Structure with Course Title

B. Sc. In Zoology

Semester – I

SN	Courses	Type of Course	Credits	Marks	Int	Ext
	Semester I					
10032401	Biological Functions	Major (Core)	2	50	50	0
		Major (Core)	2	50	50	0
		Major (Core)	2	50	50	0
10432411	Nutrition & Health	OEC	4	100	50	50
10632401	Experimental Zoology	VSC S1	2	50	50	0
10732401	Laboratory Safety Measures	SEC	2	50	0	50
	AEC Link- Click Here	AEC (English) **(Any One)**	2	50	0	50
10810111	English For Academic Writing - Paper I (For Students of English Medium)					
10810112	English Language and Literature - I (For Students of Non-English medium)					
11051111	Inception of India Knowledge System Link- Click Here	IKS (Generic)	2	50	0	50
10952111	Introduction to Indian Constitution Link- Click Here	VEC	2	50	0	50
	CC Link- Click Here	CC **(Any One)**	2	50	50	0
11450121	Basics of National Service Scheme					
11450221	National Cadets Corps. (NCC) Studies - I					
11450322	Health and Wellness					
11450421	Performing Arts Exploration					
			22	**550**	**300**	**250**

Semester – II

SN	Courses	Type of Course	Credits	Marks	Int	Ext
	Semester II					
20032411	Reproduction and Development	Major (Core)	2	50	0	50
		Major (Core)	2	50	0	50
		Major (Core)	2	50	0	50
		VSC S2	2	50	50	0
		VSC S3	2	50	50	0
20432411	Amazing Animal World	OEC	4	100	50	50
20732401	Fish Aquarium Setting	SEC	2	50	50	0
	AEC Link- Click Here	AEC (English) **(Any One)**	2	50	0	50
20810111	English For Academic Writing - Paper II (For Students of English Medium)					
20810112	English Language and Literature - II (For Students of Non-English medium)					
20952111	Environment Awareness Link- Click Here	VEC	2	50	0	50
	CC Link- Click Here	CC **(Any One)**	2	50	50	0
21450121	Volunteerism and National Service Scheme					
21450221	National Cadets Corps. (NCC) Studies - II					
21450323	Yoga Education					
21450421	Fine Art					
			22	**550**	**250**	**300**

Course Syllabus

Semester - I

.1.1 Major (Core)

Course Title	**Biological Functions**
Course Credits	2
Course Outcomes	After going through the course, learners will be able to:
	1. Analyze the structure and function of the nutritional apparatus in various organisms such as Amoeba, Hydra, Earthworm, Cockroach, Amphioxus, Pigeon,and Ruminants.
	2. Examine the structure of lungs and the physiology of respiration in humans,including the processes of gas exchange and respiratory regulation
Module 1 (Credit 1) - Study of Nutrition and Respiration	
Learning Outcomes	After learning the module, learners will be able to:
	1. Relate to the nutritional aspects in animals & humans
	2. Differentiate between respiratory structures of animals
Content Outline	• Nutrition: o Study of structure and function of nutritional apparatus of: Amoeba, Hydra,Earthworm, Cockroach, Amphioxus, Pigeon and Ruminants. o Physiology of digestion in humans • Respiration: o Study of structure and function of respiratory organs in Earthworm, Spider, Bonyfish, Frog and Pigeon. o Structure of lungs and physiology of respiration in humans
Module 2 (Credit 1) - Study of Circulation and Excretion, Osmoregulation	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyze the comparative aspects of circulation in different animals.
	2. Evaluate the structural & functional ability of human heart
	3. Relate to the excretion & osmoregulatory mechanisms in animals with respect to theirhabitats

Content Outline	• Circulation: o Types of circulation: (a) Open and Closed, (b) Single and Double o Study of hearts (structure and function): Earthworm, Cockroach, Shark, Frog, Calotes and Pigeon o Structure and mechanism of working of heart in human • Excretion and Osmoregulation: o Study of excretory and osmoregulatory structures and functions: Contractilevacuoles, Flame cells, Nephridia, Malpighian tubules o Categorization of animals based on principal nitrogenous excretory products o Structure of kidney, uriniferous tubule and physiology of urine formation inhuman

