

**Swami Ramanand Teerth Marathwada University,
Nanded**



SYLLABUS

B.Sc. Third Year

ZOOLOGY

SEMESTER PATTERN

(2013-2014)

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

Board of Studies in Zoology

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

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**B.SC.III YEAR
SEMESTER PATTERN
ZOOLOGY SYLLABUS
(ECOLOGY, ZOOGEOGRAPHY, ETHOLOGY, BIOMETRY AND BIOINFORMATICS)**

SEMESTER- V

SR.NO.	PAPER NO.	TITLE OF THE PAPER	PERIODS	MARKS
1.	PAPER-XII THEORY	ECOLOGY AND ZOOGEOGRAPHY	45	40
2.	INTERNAL -- MCQ/PROJECT WORK	--	--	10
TOTAL MARKS:				50

SEMESTER- VI

SR.NO.	PAPER NO.	TITLE OF THE PAPER	PERIODS	MARKS
1.	PAPER-XIV THEORY	ETHOLOGY, BIOMETRY AND BIOINFORMATICS	45	40
2.	INTERNAL -- MCQ/PROJECT WORK	--	--	10
TOTAL MARKS:				50

SEMESTER- V & VI

SR. NO.	PAPER NO.	TITLE OF THE PAPER	PERIODS	MARKS
1.	PRACTICAL PAPER- XVI	ECOLOGY, ZOOGEOGRAPHY ETHOLOGY, BIOMETRY AND BIOINFORMATICS	15	50
TOTAL MARKS:				50

TOTAL MARKS: 150

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

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**B.SC.III YEAR
SEMESTER PATTERN
ZOOLOGY SYLLABUS
(AQUACULTURE & PISICULTURE)**

SEMESTER- V

SR.NO.	PAPER NO.	TITLE OF THE PAPER	PERIODS	MARKS
1.	PAPER-XIII (A) THEORY	AQUACULTURE	45	40
2.	INTERNAL -- MCQ/PROJECT WORK	--	--	10
TOTAL MARKS:				50

SEMESTER- VI

SR.NO.	PAPER NO.	TITLE OF THE PAPER	PERIODS	MARKS
1.	PAPER-XV (A) THEORY	PISICULTURE	45	40
2.	INTERNAL -- MCQ/PROJECT WORK	--	--	10
TOTAL MARKS:				50

SEMESTER- V & VI

SR.NO.	PAPER NO.	TITLE OF THE PAPER	PERIODS	MARKS
1.	PRACTICAL PAPER-XVI (A)	AQUACULTURE & PISICULTURE	15	50
TOTAL MARKS:				50

TOTAL MARKS: 150

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

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**B.SC.III YEAR
SEMESTER PATTERN
ZOOLOGY SYLLABUS
(PARASITOLOGY)**

SEMESTER: V

SR. NO.	PAPER NO	TITLE OF THE PAPER	PERIODS	MARKS
01	PAPER-XIII B (THEORY)	PARASITOLOGY - I	45	40
02	INTERNAL -- MCQ/PROJECT WORK			10
TOTAL MARKS: 50				

SEMESTER: VI

SR. NO.	PAPER NO	TITLE OF THE PAPER	PERIODS	MARKS
01	PAPER-XV B (THEORY)	PARASITOLOGY - II	45	40
02	INTERNAL -- MCQ/PROJECT WORK			10
TOTAL MARKS: 50				

SEMESTER: V AND VI

SR. NO.	PAPER NO	TITLE OF THE PAPER	PERIODS	MARKS
01	PRACTICAL PAPER-XVII B	PARASITOLOGY-I & II PRACTICAL	15	50
TOTAL MARKS: 50				

TOTAL MARKS: 150

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

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**B.SC.III YEAR
SEMESTER PATTERN
ZOOLOGY SYLLABUS
(ENTOMOLOGY)**

SEMESTER: V

SR.NO.	PAPER NO	TITLE OF THE PAPER	PERIODS	MARKS
01	PAPER-XIII C (THEORY)	ENTOMOLOGY- I	45	40
02	INTERNAL -- MCQ/PROJECT WORK			10
TOTAL MARKS: 50				

SEMESTER: VI

SR.NO.	PAPER NO	TITLE OF THE PAPER	PERIODS	MARKS
01	PAPER-XV C (THEORY)	ENTOMOLOGY- II	45	40
02	INTERNAL -- MCQ/PROJECT WORK			10
TOTAL MARKS: 50				

SEMESTER: V AND VI PRACTICAL

SR.NO.	PAPER NO	TITLE OF THE PAPER	PERIODS	MARKS
01	PRACTICAL PAPER-XVII C	ENTOMOLOGY-I & II PRACTICAL	15	50
TOTAL MARKS: 50				

TOTAL MARKS: 150

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

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**B.SC.III YEAR
SEMESTER PATTERN
ZOOLOGY SYLLABUS
(ENVIRONMENTAL BIOLOGY)**

SEMESTER: V

SR. NO.	PAPER NO	TITLE OF THE PAPER	PERIODS	MARKS
01	PAPER-XIII D (THEORY)	ENVIRONMENTAL BIOLOGY - I	45	40
02	INTERNAL -- MCQ/PROJECT WORK			10
TOTAL MARKS: 50				

SEMESTER: VI

SR. NO.	PAPER NO	TITLE OF THE PAPER	PERIODS	MARKS
01	PAPER-XV D (THEORY)	ENVIRONMENTAL BIOLOGY – II	45	40
02	INTERNAL -- MCQ/PROJECT WORK			10
TOTAL MARKS: 50				

