PROGRESSIVE EDUCATION SOCIETY'S
MODERN COLLEGE OF ARTS, SCIENCE AND COMMERCE (AUTONOMOUS), SHIVAJINAGAR, PUNE-5

SUBJECT: ZOOLOGY Semester- I F.Y.B.Sc. Zoology syllabus
Sem –I Major Course Theory- 2 Credits (30 lectures)

Course code; 24ScZooU1101

Course: Systematics & Diversity of Life – Protists to Chordates

Learning outcomes After successfully completing this course, the students will be able to:

1. Develop understanding on the diversity of life with regard to protists, non chordates and chordates.
2. Group animals on the basis of their morphological characteristics/ structures.
3. Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.
4. Understand how morphological change due to change in environment helps drive evolution over a long period of time.
5. The project assignment will also give them a flavour of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills. It will further enable the students to think and interpret individually due to different animal species chosen.

Unit	Topic	No. of Lectures
I	**Origin of Life on Earth, Products of evolutionary process**	6
	1. Origin of life on Earth: Arrival of simple form from primordial chemicals. 2. Multicellularity, Biological diversity. Systematics and taxonomy, Nomenclature,Species concept. 3. Classification: morphological and evolutionary (molecular) and Relationship of taxa: phylogenetics and cladistics with special reference to paraphyly, monophyly.	
II	**Diversity in Protists and acoelomate Metazoa**	6
	1. Structure and diversity in Protists. 2. Origin of Metazoans: Diploblastic and triploblastic organization; symmetries; protostomes and deuterostomes 3. Special features and structural diversity in sponges. 4. Cnidarians: Special features; transition of third germ layer polymorphism and division of labour coral reef forming Cnidarians. 5.The Bilateria: Basic characteristics. The acoelomates	
III	**Diversity in pseudocoelomate and coelomate Non chordates**	6
	1. The Ecdysozoa: characteristics of the representative taxa	

	2. Pseudocoelomates; Basic organization and adaptive radiations in roundworms 3. The coelomates: Basic organization and adaptive radiations in Arthropods and adaptive radiations in Crustaceans, Myriapods, Chelicerates, Insects etc. 4. Basic organization and diversity in Annelids and Molluscs 5. Basic organization of Echinoderms; their affinity to Chordates.	
IV	**Study of Paramoecium**	2
	1. Morphology of Paramoecium 2. Digestion, respiration and excretion in Paramoecium 3. Reproduction in Paramoecium	
V	**Diversity in Protochordates and Chordates**	6
	1. Chordates – Primitive Chordates, .Hemichordates, Urochordates and Cephalochordates. 2.Advent of vertebrates: Cyclostomes 3. Basic organization and diversity of fishes 4. Amphibians diversity and adaptability to dual mode of life. 5. Amniotes: the amniotic egg, adaptive radiations in reptiles; 6. Birds: Adaptation from terrestrial to aerial mode of life 7. Origin of Mammals- Special features of Monotremes and Marsupials.	
VI	**Study of Labeo**	4
	1. Morphology and Digestive system 2. Reproductive system, Brain	

Recommended readings -

- Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.
- Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
- Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
- Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.
- Barrington, E.J.W. (1979) Invertebrate Structure and Functions.IIEdition.E.L.B.S. and Nelson.
- Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
- Bushbaum, R. (1964) Animals without Backbones.University of Chicago Press.

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SUBJECT: ZOOLOGY Semester- I F.Y.B.Sc. Zoology syllabus
Lab course Major-I - 2 Credit

Course code: 24ScZooU1102

Practicals on Systematics & Diversity of Life – Protists to Chordates List

of Practicals-

Sr. No	Title	No. of Practical
1	Study of classification of Protista and Porifera (one example from each class). (D)	**1P**
2	Study of classification of Cnidaria and Platyhelminthes (one example from each class). (D)	**1P**
3	Study of classification of Aschelminthes and Annelida (one example from each class). (D)	**1P**
4	Study of classification of Athropoda (one example from each class). (D)	**1P**
5	a. Study of classification of Mollusca (one example from each class). (D) b.Study of classification of Echinodermata (one example from each class). (D)	**1P**
6	Study of paramecium- Morphology, culture, cyclosis and reproduction (E)	**1P**
7	Study of spicules and gemmules in Sponges (E)	**1P**
8	Study of classification of Hemichordata, Urochordata and Cephalochordata (one example from each class). (D)	**1P**
9	Study of classification of Cyclostomata, Pisces and Amphibia (one example from each Subclass). (D)	**1P**
10	Study of classification of Reptiles And Aves (one example from each sub-class/order). (D)	**1P**
11	Study of classification of Mammalia (one example from each – subclass/order). (D)	**1P**
12	Study of Beak and feet modification in birds. (D)	**1P**
13	Study of Labeo- morphology, digestive system, reproductive system & Brain (E)	**1P**
14	Compulsory visit to National Park/ forest/water body/sea shore, study of animals in nature and collection of five species (preferably invertebrates,	**1P**

