John Wilson Education Society's

Wilson College

(Autonomous)

RE-ACCREDITED

'A'

Affiliated to the

UNIVERSITY OF MUMBAI

NEP SYLLABYUS FOR F.Y.B.Sc. 2023-24

Program Code: WSZOO

Choice based credit system (CBCS) with the effect from

Academic year 2023-2024

(Under NEP 2020).

PREAMBLE

The Government of Maharashtra implemented NEP 2020 from the academic year 2023 – 2024. The autonomous colleges were guided to prepare and implement NEP syllabus from the coming academic year. As per the guidelines the Wilson College (Autonomous) Zoology department starting its preparation for the NEP syllabus for First year UG. Series of department meeting and rounds of deliberation saw the NEP 2020 Zoology syllabus coming into shape. In both the semesters of the UG the Major and Minor Zoology course theory and practical are designed keeping in mind that the student's concepts of basic and conceptual Zoology to become clear. And in forthcoming academic year to make their subject knowledge strong. The open elective will be for the students other than zoology and so various interesting topics related to economic zoology has been introduced in that course which can help students other than zoology to become entrepreneur or have their own startups.

The skill enhancement course is aquarium setting and maintenance which will be offered to the Zoology students. This course is completely practical based where in the students will get complete hands-on experience about the aquarium setup and maintenance. They will also get information about applying to various funding agencies for setting up of aquarium business. So, the Zoology syllabus is designed keeping in mind the need of conceptual knowledge of subject, industry requirements and entrepreneurial ventures. The Zoology department of the Wilson College will always be thankful to all teachers who have contributed their time and efforts for designing of syllabus. The department is also grateful to the BOS members for their precious time and valid suggestions. With this the Zoology department feels proud and present to all the NEP 2022 first year UG syllabus.

PROGRAM OUTLINE 2023 – 2024.

	SEM	COURSR CODE	COURSE TITLE	CREDITS
FY	I	WSZOOMJ111/ WSZOOMN111	Invertebrate zoology and basic animal physiology.	2
		WSZOOMJ112/ WSZOOMN112	Biochemistry and ethology.	2
		WSZOOMJ113/ WSZOOMN113	Zoology practical	2
		WSZOOOE111	Vermiculture, parasitology and fishery	2
		WSZOOSE111	Introduction to aquarium setting	2
	II	WSZOOMJ121/ WSZOOMN121	Chordate taxonomy and life processes	2
		WSZOOMJ122/ WSZOOMN122	Molecular basis of life and Genetics	2
		WSZOOMJ123/ WSZOOMN123	Zoology practical	2
		WSZOOOE121	Worm disease, economic Entomology and animal farming	2
		WSZOOSE121	Introduction to breeding and handling of ornamental fishes	2

F.Y.B.Sc., Zoology, Semester 1, (Major + Minor)

PROGRAMME SPECIFIC OUTCOME (PSOs)

Program Specific Outcome for F.Y.B.Sc., Zoology, Sem 1, Course 1 and 2

PSO1 The learner will get complete knowledge about the levels of organization, basis that are used in animal taxonomy and classification in Non – chordate animals.

PSO2 The learner will be made familiar with various life processes that are functional in animals such as movement, locomotion, nutrition, respiration and circulation.

PSO3 The learner will be enlightened with micromolecules, macromolecules and importance of biomolecules such as Proteins and Carbohydrates.

PSO4 The learner will learn about concepts of Ethology such as Instincts, Imprinting, Displacement behaviour and Animal Communication.

PSO5: The learner will be equipped to work in a laboratory & carry out the practical in a conscious way taking into consideration the possible hazards and ways to prevent them.

PSO6: The learner will be well aware of the hazard symbols which will ensure the safety furthermore as they are working with chemicals in the laboratory.

PSO7: The learner will understand the origin and history of fish keeping.

PSO8: The learner will be acquainted with the various types of aquariums and the equipment's used in setting of it. He will get a complete insight about aquarium setup.

PSO9: The learner will be accustomed to the types of filtrations and water quality in Aquariums.

PSO10: The learner will get to know about aquarium plants, preparation of costing and feasibility report.

Program: - F.Y.B.Sc. NEP		Semester: - 1			
Course: - 1		Course Code: - WSZOOMJ111/ WSZOOMN111			
Course Title: - Invertebrate Zoology and Basic Animal Physiology					
Teaching Scheme				Evaluation Scheme	
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Internal Assessment (CIA)	Semester End Examination
2	2	NA	(2 + 1) = 3	40 Marks	60 Marks

Learning Objectives: -

- To make the learners acquire knowledge about the complex animal taxonomy.
- To make the learners know about the various life processes that are functional in the Non chordate and Chordates organisms.

Course Outcomes: -

CO1: - The learner will be able to judge the levels of organization and the basis that are used in animal taxonomy.

CO2: - The learner will be able to classify Non – chordate animals.

CO3: - The learner will be able to correlate various life processes that are functional in animals such as movement, locomotion and nutrition.

CO4: - The learner will be able to correlate life processes that are functional in animals such as respiration and circulation.

