MAHARASHTRA EDUCATION

SOCIETY'S ABASAHEB

GARWARE COLLEGE

KARVE ROAD, PUNE.

(AUTONOMOUS)

Affiliated to Savitribai Phule Pune

University Three Year B.Sc Degree

Program in Zoology (Faculty of

Science and Technology)

Syllabi under NEP 2024-2025

F.Y. B.Sc. Zoology

NEP Course Structure of the FY Zoology 24-25

Year	Semester	Course type	Course code	Course Title	Remark	Credit	No. of Lectures/ Practicals
1	I	MJ	ZOO-111 -TH	Animal Diversity I	Theory	2	30 h
1	I	MJP	ZOO 112-PR		Practical	2	15 (60 h)
	I	GE/OE	OE-113-ZOO	Fresh Water Zoology	Theory Practical	1 1	15h 7.5 (30h)
1	I	SEC	SEC-101-ZOO	Aquarium Management	Practical	2	15 (60h)
1	II	MJ	ZOO-161 -TH	Animal Diversity II	Theory	2	30h
1	I	MJP	ZOO 162 -PR		Practical	2	15 (60h)
	I	GE/OE	OE-163-ZOO	Basic Ornithology	Theory Practical	1 1	15h 7.5(30h)
1	I	SEC	SEC-151-ZOO	Biodegradable waste management	Practical	2	15 (60h)
II	III	MJ	ZOO-211-MJ	Animal Diversity III	Theory	2	30h
		MJ	ZOO-212- MJ	Parasitology	Theory	2	30h
		MJ	ZOO-213-MJP	Practical	Theory	2	15 (60h)
		VSC	ZOO-221-VSC	Entomology	Theory Practical	1 1	15h 7.5(30h)
		FP	ZOO-231-FP			2	60h
		MN	ZOO-241-MN	Animal Diversity III	Theory Practical	2 2	30h 15(60h)
		OE		Rescue,First aid of animals and Pet Care	Theory Practical	1 1	15h 7.5(30h)
		IKS	ZOO-	Zoology in ancient India	Theory	2	30h
II	IV	MJ	ZOO-251-MJ	Animal Diversity IV	Theory	2	30h
		MJ	ZOO-252- MJ	Public Health and Hygiene	Theory	2	30h
		MJ	ZOO-253-MJP	Practical	Practical	2	30h
		VSC	ZOO-271-VSC	Forensic Zoology	Theory Practical	1 1	15h 7.5 (30h)
		CEP	ZOO-281-CEP			2	60h
		MN	ZOO-291-MN	Animal Diversity IV	Theory Practical	2 2	30h 15 (60h)
		OE		Amazing Arthropods	Theory Practical	1 1	15h 7.5(30h)
		SEC	SEC-254-ZOO	Biodiversity Indices	Theory Practical	1 1	15h 7.5 (30h)
III	V	MJ	ZOO-301-MJ	Animal Diversity V	Theory	2	30h
		MJ	ZOO-302-MJ	Cell Biology	Theory	2	30h
		MJ	ZOO-303-MJ	Biochemistry	Theory	2	30h

		MJ	ZOO-304-MJ	Genetics	Theory	2	30h
		MJP	ZOO-305-MJP	Animal Diversity V Cell Biology	Practical	2	15 (60h)
		MJP	ZOO-306-MJP	Biochemistry Genetics		2	15 (60h)
		Elective	ZOO-311-MJ	Histology/ Ecology	Theory	2	30h
		Elective Practical	ZOO-311-MJP	Histology/Ecology Practical	Practical	2	15 (60h)
		VSC	ZOO-321-VSC	Biological Techniques I /Applied Zoology I	Practical	2	15 (60h)
		FP/CEP	ZOO-331-FP			2	60h
		Minor	ZOO-341-MN	Animal Behaviour	Theory	2	30h
III	VI	MJ	ZOO-351-MJ	Animal Diversity VI		2	30h
		MJ	ZOO-352-MJ	Developmental Biology		2	30h
		MJ	ZOO-353-MJ	Physiology		2	30h
		MJ	ZOO-354-MJ	Molecular Biology		2	30h
		MJP	ZOO-355-MJP	Animal Diversity VI Developmental Biology		2	15 (60h)
		MJP	ZOO-356-MJP	Physiology Molecular Biology		2	15 (60h)
		Elective	ZOO-360-MJ	Evolution/ Pathology	Theory	2	30h
		Elective Practical	ZOO-360-MJP	Evolution	Practical	2	15 (60h)
		VSC	ZOO-371-VSC	Biological Techniques II/Applied Zoology II	Practical	2	15 (60h)
		OJT	OJT-371-ZOO			4	120h
			ZOO-341-MN				