	insects) belonging to a clade. A project work on their generic identification, description and illustration with a note on their locality. Also the assessment of their relationship by constructing a cladogram using characters and character states.	
15	a. Comparison of two species of reptiles/Aves/mammals belonging to same genus (Interspecific difference). b. Comparison and weighting of characters of two reptiles/Aves/mammals belonging to same family but dissimilar genera. Group discussion or Seminar presentation on one or two related topics from the list.	**1P**

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F.Y.B.Sc Syllabus **Semester I** **SUBJECT:ZOOLOGY Sem– I (Open Elective)** **Theory-2Credits (30 lectures)**

Course code: 24ScZooU1401

Course – Preventive medicine

Learning outcomes - After completing this course the learners will be able to

1. Develop and implement public health interventions
2. Engage with health systems and public health initiatives.
3. Increase their skills, attitudes and knowledge towards causes of diseases
4. Apply knowledge of the principles of disease, injury prevention and control
5. Prepare expert educational outreach lectures and presentations
6. Increase their skills towards knowledge of community health improvement

Unit	Topic	No. of Lectures
I	**Human health and its determinants**	**6**
	Definition of health; concepts of health – Biomedical, ecological, psychological and holistic. Dimensions of health – physical, mental, social, spiritual, emotional and vocational.	
II	**Man and Medicine: Towards Health for all**	**7**
	History of scientific medicine. Concept of well-being – Epidemiology, Etiology, Pathogenesis, Disease control/elimination/eradication. Levels of Prevention. Types of Epidemiology, Uses of epidemiology.	
III	**Concept of Health and Diseases**	**9**
	Prevention and Control of Communicable Diseases, like Malaria, Cholera, Tuberculosis, Leprosy, Poliomyelitis, Viral Hepatitis, Dengue, AIDS, etc. Non communicable diseases, like coronary heart disease, hypertension, diabetes mellitus, cancers, etc.	
IV	**Health promotion and awareness programmes**	**8**
	Modes of Interventions: health promotion, specific protection Ecology of health and right to health, early diagnosis and treatment, disability limitations and rehabilitations. Health programmes in India – NVBDCP, NLEP, NTP, National AIDS control programme, AYUSH, Immunization programme.	

Reference

1. Park, K. (2017) Park's Textbook of Preventive and Social Medicine
2. Mahajan, K. (2013) Principles of Preventive and Social Medicine
3. Holland, W.W., Detels, R. & Knox, G. (2002) Oxford text book of Public Health (4th edition

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SUBJECT: ZOOLOGY **Semester- I** **F.Y.B.Sc. Zoology syllabus**
Skill Enhancement Course (SEC) **Lab course 2-Credi**

Course code: 24ScZooU1601 **Course Title: Aquaculture**

About the course

This course will give the students an understanding of the principles of aquaculture, including production systems, water quality, nutrition, spawning, larval culture and culture methodologies with special reference to fish, and prawn. The course will include an opportunity to conduct hands-on activities related to culture and husbandry of animals **Learning outcomes**
After completing this course the learners will be able to

1. Understand the aquaculture systems
2. Understand conditioning factors and how they can be manipulated
3. Describe water depuration mechanisms
4. Understand the environmental impacts of aquaculture

Sr. No	Title	No. of Practical
1	Study of morphology, Habit, habitat and culture methods of Indian major carps	1P
2	Study of Anatomy of fish.	1P
3	Study of morphology, Habit, habitat and culture methods of freshwater prawn	1P
4	Study of morphology, Habit, habitat and culture methods of crab.	1P
5	Study of fish culture in paddy fields	1P
6	Study of morphology, Habit, habitat and culture methods of pearl Oyster.	1P
7	Composite fish culture: various patterns and ornamental fish culture.	1P

8	Study of different types of pond designing used in fishery: Nursery pond, Rearing pond and Stocking pond.	**1P**
9	Study of predatory, weed fishes and their control methods in Nursery, Rearing and Stocking pond.	**1P**
10	Study of formulation of fish food and fish food organisms (Live feed culture).	**1P**
11	Fish harvesting methods: types of crafts and gears.	**1P**
12	Study of fish preservation techniques and fish by products.	**1P**
13	Study of fish disease, parasites and treatment	**1P**
14	Project report for establishment fish farm. (Recent government subsidies and schemes)	**1P**
15	Compulsory study tour/visit to aquaculture Institute/ aquaculture Research Station or fish farm	**1P**