Detailed Syllabus

	Course Code:- WSZOOMJ111/ WSZOOMN111		
	Sub Unit	**Course/ Unit Title**	**2 Credits / 30 hrs**
Unit 1		**Invertebrate Zoology**	**Total: - 15 hrs**
	1.1	1.1: Levels of organization 1.1.1: Unicellularity vs Multicellularity Colonization and organization of germ layers (Diploblastic and triploblastic condition) 1.1.2: Division of labour and organization of tissues (Brief fate of ectoderm, mesoderm and endoderm) 1.1.3: Development of Coelom: Acoelomate, pseudocoelomate and coelomate organization 1.1.4: Radial and bilateral symmetry 1.1.5: Segmentation and cephalization	
	1.2	Unicellular and multicellular organization (Salient features with examples of phyla, subphyla and classes mentioned below) 1.2.1: Unicellular organization: Phylum Protozoa 1.2.2: Multicellular organization: Colonization level- Phylum Porifera 1.2.3: Multicellular organization: Division of labour (Cell differentiation) Phylum Coelenterata	
	1.3	Triploblastic acoelomate and pseudocoelomate organization 1.3.1: Acoelomate organization - Phylum Platyhelminthes 1.3.2: Pseudocoelomate organization – Phylum Nemathelminthes	
	1.4	Triploblastic coelomate organization 1.4.1: Animals with metameric segmentation- Phylum Annelida 1.4.2: Animals with jointed appendages- Phylum Arthropoda	
Unit 2		**Basic Animal Physiology**	**Total: - 15 hrs**
	2.1	Movement and locomotion 2.1.1: Amoeboid movement	

		2.1.2: Ultra-structure of cilia and ciliary movements 2.1.3: Action of muscles (Role of muscles in movement)	
	2.2	Nutrition 2.2.1: Types of nutrition: Autotrophic and heterotrophic. Apparatus for nutrition: Food vacuole Animals without alimentary canal, ex. Amoeba Animals with incomplete alimentary canal, ex. Hydra Animals with complete alimentary canal, ex. Bird 2.2.2: Brief account of physiology of digestion in vertebrates and symbiotic digestion in Ruminants.	
	2.3	Respiration 2.3.1: Types of respiratory surfaces: General body surface: Cell membrane - ex. Amoeba Skin - ex. Earthworm and Frog Specialized respiratory structures: Trachea and spiracles, Gills of fish, Lungs of Frog and Human, Air sacs of Birds. 2.3.2: External respiration and cellular respiration with reference to human.	
	2.4	Circulation 2.4.1: Types of circulating fluids: Water, coelomic fluid, lymph and blood 2.4.2: Types of circulation: Protoplasmic streaming, open and closed circulation, single and double circulation 2.4.3: Hearts: Types, heart in Daphnia, cockroach and chordates (1, 2, 3 and 4 chambered heart) 2.4.4: Structure of cardiac muscles.	

References:

- Zoology – S. A. Miller and J. B. Harley, Tata McGraw hill.
- Invertebrate Zoology – Jordan and Verma, S. Chand Publication.
- Invertebrate Zoology – Kotpal, Rastogi Publication.
- Biological science, 3rd edition – D.J. Taylor, N. P. O. Green, G. W. Stout. Cambridge University press, Low priced edition.
- Experimental Physiology – S.C. Rastogi. New Age International Publishers.
- Animal Physiology and Biochemistry – H. R. Singh and Neeraj Kumar. Vishal Publishing Company.
- Animal Physiology – Verma and Agarwal. S Chand Publication.

Program: - F.Y.B.Sc. NEP		Semester: - 1			
Course: - 2		Course Code: - WSZOOMJ112/ WSZOOMN112			
Course Title: - Biochemistry and Ethology					
Teaching Scheme				Evaluation Scheme	
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Internal Assessment (CIA)	Semester End Examination
2	2	NA	(2 + 1) = 3	40 Marks	60 Marks

Learning Objectives: -

- To make the learners understand the biochemistry of the protein and carbohydrate biomolecules.
- To make the learners understand the basics of animal-to-animal communication, behaviour and interactions.

Course Outcomes: -

CO1: - The learner will be able to distinguish the concept of micromolecules and macromolecules.

CO2: - The learner will be able to determine the importance of biomolecules such as Proteins and Carbohydrates.

CO3: - The learner will be able to infer the concepts of Ethology such as Instincts and Imprinting.

CO4: - The learner will be able to infer concepts of Ethology such as Displacement behaviour and Animal Communication.

Detailed Syllabus

	Course Code: - WSZOOMJ112/ WSZOOMN112		
	Sub Unit	**Course/ Unit Title**	**2 Credits / 30 hrs**
Unit 1		**Biochemistry**	**Total: - 15 hrs**
	1.1	Biological micro- and macro-molecules Monomeric constituents, polymers and significance of carbon	
	1.2	Proteins 3.2.1: Amino acids: Types based on carboxylic, amino and aromatic group. 3.2.2: Peptide bond 3.2.3: Structure of proteins: Primary, secondary, tertiary, and quaternary structure. 3.2.4: Biological role of proteins.	
	1.3	Carbohydrates 3.3.1: Nomenclature, isomerism and classification. 3.3.2: Glycosidic bond 3.3.3: Types of carbohydrates: Monosaccharides: Glucose, fructose, Disaccharides: Maltose, sucrose, Polysaccharides: Starch, glycogen, heparin 3.3.4: Biological role of carbohydrates	
Unit 2		**Ethology**	**Total: - 15 hrs**
	2.1	Concept of Instinct, Innate Release Mechanism and Fixed Action Pattern, Significance of Instincts	
	2.2	Concepts of imprinting: Long term and functional aspect of Imprinting	
	2.3	Displacement behaviour: Causes and functional aspects, Ritualization of Displacement activities.	
	2.4	Animal Communication: Components necessary for Communication, Signals: Chemical, Light and Sound, Language of Communication in Bees and Primates, Concept of Interception and Deception.	

