ACADEMIC (1-BOARD OF STUDIES) SECTION

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E-mail: bos.srtmun@gmail.com

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CBCS Pattern

1. Botany
2. Certificate Course in Industrial Safety, Health and Environmental Management (SHM)
3. Chemistry
4. Computer Application
5. Computer Network
6. Computer Science
7. Geophysics
8. Mathematics
9. M.C.A.
10. Microbiology
11. Physics
12. Zoology

सदरोल परिपक्व व अभ्यासक्रम प्रस्तुत विद्यापीठत्वाया www.srtmun.ac.in या संकेतस्थापनेकर उपलब्ध आहेत, तरी सदरोल बाबा ही सर्व संबंधितांगी निदर्शनास आणून खाली.

शासनीय परिषद,
विषयपूर्व, नांदेड़ — ४३१ ६०६.

प्राप्त सदरोल परिपक्व व अभ्यासक्रम कार्यालयात

दिनांक : ११.०७.२०१९.

प्रत माहिती व पुढील कार्यवाहीमार्ग:
1) मा. कृतदेवी यांचे कार्यालय, प्रस्तुत विद्यापीठ.
2) मा. संवादाचार, पाठशा संस्थापत्य मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
3) मा. संवादाचार, सर्व संवादों संस्थापत्य परिषद, प्रस्तुत विद्यापीठ.
4) साहित्यकृतदेवी, पद्यमंडळ विभाग, प्रस्तुत विद्यापीठ.
5) उपप्रम्पिय विद्यापीठ, पाठशा विभाग, प्रस्तुत विद्यापीठ.
6) सिस्टेम एक्सपर्ट्स, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.
Swami Ramanand Teerth Marathwada University,
Nanded, PIN – 431 603
Maharashtra State, INDIA.
(NAAC ‘A’ Grade)

SCHOOL OF LIFE SCIENCES
Department of Zoology

Syllabus M. Sc. Zoology (First Year)
(Semester- I and Semester- II)
(CBCS Pattern)
Effective from June, 2019 onwards
The Two Year (Four Semester) CBCS teaching program in Zoology has an intake of 20 students. The course structure is of Choice Based Credit System (CBCS) pattern as per UGC guidelines. The course curriculum also includes dissertation for the partial fulfilment of the Postgraduate degree in Zoology from third semester onwards. The medium of instruction and examination of this course is English.

The course includes Subject specific electives (SSE) and Skill Enhancement Courses (SEC). Also there are open electives (OEC) as per the UGC Model curriculum of CBCS Pattern. The students are also encouraged to learn SWAYM and NPTL courses as web based learning.

The M. Sc. Zoology course offers Dissertation as one of the important component, it is for those students who are interested in pursuing their career in research. There is an option against dissertation to write a review on selected research topics. There is one more choice for the students those who are not willing to enter in the research field and experimentation, for such students they have to complete the Practical Paper-VIII that includes important experiments related to research and application based topics. Based on the academic performance of a student in semester-I, Semester-II the Dissertation Allocation Committee (DAC) may advice the students whether to go for the dissertation or not.

The department is also actively involved in organizing other Academic Activities, study tours for the benefit of students and researchers. For each paper in the course there is seminar component to develop the confidence of expression and explanation of the content they studied and learned during the completion of this course.
## OUTLINE OF THE COURSE STRUCTURE

<table>
<thead>
<tr>
<th>Semester</th>
<th>Code No.</th>
<th>Name of the Paper</th>
<th>No. of Periods /Semester</th>
<th>Type of Paper</th>
<th>Total Credits</th>
<th>Internal Exam Marks</th>
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**Total Credits for Theory in Semester First = 16**

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**Total Credits for Practical for Semester First = 08**

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**Total Credits for Theory for Semester Second = 16**
Practical Papers For Semester Second

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<th>Name of the Paper</th>
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Total Credits for Practical for Semester Second = 08

Credits of Theory Papers of Semester First and semester Second = 32 Credits
- Note: * indicates Elective Paper. The student may select elective paper from other courses of the schools in the University Campus.

Credits of Practical Papers for semester First and Second = 16 Credits

Total Credits of Semester First and Second for Theory and Practical = 48 Credits

Total Marks of First Year Zoology at Campus SLS, SRTMUN = 1200 Marks

- The Codes T- indicates Theory, D- indicates Dissertation and ZOL -indicates Laboratory Course.
- SEC-Skill Enhancement Courses.
- Core Paper- Core content of main content of the course.
- SSE- Subject Specific Elective

Internal Assessment = 50 %
- Two Internal Exams each of 15 Marks (based on MCQs and Theory) Assignment of 10 Marks, Seminar for 10 Marks for each paper is compulsory (15+15+10+10).