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. PowerPoint presentation on topics related to physiology
2. Preparation of working models illustrating the functional aspects of physiological processes
3. Objective type tests - MCQs with reasoning, assertion; Match the column with three columns; True / False giving reasons; Quiz on online platforms such as Kahoot, Quiznet etc.
4. Conduct survey related to topics of physiological processes e.g. blood pressure, lung capacity, rate of respiration by respirometer among the population

Note: Rubrics to be developed for subjective type of assessment

Suggested Project-based assignments

1. **Module 1 - Study of Nutrition and Respiration**

   Each student will conduct a comparative study of the nutritional apparatus in various organisms listed in the module, including Amoeba, Hydra, Earthworm, Cockroach, Amphioxus, Pigeon, and Ruminants. They will research and document the structure and function of the nutritional apparatus in each organism, focusing on similarities and differences. Students will compile their findings into a comprehensive report or presentation, highlighting key anatomical features and physiological processes involved in nutrition. Additionally, they will analyze the significance of these adaptations in meeting the nutritional needs of each organism within its ecological niche.

2. **Module 2 - Study of Circulation and Excretion, Osmoregulation**

   Each student will conduct a comparative analysis of excretory structures in different

animals, focusing on organisms such as Earthworm, Spider, Bony fish, Frog, and Pigeon. They will research and compare the structure and function of excretory organs such as contractile vacuoles, flame cells, nephridia, and Malpighian tubules across these organisms. Students will explore how excretory structures vary in complexity and efficiency based on the habitat and physiological requirements of each species. They will present their findings in a detailed report or presentation, highlighting adaptations for osmoregulation and waste elimination in diverse environments.

References:

1. Jordan, E. L., & Verma, P. S. (2015). Invertebrate Zoology (Reprint ed.). S. Chand and Co.
2. Jordan, E. L., & Verma, P. S. (1980). Chordate Zoology and Elements of Animal Physiology (1sted.). S. Chand and Co. Ltd.
3. Dhami, P. S., & Dhami, J. K. (1979). Invertebrate Zoology (1st ed.). R. Chand and Co.
4. Dhami, P. S., & Dhami, J. K. (1991). Chordate Zoology (Reprint ed.). R. Chand and Co. Ltd.
5. Miller, S. A., & Harley, J. B. (2009). Zoology (8th ed.). Tata McGraw Hill.
6. Kotpal, R. L. (2012). Modern Textbook of Zoology (Reprint ed.). Rastogi Publications.
7. Parker, T. J., & Haswell, W. A. (1992). A Textbook of Zoology, Invertebrates. Vol. I (1st Indianed.). CBS Publishers and Distributors Pvt. Ltd.
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1.4 Open Elective Courses/ Generic (OEC)

Course Title	**Nutrition & Health**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Categorize food into different component groups
	2. Design diet as per nutritional requirements
	3. Relate the symptoms to identify nutrition related problems
	4. Assess the requirements of the community related to nutrition
	5. Create awareness about balanced diet
Module 1 (Credit 1)- Concept of Nutrition and Balanced Diet	
Learning Outcomes	After learning the module, learners will be able to
	1. Relate the concepts of nutrition and balanced diet with good health
	2. Assess the food based on its nutritive value
	3. Plan and recommend diet for different age groups
Content Outline	● Definition of Food, Basic Food Groups, Functional Foods ● Concept of Nutrition, Relation of nutrition to health, Adequate nutrition, optimumnutrition, malnutrition and under-nutrition ● Concept of balanced diet, The Food Guide, Pyramid & MyPlate in the Indian context,Importance of Dietary fibres ● Concept of BMR and its calculation using Harris-Benedict equation ● Dietary recommendations for an infant, child, normal adult, pregnant women andaged ● BMI calculation and its significance
Module 2 (Credit 1) - Dietary Components	
Learning Outcomes	After learning the module, learners will be able to
	1. Classify food into different component groups
	2. Interpret the importance and role of different food components

