biosynthesis of protein hormones and mechanism of hormone action. 1.6. Biosynthesis of peptide hormones and mechanism of hormone action	Knowledge Identify, Label and Describe pituitary gland.
II	<b>Adrenal Gland</b>	2.1 Structure and histology of Adrenal gland 2.2 Adrenal cortex hormones – Mineralocorticoids and	Describe, Analyse, Explain adrenal gland.

		<p>Glucocorticoids and Renin – Angiotensin system.</p> <p>2.3 Hormones of Adrenal Medulla – Epinephrine and Norepinephrine.</p> <p>2.4 Hormones of Pancreas – Insulin and Glucagon</p> <p>2.5 Types of Diabetes: Insulin Dependent Diabetes Mellitus (IDDM) and Insulin Independent Diabetes Mellitus (IIDM)</p> <p>2.6 Structure and histology of parathyroid gland, Parathyroid hormone – Parathormone and calcium metabolism.</p>	
<b>III</b>		<p>3.1 Endocrine Role of Pineal Gland – Melatonin.</p> <p>3.2 Neurohormones – NO, CO, Endorphins</p> <p>3.3 Structure and Histology of Thyroid Gland</p> <p>Hormones of Thyroid – Thyroxine and Triiodo thyroxine biosynthesis and mechanism of steroid hormone action</p>	Understand and describe thyroid gland.
<b>IV</b>		<p>4.1 Hormones of Female Reproductive Physiology – Estrogens and Progesterone</p> <p>4.2 Placenta, Hormones of Placenta – HCG &amp; functions</p> <p>4.3 Hormones of Male</p>	Define, label and memorise male and female reproductive physiology.

		Reproductive Physiology – Androgens – Testosterone, Dihydrotestosterone.  4.4 Gastrointestinal Hormones – Gastrin, Secretin, Cholecystokinin (CCK), Gastric Inhibitory Peptide  (GIP), Vasoactive Intestinal Peptide (VIP)	
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**Specify Course Outcome:** Define, identify, and memorise concept of endocrinology with reference of mammals.

**Specify Program Outcome: :** Identify and classify animals based on morphological and anatomical features of animal species, fish culturing, management and practice cytological, genetical, endocrinological & microscopic technique.

**Signature of Teacher**



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*Pro-forma for program and course outcomes (2.6.1)*

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**Name of Teacher: Ms. Kadam P. P.**

**Department: zoology**

**Program: MSc SY    Subject: zoology**

**Course Code: LCW 402**

**Paper Title: LABORATORY COURSE WORK BASED ON THEORY PAPER-I:**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	<ol style="list-style-type: none"><li>1) Dissection of Endocrine glands in Rat or any other vertebrate</li><li>2) Determination of protein and glycogen in endocrine material (using spectrophotometer)</li><li>3) Determination of sugar level in diabetic and non-diabetic blood samples</li><li>4) Microtomy of Endocrine glands (Tissue fixation, Paraffin block preparation, sectioning, staining and Mounting).</li><li>5) Histology of Rat / Rabbit / Mammal Endocrine glands – Observation of histological section of different endocrine glands.</li><li>6) Hypophysectomy, Thyroidectomy, Adrenalectomy, Ovariectomy, in Rat / Mammal, Hysterectomy, Vasectomy.</li><li>7) Effect of Thyroxin on oxygen consumption of a fish.</li><li>8) Separation of plasma proteins by electrophoresis</li><li>9) RIA and ELISA for any hormone or second messenger.</li><li>10) Estimation of at least one hormone.</li><li>11) Preparation of vaginal smear, staining and identification of reproductive phase in Rat.</li><li>12) Identification of chemical structure of steroid hormone.</li></ol>	Dissect, Demonstrate, Separate, Identification and understanding of the various endocrine glands and chemical structure of various hormones.

**Specify Course Outcome:** Identification, understanding and analysis of the basic concept of endocrinology.

**Specify Program Outcome:** Identify and classify animals based on morphological and anatomical features of animal species, fish culturing, management and practice cytological, genetical, endocrinological & microscopic technique.

**Signature of Teacher**





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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher: Pathan .N.I.**

**Department: Zoology**

**Program : M.Sc. S.Y**

**Subject: Zoology**

**Course Code: -Zoo- 403 (B)**

**Paper Title: FISHERIES AND FISH CULTURE - I**

Unit Number	Topics	Unit-wise Outcome
<b>I</b>	1.1. Introduction, Scope and importance of Capture and Culture Fisheries 1.2. Fish culture - Study of commercially important cultivable fresh water fishes (Growth, Food and Feeding habits, Maturity, Spawning) c) Indian major carps - Rohu, Catla, Mrigal d) Exotic Carps - Common Carp, Grass Carp, Silver Carp 1.3. Monoculture and Composite Fish culture, Polyculture	Explain raring of Indian and Exotic carps of different species in fishes .
<b>II</b>	1. Fish Farm Engineering - Topography - Soil type - Water supply - Design 2. Fish Farm Management - Types of Ponds required - Management of Hatcheries - Types of Hatcheries 1. Hatching pits 2. Hapa 3. Chinese Hatchery System 4. Pre stocking, Stocking and Post stocking management of Nursery, Rearing and Stocking ponds 3. Aquatic weeds and their Control -	Explain and apply fish form management.