External Assessment = 50%
1. At the end of Each Semester there will be Theory Examination (External) for Theory Papers as per the University Examination Time Table.
2. The examinations for Laboratory Courses (External) will be held at the end of Semesters.

Non-Major Elective Course:
There are 4 Credits of theory offered to other disciplines in I, II, III Semester. Therefore the M. Sc. Zoology students have to choose one elective paper from other PG courses like M. Sc. Botany, M. Sc. Microbiology, M. Sc. Biotechnology or any other PG courses from other departments within this University.

About the Elective papers:
Following given three elective papers are offered for PG courses other than M. Sc. Zoology. Therefore M. Sc. Zoology students have to choose one elective paper in Semester-I, II, III offered by other PG Courses as given in the syllabus structure. However for M. Sc. Zoology Students earning the credits of any two elective papers of the following will be an additional credit earning and that will be counted against the completion of Dissertation/Review Writing or Practical paper-VIII.
1. For Semester-I- Generic / Open Elective- Apiculture.
2. For Semester-II- Generic/Open Elective - Goat farming.
3. For Semester-III- Generic/Open Elective - Sericulture.

Student Can complete the courses from other learning sources like NPTL, SWYM in the First Year of PG Course and produce the details of credits completed to the Head Of the Department of Zoology and The Office of Director, School of Life Sciences, based on how many credits he earned he may be eligible for exemption from completing Dissertation or any other paper/s in Second Year of the
Course. The Students are not allowed for such external courses when they are in second year to avoid the delay in Final results of the PG Course.
S.R.T.M. University, Nanded,
School of Life Sciences
Department of Zoology
M. Sc. Zoology-First Year, Semester – I (June, 2019 onwards)
(Pattern- Choice Based Credit System)
Syllabus- Theory Paper
Paper Code: ZOT- 101
Title of the Paper – Animal Taxonomy and Evolution

Total Credits – 04                                                                          Number of Periods – 60

Course Objective:

The paper is designed to make students aware not only of the great diversity which is being
displayed by animals around us but also to prepare them theoretically and practically to study
and arrange the Bio-diversity in scientific and natural manner. The theoretical background of
systematics and taxonomy thus will go a long way in elucidating the natural grouping which
exists in the biodiversity around us.

Course outcome:

The students will get basic knowledge about animal taxonomy and it will be useful to
understand the animal world around them. The students may apply this knowledge in
taxonomy related job opportunities.

UNIT – I

1. Definition and basic concept of Biosystematics, taxonomy and classification, History
   of taxonomy, systematics, Taxonomic characters and their kinds and wetage.
2. Trends in animal taxonomy: Chemo-taxonomy, Cyto-taxonomy, Molecular
   taxonomy, Immuno-taxonomy & Para-taxonomy.
4. Importance and application of Taxonomy (biosystematics) in biological studies.
5. Systematics as a profession and its future perspectives,

UNIT – II

1. Species categories and species concept.
   a) Typological species concept. b) Nominalistic species concept.
   c) Biological species concept  d) Evolutionary species concept.
2. Difficulties in application of Biological species concept.
3. Intra-specific categories & Taxons: a) variety, b) Subspecies c) super species d)
   Sibling species.
5. Taxonomic Characters, Types of taxonomic characters, origin of reproductive isolation,
biological mechanism of genetic incompatibility.

UNIT – III

1. Taxonomic procedures, Taxonomic collections. Preservations and process of identification of Insects, Helminth Parasites, Fishes.
2. Taxonomic keys: Different categories of taxonomy and their merits, demerits, Taxonomic publications.
4. Different types of camera for the field and laboratory studies.
5. Sound Recording and Echo-sound recording devices used in animal detection, Recording and Taxonomic studies.

UNIT – IV

1. Neo-Darwinism and Population Genetics: Hardy-Weinberg law of genetic equilibrium,
2. Forces for destabilization in the process of organic evolution: Natural selection, mutation, genetic drift, migration and meiotic drive.
5. Ecological significance of molecular variations (Genetic Polymorphism), Micro-evolution and Macro-evolution.

