

**Swami Ramanand Teerth Marathwada
University, Nanded.**



**SYLLABUS
MASTER OF SCIENCE
ZOOLOGY
(FIRST SEMESTER)**

SEMESTER PATTERN

w.e.f. June 2014

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
NANDED VISHNUPURI, NANDED (M.S.)**

Board of Studies in Zoology

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7.	Dr. G. Gyananath	Member,

		Professor, Department of Zoology, School of Life Science, S. R. T. M. University, Nanded Ph. No.: 09850486910
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10.	Dr. Mirza Mumtaz Baig	Member, Associate Professor, Department of Zoology, Govt. Vidharba Science Institute, Amravati Ph. No.: 09420721907 E-mail Id: mumtazbaig@gmail.com
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INTRODUCTION - ZOOLOGY CURRICULA

Revising and updating of the curricula is the continuous process to provide an updated education to the students at large. To ensure and have uniform curricula at U.G. and P.G Levels in different Indian Universities, U.G.C developed a model curriculum and forwarded the same all the universities in the country to serve as a base in updating their respective curricula.

The curriculum designing committee of SRTMU Nanded was constituted for zoology at UG and PG levels which consisted all the members of B.O.S. The members are specialist and experts in different areas of zoology.

For developing the final draft of curriculum, the committee took into account the U.G.C Suggestions regarding model curriculum, total number of teaching days available in the year and guidelines given by faculty of science of SRTMU Nanded. The curriculum designing committee held a couple of meetings In which there were through and critical suggestions on the concern syllabi. After making appropriate corrections and changes,the committee accepted the final draft of syllabus.

The SRTMU Nanded is having B.Sc and M.Sc. Zoology courses designed with semester system pattern. The course content of each theory paper is divided into four units, each having number of topics and subtopics with appropriate titles and subtitles. For each topic, total number of periods required and weightage of marks is mentioned. At the end of each theory paper the list of selected reading material is provided. A list of practical exercise to be completed in the academic year is also given, paperwise question paper models are provided in the syllabus.

Objectives

- 1.) To update curricula by introducing recent advances in the subject and enable the students to face NET , SET and other competitive examination successfully.
- 2.) To create awareness among students about the latest streams of life sciences including biotechnology, tissue culture, genetic engineering.
- 3.) To improve the quality of laboratory and field work for which zoological study tours and excursions have been made compulsory so that the students can become familiar with reality of ecosystem and surrounding study.
- 4.) To prepare students to attract and develop interest in physiology , genetics , cell biology, fisheries science, toxicology so that the students can select zoology as their carrier.

Board of Studies
Zoology
S.R.T.M.U NANDED

Swami Ramanand Teerth Marathwada University, Nanded
M.Sc. In Zoology, Semester System : 2013-2014

COURSE CODES AND TITLES

M.Sc. Zoology FIRST SEMESTER

Paper No. / Course Code	Title of the Paper	Periods / Practicals	Marks	Time duration of examination.
ZOOL. 101	Invertebrates: Structure and Function	48	50	3 Hours
ZOOL. 102	Biosystematics, Taxonomy and Evolution.	48	50	3 Hours
ZOOL.103	Quantitative Biology and Bioinformatics	48	50	3 Hours
ZOOL.104	Economic Zoology and Animal Behavior.	48	50	3 Hours
LABORATORY COURSE LC - 101	Invertebrates: Structure and Function		50	6 Hours
LABORATORY COURSE LC- 102	Biosystematics, Taxonomy and Evolution.		50	6 Hours
LABORATORY COURSE LC -103	Quantitative Biology and Bioinformatics		50	6 Hours
LABORATORY COURSE LC -104	Economic Zoology and Animal Behavior		50	6 Hours

Practical Examination Pattern

Paper No. / Course Code	Title of the Paper	Marks	Time duration of examination.
LABORATORY COURSE LC – 101 + 102	Invertebrates: Structure and Function + Biosystematics, Taxonomy and Evolution	50	6 Hours
LABORATORY COURSE LC -103 + 104	Quantitative Biology and Bioinformatics + Economic Zoology and Animal Behavior	50	6 Hours

Swami Ramanand Teerth Marathwada University, Nanded

M. Sc. In Zoology, Semester System 2013-2014

Detailed Syllabus

First Semester

Course Code: **ZOOL. 101**

Title of the Paper: INVERTEBRATES: STRUCTURE AND FUNCTION

Periods: 48

Marks: 50

Unit-I

1. Organization of coelom : Acoelomates
2. Organization of coelom: Pseudocoelomates.
3. Organization of coelom : Protostomia and Deuterostomia
4. Locomotion : Flagellar and Ciliary movement in Protozoa
5. Locomotion : Hydrostatic movement in Coelenterata, Annelida, and Echinodermata

Unit-II

1. Nutrition in Protozoa
2. Patterns of feeding and digestion in lower Metazoan
3. Filter feeding in Polychaeta, Mollusca and Echinodermata
4. Organs of respiration : Gills, lungs and trachea
5. Respiratory pigments
6. Mechanism of respiration

Unit-III

1. Organs of excretion : Coelom, Coelomoducts, Nephridia and Malpighian tubules
2. Mechanism of excretion
3. Excretion and Osmoregulation
4. Primitive nervous system : Coelenterata and Echinodermata
5. Advanced nervous system : Annelida, Arthropoda, (Crustacea and Insecta) and Mollusca (Cephalopoda)
6. Trends in neural evolution

Unit-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

Suggested Reading :

1. Hyman L.H. '**The Invertebrates. Vol I-Protozoa through Ctenophora**', McGraw Hill Co, New York.
2. Hyman, L.H. '**The Invertebrates Vol-II**', McGraw Hill Co., New York.
3. Hyman, L.H. '**The Invertebrates. Vol-VIII**', McGraw Hill Co., New York and London.
4. Barnes, R.D. '**Invertebrate Zoology, 3rd edition**', W.B. Saunders Co., Philadelphia.
5. Barrington, E.J.W. '**Invertebrate Structure and Function**', Thomas Nelson and Sons Ltd., London.
6. Sedgwick, A.A. '**Students Text Book of Zoology**', Vol. I, II and III. Central Book Depot, Allahabad.
7. Parker, T.J., Haswell, W.A. '**Text Book of Zoology**', Macmillan Co., London.

