

Year-2023-2024
Syllabus of B.Sc. Programme: [Subject Name: Zoology]
In accordance with NEP-2020

Year	Sem.	Course Code	Paper Title	Theory/Practical	Max. Marks.	Credits	
1	I	UGZY-101 (N)	Animal Physiology	Theory	100	2	
		UGZY-101 (N)(P)	Practical Work	Practical Work	100	2	
	II	UGZY-102 (N)	Diversity of Animal Life	Theory	100	2	
		UGZY-102 (N)(P)	Practical Work	Practical Work	100	2	
		Skill Enhancement Course					
		SBSZY-02(N)	Fundamental of Animal Behavior			4	
2	III	UGZY-103 (N)	Genetic and Cell Biology	Theory	100	2	
		UGZY-103(N) (P)	Practical Work	Practical Work	100	2	
	IV	UGZY-104 (N)	Hemichordata and Chordata	Theory	100	2	
		UGZY-104 (N)(P)	Practical Work	Practical Work	100	2	
3	V	Discipline Centric Elective Course					
		DCEZY-105(N)	Animal Distribution and ecology	Theory	100	2	
		DCEZY-106 (N)	Taxonomy and Evolution	Theory	100	2	
		DCEZY-107 (N)(P)	Practical Work	Practical Work	100	2	
		Skill Enhancement Course					
			SBSZY-03(N)	Economic Zoology and environmental biology	Theory	100	4
	VI	Discipline Centric Elective Course					
		DCEZY-108 (N)	Developmental Biology	Theory	100	2	
		DCEZY-109 (N)	Molecular Biology and Genetic Engineering	Theory	100	2	
DCEZY-110 (N) (P)		Practical Work	Practical Work	100	2		
Total Marks/Credit					1500	36	

B.Sc.: Subject: Zoology

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: I
Subject: Zoology		
Course Code: UGZY-101 (N)	Course Title: Animal Physiology	
Course Objectives- The course aim to develop, to knowledge about the structure and functions of various organs in our body.		
Course Outcomes: (CO):		
<ul style="list-style-type: none"> • Animal physiology is comprehensive subject that gives in depth knowledge of various physiological processes of the animal kingdom. • Students gain knowledge about the comparative physiological concepts of nutrition, digestion, respiration and physiological concept of excretion, metabolism and osmoregulation. • Students feel confident in teaching physiology as well as executive research projects. 		
Credits: 02	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Physiology I	
Unit I	Physiology of Digestion <ul style="list-style-type: none"> • Nutrition – Carbohydrates, Lipids, Proteins, Vitamins and Minerals • Feeding Mechanism • Digestive Tract and process of Digestion • Digestive Enzymes, its Regulation and Control • GIT System • Absorption of products of Digestion 	
Unit II	Physiology of Respiration <ul style="list-style-type: none"> • Respiratory System • Modes of Respiration • Structural Organization of Lungs and other Respiratory Structures • Process of Gaseous Exchange • Hemoglobin, • Respiratory Gases and its Transport • Regulation of Respiration 	
Unit III	Circulatory System <ul style="list-style-type: none"> • General plan of Circulatory Systems (Circulation) • Structure of Mammalian Heart • Excitation of Heart • Cardiac Output • Blood Vessels, Arteries, Veins and Capillaries • Blood Flow • Lymphatic System • Haemostatic Mechanisms 	
Unit IV	Excretory System <ul style="list-style-type: none"> • Nitrogen Excretion with Formation of Ammonia • Ammonotelic, Ureotelic ,Urecotelic Animals • Glomerular Filtration • Reabsorption and Secretion in Renal Tubules • Function and Regulation of Vertebrate Kidney 	
Block 2	Physiology II	
Unit V	Osmoregulation <ul style="list-style-type: none"> • Functional Principles of Osmoregulation and membrane permeability 	