SEMESTER: V AND VI PRACTICAL

SR. NO.	PAPER NO	TITLE OF THE PAPER	PERIODS	MARKS
01	PRACTICAL PAPER-XVII D	ENVIRONMENTAL BIOLOGY –I & II PRACTICAL	15	50
TOTAL MARKS: 50				

TOTAL MARKS: 150

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
B.Sc. III Year
Zoology

Semester -V

Paper: **XII**

Title of the Paper: **Ecology & Zoogeography**

Periods : 45

Marks : 40

UNIT – I ECOLOGY

12

1. Introduction to ecosystem

- 1.1. Components of an ecosystem
 - a) Abiotic components – Temperature & Water
 - b) Biotic components – Producers, Consumers & Decomposers.
- 1.2. Pond ecosystem
- 1.3. Desert ecosystem

2. Spheres of Earth

- 2.1. Atmosphere
- 2.2. Lithosphere
- 2.3. Hydrosphere
- 2.4. Biosphere
- 2.5. Ecological Succession- Hydrarch and Xerarch

3. Bio-geochemical Cycles

- 3.1. Carbon Cycle
- 3.2. Oxygen Cycle

UNIT – II ECOLOGY

11

4. Population Ecology –

Characteristics of Population

- 4.1 Natality
- 4.2 Mortality
- 4.3 Population density
- 4.4 Age distribution
- 4.5 Population Growth Form

5. Biotic interactions

- 5.1 Positive interactions – Commensalism, Mutualism
- 5.2 Negative interactions – Competition, Predation, Parasitism

UNIT – III ECOLOGY

11

6. Pollution – Sources, Effects and Control

- 6.1 Air Pollution
- 6.2 Water Pollution

6.3 Noise Pollution

7. Energy Resources

7.1 Conventional energy resources and their limitations

7.1.1 Fossil fuels

7.1.2 Nuclear power

7.1.3 Hydel power

7.2 Non-conventional energy resources – Advantages, Limitations & Latest developments

7.2.1 Solar energy

7.2.2 Wind energy

7.2.3 Tidal energy

7.2.4

UNIT – IV ZOOGEOGRAPHY AND ECOLOGICAL ADAPTATIONS

11

4. Wildlife conservation and endangered species

4.1 Aims & necessity of wildlife conservation

4.2 Wild life and Endangered species of India

4.3 Measures to protect endangered species

5. Zoogeographical Realms –

Physical features and fauna

5.1 Australian realm

5.2 Indian / Oriental realm

10. Ecological Adaptations

10.1 Ecological adaptations of animals in Aquatic habitat.

10.2 Ecological adaptations of animals in Desert habitat.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED.

B.Sc. III Year

Zoology

Semester -V

Paper: XIII (A)

Title of the Paper: **Applied Zoology- Aquaculture**

Periods : 45

Marks : 40

UNIT- I

11

1. Introduction to aquaculture

- i) Definition, Scope and importance of aquaculture
- ii) Concepts of extensive, intensive.

2. Types of aquaculture

- i) Monoculture
- ii) Polyculture
- iii) Integrated fish farming –
 - a) Paddy cum fish culture
 - b) Fish-cum pig farming
 - c) Cattle-cum fish farming
 - d) Fish-cum duck farming

UNIT – II

11

3. Culture methods

- i) Pen culture
- ii) Cage culture

4. Sewage fed fish culture

- i) Composition of sewage
- ii) Use in culture
- iii) Fish species suitable for sewage fed fishery

5. Man Made Hazards and Aquaculture

- i) Domestic Sewage
- ii) Agricultural Sewage
- iii) Industrial Effluents

UNIT- III

12

6. Aquatic weeds and their control

- i) Types of weeds
- ii) Advantages and Disadvantages of weeds
- iii) Weed Control – Manual, Mechanical, Chemical and Biological

7. Culture of Non Fish Organisms

- i) Fresh water prawn Culture
- ii) Pearl Oyster Culture
- iii) Edible Oyster Culture

UNIT - IV

11

8. Characteristics of water

- i) Physical properties of water

- ii) Chemical properties of water
- iii) Biological properties of water

9. Aquarium keeping-

- i) Construction of Aquarium
- ii) Setting up of Aquarium
- iii) Maintenance of Aquarium
- iv) Significance of Aquarium keeping
- v) Aquarium fishes

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED.

B.Sc. III Year

Zoology

Semester -V

Paper: **XIII (B)**

Title of the Paper: **Applied Parasitology (Parasitic Protozoa and Platyhelminthes)**

Periods : 45

Marks : 40

Unit -I – Parasitic Protozoa:

11

1. Introduction, Scope and Branches of Parasitology
2. Definition, Host Parasite, Vector, Parasitism
3. Classification and general organization of parasitic protozoa
4. Geographical distribution, morphology, life-cycle, pathogenicity and control measures of
 - i) *Trypanosoma gambiense*
 - ii) *Giardia intestinalis*
 - iii) *Trichomonas vaginalis*

Unit – II

12

1. Types of Parasite-Ectoparasite, endoparasite and their subtypes
2. Types of Host – Intermediate and Definitive Host, Parratenic, reservoir
3. Geographical distribution, morphology, life-cycle, pathogenicity and control measures of
 - i) *Balantidium coli*
 - ii) *Entamoeba histolytica*
 - iii) *Entamoeba coli*
 - iv) *Sarcocystis cruzi*
 - v) *Eimeria tenella*

Unit – III

11

1. Parasitic platyhelminthes – Introduction.
2. General organization of Trematodes and Cestodes.
3. Geographical distribution, morphology, life-cycle, Pathogenicity and control measures of –
 - i) *Taenia saginata*.
 - ii) *Echinococcus granulosus*
4. Reproductive organs of Trematodes and Cestodes - Comparative account.