SUGGESTED READINGS:

1. Molecular Markers, Avise, J. C.
3. Elements of Taxonomy Mayer E.
4. Biodiversity Wilson E. O.
8. Evolution Sawage
10. Evolution of Vertebrates Colbert
11. Evolution and Genetics Merrel D. J., Jones
S.R.T.M. University, Nanded,  
School of Life Sciences  
Department of Zoology  
M. Sc. Zoology First Year, Semester – I (Year 2019 Onwards)  
(Choice Based Credit System)  
Syllabus- Theory Paper  
Paper Code: ZOT- 102  
Title of the Paper –Non-Chordate and Protochordates  
Total Credits – 04, Number of Periods – 60

Course Objectives:  
1. To describe and explain the basic principles of animal classification, form and function among non-chordate phyla.  
2. To describe the main elements of the biology and evolutionary relationships of the major groups of non-chordates  
3. To describe the structure and function of vital organs among non-chordate phyla.

Course outcome:  
The students will get an idea about how the life processes goes on in the animals in their surrounding. Also the knowledge they use to monitor, manage, conserve and utilize these creatures. Also it gives an idea about how a Human being is evolved in sequential evolution process.

UNIT – I  
2. Food, feeding and reproduction in Protozoa.  
4. Spongocoel, Coelenteron.  
5. Types of Cells and their functions in Sponges  

UNIT- II  
5. Advanced nervous system in Annelida, Arthropoda and Mollusca (Cephalopoda).

UNIT – III  
1. Larval forms in Invertebrates (Porifera to Echinodermata) and their Evolutionary Significance.  
2. General characters of Cephalochordates.  
3. General characters of Urochordata  
4. Affinities of Cephalochordates to Vertebrates and Origin of Vertebrates.  
5. Introduction to Minor Phyla.

UNIT – IV  
1. Cyclostomes: General characters; Classification and characters of Pertomyzon and Myxin.  
2. Ostracoderms: Characters of Jawless fossil fishes.  
3. Placoderms: Characters of fossil Placoderms.  
S.R.T.M. University, Nanded,
School of Life Sciences
M. Sc. Zoology, First Year, Semester – I (Year 2019 Onwards)
(Choice Based Credit System)
Syllabus- Theory Paper
Paper Code: ZOT- 103
Title of the Paper – Cell Biology, Genetics, Molecular Biology
Total Credits – 04  Number of Periods – 60

Course Objectives:
1. To study the structure and function of the basic unit of living organisms.
2. To study stages in cell cycle (including cell death and cancer), cell differentiation, and organelles and other cellular structures in the growth and functioning of the cell (including membrane transport and signaling).
3. To understand the basic concepts and processes in development of an organism.
4. The objective of this course is to provide a clear understanding of DNA so that they can manipulate and understand the basic tools and techniques involved in it. Strong foundation in genetics and molecular biology enables the students to familiarize themselves with genetic engineering.

Course Outcome:
The students will be able to apply the knowledge in education and research on molecular biology in various fields at industrial, institutional levels. Nationally as well as Internationally.

Unit-I
1. Introduction to basic concepts of cell Biology, Overview of Prokaryotic and Eukaryotic cells.
2. Types of cells in animals.

Unit-II
2. Cell Cycle: Major events during G1, S, & G2 phases, regulation of cell cycle, cell cycle and apoptosis.

Unit III
1. Overview of Mendelian Genetics, Fine structure of gene, types of mutations, UV and chemical mutagens; Ames test for mutagenesis; Retroviruses.

2. Prokaryotic and eukaryotic DNA replication, Mechanism of DNA replication, enzymes and accessory proteins involved in DNA replication,

3. Types & mechanism of DNA Repair, Process & types of Recombinations, Holiday junction, gene targeting, FLP/FRT and Cre/Lox recombination, Rec A and other recombinases.

Unit IV
1. Modifications in RNA: 5’-Capping, 3’-polyadenylation, and splicing, RNA editing, RNA stability, Process of Prokaryotic and Eukaryotic transcription, RNA polymerase,

2. General and specific transcription factors, Regulatory elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional gene silencing.

3. Prokaryotic and eukaryotic translation, the translation machinery, Mechanisms of initiation, elongation and termination.