	Course Code :- WSZOOMJ113/ WSZOOMN113		
		Semester 1 **Practical's**	**2 Credit**
	1	Levels of organization in Animal kingdom A) Symmetry: 1) Asymmetric organization: Amoeba, 2) Radial symmetry: Sea anemone, Aurelia, 3) Bilateral symmetry: Planaria / liver fluke B) Acoelomate: T.S. of Planaria / liver fluke C) Pseudocoelomate: T.S. of Ascaris D) Coelomate: T.S. of Earthworm	
	2	E) Segmentation 1) Pseudo segmentation: Tapeworm 2) Metamerism: Earthworm 3) Specialization of body parts for division of labour: Head, thorax and abdomen - Insect F) Cephalization 1) Cockroach – Head, 2) Prawn/ crab – Cephalothorax	
	3	Animal Diversity Protozoa: Amoeba, Paramecium. Porifera: Leucosolenia, bath sponge Coelenterate: Hydra, obelia colony, and any one coral. Platyhelminthes: Planaria, liver fluke	
	4	Nemathelminthes: Ascaris- male and female Annelida: Nereis, leech Arthropoda: Crab, butterfly	
	5	Study of nutritional apparatus: L.S. of Hydra, Planaria, digestive system of cockroach and earthworm	
	6	Study of trachea and spiracles from cockroach, study of gills of fish, lung of frog and mammal	
	7	Study of heart of cockroach and L.S. of following hearts: fish (2-chambered), Frog (3-chambered), mammal (4-Chambered)	
	8	Determination of the rate of heart beat in Daphnia	
	9	Mounting of striated muscle fibre from fowl.	
	10	Study of effect of pH and temperature on amylase activity	
	11	Qualitative tests for proteins	

	12	Paper chromatography for separation of amino acids.	
	13	Quantitative estimation of proteins by biuret assay	
	14	Estimation of Amino – acids by Formol Titration Method.	
	15	Qualitative tests for carbohydrates	
	16	Study of warning colouration and Mimicry (Any two examples of each)	
	17	Study of Instincts and Imprinting (Any two examples of each)	
	18	Communication in Animals: Chemical Signals, Light Signals, Communication Language in Bees	
	19	Displacement Activities in animals: Courtship and Mating behaviour in animals, Ritualization	
	20	Report on observation of surrounding fauna	

References:

- Biochemistry – S. C. Rastogi, Tata McGraw Hill
- Lehninger Principles of Biochemistry – Nelson and Cox, McMillan Worth
- Animal behaviour – David Mc Farland
- An introduction to animal behaviour, 4th edition - Aubrey Manning and M. S. Dawkins. Cambridge University press, Low priced edition.
- Animal behaviour – Mohan Arora. Himalaya publication.

F.Y.B.Sc., Zoology, Semester 1, Open Elective

<table>
<tr><td colspan="3">Program: - F.Y.B.Sc. NEP</td><td colspan="3">Semester: - 1</td></tr>
<tr><td colspan="3">Course: - Open Elective</td><td colspan="3">Course Code: - WSZOOOE111</td></tr>
<tr><td colspan="6">Course Title: - Vermiculture, Parasitology and Fisheries</td></tr>
<tr><td colspan="4">Teaching Scheme</td><td colspan="2">Evaluation Scheme</td></tr>
<tr><td>Lectures (Hours per week)</td><td>Practical (Hours per week)</td><td>Tutorial (Hours per week)</td><td>Credit</td><td>Continuous Internal Assessment (CIA)</td><td>Semester End Examination (2 Assignments)</td></tr>
<tr><td>2</td><td>-</td><td>-</td><td>2</td><td>-</td><td>60 Marks</td></tr>
<tr><td colspan="6">Learning Objectives: -
• To acquaint the learner with the concepts of parasitism and its relationship in the environment.
• To introduce the learner to modes of transmission of parasites.
• To produce sustainable biological, environmental and socioeconomic benefits from renewable fisheries resources.
• To acquaint the learner with the concepts of fisheries and its relationship in the environment and socioeconomic status.</td></tr>
<tr><td colspan="6">Course Outcomes: -
CO1: - Learner will be able to explain the general epidemiological aspects of parasites that affect humans and take simple preventive measures for the same.
CO2: - Learner will be able to interpret information on economic aspects of zoology like vermiculture.
CO3: - Learner will be able to develop self-employment.
CO4: - Learner will be able to relate sustainable biological, environmental and socioeconomic benefits from renewable aquatic resources.
CO5: - Learner will be able to evaluate the Important Capture Fisheries and the Crafts and gears used on Indian Coasts.</td></tr>
</table>

Detailed Syllabus

	Course Code: - WSZOOOE111		
	Sub Unit	**Course/ Unit Title**	**2 Credits / 30 hrs**
Unit 1		**Unit 1: Introduction to Parasitology and Vermiculture**	**Total: - 15 hrs**
	1.1	Introduction to Parasitology and Types of Parasites 1.1.1 Definitions: Parasitism, Host, Parasite 1.1.2 Parasitic adaptations in Ectoparasites and Endoparasites	
	1.2	Morphology, life cycle, control measures and treatment Head louse and Bed Bug.	
	1.3	Protozoan Parasites: 1.3.1 Morphology, Mode of Infection, Life Cycle, Prophylaxis and Treatment of Plasmodium vivax (Malaria)	
	1.4	Vermiculture 1.4.1 Rearing methods management in vermiculture 1.4.2 An introduction to different types of earthworms used in vermiculture 1.4.3 Methods of vermiculture maintenance and harvesting 1.4.4 Economic importance advantages of vermiculture demands of worms market for vermicompost and entrepreneurship	
Unit 2		**Fisheries**	**Total: - 15 hrs**
	2.1	2.1 Types of Fisheries (Marine: Coastal, Offshore and deep-Sea fisheries, Brackish Water, Fresh water, Culture fisheries with emphasis on locally important species)	
	2.2	2.2 Important Capture Fisheries of India 2.2.1 Mackerel, Bombay duck fishery 2.2.2 Crabs fisheries	
	2.3	2.3 Fish preservation 2.3.1 Methods of Preservation	
	2.4	2.4 Boats and nets used on Indian Coasts for fishery.	

