

**Swami Ramanand Teerth Marathwada University,
Nanded**

FACULTY OF SCIENCE & TECHNOLOGY



**B.Sc. Third Year
Zoology
(Structure and Syllabus)**

**Choice Based Credit System (CBCS) Course Structure
Semester Pattern Syllabus
Effective from June, 2018**

Swami Ramanand Teerth Marathwada University, Nanded

Choice Based Credit System (CBCS) Course Structure

Faculty of Science & Technology

B.Sc. Third Year (Semester V & Semester VI) Syllabus w.e.f. June, 2018

Semester Pattern; Subject: Zoology

NEWLY DESIGNED CBCS CURRICULA OF B.Sc. THIRD YEAR ZOOLOGY INCLUDING SKILLS

Zoology is a branch of Science which deals with study of the **animal kingdom**. It embodies study of the structure, embryology, evolution, classification, habits, and distribution of all animals, both living and extinct. There are several specializations available to students pursuing this field. There are diverse fields in Zoology like Applied Parasitology, Protozoology, Helminthology, Fishery Science, Entomology, Environmental Biology, Ecology, Animal Physiology, Biochemistry, Embryology, Evolutionary Biology, Genetics, Molecular Cell Biology, Systematics, Ethology, etc. There are many options to choose from depending on individual capabilities and interests.

The University has introduced the Choice Based Credit System (CBCS) in its curricula. Following is a briefing about CBCS as envisaged by the UGC.

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions to begin with. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

DISCIPLINE SPECIFIC ELECTIVE COURSES:

The Discipline Specific Elective Courses (DSEC) offered to students of B.Sc. III Year Zoology are aimed at priming the students for their future careers and/or study in the fields of biological sciences. The students are prepared for pursuing their post-graduate studies. They would also be able to take up entrepreneurship related to biological sciences. Additionally, the students could chose to join public or private sectors like fishery, forestry, wildlife conservation, agricultural research, health services, environmental management and restoration.

THE SALIENT FEATURES:

Ecology & Zoogeography and **Ethology, Biometry & Bioinformatics** are the two compulsory papers in Zoology offered to the B.Sc. III year students in V & VI semesters respectively. The paper in Ecology attempts to elucidate the current state of environment degradation - a serious issue that needs addressing. A good understanding of the dynamic nature of the environment is the core of the first paper. Added to it is also an aspect on the global distribution of different species of animals. The paper on Ethology (or animal behaviour) is the second paper that deals with the different forms of behaviours seen in animals, their methods of learning and their social interactions. An understanding of animal behaviour is of utmost importance to those who deal with study, experimentation, farming or management of animals. The paper also covers fundamental aspects of biostatistics and some topics on bioinformatics.

The elective papers being offered in the last two semesters of the course are **Pisciculture and Aquaculture** covering the fields of capture and culture fishery science; **Applied Parasitology – I & II**, dealing with protozoan, helminth and arthropod parasites in human and farm organisms of economic importance; **Entomology – I & II**, dealing with biology, taxonomy, and economic importance of different insect species; **Environmental Biology – I & II**, covering the different aspects of biotic and abiotic components of environment, human influence on the environment and remedial measures at national and international level.

SKILL ENHANCEMENT COURSES

Skill enhancement is a new aspect added to the regular course in the university curriculum. Courses offered in conjunction with the regular papers in the different subjects are designed with the aim of imparting specific skills to the students as they progress through the three years of their degree education. These courses aim at imparting (self) employability skills to the students enabling them to initiate their own entrepreneurship. At the very least, these courses are an attempt to equip the students with skills that would enhance their employability in the relevant farm or agricultural enterprises.

The skill enhancement courses offered under the subject of Zoology are -

1. Parasites of Public Health Importance
2. Vermiculture & Vermicomposting
3. Aquarium keeping
4. Sericulture

UTILITY OF THE COURSES:

Study of the subjects of Ecology & Zoogeography and Ethology in conjunction with Biometry and Bioinformatics equips the student to take up further study in a wide variety of subjects. It also prepares the student for future research in any of the above or related fields. Such a broad coverage of topics in the final year of the course also helps in widening their perspective of biological sciences. The elective courses offered are related to Fishery Science, Applied Parasitology, Entomology and Environmental Biology. These courses would crystallize the understanding of the specific subjects so that the student could take up specialized post-graduate courses and also pursue research in the relevant field. The students could also explore possibilities in developing themselves in such specialized fields like Fish farming, Fishery management, Parasite control, Parasite related health services, Pest control and management, industries like Sericulture & Apiculture, Environmental Consultancy and Environmental Management services.

A knowledge and understanding of ailments caused by parasites both in man and animals is important in public health management. Intestinal parasites are distributed literally across the globe, with high prevalence in some areas. The prevention and control of these infections are now more feasible than ever before owing to the discovery of safe and efficacious drugs, the improvement and simplification of some diagnostic procedures, and advances in parasite population biology. This course would offer the students with an understanding of the prevention, control and treatment strategies (of these parasites) using the currently available regime of drugs and other chemicals.

Aristotle has said, "Earthworms are intestines of the earth." The importance of earthworms in organic waste management and recycling cannot be under-emphasized. Vermiculture and vermicomposting are the best and environment friendly methods for producing nutrient rich manure for home gardening and agriculture. The course on vermicomposting aims at imparting sufficient understanding and skill to the student for an economically viable activity. Vermiculture is environment friendly since earthworms feed on anything that is biodegradable, vermicomposting can aid in garbage disposal problems. No imported inputs are required, worms are available locally and organic matter for feeding are abundant locally as market wastes, grasses, used papers and farm waste.

The course on Aquarium keeping is an attempt at acquainting the students with the inner workings of fabrication, installation and maintenance of home aquarium. Aquarium keeping is by far the most popular hobby, with small pet shops coming up for sale of a variety of ornamental fish. In common practice, aquarium hobbyists keep glass tanks with different species of fish. Maintaining a fish tank in a healthy state requires knowledge of aquatic ecology, fish biology, species compatibility and their reproductive strategy. Through this course the students would be able take up aquarium keeping as a source of income.

Sericulture is an agro-based industry for production of raw silk both as a cottage and a medium scale industry. India being a predominantly tropical agricultural country has immense scope for

development of sericulture. The course on sericulture could become an attractive opportunity for the students to develop their skill set in this enterprise and start their own industry.

LEARNING OBJECTIVES:

Discipline Specific Elective [DSE] Course Zoology:

The Learning objectives are as follows:

DSEZ-I; Section-A: PAPER-XII- ECOLOGY AND ZOOGEOGRAPHY:

- ❖ To understand and appreciate the interactions of organisms with their environments and the consequences of these interactions for population, community, and ecosystem dynamics.
- ❖ To be aware of the current environmental issues with an understanding of the basic ecological concepts involved.
- ❖ To study the local and geographical distribution and abundance of organisms (habitat niche, community, bio-geography).
- ❖ To understand the inter-relationship between individuals in population and communities (population ecology).
- ❖ To study the structural adaptations and functional adjustment of organisms to their physical environment.
- ❖ To study the conservation and management of natural resources and pollution (applied ecology).

DSEZ-I; Section-B: PAPER-XIII (A)- PISICULTURE:

- ❖ To exchange and circulate information, ideas and practical experience on all matters relating to fisheries and their management.
- ❖ To enable students with Fishery specific knowledge for entering PG courses or fishery industries.
- ❖ To establish and maintain an appropriate Branch and Specialist section structure to meet the local, specialist and overall needs of fisheries interests.

DSEZ-I; Section-B: PAPER-XIII (B)- APPLIED PARASITOLOGY – I

- ❖ To introduce students to the basic concepts of Applied parasitology.
- ❖ To expose students to the knowledge of host-parasite relationship.
- ❖ To give students a broad perspective of epidemiology, transmission, control and treatment of parasitic diseases caused by protozoans and platyhelminthes.

- ❖ To familiarize students with morphologic criteria to differentiate between the most common protozoan and helminth parasites.

DSEZ-I; Section-B: PAPER-XIII (C)- ENTOMOLOGY- I

- ❖ To define general entomology and classifying insects according to their economic importance.
- ❖ To acquaint students with the morphology and anatomy of selected insect species.
- ❖ To introduce students to insect biology.
- ❖ To impart knowledge of insect ecology covering factors like effect of light, temperature, humidity.

DSEZ-I; Section-B: PAPER-XIII (D)- ENVIRONMENTAL BIOLOGY – I

- ❖ To identify the fundamental structure and function of an ecosystem.
- ❖ To compare and contrast different types of ecosystems.
- ❖ To study the Biodiversity and its classifications, identify threats to Biodiversity; know and apply methods to conserve Biodiversity.

DSEZ-II; Section-A: PAPER-XIV- ETHOLOGY, BIOMETRY AND BIOINFORMATICS:

- ❖ To study the behaviour of organism under natural conditions (Ethology).
- ❖ To understand the concepts of Biometry.
- ❖ To get acquainted with and apply the fundamentals of applied statistical methodology.
- ❖ To give students an introduction to the basic practical techniques of bioinformatics.
- ❖ To emphasize the application of bioinformatics and biological databases for problem solving in real-life & research.
- ❖ To familiarize student with the use of a wide variety of internet applications, biological database and to enable them to apply these methods under various situations.

DSEZ-II; Section-B: PAPER-XV (A)- AQUACULTURE:

- ❖ To introduce student to various types of aquaculture and culture methods.
- ❖ To obtain knowledge of fishery science, with a particular emphasis on the biology, assessment, and management of fish and invertebrate fisheries.
- ❖ To create awareness about manmade hazards to aquaculture.
- ❖ To elaborate the role of Larvivorous fishes in relation to public health.

- ❖ To acquire knowledge of Mariculture.
- ❖ To understand and appreciate the role of Government in aquaculture development.

DSEZ-II; Section-B: PAPER-XV (B)- APPLIED PARASITOLOGY – II:

- ❖ To provide a broad-based knowledge and understanding of Parasitology with special emphasis on Parasitic Nematodes and Arthropods.
- ❖ To understand the morphology of nematodes as it relates to their taxonomic position and their ability to cause diseases in plants and animals.
- ❖ To understand and apply the principles of controlling nematode diseases to plants and animals.
- ❖ To describe the basics of arthropods of public health importance.
- ❖ To identify vector - host - pathogen relationships in arthropod-borne diseases.
- ❖ To apply modern tools for surveillance and diagnosis of vector-borne diseases.
- ❖ To provide sufficient knowledge, understanding, and critical judgment appropriate for professional employment in Parasitology or a related discipline.