Unit – IV

11

1. Geographical distribution, morphology, life-cycle, Pathogenicity and control measures of –
 - i) *Schistosoma haematobium*.
 - ii) *Paragonimus westermani*.
 - iii) *Gastrodiscoides hominis*.
2. Parasitic adaptations in Trematodes and Cestodes.
3. Host- Specificity.
4. Larval forms in Trematodes and Cestodes.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED.
B.Sc. III Year
Zoology
Semester -V

Paper: **XIII (C)**

Title of the Paper: **Applied Zoology (Entomology-I)**

Periods : 45

Marks : 40

UNIT –I **06**

1) Introduction:

- 1.1 Definition, importance and scope of entomology
(Agriculture, Forest, Medical, Forensic and Industrial)
- 1.2 General characters of class insecta
- 1.3 Methods of insect collection, preservation and study of insects.

UNIT -II **15**

2) Type study: Cockroach

- 2.1 Classification, External Morphology
- 2.2 Digestive system
- 2.3 Respiratory system
- 2.4 Nervous system
- 2.5 Reproductive system

UNIT –III **12**

3) Insect Taxonomy

- 3.1 Salient features with suitable examples of following orders:
- a) Thysanura
 - b) Orthoptera
 - c) Odonata
 - d) Diptera
 - e) Isoptera
 - f) Hymenoptera
 - g) Lepidoptera Coleoptera

UNIT –IV **12**

4) Insect Metamorphosis-

- 4.1 Definition and Types of Metamorphosis
Ametabola, Hemimetabola, Parametabola and Hypermetabola.
- 4.2 Hormonal control of metamorphosis in insect.
- 4.3 Insect ecology: Effect of light temperature, humidity and food on insect life.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED.

B.Sc. III Year

Zoology

Semester -V

Paper: **XIII (D)**

Title of the Paper: **Applied Zoology -Environmental Biology - I**

Periods : 45

Marks : 40

Unit-I **12**

1. Introduction in Biology-

1.1 Atmosphere: Structure and composition

1.2 Hydrosphere: Physico-chemical properties of water

1.3 Lithosphere: Soil profile and process of soil formation

2. Biogeochemical Cycles

2.1 Hydrological Cycle

2.2 Nitrogen Cycle

2.3 Carbon Cycle

2.4 Sulphur Cycle

Unit: II **11**

3. Ecosystem

3.1 Concept and components

3.2 Energy flow in ecosystem

3.3 Ecological pyramids

3.4 Food chains and Food web

4. Marine Ecosystem-

4.1 Zonation in-

a) Marine habitat

b) Intertidal habitat

Unit – III **11**

5. Biodiversity-

5.1 Importance of biodiversity

5.2 Threats to biodiversity, habitat loss, poaching of wild life “Man Wildlife Conflict”

5.3 Biodiversity of India

5.4 Biodiversity conservation

i) Ex-Situ conservation

ii) In-Situ conservation

Unit-IV **11**

6. Wild life and its conservation-

6.1 Aims of Wild life Conservation

6.2 Management and Conservation of wild life

6.3 Sanctuaries and Zoological Parks in Maharashtra

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

B.Sc. III Year

Zoology

Semester- VI

Paper: XIV

Title of the Paper: **Ethology, Biometry and Bioinformatics**

Periods : 45

Marks : 40

UNIT – I Ethology **06**

1. Classification of Animal Behavior-

- 1.1. Inborn or stereotyped animal behavior – Taxis and Instincts with examples.
- 1.2. Acquired animal behavior – Imprinting, Conditioning, Habituation, Reasoning.
- 1.3 Social Behaviour in Insects –Honeybee.

UNIT – II Ethology **12**

2. Communication in animals

- 2.1 Auditory Communication
- 2.2 Chemical Communication
- 2.3 Visual Communication
- 2.4 Tactile Communication

3. Mimicry and Colouration

Introduction and Types of Mimicry- Protective, Conscious and Aggressive
Introduction and Types of Colouration- Protective, Aggressive and Warning

UNIT – III Biometry **15**

4. Collection and Classification of Data

- 4.1 Types of data - Geographical, Chronological, Quantitative, Qualitative, Continuous, Discontinuous.
- 4.2 Methods of collection of data

5. Measures of Central Tendency

- 5.1. Arithmetic Mean, Median and Mode
- 5.2. Measures of Variability – Standard Deviation & Standard Error

6. Graphic Representation of Data

- 6.1 Histogram
- 6.2 Pie Diagram
- 6.3 Polygon Frequency Curve

UNIT – IV Bioinformatics **12**

- 7.1 Computer and their Applications in Biology
- 7.2 Internet and its uses
- 7.3 Search engines.
- 7.4 World wide web
- 7.5 Introduction to Bioinformatics.
- 7.6 Applications of Bioinformatics
- 7.7 Introduction to Biological Database
 - a) NCBI
 - b) Pub Med

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

B.Sc. III Year

Zoology

Semester- VI

Paper: XV (A)

Title of the Paper: **Pisciculture**

Periods : 45

Marks : 40

UNIT I

11

1. Fish farm engineering

- 1.1 Topography
- 1.2 Soil type
- 1.3 Water supply
- 1.4 Layout of fish farm

2. Fish farm management

- 2.1 Preparation and Management of Nursery pond
- 2.2 Preparation and Management of Rearing pond
- 2.3 Preparation and Management of Stocking Pond