Content Outline	• Carbohydrates - Definition, Properties, formation of glycosidic bond, types and theirbiological role and clinical significance • Dietary fibres and significance • Lipids - Definition, classification of lipids with examples & formation of ester linkageand biological role & clinical significance of lipids • Role of essential fatty acids, PUFAs, MUFAs • Amino acids and proteins - Basic structure & classification of amino acids; Essential & Non-essential amino acids; formation of peptide bond, Biological role & clinicalsignificance • Vitamins (A, B, C, D, E) - Occurrence and biological significance • Water - Its physiological role
Module 3 (Credit 1) - Nutrition related health issues	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify the health problems related to nutritional deficiencies based on symptoms
	2. Plan the control / remedial measures for nutritional disorders
Content Outline	• Malnutrition disorders: causes, symptoms, prevention and remedy of: PEM, Anemia(Iron deficiency), Marasmus, Kwashiorkor, Goiter • Obesity- Causes, symptoms and effects • Vitamin deficiency related disorders: causes, symptoms, prevention and remedy: o Vit A: *Xerophthalmia,* night blindness o Vit B12: Pernicious anaemia o Vit. C: Scurvy o Vit D: Rickets, Osteomalacia • Acidity • Peptic ulcers
Module 4 (Credit 1) - Nutrition and Public health	
Learning Outcomes	After learning the module, learners will be able to
	1. Discuss the importance of nutrition and health status of the community
	2. Develop a report on improvement of nutritional status of the community

Content Outline	• Nutrition and Public Health • Public /Community Nutrition- Concept and Scope • National Nutrition Survey- India • UNICEF Nutrition Strategy • Anthropometric Standards • Indices of Health and Nutrition situation of a community. (IMR, MMR, TFR, Birthrate, Death rate, Life expectancy • National Nutrition week • National and International agencies in community nutrition: Role of WHO,UNICEF, FAO, UNESCO, WORLD BANK, Red Cross

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. Student presentations based on nutritional disorders
2. Group activity - Report submission based on survey related to nutrition / dietary habits and lifestyle
3. Community engagement - Documentation using photography on community health programs tocreate awareness
4. Videography based on healthy recipes
5. Preparation and submission of scrap-book based on newspaper; magazine articles based on aspectsof nutrition

Some course projects are suggested below:

1. **Module 1 - Concept of Nutrition and Balanced Diet**
   Each student will design personalized balanced diet plans for different age groups and life stages. They will research and analyze nutritional requirements based on age, gender, and physiological conditions such as pregnancy and aging. Students will consider factors such as basal metabolic rate (BMR), dietary fiber intake, and body mass index (BMI) calculations using the Harris-Benedict equation. They will incorporate recommendations from the Food Guide Pyramid or MyPlate in the Indian context, emphasizing the importance of dietary diversity and inclusion of functional foods. Each student will present their diet plans in a structured format, including food groups, portion sizes, and meal schedules.

2. **Module 2 - Dietary Components**
   Each student will conduct a qualitative nutrient data collection of common foods, focusing on carbohydrates, lipids, proteins, vitamins, and water. They will compile

a list of foods commonly consumed in their region and categorize them based on their nutrient composition. Using resources such as food labels, nutritional databases, students will interpret the significance and roles of different dietary components in human health and disease prevention. The findings will be presented in a comprehensive report, highlighting nutrient-rich food choices for optimal health.

3. **Module 3 - Nutrition-related Health Issues**

   Each student will develop an interactive health education campaign focused on raising awareness about nutrition-related health issues in their community. They will identify common nutritional deficiencies and disorders such as malnutrition, obesity, and vitamin deficiencies, along with their causes, symptoms, and preventive measures. Students will create engaging educational materials such as posters, pamphlets, infographics, or multimedia presentations to convey key messages effectively. They will organize workshops, seminars, or health fairs to disseminate information and provide practical tips for improving dietary habits and overall health.

