

# Government P. G. College, Berinag

## Department of Zoology

B.Sc. I Semester (NEP), Year – 2023-24

### Paper I - Animal Physiology and Biochemistry

SNo.	Unit	Topic	Sub-topic	Lecture Period
1.	Animal Physiology	Respiration (Dr. Vandita Kandpal)	(i) Introduction, Mechanism of breathing, Pulmonary ventilation	02 02
			(ii) Respiratory pigments, Loading and unloading of haemoglobin	02
			(iii) Gaseous transport and control of respiration,	02
			(iv) Dissociation of oxyhaemoglobin, Respiratory volume and Respiratory capacities	02
		Excretion (Dr. Vandita Kandpal)	(i) Introduction, Nitrogenous waste products, Excretory organs	02 03
			(ii) Concept of ammonotelic, ureotelic and guanotelic animals	02
			(iii) Structure of mammalian kidney, Physiology of excretion	01
			(iv) Formation and composition of urine	
		Nervous System (Dr. Kanchan Bhandari)	(i) Types of neurons, resting and action potential of nerves	02
			(ii) Synapse and transmission of nerve impulse	01
(iii) Neurotranmitter	01			

		<b>Muscular System</b> <b>(Dr. Kanchan Bhandari)</b>	(i) Types of muscles (ii) Molecular and chemical bases of muscle contraction and its mechanism (iii) Brief idea of tetanus and fatigue	<b>01</b> <b>02</b> <b>01</b>
		<b>Nutrition</b> <b>(Dr. Aman Verma)</b>	(i) Food and its constituents, the concept of balanced diet (ii) Concept of ingestion, digestion, absorption, assimilation and egestion, intra-cellular and extra-cellular digestion (iii) Structure and function of human alimentary canal, types and functions of digestive organs, steps of physical and chemical digestion (iv) Digestion and absorption of various food stuffs, carbohydrates, proteins and fats	<b>01</b> <b>01</b> <b>01</b> <b>01</b>
		<b>Blood Vascular System</b> <b>(Dr. Aman Verma)</b>	(i) Composition and functions of blood, mechanism of blood coagulation (ii) Haemopoiesis (iii) Immunity and its types (iv) Types of heart, structure of mammalian heart and a brief idea of double circulation (v) Origin, conduction and regulation of heartbeat (vi) Cardiac cycle	<b>01</b> <b>01</b> <b>01</b> <b>01</b> <b>01</b> <b>01</b>
<b>2.</b>	<b>Biochemistry</b>	<b>Introduction to Biological Molecules</b>	(i) Biomolecules and their types (ii) Definition of amino acids, their properties, classification and functions	<b>01</b> <b>02</b>

		<b>(Dr. Aman Verma)</b>	(iii) Composition and structure of proteins, their classification, properties and biological significance (iv) Composition and structure of carbohydrates, their classification, properties and biological significance (v) Composition and structure of lipids, their classification, properties and biological significance	<b>02</b> <b>02</b> <b>01</b>
		<b>Metabolic Pathway (Dr. Kanchan Bhandari)</b>	(i) Glycolysis, (ii) Krebs cycle, (iii) Gluconeogenesis (iv) Glycogenesis (v) Glycogenolysis	<b>02</b> <b>02</b> <b>02</b> <b>02</b> <b>02</b>
		<b>Mechanism of Enzyme Action and Vitamins (Dr. Vandita Kandpal)</b>	(i) Mechanism of enzyme action, kinetics (ii) Inhibition and regulation (iii) Vitamin, types, sources and deficiencies	<b>01</b> <b>01</b> <b>01</b>

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# Government P. G. College, Berinag