F. Y. B. Sc. ZOOLOGY, PAPER-I

Syllabus restructured for NEP

Paper title - ANIMAL DIVERSITY-I **Semester-l**

Paper no. ZOO- 111-TH **Credits-2** **Lectures-30**

No.	**Title & Contents**	**Number of lectures**

CHAP-1. Introduction to Animal Diversity and its significance (L-01)

CHAP-2. Principles of Classification: (L-08)

Taxonomy & Systematics

1.1 Taxonomy: Basic terminology and Introduction

a. Alpha, Beta and Gamma levels of taxonomy

b. Micro-taxonomy & Macro taxonomy: Phenetics (numerical taxonomy), Cladistics (phylogenetic systematics)

c. Evolutionary taxonomy (evolutionary systematics)

d. Classical taxonomy and experimental or neo-taxonomy

e. Biochemical taxonomy and Cytotaxonomy.

f. Significance of Taxonomy

1.2 Systematics: definition and introduction

1.3 Linnaean system of classification (Six level classification: Phylum, class, order, family, genus, species)

1.4 Concept of Species: Biological & Evolutionary

1.5 Introduction to Binomial Nomenclature.

1.6 Introduction to Five kingdom classification system.

CHAP-3. General Features of kingdom Animalia (L-02)

2.1 General characters of Kingdom Animalia

2.2 Grades of organization & Symmetry.

CHAP-4. Kingdom Protista (Phylum-Protozoa) (L-08)

3.1 Introduction to Phylum Protozoa

3.2 Salient features of Phylum Protozoa

3.3 Classification of Phylum Protozoa up to classes with two examples (names only).

Class:Rhizopoda (e.g :*Entamoeba histolytica, Arcella vulgaris*)

Class:Mastigophora (e.g: *Euglena viridis, Trypanosoma gambiense*)

Clas: Ciliata (e.*g Paramoecium caudatum, Opalina ranarum*)

Class:Sporozoa (e.g *Plasmodium vivax, Toxoplasma gondii*)

3.4 Locomotion in Protozoa: Types of pseudopodia, flagella and cilia.

3.5 Type Study: *Paramecium caudatum*: Classification, Habit and

Habitat, External morphology, Feeding and digestion, Excretion,

Reproduction (binary fission and conjugation)

CHAP-5. Origin of Metazoa (L-01)

4.1 Introduction, origin and importance of Metazoa.

CHAP-6. Phylum-Porifera (L-08)

5.1. Introduction to Phylum Porifera

5.2 Classification of Phylum Porifera up to classes with two examples

of each class (names only)

Class:Calcarea e.g*: Leucosolenia, Sycon* (Scypha))

Class:Hexactinellida e.g: *Euplectella* (venus's flower basket), *Hyalonema* (glass sponge))

Class:Demospongeae -e.g: *Chalina* (mermaid's gloves), *Spongilla* (fresh water sponge)

5.3 Canal systems in sponges: Ascon,Sycon, Leucon and Rhagon type.

5.4 Skeleton in sponges: Spicules, its types: Microscleres & Megascleres,

Monoaxon – Monactinal, Diactinal, Amphidiscs, Triaxon, Polyaxon,

Spongin fibres.