References:
9. Genomes, T. A. Brown.8th Day of Creations
S.R.T.M. University, Nanded,  
School of Life Sciences  
M. Sc. Zoology, First Year, Semester – I (Year 2019 Onwards)  
(Choice Based Credit System)  
Syllabus- Theory Paper (Elective for First semester)  
Paper Code: ZOT- 104  
Title of the Paper – Apiculture  

Total Credits – 04  
Number of Periods – 60

Course Objectives:  
To introduce the students about potential of useful insect the Bees for getting Honey and other byproducts from their scientific culture methods.  
To educate the students about conservation of bees to increase the production in agriculture due to effective pollination.

Course outcome:  
Students can start their own business of Apiculture/Bee farming, train others and will be able to enter in private, Govt sectors or in the research related to Apiculture/Bee keeping.

Unit- I - Introduction of Modern bee keeping  
1.1. Importance of beekeeping  
1.2. Scope of beekeeping  
1.3. Bee species  
1.4. Cast differentiation, Colony organization  
1.5. Division of labor in honeybee  
1.6. Life cycle of honeybee and nuptial flight

Unit- II. Scientific bee keeping  
2.1 Beekeeping equipment’s  
2.1.1 Equipments for improving efficiency of honeybees  
2.1.2 Equipments for improving efficiency of bee’s keepers  
2.1.3. Equipments for improving hygienic conditions  
2.2. Methods of Swarm capturing. 2.2.1. Capturing a Swarm from a tree branch. 2.2.2. Capturing a Swarm from Ground  
2.3. Inspection and Handling the Colony  
2.4. Hiving by dividing an established colony.  
2.5. Establishment, Seasonal Management of apiary and inspection of bee colonies.

Unit III - Apiculture in Agriculture  
3.1. Bee plants and floral calendar- Importance and qualities of good bee flora.  
3.2. Pollination, Need of bee pollination  
3.4. Management of honeybees for pollination.  
3.5. Migratory beekeeping  
3.6. Honeybee products  
3.6.2. Importance of other bee products to mankind  
a) Pollen –Method of collection, constituents, uses.  
b) Royal jelly- Method of collection, constituents, uses.  
c) Propolis - Method of collection, constituents, uses.  
d) Bee wax- Method of collection, constituents, uses.  
e) Bee venom- Method of collection, constituents, uses.

Unit-IV Problems of beekeeping industries,  
1. Natural Climate Condition,  
2. Natural enemies, pest and diseases, human activities  
3. Apiary and Hive Hygiene  
4.Economics of beekeeping

Books  
1) Introduction to disease of bee –Bailey, L
2) World of honeybee – Butter C. G.
3) Beekeeping in India – Sardar Sing (ICAR)
4) The Principle of Insect Physiology – Wigglesworth, V.S.
6) D. K. Belsare, Beekeeping for livelihood
S.R.T.M. University, Nanded,  
School of Life Sciences  
M. Sc. Zoology, First Year, Semester – II (Year 2019 Onwards)  
(Choice Based Credit System)  
Syllabus- Theory Paper  
Paper Code: ZOT- 201  
Title of the Paper – Developmental Biology

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**Course objectives:**

1. To study the structure and function of the basic unit of living organisms.
2. To study steps in animal development.
3. To determine the modern trends and tools, techniques in Animal embryology and development.

**Course Outcome:**

After learning the development of life from cell to multicellularity complex and coordinated systems in organisms the students can apply this knowledge for research, and education, to solve the problems related to development in animals through research.

**Unit I. Gametogenesis, fertilization and early development:**

1. Production of gametes-
   1.1. Spermatogenesis in mammals, structure of sperm, Semen formation and composition.
   1.2. Oogenesis in mammals, Structure of egg and types.
2. Cell surface molecules in sperm-egg recognition in animals;

**Unit II Zygote formation in animals**

1.1. Capacitation
1.2. Prevention to polyspermy (Fast block and slow block)
1.3. Acrosome reaction.
1.4. Activation of Egg metabolism.
2. Type of eggs, Cleavage and patterns of embryonic cleavage.
3. Blastula formation and fate map of blastula.
4. Gastrulation and formation of 3 germ layers in animals (Ex. Frog and Chick)
5. Extra embryonic membrane formation.

**Unit III Basic concepts of animal development:**

1. Potency.
2. Commitment.
4. Induction.
5. Competence.
6. Determination and differentiation.
7. Morphogenetic gradients.
10. Imprinting; mutants and transgenics in analysis of development.