UNIT II

11

3. Biology of Indigenous and Exotic carps.

4. Fish seed resources

- 4.1 Natural resources- Riverine resources
- 4.2 Artificial resources- Induced breeding by Hypophysation
 - a) Historical back ground
 - b) Technique of Induced breeding
 - c) Recent trends in induced breeding
 - d) Bundh breeding
 - e) Chinese hatchery
 - f) Striping method
- 4.3 Transportation of fish seed and brooders

UNIT III

12

5. Fishing Methods

- 5.1 Gears - Traps, Gill nets, Cast nets, Drag nets
- 5.2 Crafts - Masula, Catamaran, Odum, Vanchi
- 5.3 Recent advances in fishing methods - Electrical Fishing, Light Fishing and Fish finder

6. Fish Diseases

- 6.1 Parasitic Diseases – Symptoms and Treatment
 - a) Fungal- Gillrot
 - b) Protozoan- Costiasis, Ichthyophthirius
 - c) Helminth- Gyrodactylosis, Dactylogyrosis
 - d) Arthropod- Lernaeasis, Argulusis
 - e) Bacterial- Dropsy, Furunculosis, Tailrot or Finrot
- 6.2 Non parasitic diseases-

- a) Environmental fish diseases- Acidosis, Alkalosis, Gas bubble
- b) Nutritional / Dietary diseases

UNIT IV

11

7. Fish preservation and processing

- a) Causes of spoilage of fish
- b) Methods of fish preservation –
Chilling, Freezing, Freezing-drying, Smoking, Drying, Salting and Canning

8. Fish by products

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
B.Sc. III Year
Zoology
Semester- VI

Paper: XV (B)

Title of the Paper: **Applied Parasitology-II: Parasitic Nematodes and Arthropods**

Periods : 45

Marks : 40

UNIT –I **11**

Parasitic Nematodes

1. Parasitic nematodes – Introduction, Classification.
2. General organization of parasitic nematodes.
3. Geographical distribution, morphology, life-cycle, pathogenecity and control measures of –
 - i) *Enterobius vermicularis*
 - ii) *Ancylostoma duodenale*.
4. Larval forms in Nematodes.

UNIT – II **11**

1. Geographical distribution, morphology, life-cycle, pathogenecity and control measures of –
 - i) *Wuchereria bancrofti*.
 - ii) *Dracunculus medinensis*.
 - iii) *Trichinella spiralis*.
2. Parasitic adaptations in Nematodes.

UNIT – III **12**

Parasitic Arthropodes

1. Morphology, life-cycle, diseases and control measures of –
 - i) Ticks.
 - ii) Mites.
2. Parasitic flies (Any four)
3. Mosquitoes as a vector in the transmission of Malaria, Dengue fever, Elephantiasis, Yellow Fever, Chikungunia and their control measures.
4. Parasitic Hemiptera – *Cimex lacturalis*.

UNIT – IV **11**

1. Introduction to parasitic insects
2. Insect Control Method
 - i) Chemical Control
 - ii) Biological Control
3. Morphology, pathogenecity and control measures of –
 - i) *Siphonaptera* ii) *Anopleura* iii) *Mallophaga* iv) *Hymenopter*

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

B.Sc. III Year

Zoology

Semester- VI

Paper: XV (C)

Title of the Paper: **Entomology-II**

Periods : 45

Marks : 40

UNIT- I **12**

1. Pest

1.1 Definition

1.2 Types of Pests (Agricultural, Veterinary and Medical Pests)

2. Study of Agriculture Pests (classification bionomics, control measures of the following)-

a) Cotton-Boll worm, red cotton bug

b) Jawar-stem borer, Midge fly

c) Sugarcane- Pyrila

d) Oil seeds – ground nut White grub, Safflower-aphid

e) Fruits- Lemon butter fly, Mango Stem borer, mango stone weevil

f) Stored grain pest- Rice weevil, Pulse Beetle

UNIT- II **11**

3. Household and human insect pest: Structure, Binomics and control measures of-

a) Housefly

b) Mosquito

c) Rat flea

d) Bed bug

e) Head louse

4. Study of non-insect animal pests and their control-

a) Rat

b) Pig

c) Monkey

d) Birds

e) Deer

UNIT- III **11**

5. Insect Culture (Gross Study)-

a) Sericulture

b) Apiculture

c) Lac culture

UNIT- IV **11**

6. Insect control methods-

a) Chemical control and safe handling of pesticides

b) Biological control

c) Physical and Mechanical control

d) Integrated pest control of insects

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

B.Sc. III Year

Zoology

Semester- VI

Paper: **XV (D)**

Title of the Paper: **Environmental Biology -II**

Periods : 45

Marks : 40

UNIT- I **11**

1. Introduction to Environmental Pollution-

- 1.1 Biodegradable and Non- Biodegradable Pollutants
- 1.2 Water Pollution: Sources and Effects
- 1.3 Pollution by Sewage and Domestic Waste Eutrophication and Algal blooms
- 1.4 Pollution by Heavy Metals; Sources and Effects of Lead and Mercury

UNIT- II **12**

2. Air Pollution: Sources and Effects of Major Air Pollutants-

- 2.1 Thermal Power Plants, Industrial Chimney Waste, Automobile Exhausts
- 2.2 Sulphate compounds as Air pollutants: Sources and Effects
- 2.3 Oxides of Nitrogen as Air pollutants: Sources and Effects
- 2.4 Carbondioxide and Carbon Monoxide as Pollutant: Sources and effects
- 2.5 Acid rains
- 2.6 Ozone as a Protector and Destroyer
- 2.7 Chlorofluoro Carbons (CFCs)
- 2.8 Photochemical Smog