DSEZ-II; Section-B: PAPER-XV(C)- ENTOMOLOGY- II:

- ❖ To introduce students to the ecology and biology of insects of medical and agricultural importance.
- ❖ To provide students with opportunities to understand insect pest management techniques such as cultural, physical, Biological, chemical, IPM etc.
- ❖ To provide students an adequate knowledge of various types of insecticides and problems associated with their use.
- ❖ To equip students knowledge of practical applications of insecticides and maintenance of pesticide equipment.

DSEZ-II; Section-B: PAPER-XV(D)- ENVIRONMENTAL BIOLOGY – II:

- ❖ To understand pollution status, including its causes and effects on environment.
- ❖ To learn to protect oneself and the environment from the adverse effects of environmental pollution.
- ❖ To use an interdisciplinary approach to analyze environmental issues and problems.
- ❖ To develop a worldview related to an understanding of current environmental issues and how global problems affect us locally.

PRACTICALS:

- ❖ To improve the skills of students in microscopy, whole mount preparation, observations, drawings and laboratory techniques.
- ❖ To acquaint the students with operations of the different laboratory equipment.
- ❖ To equip the student with the necessary skills in standard operating procedures for laboratories and handling of chemicals, reagents and glassware.
- ❖ To instill an understanding of the methods and protocols for handling and maintenance of animals for experiments.
- ❖ To provide basic practical skills and experience in using laboratory techniques in experimentation.
- ❖ To train the students in the analysis of experimental data with statistical and computer aided techniques.
- ❖ To induct the students in the activity of field observation of natural phenomena and organisms through excursion and drafting of reports in a scientific and objective manner.
- ❖ To equip the students with the understanding of taxonomy and other aspects of different organisms so that they become capable of classifying any given organism, at least up to the level of Order.

Skill Enhancement Courses

All the skill enhancement courses included in this curriculum are intended to enable the students to become reasonably self sufficient, thereby increasing their employability. Acquisition of these skills by students will open better opportunities for them in the fields of higher studies and research in addition to increasing their employability.

SECZ –III (E): Parasites of Public Health Importance:

The main learning objectives of this skill course include study of parasites of public health importance. This course is intended to a detailed treatment of parasites with emphasis on almost all major features of Biology of these parasites. The outbreak and spread of these parasitic diseases is found across the globe and that too on a large scale. Due to this, the study of these parasites is of paramount significance, to which this skill set attempts to address.

SECZ –III (F) : Vermiculture and Vermicomposting:

The introduction of this skill in the curriculum is with the objective that the learners should be able to do vermiculture in a systematic way and also be able to get hands on experience in all related activities till vermicomposting. This will increase the awareness and skill availability in the need of the day viz. organic farming.

SECZ –IV (G): Aquarium Keeping:

There has been an increasing trend of keeping ornamental fish among the general public. Proportionately there is increasing demand for aquaria and aquarium fish also. This makes the topic of aquarium keeping a viable subject as a skill. This particular paper of skill is intended to train the students in aquarium keeping starting with the very basic aspects of aquarium fabrication, their setting and maintenance. Economic aspects of aquarium keeping are also covered in this course. Related study like fish identification, preparation of supplementary food of concern fish species is also covered. This skill is more self employability oriented.

SECZ –IV (H): Sericulture:

The skills related to sericulture are included in the curriculum with intention of introducing the students to an important market industry. Sericulture related production has a long history and it is in practice from ancient times. There has been a constant demand of sericulture products. In this view sericulture has high employability potential. For the same reason, this skill set aims to train the students in Mulberry cultivation, silkworm rearing & rearing practices, sericulture economics & marketing.

PREREQUISITES:

The study of the DSECs being offered would be based on previous learning by the student as elaborated below.

Ecology & Zoogeography-

- ❖ Basic knowledge of feeding strategy of animals and plants.
- ❖ Knowledge of interdependence of plants and animals.
- ❖ Awareness about various climatic zones of earth.
- ❖ Understanding of climatic and weather phenomena.

Ethology, Biometry and Bioinformatics-

- ❖ Knowledge of sensory systems in animals.
- ❖ Awareness about nervous systems in animals and their intelligence.
- ❖ A basic sense of behavior and different behaviors.
- ❖ Knowledge of different types of operating systems, general application software.
- ❖ Ability to use internet for searching general information and use of web browser.

Pisciculture & Aquaculture-

- ❖ Understanding of taxonomy of fish.

- ❖ Knowledge of feeding methods and habits of fish.
- ❖ Knowledge of general fish anatomy and morphology.
- ❖ Knowledge of geography of India.

Applied Parasitology-

- ❖ Awareness about morphology and taxonomy of helminthes and arthropods.
- ❖ Awareness of human parasitic diseases.

Entomology-

- ❖ Understanding of general morphology and taxonomy of phylum Arthropoda.
- ❖ Knowledge of the role of insects in agricultural and natural ecosystems.

Environmental Biology-

- ❖ Knowledge about geography of India.
- ❖ Awareness about industrial status of Maharashtra and India.
- ❖ Understanding about feeding strategy of animals and plants.
- ❖ Knowledge about basic chemical processes and various chemicals used by society.

Every paper of the skill offered in this curriculum is sufficiently related with one or the other of the optional papers of the curriculum.

The initiative by this University to remodel the curriculum and to introduce Skill Enhancement courses in respective subjects is in line with the UGC guidelines on CBCS. These changes in the overall structure of the courses are definitely going to benefit the students and also help teachers in their academic development.

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Faculty of Science & Technology
B. Sc. Third Year (Semester V & Semester VI) Syllabus w.e.f. June, 2018
Semester Pattern; Subject: Zoology

Class/ Semester	Course Number		Name of the Course/ Paper	Instruction Hrs/Week	Total Periods/ Practicals	Marks for		Total Marks	Credits	
						Internal (CA)	External (ESE)			
B.Sc. T.Y. Semester V	DSEZ-I	Section -A	PAPER-XII- ECOLOGY AND ZOOGEOGRAPHY	03	45	10	40	50	Credit:02	
		Section-B (Select Any one paper from A/B/C/D)	PAPER-XIII (A)- PISICULTURE	03	45	10	40	50	Credit:02	
			PAPER-XIII (B)- APPLIED PARASITOLOGY - I							
			PAPER-XIII (C)- ENTOMOLOGY- I							
			PAPER-XIII (D)- ENVIRONMENTAL BIOLOGY - I							
DSEZP-I	[DSEZ I & II] (Section A)	Practical Paper- XVI-ECOLOGY,ZOOGEOGRAPHY ETHOLOGY, BIOMETRY AND BIOINFORMATICS (Practical based on P-XII & XIV)	03	30	10	40	50	Credit:02		
SECZ-III		SEC-III Any one Skill to be chosen out of Two SECZ -III (E) : PARASITES OF PUBLIC HEALTH IMPORTANCE SECZ -III (F) : VERMICULTURE AND VERMICOMPOSTING	03	45	25	25	50	Credit:02		
B.Sc. T.Y. Semester VI	DSEZ-II	Section -A	PAPER-XIV- ETHOLOGY,BIOMETRY AND BIOINFORMATICS	03	45	10	40	50	Credit:02	
		Section-B (Select Any one paper from A/B/C/D)	PAPER-XV (A)- AQUACULTURE	03	45	10	40	50	Credit:02	
			PAPER-XV (B)- APPLIED PARASITOLOGY - II							
			PAPER-XV (C)- ENTOMOLOGY- II							
	DSEZP-II	[DSEZ I & II] (Section B)	{Select Any one paper from A/B/C/D}	Practical Paper- XVII (A)- PISICULTURE & AQUACULTURE (Practical based on P-XIII(A)& XV (A))	03	30	10	40	50	Credit:02
				Practical Paper- XVII(B)- APPLIED PARASITOLOGY-I & II (Practical based on P-XIII(B)& XV(B))						
				Practical Paper- XVII(C)- ENTOMOLOGY-I & II (Practical based on P-XIII(C)& XV(C))						
Practical Paper- XVII(D)- ENVIRONMENTAL BIOLOGY -I & II (Practical based on P-XIII(D)& XV(D))										
SECZ-IV		SEC-IV Any one Skill to be chosen out of Two SECZ -IV (G): AQUARIUM KEEPING SECZ -IV (H): SERICULTURE	03	45	25	25	50	Credit:02		
Total Credit for Semester V & VI						110	290	400	Credit:16	

DSEZ: Discipline Specific Elective Course Zoology, **DSEZP:** Discipline Specific Elective Course Zoology Practical, **CA:** Continuous Assessment;

ESE: End of Semester Examination, **SECZ:** Skill Enhancement Course Zoology

SECZ: CA-25: Seminar-15 & Test-10 ESE-25: Report Submission-10; Overall Skill Judgment-10 and Presentation-05

ESE for SECs SECZ-III & SECZ-IV and Practical Papers DSEZP-I & DSEZP-II (A/B/C/D) for both semesters V & VI respectively will be at the end of Academic Year in Annual Pattern.