		2.4.1 Boats: Dugout, Outrigger, Catamaran, Musula, Satpati, Trawler. 2.4.2 Net: Gill and drift net, Dol net, cast net, Purse seine, Shore Seine, Long line.	
	2.5	2.5 Ornamental fishes 2.5.1 Freshwater Ornamental fishes	

References

1. Vermiculture Technology- Clive A Edwards, Norman Q Arancon And Rhonda Sherman
2. Parasitology- Chatterjee KD, Chatterjee Medical Publishers
3. Medical Parasitology- Arora
4. Textbook Of Medical Parasitology- C K Jayaram Panikar, Jaypee Brothers
5. Textbook Of Parasitology- Kochar S K Dominant Pub & Dis, New Delhi
6. Essentials Of Parasitology- Gerald And Schmidt
7. Parasitology-Sharma P N And Ratnu L N
8. Introduction To Parasitology- Chandler And Read John Wiley And Sons
9. Economic Zoology- Shuka G S And Upadhyay
10. A Handbook On Economic Zoology- Dr. Jawaid Ahsan And Dr. Subhas Prasad Sinha
11. Vermocology, The Biology Of Earthworms By Sultan A Ismail
12. Manual Of On Farm Vermin Composting And Vermiculture By O. A. C. C

F.Y.B.Sc., Zoology, Sem 1, Skill Enhancement Course

Introduction to Aquarium Setting Course

<table>
<tr><td colspan="3">Program: - F.Y.B.Sc. NEP</td><td colspan="3">Semester: - 1</td></tr>
<tr><td colspan="3">Course: - Skill Enhancement Course</td><td colspan="3">Course Code: - WSZOOSE111</td></tr>
<tr><td colspan="6">Course Title: - Introduction to Aquarium Setting</td></tr>
<tr><td colspan="4">Teaching Scheme</td><td colspan="2">Evaluation Scheme</td></tr>
<tr><td>Lectures (Hours per week)</td><td>Practical (Hours per week)</td><td>Tutorial (Hours per week)</td><td>Credit</td><td>Continuous Internal Assessment (CIA)</td><td>Semester End Examination</td></tr>
<tr><td>-</td><td>2</td><td>NA</td><td>2</td><td>-----</td><td>60 Marks</td></tr>
<tr><td colspan="6">Learning Objectives: -
• To make the learner understand the origin and history of fish keeping.
• To make the learner acquainted with the various types of aquariums and the equipment’s used in setting of it.
• To make the learner accustomed to the types of filtrations and water quality in Aquariums.
• To make the learner familiar with aquarium plants, preparation of costing and feasibility report.</td></tr>
<tr><td colspan="6">Course Outcomes: -
CO1: - The learner will be able to categorize about types, size, volume, selection, setting and material in aquarium tanks.
CO2: - The learner will be able to state position, aqua scaping and precautions while setting aquarium.
CO3: - The learner will be able to identify the aquarium equipment’s, artificial and live fish feed.
CO4: - The learner will be able to illustrate the types of filtrations, functions and types of aquarium substrate along with various tank decorative.
CO5: - The learner will be able to analyze different parameters of water.
CO6: - The learner will be able to construct the aquarium tanks, aquarium plants, selection and introduction of ornamental fishes.
CO7: - The learner will be able to create feasibility report for various funding agencies.</td></tr>
</table>

Detailed Syllabus

	Course Code:- WSZOOSE111		
		Practical 1 Semester 1	**1 Credit**
	1	Understanding the body parts of a fish	
	2	Identification of Daphnia, Moina, Infusoria, Artemia and Chaetoceros	
	3	Identification of Aquarium accessories: • Aerator • Under Gravel Filter • Internal Filter • External / Canister Filter • Food dispensers	
	4	Estimation of Electrical conductivity by conductivity meter.	
	5	Estimation of water salinity using Refractometer.	
	6	Estimation of water temperature.	
	7	Estimation of Total Dissolved Solids from Tank water.	
	8	Determination of chloride in water by mohr method	
	9	Study of different aquarium plants	
	10	Qualitative determination of Ammonia in water by Nessler's Reagent.	
	11	Preparation of Feasibility Report	
		Practical 2 Semester 1	**1 Credit**
	1	Identification of fresh water ornamental fishes	
	2	Identification of marine water ornamental fishes	
	3	Construction of glass tanks	
	4	Setting up of fresh water aquarium	
	5	Setting up of marine water aquarium	
	6	Identification of types of substrates	
	7	Decoration of Aquarium	
	8	Calculation of fecundity	
	9	Estimation of Nitrates	
	10	Estimation of Hydrogen Sulphide.	
	11	Report on the visit to aquarium	

References:

1) Aquarium Systems - Hawlins, A.D. (Ed). Academic Press.
2) Living Aquarium - Hunnam, P. Ward Lock,
3) Aquarium Fishes and Plants - Ratjak, K. and Zukal, R
4) Seawater Aquariums - Spotte and John Wiley, S.,
5) Salt water Aquarium in the Home - Straughan, R.P.L. and Thomas Yoseloff
6) Illustrated Guide to Aquarium Fishes - Dick Mills, 1987. Published by Galley and Price, an imprint of W.H. Smith and Sons Limited, England.
7) Marine Aquarium Keeping - Stephen Spotte. A Wiley-Interscience Publication.
8) Ornamental aquarium fishes of India- 1999- K. L. Tekrival and A.A. Rao.- TFH United Kingdom.
9) Marine Ornamental species (collection, culture and conservation) – J. C. Cato and C. L. Brown. – Blackwell Science
10) Aquarium: Fish Keeping C B L Srivastava Published by Kitab Mahal
11) Home Aquarium – C. S. Thara Devi and K. V. Jayashree – Saras Publication.