**List of Practical Exercises for
LC-101: Invertebrates: Structure and Function**

- 1) Demonstration of Digestive, Reproductive and Nervous system of crab /Earthworms / Cockroach (Any two animal)
- 2) Mounting of Nephridium & Spermatheca of Earthworm: Trachea of Cockroach, Gills of Crab.
- 3) Mounting of larvae of insects and crustacea (Any five)
- 4) Museum specimens from invertebrate phyla. Five specimens from each phylum to be studied.

Five permanent stained micro preparations prepared by the examinee are to be Submitted at the time of practical examinations.

[Note-Demonstration of Dissections by Charts / Models/ Audio Visual Aids]

**Scheme of Practical Examination
LC- 101: Invertebrates: Structure and Function**

Duration 6 Hours

Marks 50

Q. 1.	Dissection – Explain dissection with model/chart with proper labeling ____	10
Q. 2.	Permanent Micro preparation _____	05
Q. 3.	Identification & comments on spots 1-5 _____	15
Q. 4.	Submission of stained Micro preparation _____	05
Q. 5.	Viva voce _____	10
Q. 6.	Practical Record book _____	05

Swami Ramanand Teerth Marthwada University, Nanded

M. Sc. - Zoology, Semester System 2013-2014

Detailed Syllabus

First Semester :

Course Code: **ZOOL-102**

Title of the Paper: BIOSYSTEMATICS, TAXONOMY AND EVOLUTION

Periods: 48

Marks: 50

Unit-I

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 categories.

Unit -II

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.
4. Taxonomic keys: Different kinds of keys, their merits and demerits.

Unit - III

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.

Unit – IV

1. Concepts of Evolution and Theories of organic evolution.
2. Neo-Darwinism and population genetics.
 - Hardy-Weinberg law of genetic equilibrium.
 - Destabilizing forces, natural selection, mutation, genetic drift, migration and meiotic drive.
3. Molecular population genetics.
 - 3.1 Pattern of changes in nucleotide and amino acid sequences.
 - 3.2 Ecological significance of molecular variations (genetic Polymorphism).
4. Molecular Evolution
 - Gene evolution
 - Evolution of gene families.

Suggested Readings:

1. Kato, M. **'The Biology of Biodiversity'**, Springer.
2. Avise, J.C. **'Molecular Markers, Natural History and Evolution'**, Chapman & Hall, New York.
3. Wilson, E.O. **'Biodiversity'**, Academic press, Washington.
4. Simpson, G.G. **'Principles of Animal Taxonomy'**, Oxford IBH publishing company.
5. Mayr, E. **'Elements of Taxonomy'**.
6. Wilson, E.O. **'The Diversity of life (College Edition)'**, W.W. Northem & Co.
7. Tikadar, B.K. **'Threatened Animals of India'**, ZSI Publication, Caculatta.
8. Dobzhansky, Th. **'Genetics and Origin of Species'**, Columbia University, Press.
9. Dobzhansky, Th., F.J. Ayala, G.L. Stebbines and J.M. Valetine **'Evolution'**, Surjeet Publicaiton, Dehli.
10. Futuyama, D.J. **'Evolutionary Biology'**, Suinuaer Associates, INC Publishers, Dunderland.
11. Jha, A.P. **'Genes and Evolution'**, John Publication, New Delhi.
12. Merrel, D.J. **'Evolution and Genetics'**, Holt, Rinchart and Winston, Inc.
13. Lull **'Organic Evolution'**.

**List of Practical Exercises for
LC-102: Biosystematics, Taxonomy and Evolution.**

1. Composition assessment of taxonomic diversity/Bio-diversity in habitat e.g. Grassland, Wetland, forest etc.
2. Equipments and Collection Methods.
3. Collection of Insects, Spreading, Pinning and Studying of Insects.
4. Study of Local Fauna Collection, Preservation of Animals.
5. Systematic studies of Animals from Protozoa to Mammals (At least five Animals from each group.)
6. Submission of Insects/Animals Collected (Compulsory.)
7. Studies on fossils, connecting links like Peripatus, Archaeopteryx, Limulus.
8. Study of Homologous Organs and Analogous Organs.
9. Excursion/Study Tour Compulsory.

Scheme of Practical Examination

LC- 102: Biosystematics, Taxonomy and Evolution.

Duration 6 Hours

Marks –50

- | | | |
|--|-------|----|
| 1. Systematic studies of Animals from
Invertebrate and Vertebrate Group (6 spots) | _____ | 18 |
| 2. Connecting Link/Fossils (2 spots) | _____ | 06 |
| 3. Collecting Equipments (2) | _____ | 10 |
| 4. Submission of Collection | _____ | 06 |
| 5. Viva Voce and Excursion Report | _____ | 05 |
| 6. Practical Record Book | _____ | 05 |

Total Marks

50

Swami Ramanand Teerth Marthwada University, Nanded

M. Sc. In Zoology, Semester System 2013-2014

Detailed Syllabus

First Semester :

Course Code: **ZOOL-103**

Title of the Paper: QUANTITATIVE BIOLOGY AND BIO-INFORMATICS

Periods: 48

Marks: 50

Quantitative Biology

UNIT -I

1. Collection of Data.
2. Classification of Data.
3. Analysis of Frequencies-
 - 3.1 Polygon Frequency Curve.
 - 3.2 Cumulative Frequency Curve (Ogive Curve).
4. Tabulation of Data.
5. Diagrammatic and Graphic Presentation of Data-
 - 5.1 Bar diagram.
 - 5.2 Histogram.
 - 5.3 Cartogram.
 - 5.4 Pie Diagram.