**Unit IV Morphogenesis and organogenesis in animals:**

1. Cell aggregation and differentiation in *Dictyostelium*;
2. Axes and pattern formation in *Drosophila*;
   2.1. Segmentation genes, 2.2. Homeotic genes
3. Nuclear transplantation and cloning in mammals.
4. The concept of totipotency embryonic stem cells
5. Differentiation of neurons,
7. Sex determination.

**Suggested readings:**

1. Developmental Biology by Gilbert Scott
2. Molecular biology of the cell By Albert et al
4. Principle of Development by Wolpert
5. Genes VIII/ IX By Benjamin Lewin
6. Developmental Biology by Balinsky
7. Developmental Biology by Berril
8. Developmental Biology by Waddington
9. Readings are also assigned from journals and from Internet resources such as Medline( http://www.ncbi.nlm.nih.gov/entrez/query.fcgi) and bio Med Net (http://www.bmn.com/) Wikipedia etc
Objectives:
To study the basic structure and function of Chordates. To determine the progress and complexity in the development and evolution of different chordate groups for their habitat selection, adaptation and regulation of the life processes.

Course outcome:
Students will get an idea about how the evolution process incurred, its sequences, adaptations and degenerations. It is a basic study can be useful for all kinds of application issues in animal science.

UNIT-I
1. Basic structure of Chordate animal and its characters.
2. Difference between Vertebrates and Chordates.
4. Distribution and characters of Lung fishes.
5. General structure and functions of Integument and its derivatives in vertebrates.

UNIT-II
1. Evolution of Heart and Aortic arches in Vertebrates.
2. Respiratory pigments in animals.
3. Structure of Gill and respiration in fishes.
4. Structure of lung and respiration in Mammals.
5. Integumentary respiration in Amphibia.

UNIT-III
1. Comparative structure of alimentary canal and associated digestive glands in vertebrates.
2. Structure of brain and spinal cord in Fishes and mammals. Cranial nerves and their functions in fishes and Mammals.

UNIT-IV
1. Jaw suspension in vertebrates.
2. Structure and functions of Brain and cranial nerves in fishes and Mammal.
3. Structure and working of Mammalian Ear and Eye.
5. Introduction to Dugong, Seal and Walrus.
6. Classification and characters of Chiroptera.

SUGGESTED READINGS
4. Chordate Zoology- Jordan and Verma
7. Evolution of Chordate Structure – Smith H. S.
Course Objective:
1. Objective of this course is to help the student to navigate the discipline of Biochemistry that explains how the collection of inanimate molecules.
2. To determine the biochemistry and biochemical reactions in the animals as their life processes.

Course Outcome:
1. The students may clear the NET/SET/GATE and other scientific screening tests conducted by various departments and agencies involved actively in research and development in science and technology.
2. There are opportunities for the students after completing this course in bioprocessing and biotechnological research institutes.

Unit-I
1. Acids and bases, Buffer solutions, Physiological and Biological Buffers.
3. Biologically important peptides.
4. Structure of proteins, Ramchandran plot. Fibrous proteins, Globular proteins, collagen, elastin, keratins, myoglobins, haemoglobins, haemoglobin variants and pathological effects, Protein sequencing.

Unit-II
1. Nucleic acids: Structure and functions.
3. RNA Types and biological functions.
5. Introduction to Enzymes and their Classification. Enzyme action. Coenzymes.

Unit-III
1. Acquired or adaptive immunity.
2. Active and Passive immunity.
3. Cells and organs related to immunity- (Generation, activation and differentiation)
   T-Cells and B-cells
4. Immunoglobulins- Classification, structure and functions.
5. Antigen-Antibody interaction and its applications.

Unit-IV
1. Hypersensitivity: Types and causing factors.
2. Immunodeficiency and AIDS.
3. Auto-immune diseases.
5. MHC (Major Histo-competability Complex) Structure and functions.
Suggested readings:

General Chemistry- Linus Pauling. W. H. Freeman and Company
Biochemistry-D. Voet and J. G. Wileymand Sons.
Laboratory Techniques in Biochemistry and Molecular Biology, Worh and Work.
Understanding Chemistry, CNR Rao, Universities Press, Hyderabad.
ELBS, 1986.
Tools of Biochemistry- T. G. Cooper.
Biochemistry- G. H. Well.
Objectives of the course:
1. To introduce the zoology students for applied education based courses like Goat Farming.
2. To promote the agro-based business like Goat-farming in the local farmers and unemployed youth for their self-employment.
3. To introduce the business thought about Goat meat is highly demanded meat all over the world hence high need of goat farming.