UNIT-III **11**

3. Environmental Pollution

- 3.1 Radioactive Pollution: Sources and Effects
- 3.2 Pollution by Solid Wastes
- 3.3 Noise Pollution: Sources and Effects

UNIT-IV **11**

4. Pollution Control Legislation

- 4.1 Environmental Protection Act 1986
- 4.2 Environmental Education in India
- 4.3 Water Resources: Infiltration, Gallflies and Wells
- 4.4 Water Treatment Methods: Sedimentation Tank, Aerobic Treatment, Trickling Filters, Anaerobic Treatments, Imhoff Tanks

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

B.Sc. III Year

Zoology

Practical Syllabus

Semester- VI

Paper: **XVI**

Title of the Paper: **Ecology, Zoo-geography**

Ethology, Biometry and Bioinformatics

Marks : 50

1. To study the Positive and Negative Phototropism with suitable examples.
2. To study the Positive and Negative Chemotactic Response with suitable examples.
3. Study of Colouration of animals with suitable examples.
4. Estimation of Dissolved O₂ from Water Sample.
5. Estimation of Dissolved CO₂ from Water Sample.
6. Estimation of Chlorides & Salinity from Water Sample.
7. Museum study of Vertebrate Endangered Species on the Basis of charts/ models/ photographs (Any Five)
8. Determination and study of Atmospheric Humidity.
9. Study of positive and negative interactions (biotic interaction) in animals.
10. To Study the ecological adaptations of Aquatic and Desert animals.

Biometry

1. Problems Based on Mean, Mode, Median, Standard Deviation, Standard Error.
2. Classification of Data- i) Histogram, ii) Pie-Diagram, iii) Polygon Frequency Curve.

Bioinformatics

1. To show the search engines
2. To show the website of biological material
3. How to access the biological data from NCBI and Pub Med.

Note: All animal based practicals should be conducted with the help of Models, Charts and Computer Aided Techniques

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
B.Sc. III Year
Zoology
Practical Question Paper Pattern
Semester- VI

Paper: XVI

Title of the Paper: (Ecology, Zoo-geography, Ethology, Biometry and Bioinformatics)

Time- 4 Hrs **Marks : 50**

- Q.1.) Estimation of dissolve O₂ / CO₂ from the given water sample. 08
- Q.2.) Estimation of Chlorides / Salinity from the given water sample. 08
OR
Show any two search engines .
- Q.3.) To determine the atmospheric humidity. 08
OR
To study the positive and negative phototropism/ chemotactic response with suitable examples.
OR
Study of colouration of animals with suitable examples.
OR
By using internet, display any website related to biological material
- Q.4.) Identify and describe. 10
(Any two endangered species, any two examples of biotic interaction and one example of Ecological adaptation).
- Q.5.) Give the diagrammatic representation of data with Histogram / Pie-Diagram. 08
OR
Solve any two problems based on Mean / Mode / Median / Standard Deviation/ Standard Error
OR
To show the biological database (NCBI and PubMed.)
- Q.6.) Record Book. 04
- Q.7.) Viva-voce. 04

Note: Demonstration of animal Dissections Should be through Models, Charts and Computer Aided Techniques

REFERENCE BOOKS (BASED ON XII & XIV):

- 1) Animal Behaviour- M.P. Arora, Himalaya publication.
- 2) Animal Behaviour- Vinod Kumar, Himalaya publication.
- 3) Principles of Ecology-Odum, Sunder Publication.
- 4) Introduction to Bioinformatics- S. Sundara Rajan, R. Balaji, Himalaya Publication.
- 5) Animal Behaviour- Arumugam, Saras Publication.
- 6) Evolution & Biostatistics- N. Arumugan, Saras Publication.
- 7) Biostatistics- S.P. Gupta
- 8) Ecology- Arumugam, Saras Publication.
- 9) Economic Zoology, Biostatistics and Animal Behaviour- Shukla, Mathur, Prasad, Upadhyay.
- 10) Animal Behaviour, Concept, Process and Method (Wadsworth)- Drickamer & Vessey.
- 11) Biology of Animal Behaviour- Grier
- 12) Introduction to Ethology (Plenum Press)- Immelmann
- 13) The Foundation of Ethology – Lorenz
- 14) An Introduction to Animal Behaviour- Manning
- 15) Animal Behaviour in Laboratory and Fields- Prince and Stoker
- 16) Ecology, Individuals, Populations and Communities-Begonm, J. L.
(BlackWell Science, Oxford, UK)
- 17) Ecological Concept- Cherrett J. M. (BlackWell Science, Oxford, UK)
- 18) Fundamental of Ecological modeling-Jorgensen S.E. (Elsevier, New York)
- 19) Animal Behaviour- A synthesis of ethology and comparative Psychology- Hinde R.A.
(Mcgraw-Hill New York)
- 20) Bioinformation- A Biologist Guide to Biocomputing & Internet- Brown,
S.M. Eaton Publication New York
- 21) Fundamental Concept of Bioinformation- Krane & Raymer, Persons Education, 2003
- 22) Introduction to Bioinformation – Attwood & Parry- Smith, Persons Education, 2003

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
NANDED
B.Sc. III Year
Zoology
Practical**