UNIT -II

1. Measures of Dispersion-
 - 1.1 Standard Deviation,
 - 1.2 Standard Error.
 - 1.3 Hypothesis of Testing.
2. Probability Theory-
 - 2.1 Patterns of Probability Theorems.
 - 2.2 Student 't' Test and its Applications.
 - 2.3 Chi square test and its Applications.

UNIT -III

1. Correlation Analysis.
 - 1.1 Coefficient of Correlation.
 - 1.2 Regression Analysis.
 - 1.3 Analysis of Variance (ANOVA).

Bio-Informatics

UNIT -IV

1. Computer and their Applications in Biology.
2. Operating Systems: DOS, WINDOWS.
3. Application Software: MS Word, MS Access.
4. MS Excel, Ms Power Point.
5. Internet and its uses.
6. Bioinformatics: Definition, History & Scope.
7. Analysis of DNA & Protein Sequences; Molecular & Genomic Databases
(e.g., GENE BANK, SWISS-PROT & Other Databases)
8. Introductory ideas on use of databases for sequence retrieval, similarity search and sequence alignment; post-transcriptional modification prediction.
9. Introductory ideas on Virtual Libraries: MEDLINE, Science Citation Index, Current Awareness Services, Electronic (E) Journals and Retrieval of other information related to Research and Career.
10. Bioinformatics in Drug Discovery.

Suggested Reading:

1. Batschetlet, E. '**Introduction to Mathematics for Life Scientists**' Springer-Verlag, Berling.
2. Jorgensen, S. E. '**Fundamentals of Ecological Modelling**' Elsevier, New York.
3. Swartzman, G. L. and S. P. O. Kaluzny, '**Ecological Simulation-Primer**', Macmillan, New York.
4. Lendren, D. '**Modelling in Behavioral Ecology**', Chapman and Hal, London, U. K.
5. Sokal, R. R. and F. J. Rohlf, '**Biometry**', Freeman San Francisco.
6. Snedecor, G. W. and W. G. Cochran, '**Statistical Methods**' Affiliated East- West Press, New Delhi(Indian ed.)
7. Green, R. H. '**Sampling Design and Statistical Methods for Environmental Biologists**', John Wiley and Sons, New York.
8. Murrar, J. D. '**Mathematical Biology**', Springer Verlag, Berlin.
9. Pielou, E. C. '**The Interpretation of Ecological Data: A Primer on Classification and Ordination**'.
10. P. Rama Krishnan, '**Biostatics**', Saras Publication, 2005.
11. Brown, S. M. '**Bioinformatics- A Biologists Guide to Biocomputing and Internet**' Eaton Publishing, New York, 2000.
12. Lesk, A. M. '**Introduction to Bioinformatics**', Oxford, 2002.
13. Bioinformatics - **Methods and Protocols. In: Methods in molecular Biology**, Vol.132, Humana Press, 2001.
14. Higgins & Taylor. '**Bioinformatics - Sequence, Structure and Databanks**', Oxford, 2000.
15. Baxevanis and Ouellete. '**Bioinformatics**' John Wiley & Sons, 1998.
16. Krane and Raymer, '**Fundamental concept of Bioinformatics**', Pearson Education, 2003.
17. Attwood and Parry-Smith, '**Introduction to Bioinformatics**', Pearson Education, 2003.

**List of Practical Exercises for
LC – 103: Quantitative Biology and Bio-Informatics**

1. Classification of data
 - i. Analysis of Frequencies.
 - ii. Histograms.
 - iii. Bar Diagrams.
 - iv. Polygon frequency curve.
 - v. Drawing Graphs and Tables on Computer.
2. Problems on Calculation of Standard Deviation.
 - i. Probability.
 - ii. 'T' Test.
 - iii. Chi square test.
 - iv. Hypothesis Testing
 - v. Binomial Distribution.
 - vi. Poisson Distribution.
 - vii. Normal Distribution.
3. Calculation of Coefficient of Correlation, Regression Analysis, Analysis of Variance.
4. Computer applications in statistical problems/Graphic representation/Data representation.
5. Study of Biological material based on Bioinformatics.

**Scheme of Practical Examination
LC- 103: Quantitative Biology and Bio-Informatics**

Duration 6 Hours

Marks –50

Q. 1	a) Problem on Frequency Distribution/Graphic Representation of Data. b) Problem on Probability/t-Test _____	12
Q. 2	Problem on Chi-Square Test/Regression coefficient/correlation coefficient _____	08
Q. 3	Computer applications in Graphic representation/Data representation _____	10
Q. 4	Demonstration/Applications of Bioinformatics _____	10
Q. 5	Viva-Voce _____	05
Q. 6	Practical Record Book _____	05

Swami Ramanand Teerth Marthwada University, Nanded

M. Sc.- Zoology, Semester System 2013-2014

Detailed Syllabus

First Semester :

Course Code: **ZOOL-104**

Title of the Paper: ECONOMIC ZOOLOGY AND ANIMAL BEHAVIOR

Periods: 48

Marks: 50

Economic Zoology

UNIT -I

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, Chikungunya and control of Mosquitoes.

UNIT -II

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 Food Fishes.
 - 3.2 Management of fish farm.
 - 3.3 Breeding Pond, Fish Seed, Hatching Pit, Nursery and Stocking Pond.
4. Pearl Culture-
 - 4.1 Pearl producing molluscs.
 - 4.2 Pearl formation and pearl industries.
5. Vermiculture and Vermicomposting.

Animal Behavior

UNIT -III

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

UNIT -IV

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 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.