F.Y.B.Sc. NEP Syllabus 2023 - 2024

F.Y.B.Sc., Zoology, Semester 2, (Major + Minor)

PROGRAMME SPECIFIC OUTCOME (PSOS).

PSO1 Learner with understand about the classification of Non - Chordates and Chordate with examples.

PSO2 Learner with acknowledge the basic essential activities of life such as Excretion and osmoregulation, Control and Co-ordination, and Reproduction.

PSO3 Learner will understand the role of lipids, nucleic acids and vitamins in sustainability of life.

PSO4 Learner will get acquaintance with basic terms in genetics and to develop conceptual clarity of Mendelian inheritance principles of inheritance and other forms.

PSO5: The learner is introduced to various adaptations in the Animal world which will arouse interest and curiosity.

PSO6: The learner is enlightened about few unique animals found in the Amazon rainforest which will help them appreciate the nature they live in.

PSO7: The learner is made aware of the biodiversity its meaning & types, conservation and the role of humans as a developed society.

PSO8: The learner will get knowledge about different helminth parasites, diseases caused by them and treatment.

PSO9: The learner will gain knowledge of small-scale industries like sericulture, bee keeping, lac culture, their host plants, their products and use.

PSO10: The learner will gain knowledge of different insect pests and their control.

PSO11: The learner will gain knowledge about dairy industry and different cattle breed.

Program: - F.Y.B.Sc. NEP		Semester: - 2			
Course: - 1		Course Code: - WSZOOMJ121/ WSZOOMN121			
Course Title: - Chordate Taxonomy and Life Processes.					
Teaching Scheme				Evaluation Scheme	
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Internal Assessment (CIA)	Semester End Examination
2	2	NA	(2 + 1) = 3	40 Marks	60 Marks

Learning Objectives: -

- To make the learners understand the special characteristics and classification of Non-Chordates and Chordate with examples.
- To make the learners understand the different types of life process that is functional in Non chordates and Chordates.

Course Outcomes: -

CO1: - Learner will be able to classify between Non chordate and chordate animals.

CO2: - Learner will be able to describe about different types of essential life processes in the body and its role in maintenance of life.

CO3: - learners will be able to differentiate about different types of excretory organ from lower invertebrate to higher organisms, Conduction of nerve impulse and reproduction.

Detailed Syllabus

	Course Code: - WSZOOMJ121/ WSZOOMN121		
	Sub Unit	**Course/ Unit Title**	**2 Credits / 30 hrs**
		Chordate Taxonomy	**Total: - 15 hrs**
	1.1	Triploblastic coelomate organization 1.1.1 Animal with mantle: Phylum Mollusca 1.1.2 Animal with enterocoel: Phylum Echinodermata	
	1.2	Phylum Hemichordata	
	1.3	Phylum Protochordate 1.3.1 Subphylum Urochordata 1.3.2 Subphylum Cephalochordata.	
	1.4	Subphylum Vertebrata Super class Pisces (Cartilaginous and bony fish)	
	1.5	Super class Tetrapoda 1.5.1 Class Amphibia 1.5.2 Class Reptilia 1.5.3 Class Aves 1.5.4 Class Mammalia	
Unit 2		**Life Processes**	**Total: - 15 hrs**
	2.1	Excretion and osmoregulation 2.1.1 Concepts of osmoregulation and excretion. 2.1.2 Modes of Excretion. 2.1.3 Excretory Organs - Flame cells, Renette cells, nephridia, Antennary gland, Malphigian tubules. 2.1.4 Nephron structure.	
	2.2	Control and co-ordination. 2.2.1 Structure of neuron and its types. 2.2.2 Conduction of nerve impulse: Resting potential, Action potential, and refractory period. 2.2.3 Synaptic transmission. 2.2.4 Endocrine regulation. 2.2.5 Sense organ: Eye and ear	
	2.3	Growth and Reproduction	

		2.3.1 Asexual Reproduction - Binary fission, Multiple fission, Budding, Gemmule formation, Regeneration. 2.3.2 Sexual reproduction- Syngamy, Conjugation, Automixis. 2.3.3 Structure of Mammalian ovum and sperm. 2.3.4 Gametogenesis – Oogenesis and spermatogenesis. 2.3.5 Fertilization – external and internal fertilization, Amphimixis and significance. 2.3.6 Oviparity, viviparity, ovo-viviparity.	

REFERENCES:

1. Chordate Zoology – Jordan and Verma, S. Chand Publication.
2. Modern textbook of Zoology Vertebrate – R.L Kotpal, Rastogi Publization.
3. Zoology – S. A. Miller and J. B. Harley, Tata McGraw hill.
4. Cell biology – P.S Verma and V. K Agrawal. 9 th edition.
5. Cell biology and genetics – P. K Gupta.
6. Biochemistry – U Satyanarayan and U Chakrapani.
7. Lehninger Principles of Biochemistry – Nelson and Cox, McMillan Worth.
8. Animal physiology – Knut and Schmidt Nielsen, 2 nd edition.

Program: - F.Y.B.Sc. NEP		Semester: - 2			
Course: - 2		Course Code: - WSZOOMJ122/ WSZOOMN122			
Course Title: - Molecular Basis of Life and Genetics.					
Teaching Scheme				Evaluation Scheme	
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Internal Assessment (CIA)	Semester End Examination
2	2	NA	(2 + 1) = 3	40 Marks	60 Marks

Learning Objectives: -

- To make the learners understand the biochemistry of bio molecules such as Lipids, Nucleic acid and Vitamins.
- To make the learners understand the basic concept of genetics, Mendelian inheritance Principles and Extension to Mendelian inheritance and others forms.

Course Outcomes: -

CO1: - Learner will be able to describe the significance role of lipids in body system.

CO2: - Learner will be able to explain the concept of nucleic acid its component.