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Choice Based Credit System (CBCS) Course Structure

Faculty of Science & Technology

B. Sc. Third Year Syllabus w.e.f. June, 2018

Zoology

Semester -V

Paper: DSEZ-I; Section –A

Title of Paper: Paper-XII -Ecology & Zoogeography

Periods : 45

Credits: 02 (Marks: 50)

UNIT – I

12

- 1. Ecology-Introduction and Scope of Ecology**
- 2. Introduction to Ecosystem**
 - 2.1. Components of an ecosystem
 - a) Abiotic components – Light, Temperature & Water
 - b) Biotic components – Producers, Consumers & Decomposers.
 - 2.2. Types of Ecosystem- **Aquatic**- Pond ecosystem.
Terrestrial- Desert Ecosystem.
 - 2.3. Food Chain, Food Web, Ecological Pyramids.
 - 2.4. Energy Flow in an Ecosystem.
- 3. Bio-geochemical Cycles**
 - 3.1. **Gaseous Cycle**- Oxygen Cycle
 - 3.2. **Sedimentary Cycle**- Sulphur Cycle
- 4. Spheres of Earth**
 - 4.1. Atmosphere
 - 4.2. Lithosphere
 - 4.3. Hydrosphere
 - 4.4. Biosphere
 - 4.5. Ecological Succession-, Trends, Basic Types, Hydrarch and Xerarch

UNIT – II

11

- 1. Population Ecology –**
Characteristics of Population
 - 1.1 Natalty
 - 1.2 Mortality
 - 1.3 Population Dispersal
 - 1.4 Population density
 - 1.5 Age distribution
 - 1.6 Population Growth Form
 - 1.7 Population Equilibrium and Fluctuation

2. Biotic interactions

- 2.1 Positive interactions – Commensalism, Mutualism
- 2.2 Negative interactions – Competition, Predation, Parasitism

UNIT – III

11

1. Pollution – Sources, Effects and Control

- 1.1 Air Pollution
- 1.2 Water Pollution
- 1.3 Noise Pollution

2. Energy Resources

- 2.1 Conventional energy resources and their limitations
 - 2.1.1 Fossil Fuels
 - 2.1.2 Nuclear Power
 - 2.1.3 Hydel Power
- 2.2 Non-conventional energy resources – Advantages, Limitations & Latest developments
 - 2.2.1 Solar Energy
 - 2.2.2 Wind Energy
 - 2.2.3 Tidal Energy

UNIT – IV

11

1. Adaptations

- 1.1 Aquatic Adaptations
- 1.2 Desert Adaptations
- 1.3 Volant Adaptations

2. Wildlife Conservation and Endangered Species

- 2.1 Aims & necessity of wildlife conservation
- 2.2 Wild life and Endangered species of India
- 2.3 Measures to protect endangered species in India
- 2.4 Sanctuaries and National parks in India

3. Zoogeographical Realms –

Physical features and fauna of following Realms in Brief.

- 3.1 Oriental Realm
- 3.2 Australian Realm

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Zoology

Semester -V

Paper: DSEZ-I; Section -B

Title of Paper: Paper- XIII (A)-Pisciculture

Periods : 45

Credits: 02 (Marks: 50)

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 **12**

1. Biology of Indigenous and Exotic carps.

2. Fish seed resources

2.1 Natural resources- Riverine resources
2.2 Artificial resources- Induced breeding by Hypophysation
a) Historical back ground d) Chinese hatchery
b) Technique of Induced breeding e) Striping method
c) Bundh breeding
2.3 Transportation of fish seed and brooders

3. Capture Fishery

Introduction, Capture Fishery Resources in India.

1. Sardine fishery 2. Mackerel fishery 3. Bombay Duck fishery

UNIT III **11**

1. Fishing Methods

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

2. Fish Diseases

2.1 Fish Diseases caused by Pathogens and Parasites- Symptoms and Treatment
a) **Bacterial-** Dropsy, Furunculosis, Tailrot or Finrot
b) **Fungal-** Gillrot, Dermatomycooses c) **Protozoan-** Costiasis, Ichthyophthirius
d) **Helminth-** Gyrodactylosis, Dactylogyrosis e) **Arthropod-** Lernaeasis, Argulusis
2.2 Non parasitic diseases- a) Environmental fish diseases- Acidosis, Alkalosis, Gas bubble
b) Nutritional / Dietary diseases

UNIT IV **11**

1. Fish Preservation and Processing

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

2. Fish By- Products- Fish Oil (Fish Liver oil and Fish body oil), Fish Meal, Fish Manure, Fish Protein, Isinglass, Fish Glue, Fish Leather, Fish Pearls, Fish Soap, Fish Insulin.

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Zoology

Semester -V

Paper: DSEZ-I; Section -B

Title of Paper: Paper- XIII (B)-Applied Parasitology-I (Parasitic Protozoa and Platyhelminthes)

Periods : 45

Credits: 02 (Marks: 50)

Unit -I – 11

1. Introduction to Parasitology :

1.1 Brief introduction of Parasitology, Parasitism, Parasite, Host, Vector, Host parasite relationship.

1.2 Scope and Branches of Parasitology.

2. Parasitic Protozoa: Classification and general organization of parasitic Protozoa

3. Study of Systematic Position, Geographical distribution, Morphology, Life Cycle, Pathogenicity, Diagnosis, Prophylaxis and Treatment of

1. *Entamoeba histolytica*,

3. *Trichomonas vaginalis*

2. *Giardia intestinalis*,

Unit – II 12

Study of Systematic Position, Geographical distribution, Morphology, Life Cycle, Pathogenicity, Diagnosis, Prophylaxis and Treatment of

1. *Trypanosoma gambiense*

4. *Plasmodium vivax*

2. *Balantidium coli*

5. *Eimeria tenella*

3. *Sarcocystis cruzi*,

Unit – III 11

Parasitic Platyhelminthes: Trematodes

1. Introduction, Classification, General organization of Trematodes.

2. Study of Systematic Position, Geographical distribution, Morphology, Life Cycle, Pathogenicity, Diagnosis, Prophylaxis and Treatment of-

i. *Schistosoma haematobium*.

ii. *Paragonimus westermani*.

iii. *Gastrodiscoides hominis*.

3. Parasitic adaptations in Trematodes.

4. Larval forms in Trematodes.

Unit – IV 11

Parasitic Platyhelminthes: Cestodes

1. Introduction, Classification, General organization of Cestodes.

2. Study of Systematic Position, Geographical distribution, Morphology, Life Cycle, Pathogenicity, Diagnosis, Prophylaxis and Treatment of-

i. *Taenia saginata*.

ii. *Taenia solium*

iii. *Echinococcus granulosus*.

3. Parasitic adaptations in Cestodes

4. Larval forms in Cestodes

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Zoology

Semester -V

Paper: DSEZ-I; Section -B

Title of Paper: Paper- XIII (C)- Entomology-I (General Entomology)

Periods : 45

Credits: 02 (Marks: 50)

UNIT –I **06**

Introduction:

1. Importance and Scope of Entomology
(Agriculture, Forest, Medical, Forensic and Industrial)
2. Salient features of class Insecta.
3. Methods of collection, preservation and study of insects.

UNIT -II **15**

Type study: Cockroach

1. Classification, External Morphology including sexual dimorphism.
2. Digestive system
3. Respiratory system
4. Nervous system and Sense organs
5. Reproductive system

UNIT –III **12**

Insect Taxonomy

Salient features with suitable examples of following orders:

- i. Thysanura
- ii. Orthoptera
- iii. Odonata
- iv. Diptera
- v. Isoptera
- vi. Hymenoptera
- vii. Lepidoptera
- viii. Coleoptera

UNIT –IV **12**

Insect Metamorphosis-

1. General idea about metamorphosis and Types of Metamorphosis
Ametabola, Hemimetabola, Paurometabola and Holometabola.
2. Hormonal control of metamorphosis in insects.
3. Insect Ecology: Effect of light, temperature, humidity and food on insect life.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) Course Structure

Faculty of Science & Technology

B. Sc. Third Year Syllabus w.e.f. June, 2018

Zoology

Semester -V

Paper: DSEZ-I; Section -B

Title of Paper: Paper- XIII (D)-Environmental Biology - I

Periods : 45

Credits: 02 (Marks: 50)

Unit-I **12**

1. Introduction and Scope of Environmental Biology
 - 1.1 Atmosphere: Composition, Structure and Importance
 - 1.2 Hydrosphere: Chemical and Physical properties of water
 - 1.3 Lithosphere: Structure and Composition, Physical and chemical properties of soil. 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**

1. **Ecosystem**
 - 1.1 Concept and structural components of an Ecosystem
 - 1.2 Energy flow in an ecosystem
 - 1.3 Ecological pyramids-
Pyramid of Numbers, Pyramid of Biomass and Pyramid of Energy.
 - 1.4 Food chains and Food web
 - (a) Food chains-Grazing, Parasitic, Saprophytic or Detritus food chain
 - (b) Food web.
2. **Marine Ecosystem-**
 - 2.1 Zonation in-
 - a) Marine habitat
 - b) Intertidal habitat

Unit – III **11**

1. **Biodiversity-** Concept and Characteristics of Biodiversity
 - 1.1 Role of Biodiversity
 - 1.2 **Threats to Biodiversity-** Habitat degradation and its loss, Invasion of non native species, Species interdependence, Soil Erosion, pollution, Over- Exploitation of Resources, Change in the Global Environment.
 - 1.3 Biodiversity conservation
 - i) In-Situ conservation
 - ii) Ex-Situ conservation
 - 1.4 Biodiversity of India

Unit-IV **11**

1. **Wild life and its conservation-**
 - 1.1 Aims and Necessity of Wild life Conservation
 - 1.2 Causes for wild life depletion.
 - 1.3 Management and Conservation of wild life
 - 1.4 Sanctuaries and Zoological Parks in India

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) Course Structure

Faculty of Science & Technology

B. Sc. Third Year Syllabus w.e.f. June, 2018

Zoology

Semester- VI

Paper: DSEZ-II; Section -A

Title of Paper: Paper- XIV-Ethology, Biometry and Bioinformatics

Periods : 45

Credits: 02 (Marks: 50)

UNIT – I Ethology **09**

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**

1. Communication in animals

- 1.1 Auditory Communication
- 1.2 Chemical Communication
- 1.3 Visual Communication
- 1.4 Tactile Communication

2. Mimicry and Colouration

- 2.1 Types of Mimicry- Protective and Aggressive
- 2.2 Types of Colouration- Protective, Aggressive and Warning

UNIT – III Biometry **12**

1. Collection and Classification of Data

- 1.1 Methods of collection of data
- 1.2 Types of classification of data - Geographical, Chronological, Quantitative, Qualitative, Continuous, Discontinuous.

2. Measures of Central Tendency

Arithmetic Mean, Median and Mode

3. Graphic Representation of Data

- 1.1 Histogram
- 1.2 Pie Diagram
- 1.3 Polygon Frequency Curve

UNIT – IV Bioinformatics **12**

- 1.1 Computer and their Applications in Biology
- 1.2 Internet and its Uses
- 1.3 World Wide Web
- 1.4 Search Engines
- 1.5 Broad Applications of Bioinformatics
- 1.6 Introduction to Biological Database
 - a) NCBI
 - b) Pub Med

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Faculty of Science & Technology

B. Sc. Third Year Syllabus w.e.f. June, 2018

Zoology

Semester- VI

Paper: DSEZ-II; Section -B

Title of Paper: Paper- XV(A)-Aquaculture

Periods : 45

Credits: 02 (Marks: 50)

UNIT- I

11

1. Introduction to Aquaculture

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

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

1. Culture Methods i) Pen culture ii) Cage culture

2. Sewage Fed Fish Culture

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

3. Man Made Hazards and Aquaculture

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

UNIT III

12

1. Characteristics of Water

- i) Physical ii) Chemical ii) Biological

2. Larvivorous Fishes

- i) Characteristics of Larvicidal Fishes.
- ii) Larvicidal Fishes in India- Exotic species; Indigenous Species
- iii) Role of Larvivorous fishes in relation to Public health

3. Aquatic weeds and their control

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

UNIT IV

11

1. Culture of Non Fish Organisms

- 1. Fresh water Prawn Culture
- 2. Pearl Oyster Culture and Edible Oyster Culture
- 3. Mussel Culture

2. Mariculture

- i) Introduction ii) Types of Mariculture
- iii) Fish Species for Mariculture

3. Government Participation in Aquaculture

ICAR, Ministry of Agriculture, Ministry of Commerce, Ministry of Food Processing Industry.