5.5 Gemmules and Regeneration in sponges.

CHAP-7. Phylum-Cnidaria (L-08)

6.1 Introduction to Phylum Cnidaria

6.2 Salient features of Phylum Cnidaria

6.3 Classification of Phylum Cnidaria up to class level with any two examples each class (names only)

Class:Hydrozoa e.g.*: Hydra, Physalia* (Portuguese-man of war)

Class:Scyphozoa e.g: *Aurelia* (Jelly fish), *Leucernaria* (Trumpet-shaped Jellyfish)

Class:Anthozoa: e.g; *Metridium* (Common sea anemone) and *Meandrina* (Brain-coral)

6.4 Polymorphism in Hydrozoa: Polyp & Medusa (polyp types: gastrozooids, dactylozooids, gonozooids) and functions.

6.5 Study of Fresh water Cnidarian :Hydra: External Morphology, budding

Reference Books-

1. Text Books of Zoology. Vol.11, Invertebrates, 1982, A. J. Marshall And W. D. Williams, ELSB And Macmillan, Hongkong.

2. General Zoology By Goodnight and others IBH Publishing Co.

3. Life of Invertebrates By Prasad,ASN,Vikas Publishing House,New Delhi

4. Phylum Protozoa to Echinodermata (series) By Kotpal,RL.,Rastogi and Co. Meerut

5. Invertebrate zoology By Barnes,Saunders College Publishing Co.,Philadelphia,USA,1987

6. Text Books of Zoology, Invertebrates Vol- II, 1992, T.J.Parker and W.A. Haswel, Edited by Marshall and Williams, CBS publications and distribution, New Dehli.

7.Invertebrates Zoology, E.L. Jordon and P.S. Verma; S. Chand and Co. Ltd., New Dehli.14th fully Revised Edition- 2007.

8. Invertebrate Zoology, 1991, Paul, A. Meglitch and Fedricks R. Schram, Oxford University Press, New York.

9. IGCSE Biology, D. G. Mackean, Published by John Murray, London. UK, 2002.

10. Invertebrate Zoology, Edited by D. T. Anderson, Oxford University Press, New York.-Indian Edition by- A.P. Offset, Dehli, 2006.

F. Y. B. Sc. ZOOLOGY, PAPER-I

Syllabus restructured for NEP

Paper title - ANIMAL DIVERSITY-I **Semester-l**

Paper no. ZOO- 111-PR **Credits-2** **Practicals 15**

1.Museum study of Phylum-Protozoa.

Eg- Amoeba, Euglena, Paramoecium, Noctiluca, Vorticella,

2. Study of locomotary organelles and Locomotion in Protozoa: Pseudopodia, Cilia and Flagella

3. Preparation of Paramoecium culture – External Characters

4. Study of Cyclosis, Trichocysts, Contractile vacuoles, Nuclei.

5. Study of binary fission and conjugation in *Paramecium*

6. Collection of water sample from river, pond and Study of protozoan and identify bio indicator protozoans . (2 Practicals)

7. Study of Parasitic protozoans – Trypanosoma, Entamoeba, Plasmodium, Giardia, Opalina

8. Museum study of Phylum-Porifera

Eg- Sycon, Leucosolenia, Euplectella, Hyalonema, Chalina , Spongilla.

9. Study of water vascular systems in Porifera and T.S. of Sycon

10. Temporary preparation of Gemmules and types of spicules.

11. Museum study of Phylum-Cnidaria (Marine)

Eg- Porpita, Vellela,, Aurelia, Metridium, Meandrina.

12. Study of fresh water Cnidaria: Study of Hydra: Morphology, asexual reproduction by Budding

13. Study of corals and their economic importance.

Organ-pipe coral, Sea-fan, Stag-horn coral, Star-coral, Favia and Fungia.