CO3: - Learner will be able to express the importance of vitamins in our body and source of it.

CO4: - Learner will be able to apply the Mendelian inheritance principle to heredity.

CO5: - Learner will be able to express the concept of Mendelian inheritance extension such as Incomplete dominance and Co-dominance, Lethal alleles, Multiple alleles in ABO blood group.

CO6: - Learner will be able to analyze about Pedigree analysis - Dominant, recessive and sex linked traits,

CO7: - Learner will be able to describe about Sex limited and sex influenced and Cytoplasmic inheritance.

Detailed Syllabus

	Course Code: - WSZOOMJ122/ WSZOOMN122		
	Sub Unit	**Course/ Unit Title**	**2 Credits / 30 hrs**
Unit 1		**Molecular Basis of Life**	**Total: - 15 hrs**
	1.1	Lipids 1.1.1 Fatty acid structure, Nomenclature, Classification. 1.1.2 Monoglyceride, Diglyceride, Triglyceride. 1.1.3 Physical and chemical properties. 1.1.5 Biological function of lipids.	
	1.2	Nucleic acid 1.2.1 Chemical Nature of the bases, pentose's 1.2.2 Watson and crick Model of DNA. 1.2.3 Structure of RNA and its types (m-RNA, t-RNA, r-RNA) 1.2.4 Differences between DNA and RNA.	
	1.3	Vitamins 1.3.1 Definition and classification. 1.3.2 Vitamin A – Source and Biological function. 1.3.3 Vitamin D – Source and Biological function. 1.3.3 Vitamin E – Source and Biological function. 1.3.4 Vitamin K – Source and Biological function. 1.3.5 Vitamin B – Source and Biological function.	
Unit 2		Genetics	Total: - 15 hrs
	2.1	Definition– Gene, Allele, Recessive and dominant allele, Homologous chromosome, Phenotype, Genotype, heterozygous, and homozygous, pure lines.	
	2.2	Mendelian genetics 2.2.1 Monohybrid cross and Dihybrid cross. 2.2.2 Law of Dominance and Law of Segregation. Law of independent Assortment.	
	2.3	Chromosomal theory of inheritance.	
	2.4	Exception to Mendelian inheritance:	

		2.4.1 Incomplete dominance and Co-dominance. 2.4.3 Lethal alleles. 2.4.4 Multiple alleles in ABO blood group.	
	2.5	Pedigree analysis – Dominant, recessive and sex linked traits. Sex limited and sex influenced.	
	2.6	Cytoplasmic inheritance – Shell coiling in snail, Sigma factor in Drosophilia.	

References:

1. Biochemistry – U Satyanarayan and U Chakrapani.
2. Biochemistry – David Hames and Nigel Hooper.Instant Notes.3 rd edition.
3. Biochemistry – S. C. Rastogi, Tata McGraw Hill
4. Fundamental of genetics – J.L Jain and Sanjay Jain and Nitin Jain.S chand publication.6 th edition.
5. Principles and techniques of Biochemistry and Molecular Biology – Keith Wilson and John walker.7 th edition.
6. Lehninger Principles of Biochemistry – Nelson and Cox, McMillan Worth.
7. Genetics – P.S Verma and V. K Agrawal. 9 th edition.
8. Genetics : The continunity of life – Fairbanks and adersons.

	Course Code WSZOOMJ123/ WSZOOMN123		
		Semester 1 Practical	**2 Credits**
	1a	Animal diversity: Mollusca: Chiton, Tusk shell, Snail, Loligo.	
	1b	Animal diversity: Echinodermata: Starfish, Brittle starfish, Sea urchin, Sea cucumber, Sea lily.	
	2	Animal diversity: Hemichordate: Balanoglossus	
	3a	Animal diversity: Protochordates Urochordata: Herdmania Cephalochordata: Amphixious.	
	3b	Animal diversity: Pisces (Chondrichthyes) – Dogfish Osteichthyes - Remora.	
	4	Animal diversity: Amphibian: Caecilian, Salamander, Frog. Reptile: Tortoise, Crocodile.	
	5	Animal Diversity: Aves: Kingfisher, Duck. Mammalia: Duck billed Platypus, bat, Squirrel.	
	6	Mounting of scales in fishes: - Placoid, Cycloid, Ctenoid.	
	7	Study of various excretory organs: Flame cells, Renette cells, Nephridia, Antennary gland, Malphigian tubules, Nephron structure.	
	8	Detection of Ammonia in water excreted by fishes.	
	9	Detection of Uric acid from bird excreta.	
	10	Study and observation of permanent slide of a. T.S of sponge gemmule. b. T.S of mammalian sperm c. T.S mammalian ovum	
	11	Qualitative tests for Lipids	
	12	Separation of lipids by TLC.	
	13	Estimation of Vitamin C by iodometric method.	

	14	Problems in Genetics a. Monohybrid cross b. Dihybrid cross c. Lethal alleles. d. Multiple allele.	
	15	Field visit and submission of report.	

F.Y.B.Sc., Zoology, Semester 2, Open Elective

Program: - F.Y B.Sc. NEP		Semester: - 2			
Course: - Open Elective		Course Code: -WSZOOOE121			
Course Title: Worm diseases, Economic Entomology and Animal Farming					
Teaching Scheme		Evaluation Scheme			
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Internal Assessment (CIA)	Semester End Examination (2 Assignments)
2	-	-	2	-	60 Marks

Learning Outcome:

- Students will be able to understand the concepts of parasitism and it's relationship in the environment.
- Students will be able to understand the economic aspects of animals like apiculture, sericulture, lacculture, their importance and different insect pests.
- Students will be able to understand different aspects of animal farming, their rearing, their importance and use.

Course Outcome:

CO1: Learner will be able to interpret the general epidemiological aspects of parasites that affect humans and take simple preventive measures for the same.