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Zoology

Semester- VI

Paper: DSEZ-II; Section -B

Title of Paper: Paper- XV (B) Applied Parasitology-II (Parasitic Nematodes and Arthropods)

Periods : 45

Credits: 02 (Marks: 50)

UNIT – I **12**

Parasitic Nematodes: Animal Nematodes

1. Introduction, Classification, General organization of Animal Nematodes.
2. Study of Systematic Position, Geographical distribution, Morphology, Life Cycle, Pathogenicity, Diagnosis, Prophylaxis and Treatment of-
 1. *Enterobius vermicularis*
 2. *Ancylostoma duodenale*.
 3. *Wuchereria bancrofti*.
3. Larval forms in Animal Nematodes

UNIT – II **11**

Parasitic Nematodes: Plant Nematodes

1. Introduction, Classification, General organization of Plant Nematodes
2. Study of Systematic Position, Geographical distribution, Morphology, Life Cycle, Pathogenicity, Diagnosis, Prophylaxis and Treatment of-
 1. *Meloidogyne* (Root knot nematode),
 2. *Heterodera* (Cyst nematode)
 3. *Tylenchulus* (Citrus nematode)

UNIT – III **11**

Parasitic Arthropodes

1. Systematic Position, Geographical Distribution, Morphology, Life Cycle, diseases and Control Measures of –
 - i. Acarina-Ticks & Mites.
 - ii. Parasitic Hemiptera -Bed Bug (*Cimex lecturalis*)
2. Parasitic flies-Outline Classification, Morphology, role as vectors of Human diseases and Control Measures of House Fly (*Musca domestica*), Bot Fly (*Dermatobia hominis*)

UNIT – IV **11**

1. Morphology, pathogenecity and Control Measures of –
 - i) *Siphonaptera* ii) *Anopleura* iii) *Mallophaga* iv) *Hymenoptera*
2. Mosquitoes as a vector in the transmission of Malaria, Dengue fever, Elephantiasis, Yellow Fever, Chikungunia and their control measures
3. Chemical and Biological Control of Insets.

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Zoology

Semester- VI

Paper: DSEZ-II; Section -B

Title of Paper: Paper- XV (C)-Entomology-II (Applied Entomology)

Periods : 45

Credits: 02 (Marks: 50)

UNIT- I

12

1. Pest

1.1 Concept of a Pest

1.2 Types of Pests: Agricultural, Veterinary and Human Pests and Household 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- Pyrilla

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

1. Human and Household insect pests (Structure, Binomics and control measures of the following)-

a) Housefly

b) Cockroach

c) Cricket

d) Mosquito

e) Rat flea

f) Bed bug

g) Head louse

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

a) Rat

b) Pig

c) Monkey

d) Birds

e) Deer

UNIT- III

11

1. Culture of Beneficial Insect (Gross Study)-

a) Sericulture

b) Apiculture

c) Lac culture

UNIT- IV

11

1. Pest Control Methods-

a) Chemical control and safe handling of pesticides

b) Biological control of insect pests

c) Physical and Mechanical control of insect pests

d) Integrated pest management of insect pests

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) Course Structure

Faculty of Science & Technology

B. Sc. Third Year Syllabus w.e.f. June, 2018

Zoology

Semester- VI

Paper: DSEZ-II; Section -B

Title of Paper: Paper- XV (D)-Environmental Biology -II

Periods : 45

Credits: 02 (Marks: 50)

UNIT- I

11

1. Introduction to Environmental Pollution-

- 1.1 Origin of Pollution.
- 1.2 Pollutants: The Creators of pollution,
- 1.3 Types of pollutants- Biodegradable and Non- Biodegradable Pollutants.
- 1.4 Kinds of pollution

2. Water Pollution

- 2.1 Types of Water pollution, Kinds and sources of Water pollutants
- 2.2 Sources and Effects of water pollution.
 - a) Pollution by Sewage and Domestic Waste, Eutrophication and Algal blooms
 - b) Pollution by Heavy Metals; Sources and Effects of Lead and Mercury
- 2.3 Assessment and Monitoring of Water pollution.
- 2.4 Control of Water pollution.

UNIT- II

12

1. Air Pollution: Types, Sources and Effects of Air Pollutants-

- 1.1 Thermal Power Plants, Industrial Chimney Waste, Automobile Exhausts
- 1.2 Sulphate compounds as Air pollutants: Sources and Effects
- 1.3 Oxides of Nitrogen as Air pollutants: Sources and Effects
- 1.4 Carbondioxide and Carbon Monoxide as Pollutant: Sources and effects
- 1.5 Acid rains
- 1.6 Ozone as a Protector and Destroyer
- 1.7 Chlorofluro Carbons (CFCs)
- 1.8 Photochemical Smog

2. Control of Air pollution.

UNIT-III

11

1. Radioactive Pollution: Sources, Effects and Control of Radioactive pollution

- 2. Pollution by Solid Wastes:** a) Types and source of Solid wastes
- b) Effects of solid waste pollution
- c) Methods of Solid wastes Disposal.

3. Noise Pollution: Sources, Effects and Control of Noise pollution

UNIT-IV

11

1. Pollution Control Legislation

- 1.1 The Water (Prevention and Control of pollution) Act-1974
- 1.2 The Air (Prevention and Control of pollution) Act-1981
- 1.3 The Environment (Protection) Act- 1986
- 1.4 Environmental Education in India (Concept and role)
- 1.4 Water Resources: Infiltration, Gallflies and Wells
- 1.5 Water Treatment Methods: Sedimentation Tank, Aerobic Treatment, Trickling Filters, Anaerobic Treatments, Imhoff Tanks

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) Course Structure

Faculty of Science & Technology

B. Sc. Third Year (Semester V & VI) w.e.f. June, 2018

Zoology

Practical Syllabus

Paper: DSEZP-I (Based on DSEZ-I; Section-A & DSEZ-II; Section-A)

Title of Paper: Paper- XVI -Ecology, Zoo-geography, Ethology, Biometry and Bioinformatics

Periods : 15+15

Credits: 02 (Marks: 50)

Ecology

1. Estimation of Dissolved O₂ from Water Sample.
2. Estimation of Dissolved CO₂ from Water Sample.
3. Estimation of Population Density from Water Sample/ Terrestrial area.
4. Determination and study of Atmospheric Humidity.
5. Study of positive and negative interactions (biotic interaction) in animals.
6. Estimation of Chlorides, Salinity, Hardness from given water sample for Water quality status
7. 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.
8. Report on a Field Visit to Zoo Park/National Park/Biodiversity Park/Wild Life Sanctuary to study management, behavior and enumeration of wild animals.

Zoogeography

1. Museum study of Vertebrate Endangered Species or Threatened Wild Animals on the Basis of charts/ models/ photographs (Any Five).
2. Identification of Zoogeographical Realms from the Map and Identify Specific Fauna of Respective Regions.

Ethology

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.

Biometry

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

Bioinformatics

1. To perform online search on Biological information/Literature
2. How to access the biological data from NCBI and Pub Med
3. BLAST- Sequence Search & alignment.

Note: All animal based practical's should be conducted with the help of Models, Charts and Computer Aided Techniques.

**REFERENCE BOOKS BASED ON PAPER: DSEZ-I& II (SECTION A), PAPER: DSEZP-I
Paper XII & XIV; XVI**

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

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Choice Based Credit System (CBCS)

Faculty of Science & Technology

B. Sc. Third Year (Semester V & VI) w.e.f. June, 2018

PRACTICAL QUESTION PAPER

SUBJECT: ZOOLOGY

PAPER- DSEZP-I: (Based on DSEZ-I; Section-A & DSEZ-II; Section-A)

TITLE OF PAPER - Ecology, Zoo-geography, Ethology, Biometry and Bioinformatics (P-XVI)

Centre:

Date:

Batch No.:

Session:

Marks: 40

Time: 04 Hrs

- Q.1** Estimation of Dissolved O₂ / CO₂ from Water Sample. *Or* **10**
Estimation of Population Density from Water Sample/ Terrestrial area. *Or*
Determination and study of Atmospheric Humidity. *Or*
Identify and comment on Biotic Interactions of Animals. (Two examples of Positive interaction and Three examples of Negative interaction)
- Q.2** Estimation of Chlorides & Salinity/ Hardness from given water sample for Water quality status **08**
OR
Identify and describe. (Any Two examples of Endangered species and Two example from Ecological Adaptation). *Or*
Identification of Zoogeographical Realms (Any Two) from the Map and Identify Specific Fauna of Respective Regions
- Q.3** To study the Positive and Negative Phototropism with suitable examples *Or* **10**
To study the Positive and Negative Chemotactic Response with suitable examples *Or*
Study of Colouration of animals with suitable examples
- Q.4** Give the diagrammatic representation of data with Histogram or Pie-Diagram or Frequency Polygon Curve. *Or* **08**
Solve any two problems based on Problems Based on Mean, Mode, Median.
OR
To perform online search on Biological information/Literature. *Or*
Determine sequence of protein or DNA from the provided file. *Or*
Any problem or activity based on bioinformatics.
- Q.5** Viva-Voce **04**

Note: 1. Practical Internal Evaluation (Continuous Assessment CA) = Total 10 Marks.

a) Submission of Record book & Submission of Report on a Field Visit = 05 Marks And

b) Internal Test on Practicals=05 Marks.