4. **Module 4 - Nutrition and Public Health**

   Each student will conduct a comprehensive assessment of the nutritional status and health status of a selected community. They will collect anthropometric data, health indicators, and dietary intake information using surveys, interviews, and observation methods. Students will analyze the data to identify prevalent nutrition-related issues and health disparities within the community. Based on their findings, they will develop a detailed report outlining strategies for improving the nutritional status and overall health outcomes of the community.

References:

1. Anderson L., Dibble M., Turkki P., Mitchell H. and Rynbergen H. (1982) Nutrition in Health andDisease. 17th Edition J.B. Lippincott Company. Philadelphia, Toronto.

2. Bamji M.S. (2019) Text book of Human Nutrition (4^{th} ed.).Oxford & IBH Publishing CompanyPvt. Limited.

3. Bagchi K. (1990) Guidelines for the management of nutrition programmes- A manual for nutrition officers. WHO EMRO Technical Publication no. 15, WHO, Geneva.

4. Bendich A and Deckelbaum R.J. (1997) Preventive Nutrition. The Comprehensive guide forhealth professional. Churchill Livingstone, Edinburg.

5. Devlin T.M. (1986) Textbook of Biochemistry with clinical correlations (2nd Edition), JohnWiley.

6. Davidson S., Passmore R. and Brock J.F., (1986), Human Nutrition and Dietetics Garrow, J.S., James, W.P.T. and Ralph, A. (2000): Human Nutrition and Dietetics, 10th Edition,Churchill Livingstone.

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8. Gopalan C., Rama Sastri B.V. and Balasubramanian S.C. (1989).Nutritive Value of IndianFoods. 2nd Edition ICMR Offset Press, New Delhi.

9. Krause M.V. and Mahan K. (1984) – Foods, Nutrition and Diet Therapy. 7th Edition, W.B.Saunders Company U.S.A.

10. Lehinger A.L. (1984), Principles of Biochemistry. Worth Publishers New York.

11. Machlin L.J. (1984) Ed., Hardbook of Vitamins – Nutritional, Biochemistry and Clinical Aspects,
M. Dekker, New York.

12. National Institute of Nutrition, (ICMR) Hyderabad, Telangana- Publications-NutrientRequirements and Recommended Dietary Allowances for Indians.

13. 14.National Institute of Nutrition, (ICMR) Hyderabad, Telangana- Publications-Indian Food composition Tables by T. Longvah, R. Ananthan, K. Bhaskaracharya, K. Venkaiah.

14. National Institute of Nutrition, (ICMR) Hyderabad, Telangana- Publications-Nutrition, Lifestyleand Immunity.

15. Pike R.L. and Brown M.L. (1984) Nutrition – An Integrated Approach, John Wiley, New York.

16. Protocol for management of malnutrition in children- Published by Ministry of health and Familywelfare, Ministry of Women and Child development, India

17. Rajalakshmi (1987) Applied Nutrition, Oxford/IBH

18. https://www.unicef.org/media/131516/file/2023-HAC-India.pdf

19. https://esurvey.nin.res.in

1.5 Vocational Skill Courses (VSC)

Course Title	**Experimental Zoology**
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Develop the experimental skills and hands on training
	2. Apply suitable techniques for studying various physiological processes
Content Outline	• Principle, structure, working, precautions while handling Microscope. • To focus slide under 10x, 40x and 100x objective • Study of mouthparts in insects-Biting and chewing, siphoning, sponging,piercing and sucking, lapping and chewing • Effect of varying pH on enzyme amylase activity • Effect of varying temperature on enzyme amylase activity • Study of nutritional apparatus - gastrovascular cavity of hydra, digestive system of liver fluke, earthworm and cockroach and bird, ruminant stomach • Dissection of preserved earthworm for its digestive system • Dissection of shark for its digestive system • Detection of blood glucose level using glucometer • Study of respiratory apparatus – spiracle and trachea of cockroach, gills ofshark and bony fish, lungs of frog and mammals • Determination of vital capacity of lung by balloon method • Study of circulatory apparatus – heart of cockroach, fish, frog and mammal • Detection of normal and abnormal constituents of urine • Types of fins in fishes – Cartilaginous and Bony • Dissection of preserved earthworm for its nervous system • Study of control and coordination – nervous system of earthworm, cockroach,sepia, T.S of nerve cord in earthworm and spinal cord in vertebrates, outer view and V.S of