Semester- VI

Paper: **XVII (A)**

Title of the Paper: **Aquaculture and Pisciculture**

Time- 4 Hrs

Marks : 50

1. Identification of Indigenous and exotic carps.
2. Identification of Phytoplankton (any five).
3. Identification of Zooplanktons (any five).
4. Study of aquatic weeds (any five).
5. Estimation of pH in water sample.
6. Estimation of hardness (magnesium and calcium) in water Sample.
7. Estimation of turbidity in water sample.
8. Examination of Stomach contents of two types (Carnivorous and Herbivorous) fishes to study feeding habits.
9. Identification of Fishing Crafts and Gears (Model) (three each).
10. Study of Fish Parasites (any three).
11. Dissection of brain, pituitary gland, reproductive system and digestive system of any locally available bony fish.
12. Study of fish by-products (any three).
13. Study of fingerlings (Indian major carps and exotic carps).
14. Construction of aquarium.
15. Study of aquarium accessories (any five).
16. Identification of Aquarium Fishes (any five).
17. Visit to Fish Breeding Farm.
18. Submission of excursion report.

**Note: Demonstration of animal Dissections Should be through Models, Charts and
Computer Aided Techniques**

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
NANDED
B.Sc. III Year
Zoology
Practical Question Paper Pattern
Semester- VI**

Paper: **XVII (A)**

Title of the Paper: **Aquaculture and Pisciculture**

Time- 4 Hrs

Marks : 50

Q1. Dissect out/Demonstrate Brain, Pituitary Gland, reproductive system and digestive system of any locally available bony fish. 12

OR

Examine Stomach Contents of Given Fish and comment on its Feeding habits.

Q2. Estimate pH/Hardness/Turbidity from the given Water Sample. 10

Q3. Identify and describe phytoplankton and Zooplankton. (any three) 09

OR

Identify and describe Aquatic Weeds (any three)

OR

Identify and describe Gears / Crafts / Fish Parasites. (One from each group)

Q4. Identify and Describe Fresh Water Fishes / Aquarium Fishes / Aquarium accessories. 09
(One from each group)

Q5. Excursion Report. 05

Q6. Record Book and Viva–Voce. 05

Note: Demonstration of animal Dissections Should be through Models, Charts and Computer Aided Techniques

REFERENCE BOOKS (BASED ON XII-A & XV-A):

1. Fish and fisheries of India- Jhingran.
2. Fresh water fish pond culture and management – Marilyn Chakroff.
Pace crops scientific publishers – Jodhapur.
3. World fish farming cultivation and Economics- E. E. Brown Pvt. Pub. Co. U. S. A. 1983.
4. Aquaculture – Bardach J. E. J. H. Ryther and W.O. Meharney Wiley – Ind. Sci., New York.
5. Aquaculture- R. J. Reay – Arnold- Heive Mann Publishers, India,
6. An Introduction to fishes – S. S. Khanna, Central Book Dept., Allahabad.
7. A Manual of fresh water aquaculture – R. Sonthanam, N. Sukumaran & P. Niligajan.
8. A text book of fishery science and Indian fisheries –C. B. C. Shrivastav
Kitalb Mahal, Nagpur.
9. Principles of Ecology- P.S. Verma, V.K. Agrawal- S.Chand Publication.
10. Elements of Ecology – N. Arumugam, Saras Publication, Nagracoil, Kanyakumari.
11. Prawn and Prawn fisheries of India- Kurian C. V. and Substian.
12. Fish Biology and Indian Fisheries- R. P. Parihar, Central Publishing House, Allahabad.
13. Encyclopedia of fishes and fisheries of India- Pandey A. K. and Sandhu.
14. Fisheries in India- Misra S.B.
15. Fisheries Global Perspective – Cherunilam.
16. Fish and fish products – Winton A. L.
17. Pond & fish culture - Hall C. B.
18. Fishes – Chand Mary
19. Fishery Management – Agrawal.
20. Costal Aquaculture in India- Santhanam R.
21. Marine Fisheries of India- VirbhadraRao and Bal.
22. Introduction to fish technology- Regenstein.
23. Fresh water fish culture- Wankhede and Deshmukh.
24. Aquaculture Development- Amitabh Patel, S. N. Pathak.
25. A Text book of Aquaculture- Rao K. R. S. S., Reddy M.S., Discovery Publication, Delhi.
26. A Text Book of Pisciculture & Aquarium Keeping- H. S. Jagtap, S. N. Mukherjee & V. K. Garad., Daya Publishing House, New Delhi.
27. Practical Manual of Pisciculture and Aquarium Keeping- H. S. Jagtap, S. N. Mukherjee & S. S. Nanware, Daya Publishing House, New Delhi.

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
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B.Sc. III Year
Zoology
Practical**

Semester- VI

Paper: **XVII (B)**

Title of the Paper: **Applied Zoology: Parasitology**

Time- 4 Hrs

Marks : 50

1. Identification, classification and description of permanent slides of -

- i) *Trypanosoma*
- ii) *Balantidium coli*
- iii) *Entamoeba histolytica*
- iv) *Eimeria tenella*
- v) *Trichomonas*

2. Collection staining, identification and description of –

- i) *Trypanosoma* from rat blood (with Gimsa's stain)
- ii) Flagellates from the rectum of frog or calotes (with Gimsa's stain)
- iii) *Balantidium*, *Nyctotherus* and *Opalina* from rectum of frog