	<ul style="list-style-type: none"> • Problems of Osmoregulation • Osmoregulation in Aqueous (Fresh, Marine) and Terrestrial Environment
Unit VI	<p>Nervous System</p> <ul style="list-style-type: none"> • Nervous System and Nerve Cells • Nerve Impulse, Action Potential • Conduction of Nerve Impulse • Synaptic Transmission, Chemical Synaptic Transmission, Post Synaptic Potential • Neurotransmitters • Neural Circuits
Unit VII	<p>Muscular System</p> <ul style="list-style-type: none"> • Structure of Vertebrate Skeletal Muscle • Mechanism and Control of Muscle Contraction • Initiation of Muscle Contraction • Cardiac and Smooth Muscle
Unit VIII	<p>Endocrine system</p> <ul style="list-style-type: none"> • Hormonal Control Mechanism • Chemical Nature, Synthesis and Storage of Hormones • Secretion of Hormones • Steroid • Thyroid and Peptide Hormones • Neuroendocrine Connection • Hypothalamus and Pituitary • Regulation of Hormones • Pheromones
<p>Suggested Text Book Readings:</p> <ol style="list-style-type: none"> 1. Knut Schmidt-Nielsen: Animal physiology 2. Philip C. Withers: Comparative Animal Physiology 3. Christopher D. Moyes and Patricia M. Schulte: Principles of Animal Physiology 4. Ian Kay: Introduction to Animal Physiology 5. Thomas Mills: A text book of animal physiology 	
<p>This course can be opted as an elective by the students of following subjects: NA</p>	
<p>Suggested equivalent online courses (MOOCs) for credit transfer: NA</p>	
<p>Electronic media and other digital components in the curriculum: Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)</p>	
<p>Name of electronic media</p> <p>https://youtu.be/d2ab1v7yIBU https://youtu.be/h1PcmyJusQw https://youtu.be/iVV1SXjv7nE https://youtu.be/UAu36gcSNtQ https://youtu.be/E8ns1b0o1s e-SLM</p>	<p>Year of incorporation: 2021-22</p>

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: II
Subject: Zoology		
Course Code: UGZY-102 (N)	Course Title: Diversity of Animal Life	
Course Objectives- Students will be able to identify and understand the basics of animal biology with a comparative knowledge on the organization of various animals group.		
Course Outcomes:(CO):		
<ul style="list-style-type: none"> • Provides students with an in-depth knowledge of diversity of animal life and their systematic position. • To make them aware of the economic importance of some classes. • To make the students observe the diversity in non chordates. 		
Credits: 02		Type of Course: Core
Max. Marks: 100		Min. Passing Marks: 36
Block 1	Comparative Forms and Functions-I	
Unit I	General characters & Classification of Protozoa <ul style="list-style-type: none"> • Locomotory Organelles • Locomotion in Protozoa. • Viruses- a Border Line Case between Living and Non Living things. • Acellular and Cellular Organisms • Prokaryotes and Eukaryotes • Biology of Flagellated Protozoans, Amoeboid Protozoans, Spore Forming Protozoans, Ciliated Protozoans and Parasitic Protozoans 	
Unit II	Body Organization & Characteristic of Metazoa <ul style="list-style-type: none"> • Symmetry: Asymmetrical, Spherical, Radial, Biradial, Bilateral • Development patterns – Cleavage, Fate of Blastopore and Germ Layers • Body Cavity – Pseudocoelom and Coelom • Origin and Evolution of Metazoa • Syncytial theory, Colonial Theory, Polyphyletic Theory 	
Unit III	General characters and classification of Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nematoda	
Unit IV	General characters and classification of Phylum Annelida, Arthropoda, Mollusca <ul style="list-style-type: none"> • Torsion and Detorsion in mollusca. • Echinodermata- Laval forms in Echinodermata 	
Block 2	Comparative Forms and Functions-II	
Unit V	Comparative form and Functions : <ul style="list-style-type: none"> • Locomotion : Significance of Hydraulic Pressure in Locomotion, Locomotion in Coelenterates, Flatworms, Nematoda, Annelida & Arthropoda • Mollusca – Foot in mollusca as a Creeping and Crawling organ, burrowing Organ , Leaping organ and Swimming organ • Ambulance system in Echinodermata • Feeding and Digestion in Sponges, Coelenterates • Structure and function of Protonephridia , Metanephridia, Malpighian Tubules and Coelomoducts of Molluscs 	
Unit VI	Respiratory , Circulatory and Nervous system <ul style="list-style-type: none"> • Respiratory System – Respiratory organs, Process of Respiration , Respiratory Pigments • Circulatory System – Open and closed type of Circulatory System • Organisation of Nervous System – Nerve Cell , Neuroglia , Ganglia • Nervous System in Platyhelminthes , Annelida , Arthropoda and Mollusca 	
Block 3	Adaption and Behavioral Pattern	