	mammalian brain ● Study of reproduction – Binary fission and Conjugation in Paramoecium, Hydra budding, T.S of mammalian testis and ovary, Hen's egg ● Study of mitosis using onion root tip ● Study of meiosis using Tradescantia bud / cockroach testis ● Study trip to diagnostic laboratory / Industry and submission of report.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

6. Journal Assessment and certification
7. End Semester Practical examination
8. Submission of visit report

Some illustrative assignments for students

1. Microscope Basics: Students will learn the principles and structure of a microscope, along with proper handling precautions, through interactive workshops and demonstrations.
2. Enzyme Activity Investigation: Students will conduct experiments to observe the effects of varying pH and temperature on the activity of the enzyme amylase, providing insights into enzyme kinetics and practical applications.
3. Insect Mouthparts Study: Through microscopic examination and research, students will explore the diverse mouthpart adaptations of insects, including biting, chewing, siphoning, piercing, and sucking, fostering an understanding of insect feeding behaviors.
4. Nutritional Apparatus Dissection: Students will dissect preserved specimens such as earthworms and cockroaches to study their digestive systems, gaining hands-on experience in anatomical observation and comparative anatomy.
5. Urine Analysis: Students will conduct experiments to detect normal and abnormal constituents ofurine, utilizing laboratory techniques to analyze urine samples and interpret diagnostic indicators.
6. Finned Fish Diversity: Through research and observation, students will categorize and compare the types of fins found in cartilaginous and bony fishes, enhancing their understanding of fish morphology and locomotion.
7. Nervous System Investigation: Students will dissect earthworms and examine the nervous system.

References:

1. Jordan, E. L., & Verma, P. S. (2015). Invertebrate Zoology (Reprint ed.). S. Chand and Co.

2. Jordan, E. L., & Verma, P. S. (1980). Chordate Zoology and Elements of Animal Physiology (1sted.). S. Chand and Co. Ltd.

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8. Parker, T. J., & Haswell, W. A. (1992). A Textbook of Zoology, Vol. II (1st Indian ed.). CBSPublishers and Distributors Pvt. Ltd.

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1.6 Skill Enhancement Courses (SEC)

Course Title	**Laboratory Safety Measures**
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Develop the skill sets required for performing experiments
	2. Translate the good laboratory practices in practical courses of the curriculum
	3. Integrate the skills in field work / mini research projects
	4. Demonstrate the SOPs to the peers for cooperative learning
	5. Analyze the results of the experiments through appropriate statistical tools
Module 1 (Credit 1) - Lab safety	
Learning Outcomes	After learning the module, learners will be able to
	1. Integrate good laboratory practices in regular practicals
	2. Demonstrate the skills acquired through carrying out SOPs correctly
Content Outline	• Introduction and scope and principles of Good Laboratory Practices; brief ideaabout the GLP certification process; SOPs & OECD guidelines. • Interpretation of safety symbols (toxic, corrosive, explosive, flammable, skinirritant, oxidizing, compressed gas, Aspiratory hazards and Biohazardous infectious agents. • SOPs for maintenance of laboratory equipment - Microscope, pH meter,Colorimeter, Centrifuge • Handling and usage of glassware • Methods of sterilization - Autoclave, Hot air oven, Laminar flow, Millipore filterassembly
Module 2 (Credit 1) - Lab skills	
Learning Outcomes	After learning the module, learners will be able to
	1. Design experiments with correct resources and accurate measurements