Suggested Reading:

1. Vinod Kumar, '**Animal Behaviour**' Himalaya Publishing House, Bombay.
2. Hinde, R.A, '**Animal Behaviour: A Synthesis of Ethology and Comparative Psychology**', Mc Graw- Hill, New York.
3. Afcock, J, '**Animal Behaviour: An Evolutionary Approach**', Sinauer Assoc. Sunderland Massachsets, USA.
4. H. S. Gundevia and H. G. Singh, '**A Text Book of Animal Behaviour**', S. Chand & Company Ltd., 2001.
5. G.S.Shukla & V.B. Upadhyay, '**Economic Zoology**'.

**List of Practical Exercises for
LC- 104: Economic Zoology and Animal Behavior**

Economic Zoology

1. Study of Protozoan Parasites of Man –
 - i) *Entamoeba histolytica*, ii) *Trypanosoma*
2. Study of Parasitic helminthes –
 - i) *Schistosoma haematobium*.
 - ii) *Taenia solium*.
 - iii) *Taenia saginata*.
 - iv) *Wuchereria bancrofti*.
3. Study of –
 - i) Life cycle of Honey bee.
 - ii) Social organization of bees.
 - iii) Hive.
 - iv) Mosquitoes- Life cycle.
4. Identification of Food Fishes and Molluscs.
 - i) *Labeo rohita*.
 - ii) *Catla catla*.
 - iii) *Cirrhina mrigala*.
 - iv) *Ophiocephalus (Channa)*.
 - v) *Perna indica*.
 - vi) *Crassostrea*.
5. Visit to Fish breeding Farm.
6. Study of life cycle of Silk moth.
7. Study of Vermiculture.

Animal Behavior

8. Study of Positive and negative phototrophism.
9. Study of Parental care in Animals.
10. Study of Social organization in Insects.
11. Study of Parasitic Adaptations.
12. Study of Positive and Negative Chemotactic Response with suitable examples.
13. Righting response in crab or any other animal.

**Scheme of Practical Examination
LC- 104: Economic Zoology and Animal Behavior**

Duration 6 Hours

Marks –50

Q.1	Identification and Comments on Parasitic Protozoans / Helminthes/ Study of Life cycle of Honey Bee/Silk Worm _____	12
Q.2	Identify, describe economic importance of 3 food fishes & 1 Molluscs _____	12
Q.3	Experiment on Animal Behavior _____	10
Q.4	Identify and describe Parental Care _____	06
Q.5	Viva-Voce _____	05
Q.6	Practical Record Book & Excursion Report _____	05

Swami Ramanand Teerth Marathawada University, Nanded

Faculty of Science

M.sc. Practical Examination

Sub: Zoology

PAPER : LC101-Invertebrates: Structure and Function

LC 102-Biosystematics, Taxonomy and Evolution

Centre :.....

Batch No.:.....

Date:.....

Time : 11.00 am To 5.00 pm

Maximum Marks :-50

-
- Q.1.A) Demonstrate/Dissect crab/earthworm/cockroach so as to expose fully its (10)
digestive/ Reproductive/nervous system and leave a well labeled diagram.
- Q.1.B) Prepare a permanent micro preparation of nephridium / spermatheca of (06)
Earthworm/trachea of cockroach/gills of crab
- Q.2. Identify spots 1-2 (Invertebrate museum study) (04)
- Q.3. Comment on taxonomic grouping, characters (Invertebrate 02 spots, (15)
Vertebrate 02 spots, Connecting link/fossils 01 spots) [spots 1-5]
- Q.4.Comment on the use of collecting equipment/animal collection (05)
- Q.5. Viva-Voce (05)
- Q.7.Submission of collection and practical Record book (05)

**Note: Demonstration of animal Dissections through Models, Charts and
Computer Aided Techniques as per U.G.C Guidelines.**

Swami Ramanand Teerth Marathawada University, Nanded

Faculty of Science

M.sc. Practical Examination

Sub: Zoology

PAPER : LC103-Quantitative Biology and Bio-informatics

LC 104-Economic Zoology and Animal Behavior

Centre :.....

Batch No.:.....

Date:.....

Time : 11.00 am To 5.00 pm

Maximum Marks :-50

Q.1.A) Problem on frequency distribution/graphic representation of data (04)

Q.1.B) Problem on probability test. (04)

Q.2. Problem on Chi-square / regression co-efficient/ correlation co-efficient (08)

Q.3. Applications of bioinformatics. (04)

Q.4. Identify, comment on parasitic protozoans/helminthes/study of life cycle of honey bee/silk worm (12)

Or

Identify and describe economic importance of food fishes.

Q.5. Experiment on animal behavior (08)

Or

Study of parental care in animals

Q.6. Viva-Voce (05)

Q.7. Practical Record book and Excursion report (05)

Note: Demonstration of animal Dissections through Models, Charts and Computer Aided Techniques as per U.G.C Guidelines.

**Swami Ramanand Teerth Marathwada
University, Nanded.**



स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड.

**SYLLABUS
MASTER OF SCIENCE
ZOOLOGY
(SECOND SEMESTER)**

SEMESTER PATTERN

w.e.f. June 2014

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NANDED VISHNUPURI, NANDED (M.S.)**

Board of Studies in Zoology

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5.	Dr. Gore Ghansham Dharbaji	Member, Head & Associate Professor, Department of Zoology, Shri Sant Gadge Maharaj Mahavidyalaya, Loha Dist. Nanded Ph. No.: 09960707490
6.	Dr. Bhalerao Sudam Sakharan	Member, Head & Associate Professor, Department of Zoology, Bahirji Smarak Mahavidyalaya, Basmat Dist. Hingoli, Ph. No.: 07798001331 E-mail Id: sudambhalerao@yahoo.com