14. Prepare the report about formation of Corals and Map the coral reefs on the world Map.

F. Y. B. Sc. ZOOLOGY, PAPER-I

Syllabus restructured for NEP

Paper title – Fresh Water Zoology **Semester-l**

Paper no. OE-113-ZOO **Credits-2** **Lectures 15**

1. Types of freshwater habitats **(3)**

    Lotic: Streams, Rivers

    Lentic: Temporary pools, Ponds, Lakes

    Specialized habitats: Cliffs and Cascades, Karsts, Phytotelma, Wetlands

2. Zones of water bodies and microhabitats **(1)**

3. Aquatic ecosystems **(3)**

    Organisation (benthos, nekton, plankton)

    Trophic levels (producers, consumers)

4. Ecosystem function **(3)**

    Factors affecting function like –

    Sunlight, Nutrients, Temperature, Dissolved Oxygen

5. Physical and chemical properties of water **(2)**

    pH, T, TDS, Salinity, EC, DO, Turbidity

6. Disturbance **(2)**

    Organic pollution, Eutrophication, BOD

7. Restoration of Aquatic Habitat **(1)**

    Pros and Cons

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Syllabus restructured for NEP

Paper title – Fresh Water Zoology **Semester-l**

Paper no. OE-113-ZOO **Credits-2** **Practicals 7.5**

1. Visit a freshwater ecosystem. **(1.5)**
2. Observation of live sample from a freshwater ecosystem **(1)**
2. Analysis of DO and BOD I, physico-chemical parameters of water **(1)**
3. Measurement of BOD II and major nutrients in water **(1)**
4. Protista and rarely encountered groups **(1)**
5. Benthic Invertebrates **(1)**

   Porifera, Cnidaria, Bryozoa, Mollusca, Crustacea, Insecta
6. Planktonic Invertebrates **(1)**

   Crustacea, Insecta

References:

- Thorp, J. H., & Rogers, D. C. (Eds.). (2014). *Thorp and Covich's freshwater invertebrates: ecology and general biology* (Vol. 1). Elsevier.
- Lancaster, J., & Downes, B. J. (2013). *Aquatic entomology*. Oxford University Press, Oxford.
- Williams, D. D. (Ed.). (2012). *The ecology of temporary waters*. Springer Science & Business Media.
- Lampert, W., & Sommer, U. (2007). *Limnoecology: the ecology of lakes and streams*. Oxford University Press, USA.
- van der Valk, A. (2012). *The biology of freshwater wetlands*. Oxford University Press.

F. Y. B. Sc. ZOOLOGY

Syllabus restructured for NEP

Paper title – Aquarium Management **Semester I**

Paper no. – SEC -101-ZOO **Credits – 2** **Practicals – 15**

1. Introduction of the aquarium fish industry as its potential scope as a cottage industry. **(1)**

   Investment, Place for set-up, Training and Formal Education, Maintenance, Associated Business Scope, Sale, Aid from the Government, and Scope of the Industry.

2. Exotic fishes in the aquarium trade. **(1)**

   Exotic species – Siamese Fighter Fish, Neon Tetra, Killifish, Dwarf Gourami, Blue Gourami, Pearl Gourami, Red Tail Shark, African Chichlids, Jewel Chichlid, Glassfish, Rainbow Fish, Angelfish, Bloodfin Tetras, White Cloud Mountain Minnow and Swordtails.
   Mismanagement – Invasive Species.

3. Endemic fishes in the aquarium trade. **(1)**
   Endemic species – African Jewelfish, Angelfish, Arowana, Bala Shark, Tiger / Sumatra Barb, Rosy Barb, Siamese Fighter Fish and Black Molly.

4. Common characters and sexual dimorphism of aquarium fishes. **(1)**

   Guppy, Molly, Swordtail, Goldfish, Angelfish, Blue morph, Anemone fish, Butterfly fish and Siamese Fighter Fish.

5. Common diseases of aquarium fishes. **(1)**

   Bacterial, viral, fungal and parasitic diseases.

6. Construction and maintenance of an aquarium. **(1)**

7. Aquarium accessories, their uses and importance. **(1)**

   Lid, Aquarium Stand, Lighting Devices, Heating Devices, Aquarium Filters (Mechanical, Chemical and Biological), Aerators, Diffusors, Feeding Rings, Thermometer, Planting Sticks, Ornamental Plants, Siphon Tube and Nets.

8. Water parameters and their importance. **(1)**

   Acidity, Alkalinity, Dissolved Oxygen, Calcium, Nitrate, Ammonia, Total hardness and Salinity.