Unit VII	Reproductive system <ul style="list-style-type: none"> • Reproductive System – Formation of Special Reproductive Unit • Asexual Reproduction – The Gemmules, Regeneration, Autotomy and Regeneration • Epitoky, Polarity and Regeneration • Prevalence and its Significance • Sexual Reproduction and its Patterns. Sexual Dimorphism, The Reproductive Organs • Mating and Fertilization, Ovipary , Vivipary , Ovovivipary , Hermaphroditism • Parthenogenesis and Metagenesis
Unit VIII	Adaptive Radiation <ul style="list-style-type: none"> • Colonial forms among Protozoans and Metazoans • Adaptive Radiations in Annelida , Arthropoda and Mollusca • Flight in Insects , Migration in Insects
Unit IX	Behavioural patterns <ul style="list-style-type: none"> • Social organization in insects – Advantage and disadvantage of Social Behavior • Kinds of Honey Bees , Production of Honey, Composition of Honey, Honey Production in India • Industrial Products – Silk , Lac, Bees Wax, Pearl, Sponge , Dyes and Pigments
Unit X	Harmful and beneficial Non-Chordates <ul style="list-style-type: none"> • Parasitic Platyhelminthes – Nematoda • Parasitic Nematoda • Economic importance of Arthropods : in agriculture, soil fertility, pollination, pest management, food chain, scavenger
Suggested Text Book Readings: <ol style="list-style-type: none"> 1. Barnes et al (2009), The Invertebrates: A synthesis, Wiley Backwell 17 2. Hunter; Life of Invertebrates (1979, Collier Macmillan) 3. Marshall: Parker & Haswell Text Book of Zoology, Vol. I (7th ed 1972, Macmillan) 4. Moore: An Introduction to the Invertebrates (2001, Cambridge University Press) 5. Jan Pechenik (2014) Biology of the invertebrates. McGraw Hill 6. Thomas C. Chung. General Parasitology. Hardcourt Brace and Co. Ltd., Asia, New Delhi. 7. Bisht. D.S. <i>Apiculture</i>, ICAR Publication. 	
This course can be opted as an elective by the students of following subjects: NA	
Suggested equivalent online courses (MOOCs) for credit transfer: NA	
Electronic media and other digital components in the curriculum: Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media e-SLM	Year of incorporation: 2021-22

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: III
Subject: Zoology		
Course Code: SBSZY-02 (N)	Course Title: Fundamental of Animal Behavior	
Course Objectives- To understand the natural behavioral of various animals. Knowledge the difference between innate and learned behavioural.		
Course Outcomes (CO):		
<ul style="list-style-type: none"> • By the completion of this course, students will be expected to gain a comprehensive understanding of the behavior of animals. • To describe innate Taxes, Reflexes, Instincts and Motivation, Kinesis. • To describe the social behavior and parental care in fish and amphibia. • Understand types of animal behavior and there importance to the organisms. 		
Credits: 02	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Fundamental of Animal Behavior – I	
Unit I	General Survey of Various Kinds of Animal Behavior <ul style="list-style-type: none"> • General Survey of Various Kinds of Animal Behavior, Types of Innate Behavior - Taxes, Reflexes, Instincts and Motivation, Kinesis. 	
Unit II	Types of Behavior <ul style="list-style-type: none"> • Types of Learned Behavior Habituation, Imprinting, Conditioned Reflexes, Trial and Error, Latent Learning, Reasoning. 	
Unit III	Introduction and Basic Mechanism of Behavior <ul style="list-style-type: none"> • Introduction and Basic Mechanism of Behavior- Role of Nervous System, Hormones, Pheromones and Genetics in Behavior, Difficulties in Studying Behavior Study of Human Behavior 	
Unit IV	Social Behavior in Insects <ul style="list-style-type: none"> • Social Behavior in Insects, Social structure and functioning of Bees and Termites. 	
Block 2	Fundamental of Animal Behavior - II	
Unit V	Parental Care in Fishes and Amphibia <ul style="list-style-type: none"> • Parental Care in Fishes and Amphibia, Maternal Vs Paternal care 	
Unit VI	Nest Building <ul style="list-style-type: none"> • Nest Building, Nesting and Brooding Behavior in Birds 	
Unit VII	Migration in Fishes and Birds <ul style="list-style-type: none"> • Migration in Fishes and Birds- physiological and behavioral changes. Cost and benefits of migration. 	
Unit VIII	Biological Clock <ul style="list-style-type: none"> • Biological Clock, Colouration, Mimicry, Adaptation and anti-predator behavior. 	
Suggested Text Book Readings:		
<ol style="list-style-type: none"> 1. Animal behavior by Reena Mathur 2. The marvels of Animal Behaviour, A publication of National Geographic Society, Washington, DC, USA. 3. Wildlife Wealth of India (Resources and Management), Edited By T.C. Mojurpuria. Published and Distributed By: Tecpress Service, Bangkok, Thailand. 4. Wildlife in India, By V.B. Saharia, Natraj Publishers, Dehradun. 5. Indian Wildllife, Edited By Samuel Israel and Toby Sinclair. Directed and Designed By Hans Johannes Hoefler, Singapore. 6. Animal behaviour (ethology) by V.K. Agrawal. 7. Animal Social Behaviour, By James F Wittenberger Duxbury Press, Boston, USA. 8. Animal Behaviour: An Evolutionary Approach, By John Alcock. Sinaver Associates, Inc, USA. 9. Sociology, By Edward O. Wilson. The Bellknap Press, USA. 		
This course can be opted as an elective by the students of following subjects: NA		
Suggested equivalent online courses (MOOCs) for credit transfer: NA		
Electronic media and other digital components in the curriculum:		
Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)		
Name of electronic media e-SLM	Year of incorporation: 2021-22	