Outcome of the course:
1. Students can start their own small scale or large scale business.
2. Students may get the jobs in the goat farms as scientific expert and manager of the farm.
3. There are research opportunities in the Goat research Institutes, Goat milk, meat and leather industries for those who complete the course successfully.

Unit-I. Introduction and Planning
1. Introduction to goat farming and support of goat farming for low income group.
2. Goat Breeds in the world: For meat, fur, milk, leather. Biography of commercially important goat species in India
3. Exotic goat species introduced in India: their success and failure.
5. Types of goat farming: success and problems in types of shelter
6. Structure, engineering and basic requirements to establish a goat farm.

Unit-II. Goat Health and Management
1. External morphology of goat, commercial use of goat body parts: Skin-Leather, Hairs, Hooves and horns, bones, Muscles and organs, Blood.
2. Characters, composition and uses of Goat milk.
4. Digestive system of goat. Basic, supplementary and nutritional food for goats.

Unit-III. Goat products, by-products, marketing management
1. Fodder plants for goat: Shrubs, trees, grass, agriculture waste.
2. Goat meat: slaughter of goat, separation of goat meat, preservation, processing, marketing, distribution and export.
3. Goat leather processing and uses.
4. Fecal waste, urine from goat farm and its management, goat manure.

Init-IV Farm management and Economics.
1. Labor, office staff, instruments, transport vehicles, maintenance and management.
2. Goat market, Local Bazaars: processes and places.
3. Economics of goat farming.
4. Goat farming research and education institutes in India.
5. Wild goat species in India.

Suggested Readings:
1. Hand Book of Goat farming In India. Engineers India Research Institute (EIRI)


1. Equipments and collection methods for the invertebrates and vertebrates from terrestrial and aquatic habitats: Protozoa, Helminthes, Arthropods, Fishes.

2. Taxonomic study and taxonomic preparation of Insects, Parasites, Fishes and higher vertebrates.

   a. Use of still camera and Video-camera, Use of Infrared night vision camera, Sound recording in animals & Underwater camera.

4. Study of local fauna for the taxonomy, distribution and conservational status and their preservation.

5. Studies on fossils, living fossils and connecting links Archaeopteryx, Peripatus, Limulus, Nautilus, Latimeria using models, photo.

6. Structure, types, management and maintenance of Museum and aquarium.

7. Problems and exercises in phylogeny of model organisms.

8. Demonstration of following organs/systems from any teleosts (Food Fish) for the study of Heart and afferent branchial arteries, Cranial nerves, Weberian ossicles, Air Bladder & Gill rakers.

9. Virtual dissection of Rat and Frog for various systems. (Computer Simulated demonstrations and Problems)

10. Museum study- based on Photo and /or models of the animals: minimum any two from each Class/Phyla given below.
   a. Protozoans- for the structural differences and habitat specificity, locomotory structures; Porifera spicules; Typical colony of Coelenterata; Arthropoda; Echinoderms; Cestodes, Trematodes, Nematodes and Molluscs.

c. Amphibians- Photo/Model based study of Ichthyophis sp., Rhacophorus sp., Hyla sp.

d. Reptiles- Photo/Model based study of Chameleon sp., Phrynosoma sp., Varanus sp., Viper sp., Rat snake sp., Cobra sp., Turtle sp.

e. Aves- Photo/Model based study of Bubo, Duck, Vulture, Pigeon, Sparrow, Crow.


12. Model or Photo based study of Horns in mammals; beak and claws in birds.

13. One long distance study tour preferably to the sea coast, to observe the animals in their natural habitat and report writing/Seminar.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED,
SCHOOL OF LIFE SCIENCES,
List of Laboratory Exercises for M. Sc. Zoology First Year (Semester- First)
(Choice Based Credit System)
(Year 2019 Onwards)
Paper Code-ZOL-2
Title of the Paper- Zoology Lab Course-II
(Biochemistry, Molecular Biology)