## Department of Zoology

B.Sc. II Semester (NEP), Year – 2023-24

### Paper I – Genetics and Cell Biology

SNo.	Unit	Topic	Sub-topic	Lecture Period	
1.	Genetics (Dr. Aman Verma)	Mendel's experiments	Mendel's life, Pre-Mendelian experiments, symbols and terminologies, Laws of dominance, segregation and independent assortment	03	
		Linkage	Coupling and repulsion hypothesis, Morgan's view of linkage, kinds of linkage, chromosome theory of linkage.	02	
		Crossing over	Types of crossing over, Kinds of crossing over, mechanism and its significance.	01	
		Eukaryotic chromosomes	Structure, chemical composition, classification and uninemetic and multinemetic concept of chromosome structure	02	
	Genetics (Dr. Kanchan Bhandari)			Structure and functions of polytene and lampbrush chromosomes	02
		Determination of sex	chromosome mechanism, Genic balance theory, External environment and sex determination	02	
		Sex linked inheritance	Inheritance of X-linked gene (Colour blindness and haemophilia in man), Sex linkage in Drosophila	02	
		Mutation	Historical background, chromosomal mutation (Chromosomal aberrations), gene mutations	02	
2.	Cell Biology (Dr. Vandita Kandpal)	The Cell	Prokaryotic and Eukaryotic cells; Ultrastructure of eukaryotic cell; Plasma membrane (Ultrastructure, chemical composition, models of plasma membrane; Specialisations of plasma membrane, functions of plasma membrane).	03	
		Cell organelles	Structure and functions of: (a) Mitochondria (b) Ribosomes (c) Lysosomes (d) Centrioles (e) Golgi Complex (f) Endoplasmic reticulum (g)	04	

			Nucleus and nucleolus.	
		<b>Cell division</b>	(a) Cell cycle	<b>01</b>
			(b) Mitosis (Process of mitosis , mitotic poisons and significance of mitosis)	<b>02</b>
			(c) Meiosis (Process of meiosis, structure and functions of synaptonemal complex, significance of meiosis)	<b>02</b>
			Cell transformation and cancer	<b>02</b>

*Kamran*

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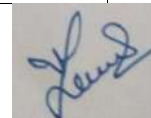
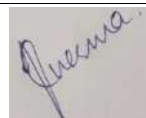
# Government P. G. College, Berinag

## Department of Zoology

B.Sc. III Semester (NEP), Year – 2023-24

### Paper I – Molecular Biology, Toxicology and Histology

SNo	Unit	Topic	Sub-topic	Lecture Period
1.	Molecular Biology (Dr. Aman Verma)	Nucleic acids (DNA & RNA)	DNA chemistry, nucleosides, nucleotides and polynucleotide chain	02
			Watson and Crick's DNA double helix model	01
		DNA	Identification of genetic material (DNA as genetic material)	02
		RNA	Chemistry, Genetic and non-genetic RNAs. Clare leaf model of RNA	01
		Genetic code	Elementary knowledge and properties of genetic code	01
			Expression of gene-protein synthesis	01
			Lac operon concept, Mechanism of DNA damage and repair	02
2.	Toxicology (Dr. Vandita Kandpal)	Toxicology	Introduction, history General principles of toxicology	01
		Environmental toxicology	(i) Kinds and sources of toxic agents - animal toxins, plant toxins, pesticides, metals and food additives	03
		Dose response relationship	(i) Frequency and cumulative responses, determination of TLm values, Lc50. (ii) Margin of safety, threshold limits	02 01
		Analytical toxicology	Toxic response of blood, organ function tests, teratogenic, reproductive and carcinogenic tests.	03
3.		Histology	(i) Structure of epithelium, connective tissue, cartilage, bone	02
			(ii) Smooth, striped and cardiac muscles	01
			(iii) Nervous tissue	01
		Histological structure	Liver, lung, pancreas, gonads and kidney in mammals.	02



# Government P. G. College, Berinag

## Department of Zoology

**B.Sc. IV Semester (NEP), Year – 2023-24**

### Paper I –Microbiology and Animal Behaviour

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Microbiology (Dr. Aman Verma)	Microbes	Kinds of microbes, structure of bacterium Gram positive and Gram negative bacteria and virus with reference to COVID	02 02
		Microbes of medicinal importance	Bacteriophages, Mycobacterium, Rickettsia, Actinomycetes and Mycoplasma	04
		HIV	Introduction, modes of transmission and control	02
	(Dr. Vandita Kandpal)	Environmental use of Microorganisms	Nutrient cycle, metal recovery, petroleum recovery	02
			Pest control, waste water treatment and Bioremediation	02
		Industrial microbiology	Food production, Dairy products, fermented food, alcoholic beverages Microbial spoilage, food preservation	02 01
		Antibiotics	Introduction and brief knowledge	02
2.	Animal behaviour  (Dr. Kanchan Bhandari)	Patterns of behaviour	Stereotype innate behaviour: Kinases, Taxes and Reflexes. Concepts of (i) Fixed action patterns (ii) Sign stimulus or releasers (iii) Innate releasing mechanism, (iv) Instinctive behaviour.	02
		Learned behaviour	Habituation, Conditioned reflexes, Selective learning, Insight learning, Imprinting Song learning in birds Hormonal control of behaviour	03 01 01
		Communication	(i)Chemical, Visual, Auditory, Electric and tactile (ii) Dance language of honeybees (iii) Biological clocks (iv) Bird migration (v)Socio-biology: Social structure in primates	01 01 01 01