Recommended readings

1. Jingran, V. G. (1983) Fish and fisheries of India , Hindustan pub. corp. New Delhi.
2. Hute, M. and Kahn, H. (2000) Textbook of fish culture, Blackwell Scientific Publication, Australia.
3.Srinivasulu, M., Reddy, K.R.S., Rao, S. (1999) Text book of Aquaculture, Discovery Publishing House New Delhi.
4. Yawn Mehta, Fisheries & Aquaculture Biotechnology (2011) Campus Books International, Prahalad street, Ansari Road, Durga Ganj, New Delhi

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Sem –II

F.Y.B.Sc Syllabus **SUBJECT:ZOOLOGY**

Major Course **Theory- 2 Credits (30 lectures)**

Course - Cell Biology and Histology- Major II **Course code: 24ScZooU2101**

About the course

The course provides a detailed insight into basic concepts of cellular structure and function. It also gives an account of the complex regulatory mechanisms that control cell function.

Learning outcomes

After successfully completing this course, the students will be able to understand:

1. Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved.
2. Acquire the detailknowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer.
3. Acquire the detailknowledge of different types of transport.
4. Understand how tissues are produced from cells in a normal course and about any malfunctioning which may lead to benign or malignant tumor.

Unit	Topic	No. of Lectures
1	**The Structure and Organelles of Prokaryotic & Eukaryotic cells**	**8**
	1. Cell biology, its scope in modern perspective. 2. Cell theory. General structure of prokaryotes, bacteria, archaea and eukaryotes. 3. Extra nuclear cell organelles: Ultrastructure and functions of endoplasmic reticulum, ribosome, Golgi apparatus, lysosome, peroxisomes. 4. Mitochondria: Origin, structure, composition, genome organization and function. 5. Cytoskeleton: composition and functions; microtubules and microfilaments. 6. Nucleus: size, shape, structure and functions.Ultrastructure of nuclear membrane and pore complex. Nucleolus	
2	**Cell membrane and transport mechanism**	**7**
	1. Cell membrane organization: cell membrane: origin, structure, composition, Recent models and function. Fluid mosaic model. 2. Lipid Composition, inner and outer leaflets. Structure and functions of membrane proteins: Integral, peripheral and lipid- anchored membrane proteins. 3. Transport across membrane: diffusion and osmosis. Active and	

	passive transport, endocytosis and exocytosis	
3	**Cell cycle and Cell signallingpathways**	**7**
	1. Cell cycle, cell division- mitosis and meiosis. 2. Cell division check points and their regulation. 3. Mutations in the genes that regulate cell cycle and division and their role in causing cancer. Programmed cell death (Apoptosis). 4. Cell regulation and Cell signaling: Signaling molecules and their receptors. 5. Functions of cell surface receptors. Regulation of signaling pathways.	
4	**Structural and functional significance of animal tissues**	**8**
	1. Introduction to tissues. Epithelial tissue: types, structure and characteristics. Basement membrane: structure and characteristics. Cell junctions. Exocrine and endocrine glands: types and structure. 2. Connective tissue cells. Structure and function of loose, dense and adipose tissue. Cartilage and bone: classification, and fine structure. Blood: plasma, blood cells, lymph– their structural and functional. Bone marrow andStructure and function of spleen. 3. Muscular tissue: ultrastructure of smooth, skeletal and cardiac muscles. 4. Structure and classification of neurons. Types of supporting (glial) cells and their function. Myelin sheath.Degeneration and regeneration of neurons.	

References

1. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments (6th edition) John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006) Cell and Molecular Biology (8th edition) Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. (5th edition) ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M.; Kleinsmith, L.J.; Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. (7th edition) Pearson Benjamin Cummings Publishing, San Francisco

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F.Y.B.Sc Syllabus **SUBJECT:ZOOLOGY** **Sem II**

Course –Practicals on Cell Biology and Histology- Major II **Course code: 24ScZooU12102**

Major II- List of Practical- 2 Credit (Any 15 practicals)

Sr. No	**Title**	**No.of Practical**
1	Study of prokaryotic and eukaryotic cell types with the help of chart, slide and video (E)	1P
2	Separation and isolation of cells by sedimentation velocity in unit gravity from blood or liver (E)	1P
3	Disruption of cells, isolation and identification of subcellular components, isolation of nuclei from blood or liver(E)	1P
4	Detection of mitochondria by Janus green-B method -(E)	1P
5	Chromosome segregation in mitosis and meiosis by using permenant slides	1P
6	Preparation of chromosome squashes from onion root tips for the observation of stages of mitosis (E)	1P
7	Study of types of tissue through permanent slides: epithelial, connective, muscular, nervous etc. (D)	1P
8	Study of histology of tissues by preparing permanent stained slides through microtomy (E)	3P
9	Group discussion or Seminar presentation on one or two related topics from the list	1P
10	Study of osmosis in human RBCs [Membrane Fragility] (E)	1P
11	Temporary mounting of tissues: Striated muscle fibres from available material (E)	1P
12	Temporary preparation of neurons from available material. (E)	1P
13	Techniques in Cell biology- Microscopy and micrometry. (D)	1P
14	Effect of colchicine on mitosis. (E)	1P