	Types of Aquatic Weeds - Advantages and Disadvantages of Aquatic Weeds - Weed Control by manual, mechanical, chemical and biological methods	
<b>III</b>	<ol style="list-style-type: none"> <li>1. Induced breeding by hormones - Selection of breeders - Injection and dosage - Breeding happa and spawning</li> <li>2. Collection of breeders from natural Bundh - Bundh breeding - Wet and Dry bundh</li> <li>3. Fish Transport - Scope and requirement of fish transport - Tools and Techniques used for fish transport - Problems in fish transport</li> <li>4. Fish sedatives and anaesthetics - Scope of sedatives and anaesthetics in fishery - Natural and synthetic sedatives and anaesthetics - Application of sedatives and anaesthetics in fishery</li> </ol>	Explain fish breeding and transport.
<b>IV</b>	<ol style="list-style-type: none"> <li>1. Fish Pathology - Symptoms and treatment of - Parasitic diseases - Non Parasitic diseases - Miscellaneous diseases</li> <li>2. Fish Preservation - Causes of Fish spoilage - Various methods of Fish preservation</li> <li>3. Fish by products</li> </ol>	Explain fish pathology and preservation.

**Specify Course Outcome:-** Explain summarise and demonstrate fish culture and management

**Specify Program Outcome:** Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endrinological & microscopic technique.

**Signature of Teacher**



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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher: Pathan N.I.**

**Department: Zoology**

**Program: M.Sc S.Y**

**Subject: Zoology**

**Course Code: Zoo- 403 (B) Lab Course**

**Paper Title: FISHERIES AND FISH CULTURE - I**

<b>Unit Number</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	1) Identification of Indian Major Carps and Exotic Carps. 2) Layout of Fish Farm. 3) Identification of Hatcheries (Model Study). 4) Identification of Aquatic weeds, Predatory Fishes, Weed Fishes, Aquatic insects. 5) Identification of Spawn, Fry and fingerlings of culturable Fishes. 6) Collection and preservation of Pituitary gland. 7) Preparation of Pituitary extract and injection of Pituitary extract – by demonstration 8) Identification of parasites and their control. 9) Visit to Fish Farm. 10) Preparation of by products like Fish manure, Fish meal, Istin glass etc.	To perform, identify fish culture and management and pathology

**Specify Course Outcome:-**To perform, identify and fish culture and management pathology

**Specify Program Outcome:** : Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endrinological & microscopic technique.

**Signature of Teacher**



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*Pro-forma for program and course outcomes (2.6.1)*

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**Name of Teacher: Ms. Shewale. P. A.**

**Department: Zoology**

**Program: MSc S.Y**

**Subject: Zoology**

**Course Code: Zoo - 404 (B)**

**Paper Title: FISHERIES AND FISH CULTURE - II**

<b>Unit Number</b>	<b>Unit Name</b>	<b>Topics</b>	<b>Unit-wise Outcome</b>
<b>I</b>	Fish culture Method	1. Scope and importance of Aquaculture 2. Inland Fishery - Riverine & Reservoir Fisheries (general introduction) 3. Culture methods : - Cage Culture - Pen Culture - Race way Culture 4. Integrated Fish Farming- Paddy cum Fish Culture	To study of analysing the importance of fishery science, and classify different culture methods in fishes.

<b>II</b>	Fish culture Method	1. Sewage Fed Fish Culture 2. Mussel Culture 3. Prawn Culture allied activities – Feed for Prawn seed, Transport of Prawn seed, Prawn seed diseases. 4. Pearl oyster Culture	To study of different method of aquaculture.
<b>III</b>	Methods of Fishing	1. Man made hazards and Aquaculture 2. Methods of Fishing - Crafts and Gears used - Electrical Fishing, Light Fishing, Fish finder	To study the different methods of fishing.
<b>IV</b>	Marine Fisheries	i) Mackerel Fishery ii) Oil Sardine Fishery iii) Bombay Duck Fishery iv) Prawn Fishery 3) Legislative framework for Fishery in India- 4.1. Biological Diversity Act 2002 with reference to fish diversity. 4.2. Illegal, Unreported, and Unregulated (IUU) Fishing – Indian Scenario 4.3. Endangered fishes of India by charts and models.	To explain marine fisheries in India.

**Specify Course Outcome:** To prepare students to attract and develop interest in fisheries science, toxicology so that the students can select zoology as their carrier.

**Specify Program Outcome:** Identify and classify animals based on morphological and anatomical features of animal species, fish culturing, management and practice cytological, genetical, endocrinological & microscopic technique.

**Signature of Teacher**



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*Pro-forma for program and course outcomes (2.6.1)*  
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**Name of Teacher: Shaikh Sir**

**Department: Zoology**

**Program: MSc.S.Y**

**Subject: Zoology**

**Course Code: Lab course: 404 (B)**

**Paper Title: FISHERIES AND FISH CULTURE - II**

Unit Number	Topics	Unit-wise Outcome
	1) Study of Cage, Pen and Race way (Model Study). 2) Identification Mussels, Prawn and Pearl oyster. 3) Study of crafts and gears: Hooks, Line-Gear, Cast net, Gill net, Drag net, Trawl net, Catamaran, Masula, Coracle, Trawler. 4) Identification of Food Fishes from Rivers, Reservoir and Sea. 5) Visit to Rivers, Reservoirs to Study Riverine & Reservoir Fisheries. 6) Study of Endangered fishes of India.	

**Specify Course Outcome:** Identify, classify different species culture in fresh water and reservoir fisheries

**Specify Program Outcome:** Identify and classify animals based on morphological, and anatomical features of animal species ,fish culturing , management and practice cytological ,genetical, endrinological & microscopic technique.

**Signature of Teacher**