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

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
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Faculty of Science & Technology
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**Zoology
Practical Syllabus**

Paper: DSEZP-II (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of Paper: Pisciculture and Aquaculture {XVII (A)}

Periods : 15+15

Credits: 02 (Marks: 50)

1. Diagrammatic presentation or Layout Plan for a Typical Fish Farm.
2. Demonstration or dissection of brain, pituitary gland, reproductive system and digestive system of any locally available bony fish.
3. Examination and Analysis of Stomach Content of Fishes (Carnivorous and Herbivorous).
4. To study the Habit and Habitat of some Indigenous and exotic culturable freshwater fishes.
5. To Study spawn, fry, Semi-fingerlings and fingerlings of Indian major carps and exotic carps.
6. To study the Habit and Habitat of some Marine water fishes for Capture Fishery (any five).
7. Preparation and identification of fishing Craft/Gear model (Using locally available material).
8. Study of Fish Diseases caused by Pathogens and Parasites (Bacterial, Fungal, Protozoan, Helminth, Arthropod etc.).
9. Study of fish Preservation Methods (e.g. Salting, Drying, Pickling, Smoking, etc.).
10. Preparation and Study of fish by-product (Fish pickle, Fish chips, decorative/utility article using fish body parts or whole fish).
11. Identification, classification and description of Fish species for Monoculture, Polyculture, Integrated fish farming and Sewage fed fish culture.
12. Estimation of O₂ content, NPK, Ca, Na in Sewage Water sample.
13. Estimation of pH, Hardness (Magnesium and Calcium) and Turbidity in water Sample.
14. Identification of Phytoplankton and Zooplanktons (any five).
15. To study the Habit and Habitat of important Larvicidal fishes (any five).
16. Identification of Common Aquatic Weeds of Freshwater Fish Ponds
17. Control of the Common Aquatic Weeds of freshwater.
18. Identification and study of Non Fish Organisms (any three).
19. Identification, classification and description of Fish species for Mariculture
20. Visit to Fish Breeding Farm/ Fish Industry and Submission of report.

Note: All animal based practical's should be conducted with the help of Models, Charts and Computer Aided Techniques.

**REFERENCE BOOKS BASED ON PAPER: DSEZ-I& II (SECTION B) PAPER: DSEZP-II
Paper XIII-A & XV-A; XVII (A)**

1. Fish and fisheries of India- V.G. Jhingran, Hindusthan Publishing Company.
2. Fish and Fisheries – K. Pandey and J.P.Shukla, Rastogi Publications, Meerut.
3. Fisheries and Aquaculture- Ravi Shankar Piska, Lahari Publications, Hyderabad.
4. Concepts of Aquaculture- Ravi Shankar Piska, Lahari Publications, Hyderabad.
5. Fresh water fish pond culture and management – Marilyn Chakroff. Pace crops scientific publishers – Jodhapur.
6. World fish farming cultivation and Economics- E. E. Brown Pvt. Pub. Co. U. S. A. 1983.
7. Aquaculture – Bardach J. E. J. H. Ryther and W.O. Meharney Wiley – Ind. Sci., New York.
8. Aquaculture- R. J. Reay – Arnold- Heive Mann Publishers, India,
9. An Introduction to fishes – S. S. Khanna, Central Book Dept., Allahabad
10. A Manual of fresh water aquaculture – R. Sonthanam, N. Sukumaran & P. Niligajan
11. A text book of Fishery Science and Indian fisheries –C. B. C. Shrivastav Kitalb Mahal, Nagpur.
12. Principles of Ecology- P.S. Verma, V.K. Agrawal- S.Chand Publication.
13. Prawn and Prawn Fisheries of India- Kurian C. V. and Substian.
14. Fish Biology and Indian Fisheries- R. P. Parihar, Central Publishing House, Allahabad.
15. Encyclopedia of Fishes and Fisheries of India- Pandey A. K. and Sandhu.
16. Fisheries in India- Misra S.B.
17. Fisheries Global Perspective – Cherunilam.
18. Fish Processing and Preservation- Charls L. Cutting, Agro Botanical Publisheres (India)
19. Fish and fish products – Winton A. L.
20. Pond & Fish culture - Hall C. B.
21. Fishery Management – Agrawal.
22. Costal Aquaculture in India- Santhanam R.
23. Marine Fisheries of India- Virbhadrarao and Bal.
24. Introduction to fish technology- Regenstein.
25. Fresh water fish culture- Wankhede and Deshmukh.
26. Aquaculture Development- Amitabh Patel, S. N. Pathak.
27. A Text book of Aquaculture- Rao K. R. S. S., Reddy M.S., Discovery Publication, Delhi.
28. A Text Book of Pisciculture & Aquarium Keeping- H. S. Jagtap, S. N. Mukherjee & V. K. Garad., Daya Publishing House, New Delhi.
29. Practical Manual of Pisciculture and Aquarium Keeping- H. S. Jagtap, S. N. Mukherjee & S. S. Nanware, Daya Publishing House, New Delhi.
30. General and Applied Ichthyology (Fish and Fisheries)- S.K.Gupta and P.C.Gupta.S.Chand & Compony Ltd., New Delhi.
31. Manual of Experimental Ichthyology-Gahlawat, Gupta,Yadava, Jain, Sihag, Sabhlok, Daya Publishing House, Delhi
32. Modern Experimental Zoology-Gupta and Chaturvedi. Raj Publishing House, Jaipur.

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
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**Choice Based Credit System (CBCS)
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI) w.e.f. June, 2018
PRACTICAL QUESTION PAPER**

SUBJECT: ZOOLOGY

Paper: DSEZP-II (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of Paper: Pisciculture and Aquaculture {XVII (A)}

Centre:

Date:

Batch No.:

Session:

Marks: 40

Time: 04 Hrs

- Q.1 Diagrammatic presentation or Layout Plan for a Typical Fish Farm **10**
OR
Dissect out/Demonstrate Brain/ Pituitary Gland/ Digestive System/ Reproductive System of any locally available bony fish
OR
Examination and Analysis of Stomach Content of Carnivorous/ Herbivorous Fish
OR
Identify, Classify and Describe Indigenous & exotic culturable freshwater fishes (Any Two), spawn/ fry/fingerlings of Indian major carp or exotic carp (Any One) and Marine water fishes for Capture Fishery (Any Two).
- Q.2 Identification and description of Fishing Craft/Gear model (using locally available material). **08**
OR
Identify and describe Fish Diseases caused by Pathogens and Parasites (Bacterial/Fungal, Protozoan, Helminth, Arthropod etc.) One from Each.
OR
Study of fish preservation methods (Salting, Drying, Pickling, Smoking, etc.)
OR
Preparation and Study of fish by-product (Fish pickle/Fish chips/ decorative/ utility article using fish body parts or whole fish)
- Q.3 Identification, classification and description of Fish species for Integrated fish farming (Any Three) and Sewage fed fish culture (Any Two). **10**
OR
Estimation of O₂ content/ NPK in Sewage Water sample.
- Q.4 Estimation of pH/ Hardness (Magnesium and Calcium)/ Turbidity in water sample **08**
OR
Identify and Describe Phytoplankton/ Zooplanktons, Larvicidal Fish/Aquatic Weeds, Non Fish Organism and Fish Species for Mariculture (One from Each)
- Q.5 Viva-Voce **04**

Note: 1. Practical Internal Evaluation (Continuous Assessment CA) = Total 10 Marks.

a) Submission of Record book & Submission of Report on a Field Visit = 05 Marks And

b) Internal Test on Practicals=05 Marks.

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

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

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Zoology

Practical Syllabus

Paper: DSEZP-II (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of Paper: Applied Parasitology {XVII (B)}

Periods : 15+15

Credits: 02 (Marks: 50)

- 1 **Identification, classification and description of Protozoan Parasites through permanent slides/photomicrographs-**
 - i. *Entamoeba histolytica*,
 - ii. *Giardia intestinalis*,
 - iii. *Trichomonas vaginalis*
 - iv. *Trypanosoma gambiense*
 - v. *Balantidium coli*
 - vi. *Sarcocystis cruzi*,
 - vii. *Plasmodium sp.*
 - viii. *Eimeria tenella*
- 2 **Collection, staining, identification and description of Parasitic protozoa from Blood sample or rectal contents of suitable animals –**
 - i. *Ciliates*,
 - ii. Flagellates,
 - iii. Malarial parasites,
 - iv. Coccidian Parasites
- 3 **Identification, classification and description of Parasitic platyhelminths through permanent slides/photomicrographs or specimens -**
 - i. *Schistosoma haematobium*
 - ii. *Fasciola hepatica*
 - iii. *Paragonimus westermani*.
 - iv. *Gastrodiscoides hominis*
 - v. *Taenia saginata*,
 - vi. *Taenia solium*
 - vii. *Echinococcus granulosus*
 - viii. *Diphyllobothrium lattum*
2. Collection, Preservation, Staining, Mounting, identification and description of Trematodes and Cestodes from locally available different hosts (Gills & intestines).
3. **Identification, classification and description of Parasitic Nematodes (Animals & Plants) through permanent slides/photomicrographs or specimens –**
 - i. *Enterobius vermicularis*
 - ii. *Ancylostoma duodenale*.
 - iii. *Ascaris lumbricoides*
 - iv. *Wuchereria bancrofti*.
 - v. *Meloidogyne* (Root knot nematode),
 - vi. *Heterodera* (Cyst nematode)
 - vii. *Tylenchulus* (Citrus nematode)
 - viii. *Anguina* (Seed Gall- nematode)
6. **Collection, Preservation, Mounting, identification and description of Animal Nematodes from locally available different hosts (intestines).**
7. **Collection, Preservation, Mounting, identification and description of Plant Nematodes from soil samples.**
8. **Study of following arthropods through permanent slides/ photographs:**
Aedes, Culex, Anopheles, Pediculus humanus, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica.
- 9 **Collection, preservation, Preparation of permanent slides and description of mouth-parts of -** House fly ii. Mosquito iii. Bed bug iv. Head louse
10. **Submission of a brief report on parasites of vertebrates.**

Note: All animal based practical's should be conducted with the help of Models, Charts and Computer Aided Techniques.