7.	Dr. G. Gyananath	Member, Professor, Department of Zoology, School of Life Science, S. R. T. M. University, Nanded Ph. No.: 09850486910
8.	Dr. Mane Anil Mahadev	Member, Associate Professor, Department of Zoology, Arts, Commerce & Science College, Shankarnagar, Tq. Biloli, Dist. Nanded Ph. No.: 09404464462 E-mail Id: anilmane531@gmail.com
9.	Dr. Patil Meena Umakant	Member, Professor, Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad Ph. No.: 09822879080 E-mail Id: patil4590@yahoo.co.in
10.	Dr. Mirza Mumtaz Baig	Member, Associate Professor, Department of Zoology, Govt. Vidharba Science Institute, Amravati Ph. No.: 09420721907 E-mail Id: mumtazbaig@gmail.com
11.	Dr. Dhonde Satish Gurunath	Member, Scientist C, Cadila Healthcare Ltd. Moraiya, Tq. Sanad, Dist. Ahmedabad Ph. No.: 08120699585 E-mail Id: satishgdhonde@zydusca

INTRODUCTION - ZOOLOGY CURRICULA

Revising and updating of the curricula is the continuous process to provide an updated education to the students at large. To ensure and have uniform curricula at U.G. and P.G Levels in different Indian Universities, U.G.C developed a model curriculum and forwarded the same all the universities in the country to serve as a base in updating their respective curricula.

The curriculum designing committee of SRTMU Nanded was constituted for zoology at UG and PG levels which consisted all the members of B.O.S. The members are specialist and experts in different areas of zoology.

For developing the final draft of curriculum, the committee took into account the U.G.C Suggestions regarding model curriculum ,total number of teaching days available in the year and guidelines given by faculty of science of SRTMU Nanded. The curriculum designing committee held a couple of meetings In which there were through and critical suggestions on the concern syllabi. After making appropriate corrections and changes,the committee accepted the final draft of syllabus.

The SRTMU Nanded is having B.Sc and M.Sc. Zoology courses designed with semester system pattern. The course content of each theory paper is divided into four units, each having number of topics and subtopics with appropriate titles and subtitles. For each topic, total number of periods required and weightage of marks is mentioned. At the end of each theory paper the list of selected reading material is provided. A list of practical exercise to be completed in the academic year is also given, paperwise question paper models are provided in the syllabus.

Objectives

- 1.) To update curricula by introducing recent advances in the subject and enable the students to face NET , SET and other competitive examination successfully.
- 2.) To create awareness among students about the latest streams of life sciences including biotechnology, tissue culture, genetic engineering.
- 3.) To improve the quality of laboratory and field work for which zoological study tours and excursions have been made compulsory so that the students can become familiar with reality of ecosystem and surrounding study.
- 4.) To prepare students to attract and develop interest in physiology , genetics , cell biology, fisheries science, toxicology so that the students can select zoology as their carrier.

**Board of Studies
Zoology
S.R.T.M.U NANDED**

Swami Ramanand Teerth Marathwada University, Nanded
M.Sc. In Zoology, Semester System : 2013-2014

COURSE CODES AND TITLES

M.Sc. Zoology SECOND SEMESTER

Paper No. / Course Code	Title of the paper	Periods / Practicals	Marks	Time duration of examination.
ZOOL. 201	Animal Ecology and Environmental Pollution	48	50	3 Hours
ZOOL. 202	Gamete Biology and Animal Development	48	50	3 Hours
ZOOL. 203	Tools and Techniques for Biology	48	50	3 Hours
ZOOL. 204	Biochemistry and Immunology	48	50	3 Hours
LABORATORY COURSE LC-201	Animal Ecology and Environmental Pollution		50	6 Hours
LABORATORY COURSE LC-202	Gamete Biology and Animal Development		50	6 Hours
LABORATORY COURSE LC-203	Tools and Techniques for Biology		50	6 Hours
LABORATORY COURSE LC-204	Biochemistry and Immunology		50	6 Hours

Practical Examination Pattern

Paper No. / Course Code	Title of the Paper	Marks	Time duration of examination.
LABORATORY COURSE LC – 201 + 202	Animal Ecology and Environmental Pollution + Gamete Biology and Animal Development	50	6 Hours
LABORATORY COURSE LC -203 + 204	Tools and Techniques for Biology + Biochemistry and Immunology	50	6 Hours

Swami Ramanand Teerth Marathwada University, Nanded

M. Sc. In Zoology, Semester System 2013-2014

Detailed Syllabus

Second Semester

Course Code: **ZOOL-201**

**Title of the Paper: ANIMAL ECOLOGY, TOXICOLOGY AND
ENVIRONMENTAL POLLUTION**

Periods: 48

Marks: 50

UNIT -I

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

UNIT -II

1. Biogeochemical Cycles and Ecosystem
 - 1.1 Carbon Cycle
 - 1.2 Nitrogen Cycle
 - 1.3 Sulphur Cycle
 - 1.4 Phosphorous Cycle
 - 1.5 Water Cycle
2. Population Ecology
 - 2.1 Characteristics of Population
 - 2.2 Population Growth
 - 2.3 Population Fluctuations and Equilibrium
 - 2.4 Population Regulation

UNIT -III

1. Introduction to Toxicology and Pollution
2. Environmental Toxicology
 - 2.1 Common Toxic Manifestations
 - 2.2 Toxic Metal Pollutants
 - 2.3 Toxic Gaseous Pollutants
 - 2.4 Toxic Inorganic and Organic Compounds
 - 2.5 Environmental Carcinogens
3. Air Pollution
 - 3.1 Introduction
 - 3.2 Composition of the Atmosphere
 - 3.3 Sources of Air Pollution
 - 3.4 Effects of Air Pollution
 - 3.5 Global Warming.
 - 3.6 Air Pollution Monitoring and Control.