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: III
Subject: Zoology		
Course Code: UGZY-103 (N)	Course Title: Genetics and Cell Biology	
Course Objectives- Students can understand the structure and functions of cell organelles. To understand the cellular components underlying the process of cell division in both somatic and germ cell.		
Course Outcomes (CO):		
<ul style="list-style-type: none"> • Structural and functional aspects of basic unit of life i.e. cell concepts. • Concepts behind genetic disorder, gene mutations, various causes associated with inborn errors of metabolism. 		
Credits: 02	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Genetics	
Unit I	Molecular basis of genetic information <ul style="list-style-type: none"> • Genetic Variation, Molecular basis of genetic information • Human Chromosomes and Human Chromosomal Abnormalities • Sex Linkage and Determination in Drosophila and Man • Sex Chromatin Bodies • Dosage Compensation and Lyon's hypothesis 	
Unit II	Blood group, DNA and RNA <ul style="list-style-type: none"> • Blood group and haemoglobin, Genetics in Man Inborn Errors of Metabolism in Man • DNA and RNA structure • Harchey chase experiment • Replication of DNA – Messelson and Stahl's Experiment 	
Unit III	DNA Polymerase and In Vitro DNA Synthesis, Transcription, Genetic Code, Gene Cloning Experiment <ul style="list-style-type: none"> • DNA Polymerase and in Vitro DNA synthesis • Transcription • Genetic Code • Gene Cloning Experiment 	
Block 2	Cell Biology	
Unit IV	Cell Biology & Microscopy <ul style="list-style-type: none"> • Definition and history of Cell Biology • Microscopy – Light Microscopy and Electron Microscopy (Fundamental of TEM and SEM) • Principle of Fixation, Staining and Autoradiography 	
Unit V	Plasma Membrane, Nucleus and Cell cycle <ul style="list-style-type: none"> • Cell Cycle – Mitosis and Meiosis , Nucleus , Nuclear Membrane and Nucleolus • Structure and Function of Plasma Membrane (Passive Transport and Active Transport) 	
Unit VI	ENDOPLASMIC RETICULUM, RIBOSOMES <ul style="list-style-type: none"> • Endoplasmic Reticulum – Morphology, Ultrastructure • Types of Endoplasmic Reticulum <ul style="list-style-type: none"> □ Smooth ER and Rough ER • Origin of ER 	

	<ul style="list-style-type: none"> • Function of ER • Ribosomes – Occurrence and Distribution • Types Of Ribosomes <ul style="list-style-type: none"> □ 70s Ribosomes □ 80s Ribosomes • Structure of Ribosomes • Dissociation and Reconstitution of Ribosomes
Unit VII	<p>Golgi body & Lysosomes</p> <ul style="list-style-type: none"> • Golgi Body – Occurrence , Distribution , Morphology , Chemical Composition , Origin and Function • Lysosomes – Chemical Composition , Lysosomal Enzymes , Lysosomal Membrane • Kinds of Lysosomes – Primary and Secondary Lysosomes • Origin and Function of Lysosomes • Lysosomes and Disease
Unit VIII	<p>Mitochondria</p> <ul style="list-style-type: none"> • Origin of Mitochondria • Mitochondria – Morphology, Chemical Composition • Function of Mitochondria • Mitochondria as Semi Autonomous Organelles
<p>Suggested Text Book Readings:</p> <ol style="list-style-type: none"> 1. John Morrow: Eukaryotic Cell Genetics 2. Gunter Ed Obe: Cytogenetics: Basic & Applied Aspects 3. Frederic Hecht: Textbook of cytogenetics 4. H C MacGregor: Introduction to Animal Cytogenetics 5. Barbara Hamkalo : Molecular Cytogenetics. 6. Cell Biology And Genetics (Hindi) 2/e PB...Gupta P K (Hindi) rastogi Publications 7. Cytogenetics, Plant Breeding, Evolution and Biostatistics ISBN #: 978-81-301-0066-1 Sunil D Purohit & Gotam K Kukda, Apex Publishing House 8. Genetics and Biotechnology Sunil D Purohit, K. Ahmed & Gotam K Kukda Apex Publishing House 9. Padaprajanan (Hindi) Hardcover – 1 January 2016 by Chandra Prakash Shukl (Author) Pointer Publishers, Jaipur 	
<p>This course can be opted as an elective by the students of following subjects: NA</p>	
<p>Suggested equivalent online courses (MOOCs) for credit transfer: NA</p>	
<p>Electronic media and other digital components in the curriculum: Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)</p>	
<p>Name of electronic media: e-SLM</p>	<p>Year of incorporation: 2021-22</p>