*Kanchan Bhandari*

*Verma*

*Kandpal*

## TEACHING PLAN

**Government P. G. College, Berinag, S.S.J. University (Almora)**

**Department of Zoology**

**B.Sc. V Semester, Session – 2023-24**

### Paper I: Microbiology, Toxicology and Histology

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	<b>Section A Microbiology (Dr. Aman Verma)</b>	<b>Microbes</b>	Types of microbes, structure of Gram positive and Gram negative bacteria, phages and virus.	<b>02</b>
		<b>Pathogenic microbes</b>	Mycobacterium, Rickettsia, Actinomycetes and Mycoplasma	<b>03</b>
		<b>HIV</b>	Introduction, modes of transmission and control	<b>01</b>
		<b>Bioremediation</b>	Microbial bioremediation	<b>01</b>
		<b>Industrial microbiology</b>	Dairy products, fermented food, alcoholic beverages and microbial spoilage	<b>02</b>
		<b>Prebiotic, probiotic and antibiotics</b>	Introduction and brief knowledge	<b>02</b>
2.	<b>Section B Toxicology (Dr. Vandita Kandapl)</b>	<b>Toxicology</b>	Introduction, history General principles of toxicology.	<b>01</b>
		<b>Environmental toxicology</b>	(i) Kinds and sources of toxic agents - animal toxins, plant toxins, pesticides, metals and food additives. (ii) Metabolism of toxic substances.	<b>02</b> <b>01</b>
		<b>Dose response relationship</b>	(i) Frequency and cumulative responses, determination of TLM values, Lc50. (ii) Margin of safety, threshold limits.	<b>02</b> <b>01</b>



		<b>Analytical toxicology</b>	Toxic response of blood, organ function tests, teratogenic, reproductive and carcinogenic tests.	<b>02</b>
		<b>Histology</b>	(i) Structure of epithelium, connective tissue, cartilage, bone.	<b>02</b>
			(ii) Smooth, striped and cardiac muscles	<b>01</b>
			(iii) Nervous tissue	<b>01</b>
		<b>Histological structure</b>	Liver, lung, pancreas, gonads and kidney in mammals.	<b>02</b>

## TEACHING PLAN

**Government P. G. College, Berinag, S.S.J. University (Almora)**

**Department of Zoology, Year – 2022**

**B.Sc. V Semester, Session – 2022-2023**

### Paper II: Animal behavior, Bioinformatics and Biostatistics

<b>S. No.</b>	<b>Unit</b>	<b>Topic</b>	<b>Sub-topic</b>	<b>Lecture Period</b>
<b>1.</b>	<b>Section A Animal behaviour (Dr. Kanchan Bhandari)</b>	<b>Patterns of behaviour</b>	Stereotype innate behaviour: Kinases, Taxes and Reflexes. Concepts of (i) Fixed action patterns (ii) Sign stimulus or releasers (iii) Innate releasing mechanism, (iv) Instinctive behaviour.	<b>02</b>
		<b>Learned behavior</b>	Habituation, Conditioned reflexes, Selective learning, Insight learning, Imprinting and Birds songs.	<b>03</b>
		<b>Communication</b>	(i) Chemical, Visual, Auditory, Electric and tactile (ii) Dance language of honeybees, (iii) Biological clocks (iv) Bird migration (v) Introduction to Socio-biology	<b>01</b>
<b>2.</b>	<b>Section B Bioinformatics (Dr. Aman Verma)</b>	<b>Introduction of computer</b>	Organisation of computer, input and output devices	<b>01</b>
		<b>Elementary idea of biological database</b>	Protein and nucleotide data	<b>02</b>

			bases	
	<b>Biostatistics</b>	<b>Data collection</b>	(i) Data collection- Random and non-random sampling, datatabulation and data presentation (Graph, Histogram, Scatter diagram) (ii) Concept of mean, mode, median and of standard deviation and standard error.	<b>02</b>

*Kamini*

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# TEACHING PLAN

Government P. G. College, Berinag, S.S.J. University (Almora)