UNIT -IV

1. Water Pollution
 - 1.1 Sources & effects of Water Pollution
 - 1.2 Physical and Chemical Examinations of Water
 - 1.3 Water Pollution and Diseases
 - 1.4 Waste Water Treatment Processes
 - a) Chemical Treatment and Biological Treatments
2. Noise Pollution – Sources, Effects and Control of Noise Pollution
3. Pollution by Solid Wastes.
 - 3.1 Sources and Effects

Suggested Reading:

1. Odum – ‘**Ecology**’.
2. P.D. Sharma, ‘**Ecology and Environment**’ Rastogi Publications, Meerut-250 002, India.
3. Edward J. Kormondy, ‘**Concepts of Ecology**’, Himalaya Publications House, Mumbai.
4. Mohan P. Arora, ‘**Ecology**’ Himalaya Publications House, Mumbai.
5. H. Loggen, ‘**Environmental Pollution**’ 2nd Edition, Holt Reinhort Wintson (1978).
6. APHA, ‘**Standard methods of Examinations of Water and Waste Water**’ 20th Edition (2000).
7. J. H. Seinfeld , ‘ **Air Pollution; Physical and Chemical Fundamentals**’, Mc Graw Hill, New York (1975).
8. T. N. Tiwari,V. P. Kudesia, ‘ **Noise Pollution and it’s Control**’ , Pragati Prakashan, New Delhi (1990).
9. G. R. Chatwal, M. C. Mehra, ‘ **EnvironmentaI Radiation, Thermal Pollution And Control**’ Amol Publication, New Delhi (1989).

**List of Practical Exercises for
LC- 201: Animal Ecology, Toxicology and Environmental Pollution**

1. To Study Abiotic Components i.e. P^H, Turbidity / Light Intensity / Temperature of Pond Water Ecosystem (Any Two Parameters).
2. Study of Population Growth by model assumption and problems.
3. Estimation of Carbonate or Nitrate from the soil sample.
4. Estimation of Sulphate or Phosphate in the water sample.
5. Ecological Adaptations (Any two examples from each to be studied)
 - a) Volant Adaptations.
 - b) Aquatic Animals (from fresh water and marine environment).
 - c) Desert Animals.
6. To study the effect of pollutant on heart beat on given animal (Crab/Fish/ Daphnia).
7. Estimation of Chlorides/Salinity/Hardness from given water sample.
8. Determination of LC₅₀ in relation to any toxicant in given aquatic animal.
9. Study of rate of oxygen consumption by aquatic animals under environmental stresses.

Scheme of Practical Examinations

L. C. 201 Animal Ecology and Environmental Pollution

Duration 6 Hours

Marks - 50

Q. 1	Estimation of Carbonate/Nitrate from soil sample OR estimation of sulphate or phosphate in water sample _____	10
Q. 2	Ecological adaptations _____	10
Q. 3	Effect of pollutant on heart beat on animal OR oxygen consumption by aquatic animals under environmental stress. _____	10
Q. 4	Estimation of chlorides/Salinity/hardness from water sample. _____	10
Q. 5	Viva-voce _____	05
Q. 6	Practical Record book _____	05

Swami Ramanand Teerth Marathwada University, Nanded

M. Sc. In Zoology, Semester System 2013-2014

Detailed Syllabus

Second Semester :

Course Code: **ZOOL 202**

Title of the Paper: GAMETE BIOLOGY AND ANIMAL DEVELOPMENT

Periods: 48

Marks: 50

UNIT -I

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.

UNIT -II

1) Ovarian follicular growth & differentiation

- 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, GIFT etc.
 - 4.4 Cloning of animals by nuclear transfer

5) Embryonic stem cells, renewal by stem cells, stem cell disorders: Brief Account.

UNIT -III

- 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

UNIT -IV

1. Metamorphosis
 - 1.1 Metamorphosis in amphibians & its hormonal control.
 - 1.2 Metamorphosis in insects & its hormonal control.
2. Regeneration
 - 2.1 Regeneration in invertebrate & vertebrate animals.

Suggested Readings:

1. Balinsky, B.I. **‘Introduction to Embryology’**, Saunders,
Philadelphia
2. Beril, N.J. and Karp, G **‘Developmental Biology’**
Tata McGraw Hill, New Delhi
3. Davidson, E.H. **‘Gene activity during early development’**
Academic press, New York
4. Gilibert, S.F. **‘Developmental Biology’**,
Sinaver Associated IAC; Massachusetts
5. Muthukaruppam **‘Animal Development’**
A laboratory Guide 1979 MKV Madurai.
6. Patten Foundation of Embryology
7. Suresh. C. Goel **‘Principles of Animal Developmental Biology’**
Himalaya Publishing House,
8. Vasudeo Rao **‘Developmental Biology – A Modern Synthesis’**
Oxford & IBH Pub. Co. Pvt Ltd.
9. Verma & Agarwal **‘Chordate Embryology’**.

List of Practical Exercises for LC- 202: Gamete Biology and Animal Development

1. Histological study of different stages of Gametogenesis.
2. Sperm motility and analysis.
3. Histological study of gonads of Frog/ Rat.
4. Demonstration of Reproductive system of Leech and Rat.
5. Mounting of Chick embryos of different hours (whole mount).
6. Study of permanent whole mount slides of Chick embryos of different hours.
7. Study of L.S/ T.S. of chick embryo through head and heart regions.
8. Study of Development of Frog/Embryology of Frog.
9. Studies on metamorphosis of Insect.