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: IV
Subject: Zoology		
Course Code: UGZY-104 (N)	Course Title: HEMICHORDATES & CHORDATES	
Course Objectives- To understand different categories of chordates. To understand general characters of chordates and affinities of hemichordates and chordates. To understand the comparative anatomy of chordates.		
Course Outcomes: (CO):		
<ul style="list-style-type: none"> • Imparts conceptual knowledge of vertebrates • Classify phylum protochordata to mammalia. • Understanding of origin and salient features of Ostracodrms to Actinopterygii, adaptive radiation of amphibian, reptiles, birds and mammals. • To make the student observe the diversity in chordates and their systematic position. • To make them aware the economic importance of some classes. 		
Credits: 02	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	HEMICHORDATES & CHORDATES	
Unit I	Hemichordata and Cephalochordata General Characters of Hemichordata and Affinities of Balanoglossus Classification and Detailed Study (Habits, Morphology, Anatomy and Physiology) of Branchiostoma	
Unit II	UROCHORDATA Classification and Detailed Study (Habits, Morphology, Anatomy, Physiology and Post Embryonic Development) of Herdmania	
Unit III	FISH , Amphibia & Reptilia Classification and Detailed Study (Habits, Morphology, Anatomy and Physiology) of Scoliodon General Characters and Classification of Amphelia and reptilian up to Order with examples	
Unit IV	General Characters and Classification of Aves Up To Order With Examples, Flying Adaptations In Birds	
Block 2	Functional Anatomy of Chordates	
Unit V	Comparative Anatomy of vertebrates Histology , Comparative Study Of Integument And Skeleton	
Unit VI	Digestive system & Respiratory system Brief Account of Alimentary Canal And Digestive Glands in vertebrates Brief Account of Gills and Air Sacs, Swim Bladder	
Unit VII	Circulatory system & Urinogenital system Evolution of Heart And Aortic Arches in vertebrates Succession of Kidney , Evolution Of Urinogenital Ducts	
Unit VIII	Nervous system & Sense Organs Comparative Account Of Brain Types Of Receptors	
Suggested Text Book Readings:		
<ol style="list-style-type: none"> 1. Harvey et al: The Vertebrate Life (2006) 2. Kenneth V. Kardong (2015) Vertebrates: Comarative Anatomy, Function, Evolution McGraw Hill 3. Parker and Haswell: Textbook of Zoology, Vol. II (1978, ELBS) 4. Romer and Parsons: The Vertebrate Body (6th ed 1986, CBS Publishing Japan) 5. Young: The life of vertebrates (3rd ed 2006, ELBS/Oxford) 		
This course can be opted as an elective by the students of following subjects: NA		
Suggested equivalent online courses (MOOCs) for credit transfer: NA		
Electronic media and other digital components in the curriculum: Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)		
Name of electronic media: e-SLM	Year of incorporation: 2021-22	

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: V
Subject: Zoology		
Course Code: DCEZY-105 (N)	Course Title: Animal Distribution and Ecology	
Course Objectives- Students will be able to distribution of fauna in different realms interaction branches of ecology and various kinds of animals adaptations.		
Course Outcomes:(CO):		
<ul style="list-style-type: none"> • Knowledge about branches of ecology and animal distribution. • Knowledge of eras and evolution of species. • Understand the concept of environment, ecology and ecosystem • Structure and organization of ecosystem with biotic and abiotic component. • Energy flow and nutrient cycle in ecosystem and various kinds of animal adaptations. • Community, population and role of ecology in human welfare. 		
Credits: 02	Type of Course: Core (√) /Elective	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Animal distribution	
Unit I	Geological and Geographical <ul style="list-style-type: none"> • Animal Distribution – Geological and Geographical Distribution of Animals , with their Characteristic Fauna 	
Unit II	Fossils, Barriers and Dispersal	
Block 2	Ecology – I	
Unit III	Branches and significance of Ecology <ul style="list-style-type: none"> • Ecology – Definition, Branches of Ecology , Significance of Ecology For Man • Growth of Animal Ecology, • Desert Ecology • Pollution Ecology 	
Unit IV	Atmosphere – Hydrosphere & Lithosphere <ul style="list-style-type: none"> • Various Zone of Atmosphere • Hydrosphere (Water) – Physical and Chemical Properties Of Water • Effect of Factor of Aquatic Environment On Aquatic Organisms • Lithosphere (Soil) – Process of Soil Formation • Soil Types, Morphology of Soil • Physical and chemical, Properties of Soil • Soil Fauna and Flora 	
Unit V	Ecological Environmental Factors <ul style="list-style-type: none"> • Ecological Environment, Factors (Biotic and abiote) and Limiting Factors • Component of Ecosystem , Tolerance Range And Limiting Factor , Tropic Level 	
Block 3	Ecology – II	
Unit VI	Ecological Pyramids & Biogeochemical Cycle <ul style="list-style-type: none"> • Ecological Pyramids • Energy Flow • Food Chain and Food Web • Biogeochemical Cycle 	
Unit VII	Population Ecology	