**REFERENCE BOOKS BASED ON PAPER: DSEZ-I& II (SECTION B) PAPER: DSEZP-II
Paper XIII-B & XV-B; XVII (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. Animal Nematodes from Indian Mammals- H. S. Nama, G. B. Shinde and B. V. Jadhav
7. Applied Parasitology- A Practical Manual – C. J. Hiware, B. V. Jadhav, A. D. Mohekar, Mangaldeep Publication, Jaipur.
8. Parasitology Insects-B. D. Patnaik, Dominant Publishers and Distributors, New Delhi, 2001
9. Handbook of Entomology-T.V. R. Ayyar
10. Useful and Destructive Insects- Metacalf and Flint
11. Protozoology- Kudo
12. Biology of Protozoa- Sleials
13. Clinical Parasitology- Faust
14. Medical Helminthology- Watson
15. Indian Insect Life- Lefrey
16. General Parasitology- Cheng
17. Bench Aids for the diagnosis of Malaria- WHO, 1985.
18. Human Parasitology- Burton J. Bogistch, Clint E. Carter, Thomas N. Oeltmann. 2005. Third Edition, Elsevier Academic press.
19. Malaria: Principles and Practice of Malariology. Vol. I and II,- Warnsdorfer W.H. and Sri. Mc Gregor, I. 1998. Churchill Livingstone, New York.
20. Parasitology (Medical Zoology)- H.S.Singh and P.Rastogi. Rastogi Publications. Meerut
21. Medical Parasitology- N.C. Dey and T.K.Dey. Allied Agency, Kolkatta.
22. A Modern Text Book of Parasitology- Dr.A.N.Latey, Narendra Prakashan, Pune
23. Medical Zoology-R.C.Sobti,Shoban Lal Nagin Chand & Co., Jalandhar.

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
NANDED**

**Choice Based Credit System (CBCS)
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI) w.e.f. June, 2018
PRACTICAL QUESTION PAPER**

SUBJECT: ZOOLOGY

Paper: DSEZP-II (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of Paper: Applied Parasitology {XVII (B)}

Centre:

Date:

Batch No.:

Session:

Marks: 40

Time: 04 Hrs

- Q.1** Collect, Prepare a permanent slide, identify and describe Ciliates/ Flagellate/ Malarial Parasites/ Coccidian parasites from Blood sample/ rectal contents of suitable animals **10**
- OR
- Collect, Prepare a permanent slide, identify and describe Trematodes/ Cestodes from locally available Host (Gill/ Intestine)
- Q.2** Identify, classify and describe Parasitic Protozoa (Two), Platyhelminths (One Trematode and One Cestode) by using permanent slides/photomicrographs/ or specimens. **08**
- Q.3** Collect, Prepare a permanent slide, identify and describe Animal Nematodes from locally available Host Intestine/ Plant Nematodes from soil samples. **10**
- OR
- Prepare a permanent slides of mouth parts from the given specimen and identify by giving reasons
- Q.4** Identify, classify and describe Parasitic Nematodes (One Animal Nematode and One Plant Nematode) and Arthropods (Two) by using permanent slides/photomicrographs/ or specimens. **08**
- Q.5** Viva-Voce **04**

Note: 1. Practical Internal Evaluation (Continuous Assessment CA) = Total 10 Marks.

- a) Submission of Record book & Submission of brief report on parasites of vertebrates = 05 Marks &
b) Internal Test on Practicals=05 Marks.

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

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
NANDED**

**Choice Based Credit System (CBCS) Course Structure
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI) w.e.f. June, 2018**

**Zoology
Practical Syllabus**

Paper: DSEZP-II (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of Paper: Entomology {XVII (C)}

Periods : 15+15

Credits: 02 (Marks: 50)

1. Study of Methods of collection, preservation and identification of insects.
2. Mounting of mouthparts of insect: Biting and Chewing, piercing and sucking, siphoning and sponging type.
3. External morphology of Cockroach, Sexual dimorphism.
4. Dissection (Cockroach): Digestive System, Respiratory, Nervous System and Reproductive System.
5. Museum Study of Insect Orders: (At least Two specimens from each Insect order)
 - a. Thysanura
 - b. Orthoptera
 - c. Odonata
 - d. Hymenoptera
 - e. Lepidoptera
 - f. Coleoptera
 - g. Diptera
 - h. Isoptera
6. Preparation and identification of permanent slide and study of developmental stages of Cockroach.
7. Collection, Identification and preservation of agricultural insect pests from local area (Minimum 10).
8. Collection, Preservation and Study of House hold and medically important Pests: Rat flea, Housefly, Head louse, Mosquito, Crickets.
9. Study of non insect animal pests:
 - a. Rat
 - b. Birds
 - c. Monkey
 - d. Pig
 - e. Deer
 - f. Ticks and Mites
10. Collection and submission of major crop insect pests from local area (Minimum 10).
11. Preparation and identification of permanent slides and study the Life Cycle (developmental stages) of Silk moth, Honeybee, Lac insects.
12. To study Equipments used in Sericulture, Apiculture, Lac culture.
13. Study of Vertebrates important for biological control against insect pests - Guppy fish, Frog, Gecko, Wood pecker, Bat, Scaly anteater etc.
14. Demonstration of use of different equipments such as drills, sprayers, dusters for insect control.
15. Study tour: At least two visits to the crop fields, Agricultural Research Institutes and submission of Study tour report along with photographic documentation of Entomology related issues.

Note: All animal based practical's should be conducted with the help of Models, Charts and Computer Aided Techniques.

**REFERENCE BOOKS BASED ON PAPER: DSEZ-I& II (SECTION B) PAPER: DSEZP-II
Paper XIII-C & XV-C; XVII (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
27. Alaka Prakash- Laboratory manual of entomology.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS)

Faculty of Science & Technology

B. Sc. Third Year (Semester V & VI) w.e.f. June, 2018

PRACTICAL QUESTION PAPER

SUBJECT: ZOOLOGY

Paper: DSEZP-II (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of Paper: Entomology {XVII (C)}

Centre:

Date:

Batch No.:

Session:

Marks: 40

Time: 04 Hrs

- Q.1** Prepare a slides of Insect from the given Material and identify giving reasons with description/ **10**
Prepare a slides of mouth parts from the given Material and identify with comments.
- OR**
- Dissect/Demonstrate Digestive /Respiratory/ Nervous / Reproductive System of Cockroach.
- Q.2** Identify, classify and describe salient features of specimens from orders Viz. Thysanura, Orthoptera, Odonata, Hymemptera, Lepidoptra, Coleoptera, Diptera, Isoptera (any four) **08**
- OR**
- Identification/Preparation of permanent slide of developmental stages of Cockroach.
- Q.3** Identify and comment on its importance of agricultural insect pests (Three), Human and House hold Pests (Two) *Or* **10**
Preparation of permanent slides of agricultural insect pests/ Human Pests/ House hold Pests from given material.
- OR**
- Identify and comment on its importance of non insect animal pest and their Control viz. Rat , Bird, Monkey, Pig, Deer
- Q.4** To study the Life cycle (developmental stages) of Silk moth/ Honey bee/ Lac insect by using charts/models **08**
- OR**
- Comments on Equipments used in Sericulture/ Apiculture/ Lac culture.
- OR**
- Identification, classification and description of Vertebrates important for biological control (any Two) and Identification and description of equipments for household insect control (any Two)
- Q.5** Viva-Voce **04**

Note: 1. Practical Internal Evaluation (Continuous Assessment CA) = Total 10 Marks.

a) Submission of Record book & Submission of Report on a Field Visit = 05 Marks And

b) Internal Test on Practicals=05 Marks.

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

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
NANDED**

**Choice Based Credit System (CBCS) Course Structure
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI) w.e.f. June, 2018**

**Zoology
Practical Syllabus**

Paper: DSEZP-II (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of the Paper: Environmental Biology {XVII (D)}

Periods : 15+15

Credits: 02 (Marks: 50)

- 1) Recording of Atmospheric Temperature and
- 2) Recording of Relative Humidity.
- 3) Estimation of Dissolved Oxygen Content (DO), free Carbon dioxide (CO₂) in Water sample.
- 4) To estimate Total Dissolved Solids (TDS), Suspended Solids in Water sample.
- 5) Qualitative and Quantitative Study of Phytoplankton and Zooplankton in water sample.
- 6) To estimate pH of Water sample and Soil Sample by pH Meter.
- 7) To study the physical characteristic (Texture, Colour and Temperature) of the soil
- 8) To Estimate Organic Matter in soil sample.
- 9) Detection of NPK in the soil sample.
- 10) Demonstration of basic equipment needed in wildlife studies use, care and maintenance.
- 11) Identification of flora, insect and avian fauna.
- 12) Field Visit to Biodiversity Park/Wild Life Sanctuary/ Zoo Park/National Park/ to study wild animals
- 13) Effect of Heavy Metals/Pesticide on Oxygen consumption of Crab/Fish any suitable animal.
- 14) Effects of Pollutant/Pesticide on Heart beats of/ Any Suitable animal.
- 15) To Study Effects of Hydrogen sulphide gas pollutant on the Plant parts.
- 16) Estimation of Chlorides & Salinity from Water Sample to Assess the Water Quality.
- 17) Comparative analysis of air sampling from clean and polluted area using key parameters.
- 18) Field visit to river/lake and water and wastewater treatment plants.

Note: All animal based practical's should be conducted with the help of Models, Charts and Computer Aided Techniques.

**REFERENCE BOOKS (BASED ON PAPER: DSEZ-I& II (SECTION B) PAPER: DSEZP-II
Paper XIII-D & XV-D; XVII (D))**

1. Odum – ‘**Ecology**’.
2. P.D. Sharma, ‘**Ecology and Environment**’ Rastogi Publications, Meerut-250002, 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).
10. Trivedi P.K. and Goel P.K. ‘**Chemical and Biological methods for Water Pollution Studies**’ (Published by Environmental Publisher KARAD).
11. Trivedi P.K. and Raj Gurudeep ‘**Environmental Water and Soil Analysis**’.
12. Published by Akashdeep Publication House New Delhi.
13. P. S. Verma and V.K. Aggrawal :**Environmental Biology**
14. P.D. Sharma : **Environmental Biology**
15. P.D. Sharma : **Toxicology**
16. E. P. Odum : **Fundamentals of Ecology**
17. E. P. Odum : **Fundamentals of Ecology**
18. Ranganalla : **Water and Waste Water Engineering**
19. P. D. Sharma : **Microbiology**
20. P. D. Sharma : **Microbiology**
21. Kndosia : **Water Pollution**
22. M. V. Rao : **Air Pollution**
23. NEERI Nagpur : **Manual on Waste Water Analysis.**

Swami Ramanand Teerth Marathwada University Nanded
Choice Based Credit System (CBCS)
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI)
PRACTICAL QUESTION PAPER

SUBJECT: ZOOLOGY

Paper: DSEZP-II (Based on DSEZ-I; Section-B& DSEZ-II; Section-B)

Title of the Paper: Environmental Biology {XVII (D)}

Centre:

Date:

Batch No.:

Session:

Marks: 40

Time: 04 Hrs

Q.1 Recording of Atmospheric Temperature / Relative Humidity **10**

OR

To estimate the amount of Dissolved Oxygen Content (DO)/ free Carbon dioxide (CO₂) *Or*
Total Dissolved Solids (TDS)/ Suspended Solids in Water sample.