Department of Zoology

B.Sc. VI Semester, Session – 2022-2023

## Paper I: Animal physiology, Endocrinology and Biological Chemistry

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A (Dr. Aman Verma)	Nutrition	Food constituents, intracellular and extracellular digestion	02
			Digestion and absorption of : Carbohydrate, fat and protein	03
	Section B (Dr. Kanchan Bhandari)	Respiration	Pulmonary ventilation, respiratory pigments. Gaseous transport and control of respiration.	02 02
		Blood vascular system	Haemopoiesis, composition and functions of blood, blood coagulation. A brief account of immunity. Types of heart, origin and conduction of heart beat.	03 03
		Nervous system	Resting and action potential of nerves, synapse and transmission of nerve impulse.	02
		Muscular system	Muscle contraction and its Mechanism A brief idea of tetanus and fatigue.	01 01
Excretion	Concept of ammonotelic, ureotelic and guanotelic animals, urine formation in mammals.	02		
2.	Section B (Dr. Vandita Kandpal)	Endocrine system	Structure and hormonal function of Pituitary, Thyroid, Pancreas, Adrenal, Testis and Ovary	06
		Endocrine disorders	Elementary knowledge of Dwarfism, gigantism, acromegaly, diabetes insipidus, goiter, cretinism, myxoedema, diabetes mellitus and addison's disease	02 02 02
		Biochemistry	Structure, classification and significance of carbohydrates, protein and lipids	04
			Brief knowledge of enzymes, vitamins and minerals	03

# TEACHING PLAN

Government P. G. College, Berinag, S.S.J. University (Almora)

Department of Zoology

B.Sc. VI Semester, Session – 2022-2023

## Paper II: Elementary Entomology and Ichthyology

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A (Dr. Aman Verma)  (Dr. Kanchan Bhandari)	Entomology	Classification of insects up to orders: Brief knowledge of general characters of following insect orders- Thysanura, Collembola, Orthoptera, Isoptera, Thysanoptera, Herteroptera, Homoptera, Coleoptera, Lepidoptera, (i)Hymenoptera and Diptera. (ii)Methods of their collection and preservation. Parental care in insects. Social life in insects. Insect pollinators. Household insects: Cockroach and Silverfish Insect injurious to man and Livestock: Mosquitoes, House fly and Bedbug Economic importance of insect as food medicine	05  01 02 02  01 02  01
2.	Section B (Dr. Vandita Kandpal)	Ichthyology	Classification of fishes up to orders, Integrated fish farming. Ornamental fishes: Construction of aquaria and its maintenance Exotic fishes Carp farming Hill stream fishes and their adaptations Induced Breeding: Induction agents and their applications Methods of fish collection and types of nets, fish processing and preservation techniques	02  01  02 01 01 01  03

**Dr. Aman Verma**

S.No	Unit	Topic	Sub-topic	Lecture Planned
1.	<b>Section A</b>	<b>Introduction to Microbiology</b>	i)History and importance of microbiology, Introduction to the classification of microorganisms (Bacteria, Virus)	<b>03</b>
2		<b>Kinds of Microorganisms</b>	i) Animal and plant viruses, ii)Bacteriophages, Rickettsiae, Bacteria, Mycoplasma, Fungi, Slime moulds etc	<b>01</b> <b>02</b>
3		<b>Microorganisms in their natural habitat</b>	i)Atmosphere, Hydrosphere, Lithosphere & Extreme habitats. Microbial interaction (Symbiotic and asymbiotic)	<b>03</b>
4		<b>Microbial morphology and physiology</b>	i)Bacteria (typical structure and classification, chemical composition, nutrition, locomotion, reproduction and culture) and Colicins	<b>02</b>
5		<b>Microbial media &amp; culture techniques</b>	i)Development of pure culture methods, Enrichment culture methods, Principles of microbial nutrition, ii)Theory and practice of sterilization, Construction of culture media, Culture collection and maintenance of cultures	<b>02</b> <b>02</b>
6		<b>Microbial Growth</b>	i)Mathematical expression of growth, growth curve, Measurement of growth and growth yields, Synchronous growth, Growth as affected by environmental factors like temperature, acidity, pH, water availability and oxygen	<b>02</b>
1	<b>Section B</b>	<b>Viruses</b>	i)Structure and composition, classification, physical properties and viral action, isolation, culture and purification of viruses, Viroids & Prions,RNA & DNA viruses, Lytic and Lysogenic cycles. Production of vaccines	<b>03</b>
2		<b>Microbiology of Water</b>	i)Types of water, Microorganisms of water, Microbiology of potable water, Purification of water, Microbiology of sewage, Bioremediation	<b>02</b>
3		<b>Microbiology of Soil</b>	i)Microorganisms of soil, Factor affecting microbial community in soil, microorganisms associated with organic matter decomposition, Rhizosphere microorganisms, Cycles of elements (Carbon, Sulphur and Nitrogen)	<b>03</b>
4		<b>Microbiology of Air (Aero microbiology)</b>	i)Distribution of microorganisms in air, Aeroallergens, collection and enumeration of aerial microorganisms	<b>02</b>
5		<b>Microbiology of food</b>	i)Microbial contamination and spoilage of industrial and domestic food, sources of food poisoning, some fermented foods,	<b>02</b>