Credits- 4  Marks - 100 Marks

1. Determination of Blood group in human.
2. Estimation of Blood Cells, Blood cell count.
4. To determine the antigen antibody reaction by gel diffusion.
5. Separation and Identification of RBC, WBC, and Microphages from blood by using electrophoresis method.
6. To determine the blood clotting time.
7. Separation of amino acids by paper chromatography method.
8. Separation of antigen antibody by gel electrophoresis.
9. Solution Preparation, understanding Molarity, Normality, buffer, pH Meter
10. Amplification of DNA by using PCR Tools.
11. Experiments on enzyme activity (Amylase, Protease, Lipase, inhibitors)
12. Verification of Lambert Beer’s Law.
13. Estimation of Reducing/Non-Reducing sugars by colorimetry/Spectrophotometry
   Introduction to Gas Chromatography (GC).
15. Separation of amino acids and proteins by polyacrylamide Gel Electrophoresis (PAGE)
16. Introduction and uses of HPLC
2. Cell organelle separation by Centrifugation: Nucleus. Mitochondria, Chloroplast
3. Cell division study- Mitosis and Meiosis,
   Onion/Garlic root tip, Grasshopper testis, snails.
5. Study of semen for sperm motility and abnormalities.
7. Study of developmental stages in fertilized egg of hen.
8. Study of regeneration in earthworms and cultivable fishes.
9. Preparation and submission of five slides of cells isolated from different organs of
   invertebrate and vertebrate animals.
10. Techniques of cryopreservation of Ova and sperms.
11. Computer simulated experiments in animal embryology and cell biology.
12. Problems based on gene linkage, sex linked inheritance and crossing over.
13. Isolation of genomic DNA/RNA from Bacteria, animal and plant cells.
15. Study of in-vitro transcription and translation using PCR.
1. Ecology and Biodiversity of producers and consumers from terrestrial freshwater and marine ecosystem: Identification, characters and their role in ecosystems.
   a) Unicellular/Filamentous algae: Aquatic weeds – Hydrilla, Ipomoea, Eichornia
   b) Marine phytoplankton & Marine Zooplankton; Grasshopper sp, Backswimmers, Beetle, Cotton Boll-worm.
   c) Determination of Avian diversity from a habitat like reservoir, River, Forest, Grassland.
2. Estimation of Dissolved O$_2$, CO$_2$, Chlorides, Alkalinity of water samples.
4. Experiments on productivity in Aquatic environment & Biomass estimation
5. Experiment on positive and negative photo taxis.
8. Types of Media, its preparation and use.
9. To study the various equipments in microbial study- Standard pipettes, Wireloop, Micropipettes, Petriplates and its use.
10. Sterilization equipments and their uses un microbial study- Autoclave, Oven, laminar Airflow, Use of ethanol, fumigation of laboratory.
11. Isolation of bacteria from Fish gills/fish body and their gram staining.
12. Computer simulated experiments on animal behaviour.
Q. 1. Major Question 20 Marks

Q. 2. Minor Question 15 Marks

Q. 3. Record Book and submission 10 Marks

Q. 4. Viva Voce 05 Marks

1. Signature of External Examiner-----------------------------
   Name, Address of the Examiner-----------------------------

2. Signature of Internal Examiner-----------------------------
   Name, Address of the Examiner-----------------------------
Question Paper Internal / External Practical Examination

Marks-50 | Time-04 Hours | Date:

Q. 1. Major Question | 20 Marks

Q. 2. Minor Question | 15 Marks

Q. 3. Record Book and submission | 10 Marks

Q. 4. Viva Voce | 05 Marks

1. Signature of External Examiner-----------------------------
   Name, Address of the Examiner-----------------------------

2. Signature of Internal Examiner-----------------------------
   Name, Address of the Examiner-----------------------------
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED,
SCHOOL OF LIFE SCIENCES,
M. Sc. Zoology First Year
(Choice Based Credit System)
(Year 2019 Onwards)
Practical Paper-Code-3
Title of the Paper- Zoology Lab Course–III

Question Paper Internal / External Practical Examination

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<th>Marks-50</th>
<th>Time-04 Hours</th>
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<td>20 Marks</td>
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1. Signature of External Examiner-----------------------------
   Name, Address of the Examiner-----------------------------

2. Signature of Internal Examiner-----------------------------
   Name, Address of the Examiner-----------------------------
Question Paper for Internal/External Practical Examination

Marks-50 Time-04 Hours Date:

Q. 1. Major Question 20 Marks

Q. 2. Minor Question 15 Marks

Q. 3. Record Book and submission 10 Marks

Q. 4. Viva Voce 05 Marks

1. Signature of External Examiner-----------------------------
   Name, Address of the Examiner--------------------------------

2. Signature of Internal Examiner-----------------------------
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