	<ul style="list-style-type: none"> ● Population Dynamics – Density , Natality , Mortality , Age Distribution , Population Distribution ● Population Growth – Factors Affecting Biotic Potential , Carrying Capacity ● Population Regulation
Unit VIII	Adaptation <ul style="list-style-type: none"> ● Adaptation of Animals In Deserts and Fresh Water
Unit IX	Wildlife Conservation <ul style="list-style-type: none"> ● Wildlife Conservation – Defining Wildlife , Treats to Wildlife , Measures For Conservation of Wild Life
Suggested Text Book Readings: <ol style="list-style-type: none"> 1. Clarke: Elements of Ecology 2. Eugene P. Odum: Ecology 3. Edmond Hillary: Ecology 4. Allan Frewin Jones: Environmental Biology 5. P.S. Verma and V.K. Agrawal: Environmental Biology (Principles of Ecology) 6. Environmental Biology and Phytogeography ISBN #: 978-81-301-0064-7B. L. Chaudhary, Gotam K Kukda& Jitendra Kumar Joshi 7. Odum, F.P. Fundamentals of Ecology, Latest Ed., Saunders 8. Sharma, P.D. Elements of Ecology, Latest Ed., Rastogi Publications 9. Ambasht, R.S. & Ambasht, N.K. A Text Book of Plant Ecology, Latest Ed., CBS Publication & Distributors 10. Mani, M.S. Bio-Geography of India, Latest Ed., Springer-Verlag. 	
This course can be opted as an elective by the students of following subjects: NA	
Suggested equivalent online courses (MOOCs) for credit transfer: NA	
Electronic media and other digital components in the curriculum: Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media: e-SLM	Year of incorporation: 2021-22

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: V
Subject: Zoology		
Course Code: DCEZY-106 (N)	Course Title: Taxonomy and Evolution	
Course Objectives- This paper to introducing the learner for the salient features of Taxonomy and Evolution.		
Course Outcomes:(CO):		
<ul style="list-style-type: none"> To give a through understanding in the functional principles of systematic in which the animals are, to classify according to their characters and international rules of nomenclature. Introduction of Elementary statistics Understanding of origin of life. 		
Credits: 02		Type of Course: Core
Max. Marks: 100		Min. Passing Marks: 36
Block 1	Taxonomy and Evolution – I	
Unit I	Taxonomy and biological species concept <ul style="list-style-type: none"> Principle of Systematics and Taxonomy Biological Species Concept Taxonomy practices 	
Unit II	Evidences of evolution and comparative anatomy <ul style="list-style-type: none"> Evidences of evolution from classification (taxonomy), Comparative anatomy, connecting link, homology, analogy and vestigial organ 	
Unit III	Evidences of evolution from comparative embryology, physiology and biochemistry <ul style="list-style-type: none"> Evidences of evolution from comparative embryology, comparative physiology and biochemistry 	
Block 2	Taxonomy and Evolution – II	
Unit IV	Classification and population taxonomy <ul style="list-style-type: none"> Objectives of classification, Theories of classification, grouping and ranking, diversity of individuals, principle of hierachy, population taxonomy, information retrieval 	
Unit V	Modern concept in taxonomy <ul style="list-style-type: none"> Taxonomic and non-taxonomic attributes, morden concepts in taxonomy. 	
Unit VI	International code of Zoological nomenclature <ul style="list-style-type: none"> Definitions, Uses and application of international code of zoological nomenclature 	
Unit VII	Elementary Statistics <ul style="list-style-type: none"> Elementary statistics, Mean, Median and Mode, Measures of dispersion variation, Standard deviation) 	
Unit VIII	Origin of Life, Mutation, Migrations, Isolation <ul style="list-style-type: none"> Origin of life, synthetic theory of evolution, selection , mutation, migration, genetic drit, mimicry isolation and speciation 	
Suggested Text Book Readings: <ol style="list-style-type: none"> Verma A.: Principles of Animal taxonomy Futuyama, D.J. Evolution Lull, R.S. Organic Evolution. Organic evolution by A.K. Berry. Richard E. Blackwelder: Taxonomy: a Text and Reference book. 		
This course can be opted as an elective by the students of following subjects: NA		
Suggested equivalent online courses (MOOCs) for credit transfer: NA		
Electronic media and other digital components in the curriculum: Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)		
Name of electronic media: e-SLM		Year of incorporation: 2021-22