CO2: Learner will be able to establish knowledge on animals useful to mankind.

CO3: Learner will be able to apply the modern techniques in animal animal husbandry.

CO4: Learner will be able to would manage entrepreneurship as a career.

	Course Code: -WSZOOOE121		
		Course Title: Worm diseases, Economic Entomology and Animal Farming	
Unit 1		**1.1 Worms infection Parasitology**	**15 hours**
		Morphology, mode of infection and Treatment of Helminths (worms): • Pork tapeworm, • Human pinworm,	

		• Intestinal hookworm, • Filarial worm, • Guinea worm	
		1.2 Economic Entomology	
		1.2.1 Apiculture: • Honeybee types • Composition of honey Economic Importance. 1.2.2 Lac culture: • lac cultivation, • Processing, products and uses of lac. 1.2.3 Seri culture: • Morphology of silk moth, • Silk worm rearing technique • Economic Importance.	
Unit 2		**Animal Farming**	**15 hours**
		2.1 Poultry: • Definition and common breeds of fowl used for farming in India, • Origin, average body weight and egg laying capacity. 2.2 Dairy Science: • Current status of dairy industry in India • Composition of Milk, Methods of Preservation of Milk Products. • Milk product -Paneer, Ghee, Curd. 2.3 Sheep farming • Advantages of sheep farming • Various breeds of sheep and their common names (Exotic and indigenous). 2.4 Cattle Farming • Advantages of cattle farming and its products.	

Reference:

1. A handbook on Economic Zoology, S. Chand & Co.
2. Economic Zoology – Shukla G. S. & Upadhyay V. B., Rastogi Publication.
3. Parasitology by K.D. Chatterjee.
4. Medical Parasitology by Arora.
5. Textbook of Medical parasitology by C. K. Jayaram Paniker.

F.Y.B.Sc., Zoology, Sem 2, Skill Enhancement Course

Introduction to Aquarium Setting Course

Program: - F.Y.B.Sc. NEP			Semester: - 1		
Course: - Skill Enhancement Course			Course Code: - WSZOOSE121		
Course Title: - Introduction to breeding and handling of ornamental fishes					
Teaching Scheme				Evaluation Scheme	
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Internal Assessment (CIA)	Semester End Examination
-	4	NA	2	-----	60 Marks

Learning Objectives: -

- To make the learner understand the ornamental fish breeding.
- To make the learner familiar with handling of ornamental fish for breading.
- To make the learner acquainted with the various types ornamental fish diseases.
- To make the learner skilful in preparation of fish feed of brooders, larvae and young ones.
- To make the learner familiar with handling, packaging and transportation ornamental fishes
- To make the learner how to estimate the water parameters.
- To make the learner familiar with basic identification of microorganisms in aquarium.
- To make the learner how to sanitize the aquarium tanks.
- To make the learner skilful marketing of fish
- To make the learner how to use different invertebrates in aquarium tanks.
- To make learner skillful in packaging of ornamental fishes for transport

Course Outcomes: -

CO 1: - The learners will able to operate ornamental fish brooders

CO 2: - The learners will able to prepare breeding tanks for brooders.

CO 3: - The learners will able to identify and differentiate the different aquarium/ornamental fish diseases.

CO 4: - The learners will able to estimate different aquarium fish tank water parameters.

CO 5: - The learners will able to prepare live feed and artificial feed for brooders, larvae and young ones.

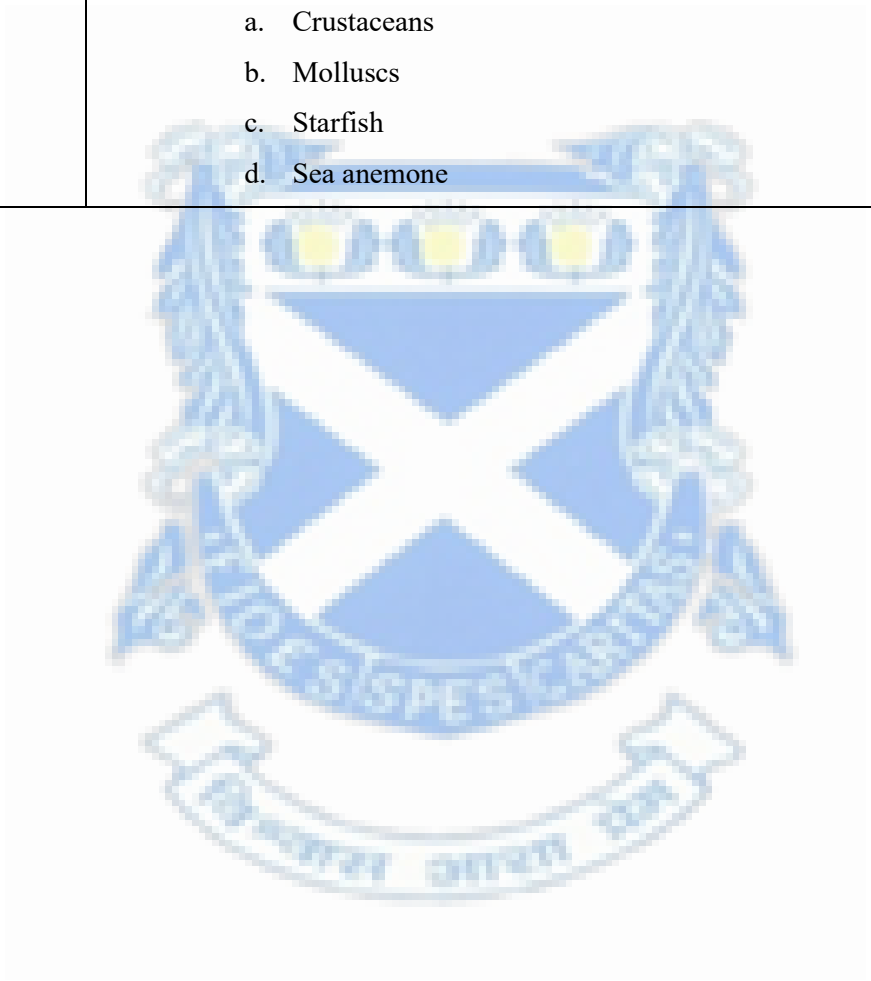
CO 6: - The learners will able to analyse, treat the aquarium fish infection and diseases.