Q.2 Qualitative/ Quantitative Study of Phytoplankton/ Zooplankton in water sample. *Or* **08**

To estimate pH of Water sample/Soil Sample by pH Meter.

OR

To study the physical characteristic (Texture, Colour and Temperature) of the soil. *Or*
To Estimate Organic Matter in soil sample/ Detection of NPK in the soil sample.

OR

Comments on Equipments (Two) needed in wildlife studies, Identification and Comment on
insect (One) and avian fauna (One).

Q.3 Effect of Heavy Metals/Pesticide on Oxygen consumption of Crab/Fish any suitable
animal. **10**

OR

Effects of Pollutant/Pesticide on Heart beats of/ Any Suitable animal.

Q.4 To Study Effects of Hydrogen sulphide gas pollutant on the Plant parts. **08**

OR

Estimation of Chlorides & Salinity from Water Sample to Assess the Water Quality.

Q.5 Viva-Voce **04**

Note: 1. Practical Internal Evaluation (Continuous Assessment CA) = Total 10 Marks.

a) Submission of Record book & Submission of Report on a Field Visit = 05 Marks And

b) Internal Test on Practicals=05 Marks.

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

Swami Ramanand Teerth Marathwada University Nanded
Choice Based Credit System (CBCS)
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI)
PRACTICAL PAPER
CONTINUOUS ASSESSMENT (CA)

SUBJECT: ZOOLOGY

Paper: DSEZP-I: (Based on DSEZ-I; Section-A & DSEZ-II; Section-A)

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

Centre:

Date:

Maximum Marks: 10

SEAT NUMBER:

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Submission of Record book & Submission of Report on a Field Visit	05	
2.	Internal Test on Practicals	05	
	Total Marks	10	

Swami Ramanand Teerth Marathwada University Nanded
Choice Based Credit System (CBCS)
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI)
PRACTICAL PAPER
CONTINUOUS ASSESSMENT (CA)

SUBJECT: ZOOLOGY

Paper: DSEZP-II: (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of the Paper: Pisciculture and Aquaculture {XVII (A)}

Centre:

Date:

Maximum Marks: 10

SEAT NUMBER:

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Submission of Record book & Submission of Report on a Field Visit	05	
2.	Internal Test on Practicals	05	
	Total Marks	10	

Swami Ramanand Teerth Marathwada University Nanded
Choice Based Credit System (CBCS)
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI)
PRACTICAL PAPER
CONTINUOUS ASSESSMENT (CA)

SUBJECT: ZOOLOGY

Paper: DSEZP-II: (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of the Paper: Applied Parasitology {XVII (B)}

Centre:

Date:

Maximum Marks: 10

SEAT NUMBER:

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Submission of Record book & Submission of brief report on Parasites of Vertebrates	05	
2.	Internal Test on Practicals	05	
	Total Marks	10	

Swami Ramanand Teerth Marathwada University Nanded
Choice Based Credit System (CBCS)
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI)
PRACTICAL PAPER
CONTINUOUS ASSESSMENT (CA)

SUBJECT: ZOOLOGY

Paper: DSEZP-II: (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of the Paper: Entomology {XVII (C)}

Centre:

Date:

Maximum Marks: 10

SEAT NUMBER:

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Submission of Record book & Submission of Report on a Field Visit	05	
2.	Internal Test on Practicals	05	
	Total Marks	10	

Swami Ramanand Teerth Marathwada University Nanded
Choice Based Credit System (CBCS)
Faculty of Science & Technology
B. Sc. Third Year (Semester V & VI)
PRACTICAL PAPER
CONTINUOUS ASSESSMENT (CA)

SUBJECT: ZOOLOGY

Paper: DSEZP-II: (Based on DSEZ-I; Section-B & DSEZ-II; Section-B)

Title of the Paper: Environmental Biology {XVII (D)}

Centre:

Date:

Maximum Marks: 10

SEAT NUMBER:

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Submission of Record book & Submission of Report on a Field Visit	05	
2.	Internal Test on Practicals	05	
	Total Marks	10	

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS)

Faculty of Science & Technology

B. Sc. Third Year (Semester V & VI)

PATTERN OF THEORY QUESTION PAPER

w.e.f. Academic Year 2018-2019

SUBJECT: ZOOLOGY

Semester-V/VI

Paper:

Title of Paper:

Time- 2 Hrs

Marks : 40

N.B.:- (i) Attempt All Questions.

(ii) All Questions carry equal Marks.

(iii) Illustrate your answers with suitable labeled diagrams wherever necessary.

Q. 1 Attempt *Any Four* of the following: (Each of Two Marks) Based on Unit I, II, III, IV 08

- a)
- b)
- c)
- d)
- e)
- f)

(Minimum one and maximum two from each Unit)

Q. 2 Attempt *Any Two* of the following: (Each of Four Marks) (Based on Unit I & Unit II) 08

- a)
- b)
- c)

(Minimum one and maximum two from each Unit)

Q. 3 Attempt *Any One* of the following: (Each of Eight Marks) (Based on Unit I & Unit II) 08

- a)
- b)

Q. 4 Attempt *Any Two* of the following: (Each of Four Marks) (Based on Unit III & Unit IV) 08

- a)
- b)
- c)

(Minimum one and maximum two from each Unit)

Q.5 Attempt *Any One* of the following: (Each of Eight Marks) (Based on Unit III & Unit IV) 08

- a)
- b)

Swami Ramanand Teerth Marathwada University, Nanded

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science And Technology

B.Sc. THIRD Year, Semester – V

Skill Enhancement Course

SECZ –III (E): PARASITES OF PUBLIC HEALTH IMPORTANCE

Periods: 45

Credits:02 (Marks:50)

Unit I

12

Brief introduction of Parasitology, Parasitism, Parasite, Host, Vector.

MALARIAL PARASITES.

History, Geographic distribution, Taxonomic position of different Species of malarial parasites. Distinguishing characters of different species of human malarial parasites, Life cycle, Pathogenicity, Prevention and control measures of Malarial parasites.

Practicals:

1. Preparation of stains- JSB I and II, Leishman and Giemsa.
2. Preparation of blood smears (thick and thin) and staining with JSB, Leishman and Giemsa for malaria parasite infection.
3. Dissection and examination of mosquitoes for malaria parasite infection.
4. Identification of various stages of malaria parasites:
(I) *Plasmodium vivax* (II) *P. falciparum* (III) *P. malariae* (IV) *P. ovale*

Unit II

11

PARASITIC PLATYHELMINTHES

History, Geographic distribution, Morphology, Life Cycle, Pathogenicity, Prevention and control measures of *Schistosoma haematobium* and *Taenia solium*

Practicals:

1. Examination of Urine and stool sample for assessment of presence and intensity of *Schistosoma* infection.
2. Collection and preservation of Cestodes from locally available hosts intestines.
3. Staining, Mounting, drawing and identification of Cestode Parasites.
4. Identification, classification and description of Parasitic platyhelminths (*Schistosoma haematobium* and *Taenia solium*) through permanent slides/photomicrographs or specimens.

Unit III

11

LYMPHATIC FILARIAL PARASITES- *Wuchereria bancrofti*.

History, Geographic distribution of lymphatic filariasis, Taxonomic position of Filarial worm (*Wuchereria bancrofti*), Distinguishing characters, Life cycle, Pathogenicity, Prevention and control measures.

Practicals

1. Dissection and examination of mosquitoes for filarial parasite (*Wuchereria bancrofti*) infection.

2. Staining and examination of blood smears for detection of microfilariae.
3. Identification, classification and description of Lymphatic Filarial Parasites- *Wuchereria bancrofti* through permanent slides/photomicrographs or specimens.

Unit-IV

11

INSECTS OF MEDICAL IMPORTANCE

Morphology, Medical importance and Control of *Pediculus humanus*, *Xenopsylla cheopis*, *Anopheles*, *Culex*, *Aedes*.

Practicals

1. Study of arthropod vectors associated with human diseases: *Pediculus*, *Xenopsylla*, *Culex*, *Anopheles*, *Aedes*.
 2. Study of different kinds of mouth parts of insects
 3. Study of following insect vectors through permanent slides/ photographs: *Pediculus humanus*, *Xenopsylla cheopis*, *Aedes*, *Culex*, *Anopheles*
 4. Study of different diseases transmitted by insect vectors.
 5. Preparation of slide mounts of insects and their mouth parts.
- **Submission of a brief report on parasites of Public health importance.**

REFERENCE BOOKS

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.
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. Parasitic Insects-B. D. Patnaik, Dominant Publishers and Distributors, New Delhi, 2001
8. Handbook of Entomology-T.V. R. Ayyar
9. Protozoology- Kudo
10. Clinical Parasitology- Faust
11. Medical Helminthology- Watson
12. Indian Insect Life- Lefrey
13. General Parasitology- Cheng
14. Bench Aids for the diagnosis of malaria- WHO, 1985.
15. Human Parasitology- Burton J. Bogistch, Clint E. Carter, Thomas N. Oeltmann. 2005. Third Edition, Elsevier Academic press.
16. Malaria: Principles and Practice of Malariology. Vol. I and II,- Warnsdorfer W.H. and Sri. Mc Gregor, I. 1998. Churchill Livingstone, New York.
17. Parasitology (Medical Zoology)- H.S.Singh and P.Rastogi. Rastogi Publications. Meerut
18. Medical Parasitology- N.C. Dey and T.K.Dey. Allied Agency, Kolkatta.
19. A Modern Text Book of Parasitology- Dr.A.N.Latey, Narendra Prakashan, Pune
20. Medical Zoology-R.C.Sobti, Shoban Lal Nagin Chand & Co., Jalandhar.

Swami Ramanand Teerth Marathwada University, Nanded

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science And Technology

B.Sc. THIRD Year, Semester – V

Skill Enhancement Course

SECZ –III (F) : VERMICULTURE AND VERMICOMPOSTING

Periods: 45

Credits:02 (Marks:50)

UNIT – I

11

1. Vermiculture – Definition, History, scope and economic importance.
2. Earthworms-Taxonomic Position and Diversity of different species of earthworms.
3. *Eisenia fetida*- Systematic position, Morphology and Life cycle.