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: V
Subject: Zoology		
Course Code: SBSZY-03	Course Title: Economic Zoology and environmental biology	
Course Objectives- The main objectives of the course is to make learner aware of economic important of various invertebrates and scope and methodology of aquaculture.		
Course Outcomes:(CO):		
<ul style="list-style-type: none"> • Economic uses of various animal products. • Understand morphology, life cycle and economic important protozoa, platyhelminthes aschelminths and Arthropods. • Understands concepts of fisheries, fishing tools and site selection. • Aquaculture system, induced breeding techniques, post harvesting techniques. 		
Credits: 02	Type of Course: Core (√) /Elective	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Economic Zoology	
Unit I	Protozoa <ul style="list-style-type: none"> • Protozoan Parasitic Diseases Of Man And Domestic Animals With Special Reference To Zoonotic Significance Of Entamoeba histolytica Plasmodium • Protozoa And Soil Fertility 	
Unit II	PLATYHELMINTHES & ASCHELMINTHES <ul style="list-style-type: none"> • Life Cycle and Zoonotic Significance of Diphyllbothrium latum • Life Cycle and Zoonotic Significance of Dracunculus medinensis 	
Unit III	Arthropoda <ul style="list-style-type: none"> • Life Cycle and Zoonotic Significance of Representation Tick And Mite • Beneficial and Harmful Insects 	
Unit IV	Plant and stored grain pest and role of insecticides in their control <ul style="list-style-type: none"> • Interrelationship of mosquito with Malaria, Yellow fever, Dengue, Encephalitis and Dermatobia, their presentation and control • Biological control of insect pests 	
Block 2	Environmental Biology	
Unit V	Aquaculture <ul style="list-style-type: none"> • Its Basic Concepts , Management and Economics(Including Pearl Fishery) 	
Unit VI	Air Pollution <ul style="list-style-type: none"> • Nature of Pollutants , Their Sources and Effects On Humans , Plants And Animals And Their Control 	
Unit VII	Water Pollution& Soil Pollution <ul style="list-style-type: none"> • Sources , Consequences And Control • Sources , Nature And Harmful Effects 	
Unit VIII	Environmental Health <ul style="list-style-type: none"> • Animal In Relation To Human Health • Water In Relation To Human Disease • Urbanisation Stress And Health • Behaviour Patterns Of Health And Disease 	
Suggested Text Book Readings:		
<ol style="list-style-type: none"> 1. Harvey et al: The Vertebrate Life (2006) 2. Parker and Haswell: Text Book of Zoology, Vol. II (1978, ELBS) 3. Romer and Parsons: The Vertebrates Body (6th ed 1986, CBS Publishing Japan) 4. Brusca and Brusca (2016) Invertebrates, Sinauer. 5. Bisht. D.S. Apiculture, Oxford and IBH, New Delhi. 6. Boyd, C.E. & Tucker. C.S., Pond aquaculture water quality management. 		

7. Pedigo, L.P. (2002), Entomology and Pest Management, Prentice Hall.
8. Ranganathan L.S., Vermicomposting technology-soil health to human health.
9. Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5th edition. The wildlife Society, Allen Press.

This course can be opted as an elective by the students of following subjects: NA

Suggested equivalent online courses (MOOCs) for credit transfer: NA

Electronic media and other digital components in the curriculum:
 Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)

Name of electronic media: e-SLM

Year of incorporation:
2021-22

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: VI
Subject: Zoology		
Course Code: DCEZY-108 (N)	Course Title: Development Biology	
Course Objectives- The main objective of course, students are able to know various stages involved in the embryonic development. To study of process of fertilization and development of various organs.		
Course Outcomes:(CO):		
<ul style="list-style-type: none"> • Knowledge about development biology and organogenesis • Gain knowledge about gametogenesis, cleavage mechanisms, gastrulation and role of hormones in metamorphosis and regeneration. • Understanding of evolutionary significance of internal fertilization, neoteny etc. 		
Credits: 02	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Development Biology – I	
Unit I	Asexual reproduction (fission, budding, gemmule formation) <ul style="list-style-type: none"> • The Morphogenetic Processes And The Stages (Blastema ,Blastogenesis ,And Blastozooides), The Kinds (Fission , Budding , Gemmule Formation) And Comparion Between Blastogegesis And Embryogenesis 	
Unit II	Sexual reproduction (spermetogenesis, oogenesis and vitellogenesis) Gametogenesis (Spermatogenesis And Oogenesis) Maturation Of Gametes : Vitellogenesis	
Unit III	Parthenogenesis	
Unit IV	Metamorphosis The Morphogenetic Processes And Cauation In Amphibians And Insects , Tissue Reactivity	
Block 2	Development Biology – II	
Unit V	Induction process (factors controlling moultingin insects)	
Unit VI	Regeneration (Ability of regeneration, amphibian limb regeneration) The Morphogenetic Process In Regeneration ,Ability Of Regeneration In Different Group Of Animal , Amphibian Limb Regeneration	
Unit VII	Growth and Ageing Concept Of Growth , Degrowth And Cell Death , Mechanism Of Growth	
Unit VIII	Growth curve and its interpretation (types of cell growth, ageing)	
Suggested Text Book Readings:		
<ol style="list-style-type: none"> 1. Essential Development Biology, Johnahan, M.W. Slack (3rd ed.), Welly Blackwell. (2012) 2. Current Topics in Development Biology: Roger A, Pedersen, Gerald P. Schatten, Elsevier. (1998) 3. Development Biology: Werner A. Moller, Springer Science & Business Media. (2012) 4. Development Biology: Michael J. F., Barresi, Scott F. Gilbert, Oxford University Press (2019) 		
This course can be opted as an elective by the students of following subjects: NA		
Suggested equivalent online courses (MOOCs) for credit transfer: NA		
Electronic media and other digital components in the curriculum: Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)		
Name of electronic media: e-SLM	Year of incorporation: 2021-22	