	2. Analyze the results of the experiments through appropriate statistical tools
Content Outline	• Collection of data and Preparation of Frequency Distribution Table • Graphical representation of the statistical data through - Bar diagram, Histogramand Pie diagram. • Prepare molar and normal solutions of different concentrations • Perform serial dilutions and find the concentration of unknown diluted samplesusing standard graphs. • Titration of strong acid - strong base • Titration of weak acid - weak base • Calibration of Colorimeter, pH meter & Analytical balance

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

9. Journal Assessment and certification

10. End Semester Practical examination

11. Solving problems based on central tendencies and / or appropriate graphical representation ofthe given data

12. Ill-defined practical preparation to be improvised by students

13. Laboratory mini-research project based on the skill / SOPs learnt in this course

Some Illustrative assignments for students

1. Laboratory Safety Practices Integration: Students will learn about good laboratory practices (GLP) and safety symbols, integrating these principles into regular practical sessions to ensure safe experimentation and equipment maintenance.

2. Experimental Design and Statistical Analysis: Through hands-on activities, students will compile data such as number of types of shells (if there is a collection available), height of students, etc. They will learn to interpret results using statistical tools such as frequency distribution tables, graphical representations, and titration techniques, enhancing their analytical skills in laboratory settings.

3. Glassware Handling and Sterilization Techniques: Students will acquire proficiency in handling laboratory glassware and master methods of sterilization including autoclaving, hot air oven usage, and laminar flow techniques, ensuring the integrity of experimental setups and minimizing contamination risks.

4. Solution Preparation and Dilution Techniques: Participants will gain expertise in preparing molar and normal solutions of varying concentrations, as well as performing serial dilutions and analyzing unknown samples using standard graphs. This skillset is crucial for accurate chemicalanalyses and experimentation.

References:

1. Biological instruments and methodology – Dr. P. K. Bajpai, December 2010 Edition. S. Chand company Ltd.

2. Calculations in Molecular biology and Biotechnology - Frank H. Stephenson,3rd Edition 2016 Academic Press.

3. A Manual of Medical Laboratory Technology -A. H. Patel, 2016 Edition, Navneet Prakashan Ltd.

4. Introduction to Practical Biochemistry – David T. Plummer, 3rd Edition 2017, TataMcGraw Hill Publishing Co. Ltd.

5. Introductory Practical Biochemistry – S.K. Sawhney and Randhir Singh, Reprint2014 Edition, Narosa Publishing House

6. Microscopy and Cell Biology - V. K. Sharma, First Edition 1991, TataMcGraw Hill Publishing Co. Ltd.

7. Bioinstrumentation – L. Veerakumari, January 2011 Edition, M.J.P. Publishers

8. Principles and Techniques of Practical Biochemistry – Keith Wilson and John Walker, 5th Edition2000, Cambridge University Press.

Semester - II

.2.1 Major (Core)

Course Title	**Reproduction and Development**
Course Credits	2
Course Outcomes	After going through the course, learners will be able to:
	1. Relate how the various physiological processes help the organisms to adapt to theirenvironment
	2. Evaluate the interrelationship between the various human physiological processes
Module 1 (Credit 1) - Locomotion, Control and Coordination	
Learning Outcomes	After learning the module, learners will be able to:
	1. Compare the locomotory organs among the invertebrates and vertebrates
	2. Relate the control and coordination process with the habits and habitats of theorganisms
Content Outline	● Locomotion: o Locomotory organs - structure and functions of: Pseudopodia in Amoeba, Ciliarymovement in Paramecium, Setae and peristaltic movement in annelids, Jointed legs in arthropods, Tube feet in starfish o Structure of striated muscle fibre in human and sliding filament theory ● Control and Coordination o Irritability in Paramecium, nerve net in Hydra, nerve ring and nerve cord inearthworm. o Types of neurons based on the structure and function. o Conduction of nerve impulse: Resting potential, Action potential and Refractoryperiod, Synaptic transmission
Module 2 (Credit 1) - Reproduction	
Learning Outcomes	After learning the module, learners will be able to:
	1. Compare the modes of reproduction among the invertebrates and vertebrates
	2. Interpret the advancements in the reproductive system among the organisms