CO 7: - The learners will able to estimate water parameters for breeding practice. CO 8: - The learners will able to identify basic bacterial pathogens. CO 9: - The learners will able to practice sanitization of the breeding tank. CO 10: - The learners will able to identify and use indifferent invertebrates in aquarium tank. CO 11: - The learners will able to prepare live feed and artificial feed for brooders, larvae and young ones. CO 12: - The learners will able to perform packaging of aquarium fish for transportation.

Detailed Syllabus

	Course Code: - WSZOOSE121		
		Practical 1 Semester 1	1 Credit
	1	Setting up of spawning tank for breeding of ornamental fishes.	
	2	Ornamental fish reproductive organs, reproductive maturity	
	3	Ornamental fish sexual dimorphism, Primary characters, secondary characters and breeding habits.	
	4	Spawning of egg-depositors (demonstration practical)	
	5	Spawning of live bearer (demonstration practical)	
	6	Spawning of nest builder ornamental fish (demonstration practical)	
	7	Maintenance of breeding tank.	
	8	Identification of common bacterial, fungal, protozoan, helminthic, crustacean pathogen of aquarium fish.	
	9	Identification of common deficiency diseases a. Protein symptoms b. Carbohydrate symptoms c. Lipid symptoms d. Mineral and vitamin symptoms	
	10	Fish disease diagnosis. (demonstration)	
		Practical 2 Semester 1	1 Credit
	1	Estimation of Dissolved Oxygen from aquarium water.	
	2	Estimation Hardness from aquarium water.	
	3	Estimation of turbidity and pH from aquarium water.	
	4	Estimation of Carbon Dioxide	

	5	Estimation of chlorine from given aquarium water.	
	6	Gram staining technique.	
	7	Identification of different Bacilli, Cocci and Vibrio bacterial pathogens.	
	8	Practical steps in sanitization of aquarium tank.	
	9	Field visit to ornamental fish aquarium or aquarium shop.	
	10	Identification of Packaging of aquaculture fish	
	11	Packaging of aquaculture fish.	
	12	Identification of aquarium invertebrates a. Crustaceans b. Molluscs c. Starfish d. Sea anemone	



ANNEXURE -I

Suggested Field Visits

Field visits are to be organized to facilitate students to have in-hand experience and exposure to functioning of an organization / unit or witness a relevant activity.

Each student must make at least 01 (one) such visits to the units/markets/public aquarium visits organized by the college.

i. Visit to one of the units with one or multiple activities such as Ornamental fish farm / Nursery/ Hatchery.

ii. Visit any production units such as
   a. Ornamental fish Food production facility.
   b. Ornamental fish tank decorative articles production unit
   c. Fish feed production facility
   d. Ornamental fish hatchery

iii. Govt. Offices such as
   a. Fishery Department.
   b. MPEDA Mumbai
   c. NFDB, Hyderabad
   d. CIFI, Mumbai

iv. Visit to National Laboratories and National Research Labs which are imparting techniques in aquarium fish technology :- CMFRI (Cochin), CIFE, Mumbai, Fishery College, Ratnagiri etc.

ANNEXURE –II

Suggested Topics for Entrepreneurial Skill Development

1. Feasibility report on Setting and Maintenance of fresh water aquarium.
2. Feasibility report on Setting and Maintenance of marine aquarium.
3. Feasibility report on Breeding of various aquarium fishes.
4. Feasibility report on Preparation of aquarium fish feed.
5. Feasibility report on Breeding of aquarium fish hatchery.
6. Feasibility report on packaging and transportation of ornamental fishes.
7. Students can select any of the relevant topic which fits to the syllabus objectives. Before star working on the assignment topic, he/she has to confirm the topic with the concern teacher in advance.

References:-

1. Guide to tropical fish keeping: 1967 – Brymer, J.H. P. Ilifie.
2. Tropical marine aquaria: 1971 – Col, G.I. Harmlyn.
3. Aquarium system: 1981 – Himlins A.D. (Ed.) Academic Press.
4. Living aquarium: 1981 – Hunnam F. Ward Lock.
5. Aquarium fishes & plants: 1971 – Rataj R and R. Zukal Hamlyn.
6. Sea water aquarium: 1979 – Spotte A. John Wiley.
7. Ornamental fish for Garden ponds and home aquarium: 1956 – Ray L.P. Home aquarium.
8. Complete aquarium : 1963 – Vagi D. and H. Wermuth Thomas.
9. Aquarium : Fish Keeping C B L Srivastava Published by Kitab Mahal
10. Marine Aquarium (Fish: Keeping and Breeding Them in Captivity) Boruchowitz, Davie. Published by Chelsea House Publications (1998)
11. Aquarium Setting Up (Fish: Keeping and Breeding Them in Captivity) Axelrod, Herbert R. Published by Chelsea House Publications (1998)
12. The Tropical Freshwater Aquarium Problem Solver: Practical and Expert Advice on Keeping Fish and Plants Sand ford, Gina Published by Voyageur Press (MN) (1998)
13. Aquariums: The Complete Guide to Freshwater and Saltwater Aquariums, Jan 2009 by Thierry Maitre-alain (Author), Chrisitan Piednoir (Author)