3. Identification, classification and description of permanent slides of –

- i) *Schistosoma haematobium*
- ii) *Fasciola hepatica*
- iii) *Taenia saginata*
- iv) *Echinococcus granulosus*
- v) *Enterobius vermicularis*
- vi) *Ancylostoma duodenale*
- vii) *Ascaris lumbricoides*
- viii) *Wuchereria bancrofti*
- ix) *Dracunculus medenensis*

4. Collection, preservation, staining, identification, classification and description of Helminths (Nematodes and Cestodes) one slide from each–

- i) Fish
- ii) Rat
- iii) Fowl
- iv) Goat / Sheep

5. Collection, preservation, classification and description of –

- i) Bedbug
- ii) House fly
- iii) Mosquito
- iv) Head louse

6. Preparation of permanent slides of mouth-parts of –

- i) House fly
- ii) Mosquito
- iii) Honey bee
- iv) Bed bug
- v) Cockroach

LIST OF REFERENCE BOOKS FOR PARASITOLOGY (XIII-B & XV-B):

1. Introduction to Parasitology- Chandler and Reid
2. Parasitology – K. D. Chatterjee
3. Essentials of Parasitology- Gerald D. Schmidt, 4th Edition, Universal Book Stall, New Delhi, 1990, Reprint
4. An Introduction to Parasitology- Bernard E. Mathews, Cambridge University, Press, 1998
5. Textbook of Parasitology- Kochhar S. K., Dominant Publishers and Distributors, New Delhi, 2004
6. Applied Parasitology- A Practical Manual – C. J. Hiware, B. V. Jadhav, A. D. Mohekar, Mangaldeep Publication, Jaipur
7. Cestodes from Indian Fishes- Baba Jadhav
8. Animal Nematodes from Indian Mammals- H. S. Nama, G. B. Shinde and B. V. Jadhav
9. Parasitic Insects-B. D. Patnaik, Dominant Publishers and Distributors, New Delhi, 2001
10. Handbook of Entomology-T.V. R. Ayyar
11. Useful and Destructive Insects- Metacalf and Flint
12. Protozoology- Kudo
13. Biology of Protozoa- Sleials
14. Biology of Parasites- Cheng
15. Clinical Parasitology- Faust
16. Medical Helminthology- Watson
17. Indian Insect Life- Lefrey
18. General Parasitology- Cheng

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
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B.Sc. III Year
Zoology
Practical Question Paper Pattern
Semester- VI**

Paper: **XVII (B)**

Title of the Paper: **Applied Zoology: Parasitology**

Time- 4 Hrs

Marks : 50

Q.1. Prepare a permanent slides of the flagellate parasite from the blood of rat/rectal content of frog / calotes and identify by giving reasons. 08

OR

Prepare a permanent slide of ciliate parasite from the rectal content of frog and identify by giving reasons.

Q.2. Prepare a permanent slide of trematode / cestode / nematode from the vertebrate host. 08

Q.3. Prepare a permanent slides of mouth parts from the given specimen and identify by giving reasons. 08

Q.4. Identify, classify and describe the following eight parasites 12
(Each having 2 marks)

Protozoans – 1)..... 2)

Helminths – 1)..... 2)

Arthropodes – 1)..... 2)

Q.5. Project Work/ Excursion report 06

Q.6. Record Book and Viva-voce. 08

Note: Demonstration of animals through Models, Charts and Computer Aided Techniques

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
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B.Sc. III Year
Zoology
Practical**

Semester- VI

Paper: **XVII (C)**

Title of the Paper: **Entomology**

Periods- 15

Marks : 50

1. External morphology of Cockroach.
2. Methods of collection and preservation of insects.
3. Dissection (Cockroach): Digestive System, Nervous System and Reproductive System.
4. Mounting of mouthparts of insect: Biting and Chewing, piercing and sucking, siphoning and spooning.
5. Study of Insect Orders (Museum Study):
(At least 10 specimens preferably from different Insect orders to be selected)
 - a. Thysanura
 - b. Orthoptera
 - c. Odonata
 - d. Hymemoptera
 - e. Lepidoptra
 - f. Coleoptera
 - g. Diptera
 - h. Isoptera
- 6) Study of various stages of metamorphosis of following insects- Silk moth, Honeybee, Cockroach.
- 7) Collection, Identification and preservation of agriculture insect pests from local area (Minimum 10).
- 8) Collection, Preservation and Study of House hold and Human Medicinal Pests:
Rat flea, Housefly, Head louse, Mosquito.
- 9) Study of non insect animal pest:
 - a. Rat
 - b. Bird
 - c. Monkey
 - d. Pig
 - e. Deer
- 10) Collection and submission of major crop insect pests from local area (Minimum 10).
- 11) Study tour: At least two visits to the crop field.
- 12) Project Work

Note: Demonstration of animals through Models, Charts and Computer Aided Techniques

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
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B.Sc. III Year
Zoology
Practical Question Paper Pattern
Semester- VI**

Paper: **XVII (C)**

Title of the Paper: **Entomology (I & II)**

Time- 4 Hrs

Marks : 50

- | | |
|---|----|
| Q1. Dissect ----- so as to expose its----- system | 10 |
| Q2. Make a temporary mount of material provided | 05 |
| OR | |
| Describe the given insect as per the instruction | |
| Q3. Comment on Metamorphosis stage of material provided (any two) | 10 |
| OR | |
| Identify and comment on insects "A-E" as per the instructions | |
| Q4. Identify and comment on insects pests (1-5) as per the instruction
(3-crop pests, 1-human pest, 1-non insect pest) | 10 |
| Q5. Project work (Entomology) / Excursion report & Submission. | 10 |
| Q6. Record Book and Viva-Voce. | 05 |