			preservation of foods	
6		<b>Antibiotics</b>	i)History of Penicillin, Classification of Antibiotics, Non-medical uses of antibiotics, Biological action of antibiotics	<b>02</b>
7		<b>Microbial Diseases &amp; Disease reservoirs</b>	i)Epidemiological terminologies, Infectious disease transmission, Sexually transmitted diseases including AIDS, Food, water and air borne microbial diseases ii)Diseases transmitted by animals (rabies, plague), Bacteria & viruses as pathogens in aquaculture	<b>03</b> <b>02</b>
8		<b>Biohydrometallurgy</b>	i)History of bioleaching, Microbiology of leaching of Sulfide minerals,Applications of bioleaching techniques	<b>02</b>

S. N	Unit	Topic	Sub-topic	Lecture Planned
1	Section A	General classification	i)Habit and habitats, characters, of Non-Chordate Phyla	01
2	(Dr. Aman Verma)	Protozoa	i)Nutrition (Holophytic, Holozoic, Saprophytic, Myxotrophic and Parasitic), Locomotion (Locomotory organelles, and types of locomotion	02
			ii)Reproduction (Asexual, Sexual reproduction and Parthenogenesis) Life- cycle of <i>Trypanosoma</i>	02
3	(Dr. Vandita Kandpal)	Porifera	i)Canal system,Reproduction (Asexual, Sexual Reproduction and Parthenogenesis) and Phylogeny	01
4		Coelenterata	i)Polymorphism,Corals and coral reefs Structure and affinities of Ctenophora	02
5		Helminthes	i)Life-cycle of <i>Wuchereria</i> and <i>Schistosoma</i> ,Parasitic adaptations	02
6		Minor Phyla	i)Organization and Affinities of Rotifera and Brachiopoda	01
1	Section B	Annelida	i)Segmental Organs ,Adaptive Radiations in Polychaeta	01
2	(Dr. Kanchan Bhandari)	Arthropoda	i)Larval forms in Crustacea ,Mouth parts in Insects ,Social-life in Honey-Bees and Termites, Onychophora: Organization and Affinities	03
3		Mollusca	i)Major features of Respiratory and Reproductive Systems, Torsion Pearl formation	02 01
4		Echinodermata	i)Water Vascular System Larval forms	02

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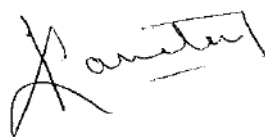
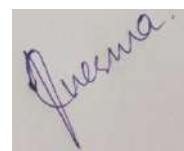
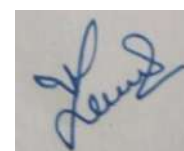