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F.Y.B.Sc Syllabus **SUBJECT:ZOOLOGY**

Semester II

(Open Elective) Theory – 2Credits (30lectures) Course code: 24ScZooU2401

Lab Course – Practicals in Public Health and Hygiene

Sr. No	Title of the practical	No. of Practicals
1	To detect adulterants in the food samples by appropriate tests	1P
2	Epidemiological study of chicken guinea, measles, swine flu	1P
3	Survey with the help of questionnaire in 10 families. Communicable diseases b. Vaccines	1P
4	Study of pets: Ectoparasites of cats, dogs & birds	1P
5	Testing potability of water for human consumption by MPN method	1P
6	Medical entomology - Study of household insects/pests with respect to public health and hygiene	1P
7	Study of Health administration policies on International, National, State and City level	1P
8	A compulsory visit to water purification (treatment) plant	1P
9	Study of any one food borne/water borne/air borne diseases with respect to their treatment, causative agents and preventive measures	1P
10	To detect artificial colour by TLC method	1P
11	Study of common endoparasites in humans	1P
12	Study of human ectoparasite insects	1P
13	Case study of a disease (nutritional, lifestyle, infectious) public health issues/regulations, precautions associated with that disease	1P
14	Malaria and AIDS control prevention through WHO, UNICEF	1P
15	Visit to Government food testing laboratory	1P

16	Study of Zoonotic diseases	1P
17	Study of Mumps, Rubella, Chickenpox	1P

Reference Books

1. A text book of preventive and social medicine 2011, 21st Edn. Park. K., Banarsidas Bhanot Publishers, Jabalpur, India
2. Preventive and social medicine in India, 2013, 4th Edn. B. K. Mahajan, M. C. Gupta, Jaypee Brothers Medical Publishers, New Delhi, India
3. Medical Zoology and Medical Technology. R.C. Sobti, Shobanlal and Co., Jalandhar
4. Review in community medicine, 2006, 2nd Edn. V. V. R. Seshu Babu, Paras Medical Books Pvt. Ltd., Hyderabad.

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F.Y.B.Sc Syllabus **SUBJECT:ZOOLOGY**

Semester II **Skill Enhancement Course (SEC)**

Lab Course Name: Vermitechnology (2Credits)

Course code: 24ScZooU2601

Learning outcomes:

1. To create awareness of all the types waste among the students
2. To know the importance and usefulness of earthworm.
3. Student will learn structure of earthworm.
4. Student will able to set large scale and small scale vermiculture unit.
5. Student will come to know importance of soil and vermicompost.
6. Student will start up their own vermiculture project and create employability.

List of Practical

Sr. No	Title	No. of Practical
1	Study of different waste and waste management (E)/ (FP)	1P
2	Taxonomy of Useful species of earthworms (D)	1P
3	Study of morphology and digestive system of the earthworm (E)	1P
4	Study of Reproductive system of the earthworm. (E)	1P
5	Study of setting of vermiculture unit. (E)	1P
6	Maintenances of vermiculture unit. (E)	1P
7	Study of microbial use in vermiculture. (E)	1P
8	Vermiwash production.(E)	1P
9	Harvesting of vermicompost.(E)	1P
10	Enemies, predators and diseases and their treatments of earthworm. (D)	1P
11	Chemical analysis of soil w.r.t. vermiculture. (E)	1P
12	Physical analysis of soil w.r.t. vermiculture. (E)	1P
13	Setting of small scale vermicomposting unit at home. (E)	1P
14	Project report preparation (Bank schemes and subsidies). (E)	1P
15	Visit to the vermiculture farm. (E)	1P

Recommended readings

1. Shukla, G.S. and Upadhyaya, V.B. (1999-2000). Economic Zoology (Rastogi Publishers).

2. Mani, M.S. (2006). Insects, NBT, India.
3. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture.
4. Satyendra M. Singh (2007) Earthworms for solid waste Management, International Book Distribution company.
5. Clive A. Edwards (9198), Earthworm Excology.
6. K.L. Chand and M.S.Swaminathan (2006), Environment and Agriculture.
Bimal C. Bhattacharyya and Rintu Banerjee (2007) Environment and Biotechnology. (Oxford)