Note: Demonstration of animals through Models, Charts and Computer Aided Techniques

RECOMMENDED BOOKS FOR ENTOMOLOGY (XIII-C & XV-C):

1. K. K. Nayar, TnantKirshnanand B.W. David- General and applied Entomology.
2. C. L. Metcalf and W. P. fling- Destructive and useful inset.
3. Hemsingpruthi: A Text Book of Agricultural Entomology
4. Wigglesworth: Principles of insect physiology.
5. ESSIG: College entomology.
6. M. S. Mani: A text book of General Entomology.
7. Government of Maharashtra: Crop pests and how to fight them.
8. Oldoyd, N.: A collection, preserving and studying insects.
9. Roger P. and Anderson: Forest and Shade tree Entomology.
10. D. B. Tembhare: Modern Entomology
11. R. E. Fradt: Fundamentals of Applied Entomology.
12. K. C. V. Smith: Insects and other Arthropods of Medical
13. D. N. Ray and A. W. A Brown: Entomology Medical and Veterinary
14. Chandler A. C. and Read C.P. -Introduction of Parasitology.
15. P. Debatch: Biological control of natural enemies.
16. Apple J. L. and Smith R.F.: Integrated Pest Management.
17. Cheny: General Parasitology.
18. Corbet J.R.: The biochemical mode of action of Pesticides.
19. Champman R. F.: Insects – Structure and Function.
20. O. W. Richards and R. G. Davies: Imms Text Book of Entomology
21. Bursell E.: An introduction to insect physiology.
22. Rockstein M Vol. (I-VI): The Physiology of Insects.
23. Shrivastave K. P. Vol (I-III): A Text Book of Applied Entomology
24. Hohanson O. A.: Ebryology of Insects and Myriopods.
25. Ross H. A.: A Text Book of Entomology.
26. Srivastava K.P.: A Text Book of Applied Entomology – II

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Semester- VI

Paper: **XVII (D)**

Title of the Paper: **Environmental Biology and Environmental Pollution**

Periods- 15

Marks : 50

- 1) Measurement of Relative Humidity.
- 2) Estimation of Dissolved Oxygen Content in Water sample.
- 3) Estimation of Carbondioxide in Water sample.
- 4) Estimation of Organic Matter in soil sample.
- 5) Detection of NPK in the soil sample.
- 6) Determination of pH of Water by Digital pH Meter/ Narrow pH range paper.
- 7) Estimation of Total Dissolved Solids (TDS) in Water.
- 8) Study of Suspended Solids in Water.
- 9) Study of Phytoplankton and Zooplankton in Fresh Water.
- 10) Effect of Heavy Metals/Pesticide on Oxygen consumption of Crab/Fish any suitable animal.
- 11) To Study Effects of Hydrogen sulphide gas pollutant on the Plant parts.
- 12) Effects of Pollutant/Pesticide on Heart beats of/ Any Suitable animal.
- 13) Study of Fresh Water Ecosystem- Visit to a Pond/ River for on the spot study.
- 14) Project / MCQ (Compulsory)

Note: Demonstration of animal Dissections Should be through Models, Charts and Computer Aided Techniques

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
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B.Sc. III Year
Zoology
Practical Question Paper Pattern
Semester- VI**

Paper: **XVII (D)**

Title of the Paper: **Environmental Biology and Environmental Pollution**

Time- 4 Hrs

Marks : 50

Q.1 Estimation Dissolved Oxygen/Carbon Dioxide in given Water Sample. 10

Q.2 Measure the Relative Humidity of Atmosphere 10

OR

Estimation of NPK in the soil/ Dissolved solids/Suspended Solids in Water

Q.3 Effect of Heavy Metal on Oxygen Consumption from given animal 10

OR

Effect of Pesticide on Oxygen Consumption from given animal

OR

Detection of pH of water sample with help of pH meter/Narrow range pH paper.

OR

Effect of Hydrogen Sulphide gas on Plant parts.

Q.4: Identify and describe Phytoplankton's/Zooplanktons from water sample/charts/figures. 06

Q.5: Project Work/ Excursion 10

Q.6: Viva Voce and Record Book. 04

Note: Demonstration of animal Dissections Should be through Models, Charts and Computer Aided Techniques

**RECOMMENDED BOOKS FOR ENVIRONMENTAL BIOLOGY AND
ENVIRONMENTAL POLLUTION (XIII-D & XV-D)**

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, ‘**Environmental Radiation, Thermal Pollution And Control**’ Amol Publication, New Delhi (1989).
6. Trivedi P.K. and Goel P.K. ‘**Chemical and Biological methods for Water Pollution Studies**’ (Published by Environmental Publisher KARAD).
7. Trivedi P.K. and Raj Gurudeep ‘**Environmental Water and Soil Analysis**’.
8. Published by Akashdeep Publication House New Delhi.
9. P. S. Verma and V.K. Aggrawal :**Environmental Biology**
10. P.D. Sharma : **Environmental Biology**
11. P.D. Sharma : **Toxicology**
12. E. P. Odum : **Fundamentals of Ecology**
13. E. P. Odum : **Fundamentals of Ecology**
14. Ranganalla : **Water and Waste Water Engineering**
15. P. D. Sharma : **Microbiology**
16. P. D. Sharma : **Microbiology**
17. Kndosia : **Water Pollution**
18. M. V. Rao : **Air Pollution**
19. M. Y. Kulkarni, S. V. Shivnikar and R. D. Barde : **Water Analysis**
20. NEERI Nagpur : **Manual on Waste Water Analysis.**