9. Fish transportation. **(1)**
   Fish handling, packing and forwarding techniques.
10. Aquarium fish breeding methods. **(1)**

    Natural and Induced breeding.

11. Visit to a fish breeding / rearing centre. **(2)**

12. Visit to an aquarium business / commercial aquarium centre. **(2)**

13. Project and Report **(1)**

F.Y.B.Sc. ZOOLOGY, PAPER-Il

Syllabus restructured for NEP

Paper title-ANIMAL DIVERSITY-Il, **Semester-ll.**

Paper no. ZOO-161-TH **Credits-2** **Lectures-30**

No.	**Title &Contents**	**Number of lectures**

CHAP-1, Phylum-Platyhelminthes (L-06)

1.1 Introduction to Phylum Platyhelminthes

1.2 Salient features of Phylum Platyhelminthes

1.3 Classification of Phylum Platyhelminthes up to classes with two examples each class (names only)

Class: Turbellaria (e.g: *Dugesia, Bipalium*)

Class: Trematoda (e.g: *Fasciola hepatica, Schistosoma haematobium*)

Class: Cestoda: (*Taenia solium* (pork-tapeworm), *Echinococcus granulosus* (dog-tapeworm))

1.4 Parasitic adaptations in Platyhelminthes: structural and physiological.

CHAP-2, Phylum-Aschelminthes (L-04)

2.1 Introduction to phylum Aschelminthes

2.2 Salient features of Phylum Aschelminthes

2.3 Classification of Phylum Aschelminthes ,

Class: Nematoda with two examples – *Ascaris lumbricoides, Wuchereria bancrofti*.

CHAP-3, Phylum-Annelida (L-12)

3.1 Introduction to Phylum Annelida

3.2 Salient features of Phylum Annelida.

3.3 Classification of Phylum Annelida up to classes with two examples (names only)

Class: Polychaeta e.g*: Nereis virens, Aphrodita aculeata*

Class: Oligochaeta e.g*.: Pheritima posthuma, Tubifex*

Class: Hirudinea e.g: *Hirudinaria granulosa, Pontobdella*

3.4 Type study of Earthworm, *Pheretima posthuma* with respect to Systematic position,

External characters, Digestive, Nervous, Circulatory, Respiratory, Excretory and Reproductive system.

3.5 Economic importance of Annelida with reference to earthworms as friends of farmers and their role in vermicomposting.

CHAP-4. Phylum-Arthropoda (L-08)

4.1 Introduction to Phylum Arthropoda

4.2 Salient features of Phylum Arthropoda

4.3 Classification of Phylum Arthropoda upto class level with any examples (names only)

Class: Crustacea:*Palaemon palaemon ,Brachyura spp*.

Class: Chilopoda: *Scolopendra sp*.

Class: Diplopoda*: Julus*

Class: Insecta: Periplaneta americana , Anopheles stephensii.

Class: Arachnida- Signature spider, *Buthus sp.*

4.4 Mouth parts of insects: Mandibulate, Piercing and sucking, Chewing and lapping type.

CHAP-5. Phylum-Mollusca (L-06)

5.1 Introduction to Phylum Mollusca

5.2 Salient features of Phylum Mollusca

5.3 Classification of Phylum Mollusca with any two examples (names only)

Class: Gastropoda e.g *Pila globose, Patella*

Class: Pelecypoda e.*g Lamellidens marginalis, Mytilus*

Class: Polyplacophora e.g *Chiton*

Class: Cephalopoda e.g: *Octopus vulgaris, Sepia officinalis*

Reference Books-

1. Text Books of Zoology. Vol.11, Invertebrates, 1982, A. J. Marshall And W. D.

Williams, ELSB And Macmillan, Hongkong.

2. General Zoology By Goodnight and others IBH Publishing Co.

3. Life of Invertebrates By Prasad,ASN,Vikas Publishing House,New Delhi

4. Phylum Protozoa to Echinodermata (series) By Kotpal,RL.,Rastogi and Co. Meerut

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F. Y. B. Sc. ZOOLOGY, PAPER I

Syllabus restructured for NEP

Paper title – ZOO-162-PR **Semester-II**

Credit-2 **Practicals-15**

1. Study of Phylum-Platyhelminthes

   . Planaria, Liver-fluke and its life cycle.