Scheme of Practical Examination LC- 202: Gamete Biology and Animal Development

Duration 6 Hours	Marks 50
1. Demonstration of reproductive system of Leech/Rat _____	10
2. Permanent mounting of chick embryo _____	09
3. Study of chick embryo slide (any four) _____	12
4. Study of developmental stages of frog/ insect (any three) _____	09
5. Viva-Voce _____	05
6. Practical Record Book _____	05

Swami Ramanand Teerth Marathwada University, Nanded

M. Sc. In Zoology, Semester System 2013-2014

Detailed Syllabus

Second Semester :

Course Code: **ZOOL-203**

Title of the Paper: TOOLS AND TECHNIQUES FOR BIOLOGY

Periods: 48

Marks: 50

UNIT -I

1. Importance of Tools and Techniques for Biology.
2. Principles, Working Mechanisms and Uses of Analytical Instruments –
Balances, PH Meter, Colorimeter, Spectrophotometer, Ultracentrifuge,
Densitometric Scanner, Spectrofluorometer, Chemi-illuminometer, Radioactive
Counters, Differential Scanning Calorimeter, ESR and NMR spectroscopy

UNIT -II

Microscopy:
Principles and Application of Light, Phase Contrast, Fluorescence, Scanning
and Transmission Electron Microscopy.

UNIT -III

4. Separation Techniques in Biology
 - 4.1) Molecular Separation by Chromatography, Electrophoresis, Precipitation
and HPLC.
 - 4.2) Organelle Separation by Centrifugation
 - 4.3) Cell Separation by Flow Cytometry, Density Gradient Centrifugation,
Unit Gravitational Centrifugation, Affinity Adsorption.

UNIT -IV

5. Computer Aided Techniques for Data Presentation, Data Analysis, Statistical
Techniques, Spare Software for Specific Task.

Suggested Reading:

1. Robert Braun, '**Introduction to Instrumental Analysis**', Mc Graw Hill International Editions.
2. K. Wilson and K. H. Golding, A Biologists Guide, '**Principles and Techniques of practical Biochemistry**', ELBS Editions.
3. Keith Wilson and John Walker, '**Practical Biochemistry**' (**Principles and Techniques**).
4. Mido and Satake, '**Introduction to Nuclear Chemistry**'.
5. John R. W., '**A Practical Approach- Animal Cell Culture**', IRL Press.
6. Arora M. P. and Singh, '**Nuclear Chemistry**'.

**List of Practical Exercises for
LC-203: TOOLS AND TECHNIQUES FOR BIOLOGY**

- 1 Principles and Use of different Microscopes.
- 2 Principles of Paper and Thin Layer Chromatography, Separation of Amino Acids from tissue extracts.
- 3 Principles of Electrophoresis, Separation of Proteins using Gel Electrophoresis.
- 4 Principles, Uses and Working Mechanism of High Performance Liquid Chromatography (HPLC).
- 5 Principles of Centrifugation and Sub-Cellular Fractionation (Hepatopancreas of Crab and Foot of Bivalves).
- 6 Principles of Calorimeter and Calorimetric Estimation of Protein / Glucose from Fish Gills / Hepatopancreas of Crab / Foot of Bivalves.

**Scheme of Practical Examination
LC- 203: Tools and Techniques for Biology**

Duration 6 Hours

Marks –50

Q.1.Explain principle, working and use of microscope. _____	12
Q.2.Experiment on Molecular separation by paper chromatography. _____	08
Q.3.Principal of Electrophoresis and separation of proteins using Gel Electrophoresis / HPLC. _____	10
Q.4 Estimation of protein /Glucose from Fish Gills/ Hepatopancreas of Crab____	10
Q.5 Viva-voce. _____	05
Q.6 Practical record book. _____	05

Swami Ramanand Teerth Marathwada University, Nanded
M. Sc. In Zoology, Semester System 2013-2014

Detailed Syllabus

Second Semester :

Course Code: ZOOL-204

Title of the Paper: BIOCHEMISTRY AND IMMUNOLOGY

Periods: 48

Marks: 50

Biochemistry

UNIT -I

1. 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).

UNIT -II

1. Lipid Metabolism-

- 1.1 The β Oxidation (beta oxidation) pathway.
- 1.2 Energy yield from fatty acid oxidation.
- 1.3 Oxidation of unsaturated fatty acids.
- 1.4 Control of fatty acid oxidation.
- 1.5 Ketosis, Ketolysis and Ketogenesis.

2. Fatty Acid Biosynthesis-

- 2.1 Biosynthesis of Palmitate from acetyl Co A.
- 2.2 Control of fatty acid synthesis.

3. Nitrogen Metabolism-

- 3.1 Amino acid degradation
- 3.2 Transamination, deamination and decarboxylation reactions of amino acids.
- 3.3 Disposal of Ammonia (Detoxification & Excretion) – Krebs-Henseleit Urea Cycle

Immunology

UNIT –III

1. Innate (Non-specific) Immunity.
2. Adaptive or Acquired (Specific) Immunity-
 - 2.1 Passive & Active Acquired Immunity.
3. Cells & Organs of Immune System-
 - 3.1 T- cell & T- cell receptor.
 - 3.2 T- cell maturation, activation & differentiation.
 - 3.3 B-Cell, B-cell generation, activation and differentiation.
4. Immunoglobulin:
 - 4.1 Introduction
 - 4.2 Structure of Antibody
 - 4.3 Classification, Structure and Functions of Immunoglobulin.
5. Nature of antigen & super antigens-
 - 5.1 Epitopes & haptens.
 - 5.2 Antigenicity & immunogenicity.
 - 5.3 Factors influencing immunogenicity.
 - 5.4 Antigen- antibody interaction & their applications.