Content Outline	• Reproduction o Types of reproduction – asexual and sexual o Asexual – Types of fission, Types budding, Parthenogenesis; Sexualreproduction – Syngamy, Conjugation in Paramoecium o Gametogenesis, Types of gametes, External and internal fertilization o Oviparity, ovoviviparity and Viviparity o Reproductive system of earthworm o Reproductive system of rat

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

No Internal Examination.

References:

1. Invertebrate Zoology. E. L. Jordan and P. S. Verma. Reprint Edition, 2015. S. Chand and Co.
2. Chordate Zoology And Elements of Animal Physiology - E. L. Jordan, P. S. Verma. 1st Edition,1980. S. Chand and Co. Ltd.
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.2.6 Open Elective Courses/ Generic (OEC)

Course Title	**Amazing Animal World**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Interpret the uniqueness of the animals enlisted
	2. Relate the distinguishing characteristics with the adaptations
	3. Create awareness of the wonders of animal kingdom through activities
	4. Prepare models of the animals to illustrate their unique characters
Module 1 (Credit 1) - Fauna of National / State	
Learning Outcomes	After learning the module, learners will be able to
	1. Enlist the distinguished characteristics
	2. Evaluate the unique characteristics as per the adaptations
Content Outline	General Morphology, Habits and habitat and Significance: ● Butterflies - the flying jewels - Blue Mormon, Kaiser-i-Hind ● Herpetofauna of India- *Rhacophorus malabaricus*, Monitor lizard, Chameleon ● Feathered Bipeds: Yellow footed green Pigeon, Peacock ● Mammals of India: Giant Indian Squirrel, Gangetic Dolphin, Royal Bengal Tiger, Elephant, Swamp Deer, Rhinoceros
Module 2 (Credit 1) - Amazing animals	
Learning Outcomes	After learning the module, learners will be able to
	1. Enlist unique characteristics of the animals
	2. Interpret the significance of the unique characteristics

Content Outline	General Morphology, Habits and habitat and Unique features: ● Jelly fish - *A. victoria* ● Pistol Shrimp ● Suicidal Ant ● Praying mantis ● Pearl oysters ● Electric eel ● Puffer fish ● Axolotl larva ● Pebble toad ● Flying Snake ● Indian Cuckoo ● Red Panda
Module 3 (Credit 1) - Incredible Fauna	
Learning Outcomes	After learning the module, learners will be able to
	1. Enlist the recently discovered fauna
	2. Justify the uniqueness of the fauna listed
Content Outline	● **Recently discovered fauna:** ○ Tapir Frog ○ Stealthy Gecko ○ Rose-rainbow fish ○ Southern maned sloth ○ Sea anemone from Japan – *Stylobatus* ● **Unique fauna:** ○ Kangaroo ○ Duck-billed Platypus ○ Penguins ○ Whale ○ Sphenodon
Module 4 (Credit 1) - Marvels of animals	
Learning Outcomes	After learning the module, learners will be able to
	1. Relate the marvels with their application in the practical world
	2. Evaluate the significance of the marvels for the survival of the animals

Content Outline	• Coral reef • Bioluminescent animal - Fireflies, Angler fish • Parental care in fishes • Parental care in amphibians • Migration in birds • Social organization - Honey bee, Hanuman Langur • Hibernation/aestivation in frog • Echolocation - Bats, Dolphin

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. Presentation based on related topics
2. Preparation models of the animals to illustrate their unique characters

Some illustrative assignments for students:

1. **Module 1 Project: Animal Adaptation Garden**
   Students will create a miniature garden or terrarium representing a specific habitat (e.g., desert, rainforest) and populate it with plant species and small animal figurines. They will research the adaptations of animal's native to their chosen habitat and strategically place the figurines within the garden to reflect these adaptations. For example, animals with camouflage adaptations could be placed among plants with similar colors and patterns. This project will not only reinforce understanding of animal adaptations but also provide hands-on experience in designing and creating habitat models.