2. Study of Tapeworm, life cycle and study of permanent slides-Scolex and mature proglottid.

3. Museum study of

a. Phylum-Aschelminthes,

e.g. - Ascaris lumbricoides, Wuchereria bancrofti,

b. Phylum-Annelida,

e.g. - Nereis, Aphrodite, Leech

4. Museum study of Phylum-Arthropoda e.g. - Peripatus, Prawn, Julus, Scolopendra, Praying mantis, Scorpion

5. Use of identification key to identify insects – specimens from orders - Diptera, Orthoptera, Lepidoptera, Coleoptera

6. Study of different types of mouth parts with examples: Biting and chewing, sponging, siphoning, piercing and sucking.

7. Museum study of Phylum-Mollusca e.g. Bivalve, Chiton, Dentalium, Octopus, Pila.

8. Study of Shell and foot modification in Mollusca

9. Dissection of Earthworm: External characters, Digestive system and mounting of setae.

10. Dissection of Earthworm: Nervous system and mounting of blood glands.

11. Dissection of Earthworm : Reproductive system

12. Visit to INORA / vermiculture unit and submission of report (1.5 Practicals)

13. Submission of five photographs of insects from your locality

14. Study of Insects preservation technique and submission of two preserved insects (1.5)

F. Y. B. Sc. ZOOLOGY

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SEM II

Paper no – OE-163-ZOO **Paper title – Basic Ornithology**

Credits-01 **Lectures-15**

1. Introduction to Indian Ornithology	1
2. Basic classification of birds	2
3. Bird habitats	1
4. Bird morphology and anatomy	2
5. Avian adaptations (Flight) of Birds	2
6. Beak and feet modifications	1
7. Food, feeding and breeding behaviour	2
10. Bird migration	2
12. Conservation strategies	2

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Syllabus restructured for NEP

Semester-lI

Paper no – OE-163-ZOO **Paper title – Basic Ornithology**

Credits-01 **Practicals- 7.5**

1. Classification of birds – Avian Diversity – Common avian orders (at least 4 with one example each)

3. Study of basic avian morphology – Feathers, Claws etc.

4. Study of Beak and feet modifications (at least 4 examples)

5. Field Identification of birds – field visit to avian diversity rich terrestrial habitat (equivalent to 2 practicals)

6. Submission of self-photographed bird catalogue (at least 10 examples) (1.5 practicals)

F. Y. B. Sc. ZOOLOGY

Syllabus restructured for NEP

Paper title – Bio-Degradable Waste Management **Semester lI**

Paper no. – SEC-151-ZOO **Credits 2** **Practicals 15**

1. Introduction to Waste Management **(1)**

   Need and importance, decentralised waste management, degradable and non-degradable waste – urban and agricultural: types, components, segregation, collection and transport, treatment and disposal. Environmental impacts.

2. Composting food web – Biological components, their roles and their contribution in waste management. Identification of organisms from a detritus sample. **(1)**
3. Aerobic composting – set-up, maintenance and products. **(1)**
4. Vermicomposting – set-up, maintenance and products. **(1)**
5. Earthworm species used in vermicomposting. **(1)**
6. Anaerobic composting and digestion – biogas, waste to energy. **(1)**
7. Factors affecting the quality of aerobic, anaerobic and vermicomposting. **(1)**
8. Quality checks of compost: moisture, pH, NPK content, C:N ratio. **(1)**
9. Bio-enzymes – introduction, set-up and uses. **(1)**
10. Locking Carbon – introduction, carbon sinks, upcycled products and alternative uses, biomass briquettes and bio-char. **(1)**
11. Visit to a solid waste management facility / composting or vermicomposting unit. **(2)**
12. Visit to a waste-water treatment plant / biogas generation unit. **(2)**
13. Project and Report. **(1)**