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: VI
Subject: Zoology		
Course Code: DCEZY-109 (N)	Course Title: Molecular Biology & Genetic Engineering	
Course Objectives- This paper to the aimed to introduce molecular biology & genetic engineering.		
Course Outcomes:(CO):		
<ul style="list-style-type: none"> • Imparts the knowledge to culture animal cells in artificial media. • Use in recombinant DNA technology, genetic manipulations and in a variety of industrial processes. • Types of immunity, antigens-antibodies and their properties. • Applications of DNA technology and molecular biology for research. 		
Credits: 02	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Molecular Biology & Genetic Engineering – I	
Unit I	Prokaryotic and Eukaryotic genome <ul style="list-style-type: none"> • Eukaryotic genome and its organization, unique and repetitive DNA, recombination and chromosome mapping in bacteria and virus, Molecular basis of gene regulation in prokaryotes inducible repressible system 	
Unit II	Concept of immunology <ul style="list-style-type: none"> • Introduction to Basic Concepts In Immunology • Components of Immune System • Principles of Innate and Adaptive Immune System • Haemopoiesis • Cells of Immune System and Organs(Primary And Secondary Lymphoid Organs)of The Immune System 	
Unit III	Basic properties of Antigens, Immune System and disorders <ul style="list-style-type: none"> • Basic Properties of Antigens • B and T Cells • The Immune System and disease, HIV • Antigen Antibody Interactions as Tools for Research and Diagnosis 	
Unit IV	Gene regulation in somatic cells, Antibody structure and classes <ul style="list-style-type: none"> • Gene Regulation in Heterokaryons and Somatic Cells • Somatic Hybridization And Studies In Malignancy • Structure, Classes And Functions Of Antibodies • Monoclonal Antibodies • Structure And Function Of MHC 	
Block 2	Molecular Biology & Genetic Engineering – II	
Unit V	Immune system and disease, various types of vaccines	
Unit VI	Scope of genetic engineering and nucleotides <ul style="list-style-type: none"> • Scope of Genetic Engineering • Restriction Enzymes And Their Uses In Gene Cloning • Nucleotide Sequencing Isolation And Ananalysis Of mRNA and cDNA Probes and Their Synthesis 	
Unit VII	Recombinant DNA Technology <ul style="list-style-type: none"> • In Vitro Synthesis of Recombinant DNA And Gene Cloning Techniques • Non Coding Intervening Sequences Within Eukaryoticgenes • Application Of Recombinant DNA Technology • Microinjecting Gene Into Animal Oocytes , Eggs And Embryos 	
Suggested Text Book Readings:		
<ol style="list-style-type: none"> 1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004), 2. Albert et al: Molecular Biology of the cell: Garland (2002) 3. Karp: Cell and Molecular Biology: Willey (2002), Pierce B. Genetics. Freeman (2004) 4. Lewin B. Genes VIII, Pearson (2004). 5. Waston et al. Molecular Biology of the Gene. Pearson (2004) 		

6. Thomas J, Kindit, Richard A. Goldsby, Barbara A. Osborne, Janis Kubykuby Immunology, W H Freeman (2007).
7. Delves Peter J., Martin Seamus J., Burton Dennis R., Roitt Ivan M. Roitt's Essential Immunology, 13th Edition, Wiley Blackwell (2017).
8. Primrose, SB. 1995. Principles of Genome Analysis. Blackwell Science Ltd.Oxford, UK.
9. E.J. Gardner and D.P. Snustad. PRINCIPAL OF GENETICS (1984), John Wiley & Sons, Ney York.
10. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring Harbour Lab. Press, Pearson Pub.
11. P.K. Gupta. BIOTECHNOLOGY AND GENOMICS. Rastogi Publications, 7th Reprint (1st Edition): 2016-2017.
12. A Textbook of Basic and Molecular Genetics (pb)ISBN : 9788188826193Edition : 01Year : 2018Author : Dr. Parihar P

This course can be opted as an elective by the students of following subjects: NA

Suggested equivalent online courses (MOOCs) for credit transfer: NA

Electronic media and other digital components in the curriculum:

Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)

Name of electronic media: e-SLM

Year of incorporation:
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