UNIT -IV

1. Hypersensitivity
 - 1.1 Introduction & Factors causing Hypersensitivity.
 - 1.2 Types of Hypersensitivity.
 - 1.3 Type-I : Anaphylactic Hypersensitivity
 - 1.4 Type-II: Antibody Dependent Cytotoxic Hypersensitivity
 - 1.5 Type-III: Immune Complex Mediated Hypersensitivity
 - 1.6 Type-IV: Cell Mediated Delayed Hypersensitivity
 - 1.7 Type-V: Stimulatory Hypersensitivity
2. Cytokines-
 - 2.1 Properties of cytokines.
 - 2.2 General structure of cytokines, functions of cytokines.
3. Complement System-
 - 3.1 Complement components.
 - 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

Suggested Reading:

Biochemistry

1. Principles of Biochemistry- Lehninger, Nelson & Cox, CBS Publishers, New Delhi.
2. Biochemistry- Lubert Stryer.
3. Biochemistry- Voet D. & Voet J. G. John Wiley & Sons.
4. Text Book of Biochemistry- Devlin, T. M. John Wiley & Sons.
5. Biochemistry- Zubay, CBS Publication.
6. Fundamentals of Biochemistry- J. L. Jain, Sanjay Jain & Nitin Jain, S. Chand and Company.
7. Harpers Illustrated Biochemistry- Robert K. Murray, Daryll K. Cranner, Peter A. Mayes & Victor W. Rodwell, International Edition, LANGE- Mc Graw Hill.
8. Biochemistry- Christopher K. Mathews, K. E. Van Holde & Kelvin G. Ahern- Pearson Education.
9. Modern Experimental Biochemistry, Rodney Boyer, Pearson Education Third Edition.
10. A Biologists Guide to Principles & Techniques of Biochemistry- K. Wilson & K.H. Goulding.
11. Hawks Physiological Chemistry- B. L. Oser, Tata Mc Graw Hill Company, New Delhi.
12. Practical Biochemistry- Wilson and Walker, Cambridge.
13. Experimental Biochemistry- Clark- Swizer.

Immunology

14. Kuby Immunology- Richard A. Goldsby, Thomas J. Kindt & Barbara A. Osborne, W. H. Freeman & Company, New York.
15. Essential Immunology- Roitt I. M., ELBS Edition.
16. Fundamentals of Immunology- Paul W.
17. Modern Immunology- Das Gupta.
18. Immunology & Serology- Carpenter.
19. The Immune System- Hobert & Mc Cornel.
20. Practical Immunology- Hay & Hudson.
21. Immunology- Donald M. Weir & John Stewart, ELBS Publication.
22. Practical Immunology- Volume I & II, Talwar and Gupta.

List of Practical Exercises for LC- 204: Biochemistry and Immunology

Biochemistry

1. Determination of Glycogen/ Glucose.
2. Determination of Lipids/ Cholesterol.
3. Separation of serum proteins /tissue proteins by Electrophoresis.
4. Estimation of SDH & LDH activity.
5. Estimation of free amino acids / Proteins/Urea/Uric Acid.
6. Estimation of an Enzyme – Amylase, Protease, Acetylcholine Esterase (AchE) activity
(Any one).

Immunology

7. Identification of Blood Groups: A, B, AB, O with Rh factor.
8. Separation of Proteins (alpha, beta, gamma) by Paper / Gel Electrophoresis.
9. Differential Leucocytes Count (DLC).
10. Study of Histological Structure of Lymphoid Organs – Spleen, Lymph Node, Thymus.
11. Preparation and Observation of Bone Marrow Smear.
12. ELISA (Enzyme Linked Immuno Sorbent Assay).

Scheme of Practical Examination
LC- 204: Biochemistry and Immunology

Duration 6 Hours

Marks -50

Q1. Biochemistry Experiment _____ 10 Marks

Q2. Biochemistry Experiment _____ 10 Marks

Q3. Immunology Experiment _____ 10 Marks

Q4. Immunology Experiment _____ 10 Marks

Q5. Viva-voce _____ 05 Marks

Q6. Practical Record Book _____ 05 Marks

Total Marks - 50 Marks

Swami Ramanand Teerth Marathawada University, Nanded
Faculty of Science
M.sc. Practical Examination
Sub: Zoology
PAPER : LC201-Animal Ecology and Environmental Pollution
LC 202-Gamete Biology and Animal Development

Centre :.....

Batch No.:.....

Date:.....

Time : 11.00 am To 5.00 pm

Maximum Marks :-50

-
- Q.1. Estimation of Chlorides/ Salinity/ hardness from water sample (10)
Or
Estimation of carbonates or nitrates from soil sample
Or
Estimation of sulphate or phosphate in water sample
- Q.2. To study the effect of pollutant on heart beat of given animal. (10)
Or
Oxygen consumption by aquatic animal under environmental stress
- Q.3. Demonstrate leech/rat so as to expose/Sketch its reproductive system and leave a well labeled diagram. (10)
- Q.4 Comment on spots 1 to 5.(Ecological adaptations, histological study of gonads of frog/rat, chick embryos of different hours ,developmental stages of frog/insects (10)
- Q.6. Viva-Voce (05)
- Q.7. Practical Record book (05)

Note: Demonstration of animal Dissections through Models, Charts and Computer Aided Techniques as per U.G.C Guidelines.

Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science
M.sc. Practical Examination
Sub: Zoology
PAPER : LC203-Tools and Techniques for Biology
LC 204-Biochemistry and Immunology

Centre :.....

Batch No.:.....

Date:.....

Time : 11.00 am To 5.00 pm

Maximum Marks :-50

-
- | | |
|--|------|
| Q.1 Experiment on molecular separation by paper chromatography | (10) |
| Q.2.A) Explain principle, working and use of microscope /centrifugation /HPLC /
Colorimeter /Electrophoresis | (05) |
| Q.2.B) Estimation of protein /glucose from locally available animal tissue | (05) |
| Q.3.Estimation of glycogen/lipids/cholesterol/SDH & LDH activity/glucose/free
Amino acid /urea/uric acid/enzyme activity from locally available animal tissue | (10) |
| Q.4. Identification of blood groups with Rh factor/ Differential Leucocytes Count/
Histological Study of Lymphoid Organs | (10) |
| Q.5. Viva-Voce | (05) |
| Q.6. Practical Record | (05) |
-

**Note: Demonstration of animal Dissections through Models, Charts and
Computer Aided Techniques as per U.G.C Guidelines.**