2. **Module 2 Project:** Students will collect data of different amazing animals (apart from the syllabus) and write a informatory articles and disseminate this communication through weekly poster exhibits.

3. **Module 3 Project: Neighborhood Biodiversity Survey**
   Students will conduct a biodiversity survey in their neighborhood or local park to identify and document animal species present in the area. Using basic tools such as binoculars, field guides, and smartphone apps, they will observe and record sightings of birds, insects, mammals, and such fauna. Students will then compile their data and create a report or presentation highlighting the diversity of species found, as well as any trends or patterns observed. This project will enable students to apply their knowledge of animal taxonomy and ecology while also contributing to scientific research and conservation efforts in their community.

4. **Module 4 Project: Conservation strategies**
   Using case studies and real-world scenarios, students will present the various success stories of the wildlife conservation and also highlight where such efforts are needed

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.2.7 Skill Enhancement Courses (SEC)

Course Title	**Fish Aquarium setting**
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Acquire skills of fish aquarium setting
	2. Prepare a list of resources required for aquarium setting
	3. Perform experiments related to aquarium maintenance
	4. Create aquarium keeping as one of the departmental activities
Module 1 (Credit 1) - Ornamental fishes, Aquarium plants & Fish feed	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify various ornamental fishes and their feed
	2. Identify various aquarium plants
Content Outline	• Identification and breeding and maintenance of: Ornamental fishes: Angel, Danio,Discus, Flower horn, Gourami, Siamese fighter, Goldfish • Aquarium plants: Hydrilla, Amazon sword, Aqua rose, Pistia, Cork screw, Cobamba.Ludwigia • Fish Feed : Live feed - Artemia, Daphnia, Moina, Infusoria, Chaetoceros, Bloodworms • Formulated feed - Composition and nutritional value
Module 2 (Credit 1) - Aquarium equipment	
Learning Outcomes	After learning the module, learners will be able to
	1. Perform experiments of water testing parameters
	2. Demonstrate use of various accessories by setting up aquarium
Content Outline	• Aquarium set up: o Monitoring water quality parameters - pH, Temperature, Conductivity, DissolvedOxygen, Free Carbon dioxide, Ammonia, Nitrate, Phosphates o Monitoring the air siphons, cleaning techniques, aerators, filters o Types of gravel

	o Types of feeding cups

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

3. Journal Assessment and certification
4. End Semester Practical examination
5. Aquarium setting up and maintenance based on this course

Some Illustrative assignments for students:

1. Ornamental Fishes, Aquarium Plants & Fish Feed

Each student will select a specific ornamental fish species from the list provided in the course outline (e.g., Angel, Danio, Discus, etc.). They will research and document the key characteristics, habitat preferences, and feeding habits of their chosen fish species. Using this information, students will set up a small aquarium at home or in the lab, carefully selecting appropriate tank mates and aquarium plants to mimic the fish's natural environment. Over the course of several weeks, students will observe and record the behavior of their fish, noting feeding patterns, interactions with tank mates, and any signs of distress.

2. Aquarium Equipment

Each student will design and conduct a series of experiments to evaluate the effectiveness of various aquarium equipment in maintaining water quality. They will set up identical experimental tanks, each equipped with different types of filtration systems, aerators, and monitoring devices. Throughout the experiment, students will measure and record key water quality parameters such as pH, temperature, ammonia levels, and dissolved oxygen concentrations at regular intervals. They will also assess the efficiency of different cleaning techniques and gravel types in maintaining water clarity and reducing organic waste buildup. Based on their experimental data, students will analyze the performance of each equipment setup, identifying strengths and weaknesses in water quality management. Finally, they will compile their findings into a comprehensive report stating optimizing aquarium equipment for effective water quality maintenance.

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