Practicals:

1. To Study different species of earthworms.
2. To Study morphological features of composting earthworm, *Eisenia Fetida*
3. To study Life cycle of *Eisenia Fetida*.
4. Identification of Earthworm cocoons and vermi casts

UNIT – II

11

1. Common species for Vermiculture; Environmental requirements; culture methods
2. Applications of Vermiculture.
3. Earthworm Pests and Diseases.

Practicals:

1. Collection and identification of common species of earthworms for vermiculture.
2. Study of Earthworm Pests and diseases.

UNIT – III

12

VERMICOMPOSITING

1. Vermicomposting Materials
2. **Types of vermicomposting:**
 - a) Small Scale Vermicomposting
 - b) Large Scale Vermicomposting
3. **Methods of Vermicomposting:** Bed Method, Pit Method.
4. Phases and Steps of Vermicomposting.

Practicals:

1. Study of Vermicompost equipments, devices.
2. Preparation of Vermibeds.
3. Demonstration of preparation pit method.
4. Preparation of vermicomposting pits at local area (college or home gardens)

UNIT- IV

11

VERMICOMPOSTING

1. Harvesting
2. Nutrient Content of Vermicompost
3. Advantages of Vermicompost
4. Vermiwash, Preparation and Applications
5. Prospects of vermi-culture as self employment venture

Practicals:

1. Collection of vermiwash and use of vermiwash.
2. To study the effect of vermicompost on any plant.
3. Visit to Agricultural Farm/Field to nearby Krishi Vidnyan Kendra to study vermicultures and vermicomposting Units.

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CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science And Technology

B.Sc. THIRD Year, Semester – VI

Skill Enhancement Course

SECZ –IV (G) : AQUARIUM KEEPING

Periods: 45

Credits:02 (Marks:50)

Unit I **11**

Introduction to Aquarium Keeping,

Aquarium – Definition, Shape and size

- Types of aquarium- wooden, Steel, fibre glass, plastic acrylic, iron frame, full glass, garden pool etc.

Practicals:

1. To study different types of aquarium
2. Visit to Aquaria

Unit II **12**

Construction of aquarium

Design and fabrication

Materials - Aluminum/ Iron angle, Hack saw, blade, drilling machine, Hammer, glass, glass cutter, tape, file, set square, angle cutter, sticky tape, aquarium cement, silicon tube, silicon gun etc.

Practicals:

1. Angle cutting for frame of aquarium.
2. Rivetting of angle to form a side of aquarium.
3. Fixing of glass of one side in the frame of aquarium with the help of bitumen/ aquarium cement / silicon etc.
4. Cutting of glasses of given size

Unit III **11**

Setting of Aquarium-

- Selection of place for aquarium, table or stand, cover for aquarium, light, watering, planting, preparation of bed-sand, gravels, rocks, coarals, back glass painting or poster, **Aquarium accessories-** Aerator, air-stone, toys, filtration, hand net, rubber tube and connectors. Thermometer, heater etc.

Practicals:

1. Identification of various aquarium tools
2. Identification of various aquarium accessories

3. Preparation of aquarium bed.
4. Watering of aquarium
5. Planting of aquarium
6. Lighting of aquarium

Unit – IV

11

Maintenance

- Water parameters/ test and monitor, cycling of water.
- Cleaning of aquarium, light management
- Food of feeding- live food and dry food/
- Preparation of supplementary food for aquarium fishes.
- Aquarium fishes
- Significance of aquarium.

Practicals:

1. Cleaning of aquarium
2. Identification of aquarium fishes
3. Preparation of supplementary food from grains for aquarium fishes
4. Checking fish health
5. Marketing

REFERENCE BOOKS

1. Guide to keeping and breeding the aquarium fishes (1968). Bombay aquarium Society, Mumbai.
2. Fresh water aquarium, Dawes, J.A., Roberts Royce Ltd. London
3. A Text Book of Pisciculture and Aquarium Keeping- DhananjayJadhav, Mohan Babre.
4. Hand Book of Fish aquarium- Hiware and Sonwane,
5. A Text Book of Pisciculture & Aquarium Keeping- H. S. Jagtap, S. N. Mukherjee & V. K. Garad., Daya Publishing House, New Delhi.
6. Practical Manual of Pisciculture and Aquarium Keeping- H. S. Jagtap, S. N. Mukherjee & S. S. Nanware, Daya Publishing House, New Delhi
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8. How to maintain your fresh water aquarium-ThomsRiggson
9. The Complete aquarium Book- NilliamT.innes

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CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science And Technology

B.Sc. THIRD Year, Semester – VI

Skill Enhancement Course

SECZ –IV (H) : SERICULTURE

Periods: 45

Credits:02 (Marks:50)

UNIT – I

11

Introduction of Sericulture

- 1.1 History and Scope of Sericulture, Present status of sericulture in India.
- 1.2 Types of silkworm- Mulberry, Tasar, Eri and Muga silkworm
- 1.3 Systematic position, Morphology, Life Cycle of Silkworm
- 1.3 Cultivation of Mulberry- Planting, grafting and Harvesting.
- 1.4 Mulberry diseases and pest managements.
 - a) Foliar Disease
 - b) Root rot Disease
 - c) Root knot Disease
 - d) Common pest of Mulberry

Practicals:

1. Identification of different types of silkworms.
2. Morphology of egg, larva, pupa and adult of different silkworm types.
3. Sex differentiation of Larva, Pupa and Adult Silkworms
4. Identification of root knot diseases, root galls, egg masses, larvae and nematodes

UNIT – II

12

Silk worm Rearing

- 1.1 Prerequisite for silkworm rearing.
- 1.2 Silkworm Rearing Equipments
- 1.3 **Rearing Practices**- Procurement of quality seeds, Brushing, Preparation of feed bed and feeding, Bed Cleaning, Spacing, Mounting, Harvesting of Cocoons, Post Cocoon Processing- Stifling, Reeling.
- 1.4 Role of Environmental factors in rearing.

Practicals:

1. Estimation of Hatching and Brushing Percentage of silkworm Eggs
2. Estimation of Moisture Content of Mulberry Leaves for chawki Rearing
3. Determination of mulberry Leaf Driage in the Rearing Bed
4. Practical demonstration of cooking, reeling and re-reeling of a sample cocoon.

UNIT- III

11

Pests and Diseases

- 1.1 Introduction and classification of different types of silkworm diseases
- 1.2 Influence of environment and Nutrition on the incidence of diseases.
- 1.3 Pests of silkworm: Uzi fly, dermestid beetles and vertebrates
- 1.4 Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial
- 1.5 Control and prevention of pests and diseases

Practicals:

1. Identification of different silkworm diseases and Method of their disposal.
2. Identification of major silkworm pests.
3. Estimation of Uzi fly infestation during late age silkworm rearing.
4. Visit to Sericulture Centre.

UNIT- IV**11****Sericulture Economics and Marketing**

- 1.1 Mulberry cultivation (per hectare) –Cost and returns under irrigation and rainfed condition.
- 1.2 Economics of egg production: Expenditure and income.
- 1.3 Economics of silkworm rearing: Investment and returns
- 1.4 Economics of silk reeling (per kg of raw silk): Cost and returns for different types of reeling establishments.
- 1.5 Sericulture marketing organization for seed cocoon, raw silk and silk fabric
- 1.6 Traditional and regulated markets, their merits and limitations

Practicals:

1. Identification of Textile fibres by physical and chemical tests—microscopic examinations, flame test and solubility test for polyester, cotton, silk.
2. Study Tour to Silk fabric manufacturing unit, Power loom and Handloom.

REFERENCE BOOKS

1. Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
2. Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
3. Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore.
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10. Crop pests and how to fight them- Govt. of Maharashtra Pub. Bombay.
11. Sericulture Training Manual by Soo-ho-Lim, Sang-Poong Lee.

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B. Sc. Third Year; Semester V
SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)
SECZ –III (E): PARASITES OF PUBLIC HEALTH IMPORTANCE
Or
SECZ –III (F): VERMICULTURE AND VERMICOMPOSTING
CONTINUOUS ASSESSMENT (CA)

CENTRE:

DATE:

Maximum Marks: 25

SEAT NUMBER:

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Seminar Presentation	15	
2.	Test	10	
	Total Marks	25	

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CHOICE BASED CREDIT SYSTEM (CBCS)

Faculty of Science And Technology

ZOOLOGY

B. Sc. Third Year; Semester VI

SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

SECZ -IV (G): AQUARIUM KEEPING

Or

SECZ -IV (H): SERICULTURE

CONTINUOUS ASSESSMENT (CA)

CENTRE:

DATE:

Maximum Marks: 25

SEAT NUMBER:

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
3.	Seminar Presentation	15	
4.	Test	10	
	Total Marks	25	

Swami Ramanand Teerth Marathwada University, Nanded
CHOICE BASED CREDIT SYSTEM (CBCS)
Faculty of Science And Technology
ZOOLOGY
B. Sc. Third Year; Semester V
SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)
SECZ –III (E): PARASITES OF PUBLIC HEALTH IMPORTANCE
Or
SECZ –III (F): VERMICULTURE AND VERMICOMPOSTING
END OF SEMESTER EXAMINATION (ESE)

CENTRE:

DATE:

Maximum Marks: 25

SEAT NUMBER:

Sr. No.	End of Semester Examination (ESE)	Maximum Marks	Marks Obtained
1.	Skill Work Report Submission	10	
2.	Overall Skill Judgment	10	
3.	Skill Work Presentation	05	
	Total Marks	25	

Name & Signature
Examiner – 1

Name & Signature
Examiner – 2

Swami Ramanand Teerth Marathwada University, Nanded

CHOICE BASED CREDIT SYSTEM (CBCS)

Faculty of Science And Technology

ZOOLOGY

B. Sc. Third Year; Semester VI

SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

SECZ -IV (G): AQUARIUM KEEPING

Or

SECZ -IV (H): SERICULTURE

END OF SEMESTER EXAMINATION (ESE)

CENTRE:

DATE:

Maximum Marks: 25

SEAT NUMBER:

Sr. No.	End of Semester Examination (ESE)	Maximum Marks	Marks Obtained
1.	Skill Work Report Submission	10	
2.	Overall Skill Judgment	10	
3.	Skill Work Presentation	05	
	Total Marks	25	

**Name & Signature
Examiner – 1**

**Name & Signature
Examiner – 2**