S.No	Unit	Topic	Sub-topic	Lecture Planned
1.	<b>Section A</b>	<b>Ecology</b>	i)Its relevance to human welfare, subdivisions and scope. The Environment: physical environment; biotic environment; biotic and abiotic interactions, ecosystem diversity, ecosystem services	<b>03</b>
2.		<b>Habitat and Niche</b>	i)Concept of habitat and niche; niche width and overlap; fundamental and realised niche; resource partitioning; character displacement	<b>02</b>
3.		<b>Ecosystem's structure and function</b>	i)Abiotic and biotic components of aquatic (Lake) and Terrestrial (forest) ecosystems, primary and secondary productivity, ii)Movement of energy and materials, energy efficiency, thermal stratification and circulation in lake, Lake's typology	<b>02</b> <b>02</b>
4.			<b>Limiting factors</b>	i)Laws of limiting factors, impact of temperature, moisture and pH on organisms
5.		<b>Population Ecology</b>	ii)Characteristics of a population; population growth curves, population regulation; life history strategies (r and K selection); concept of meta-population-demes and dispersal, interdemec extinctions, age structured	<b>02</b>
6.		<b>Community Ecology</b>	i)Community nomenclature, completion, community attributes namely dominance, various types of diversity indices, similarity coefficient, ecotone and edge effect	<b>02</b>
7.		<b>Ecological Succession</b>	i)Types; mechanisms, changes involved in succession, concept of climax	<b>01</b>
8.	<b>Section B</b>	<b>Stressed ecosystems</b>	i)Point and non-point sources of pollution, assessment of freshwater pollution using various parameters; Water quality monitoring using abiotic factors (e.g. pH, oxygen, nitrate, ammonia, phosphate, BOD) ii)Bio monitoring (phytoplankton, zooplankton and zoo benthos), Environmental Impact Assessment (EIA)-impact of environmental stress on biotic and abiotic factors	<b>02</b> <b>02</b>
9.			<b>Eutrophication</b>	i)Its causes, assessment, consequences and control; Indicators of pollution and eutrophication
10		<b>Global Environmental Problems</b>	i)Climate change, Global warming, acid rains, ii)greenhouse effects, ozone layer depletion	<b>01</b> <b>01</b>

11		<b>Biodiversity</b>	i)Status, monitoring and documentation; major drivers of biodiversity change; biodiversity conservation and management, project tiger, biosphere reserves	<b>02</b>
12		<b>Conservation Ecology</b>	ii)Principles of conservation, major approaches to management, Indian case studies on conservation and management programs (National Lake Conservation Program; “Namami Gange Pariyojana” and Ganga Action Plan); theory of island biogeography	<b>03</b>



S.No	Unit	Topic	Sub-topic	Lecture Planned
1	<b>Section A</b> (Dr. Kanchan Bhandari)	<b>Introduction to Systematics and Taxonomy</b>	i)Significance and brief History of Taxonomy Modern approaches in Taxonomy	<b>01</b>
2		<b>Concepts of Zoological classification</b>	ii)Functions, systems of classification, Linear hierarchy, Taxonomic Aids (Museums, National Parks, and Keys)	<b>02</b>
3		<b>Species Concept</b>	i)Typological, Nominalistic, Biological and Evolutionary	<b>01</b>
4		<b>Rules of Zoological Nomenclature</b>	i)International Commission on Zoological Nomenclature (ICZN), Taxon, Rank and Categories	<b>01</b>
5		<b>Collection</b>	i)Collection, Preservation and Identification of insects and other specimens using Keys	<b>02</b>
6	<b>Section B</b> (Dr. Aman Verma)	<b>Modern Synthetic Theory</b>	i)Genetic variability in populations, Significance of Genetic Variability, Natural Selection. Genetic Drifts, Isolation, Origin of New Species	<b>02</b>
7		<b>Variations</b>	i)Nature of Variations, Kinds of Variations (Meristic and Substantive, Continuous and Discontinuous, Determinate and Indeterminate, Somatic and Germinal, Polymorphic, Cryptic and Geographical Variations)	<b>02</b>
			ii)Sources of Variations (Environment, Endocrine Glands), Cytological Basis of Variations (Gene mutations, Chromosomal mutations, Changes in Chromosomal number,	<b>03</b>
			iii)Sexual Recombination, Recombination due to exchange of genes between Chromosomes, Hybridization)	<b>02</b>
8		<b>The Origin of Species</b>	i)Concepts of Species, categories of species (Demes, Geographical Races, Ecological Races, Climes), Types of Species (Sibling species, Monotypic and Polytypic species)	<b>03</b>
9	<b>(Dr. Vandita Kandpal)</b>	<b>Speciation</b>	i)Phyletic Speciation, Quantum Speciation, Gradual Speciation (Allopatric, Sympatric, Parapatric)	<b>01</b>
10		<b>Basic Patterns of Evolution:</b>	i)Microevolution, Macroevolution and Mega evolution, Mechanisms of evolution, Essential features of Macroevolution and Mega evolution	<b>02</b>
11		<b>Mimicry and Protective Coloration</b>	i)Kinds of Mimicry (Protective Mimicry, Aggressive, Batesian and Mullerian), Significance of Mimicry; Coloration (Colour Production, Biological Significance of Coloration)	<b>02</b>

S. N	Unit	Topic	Sub-topic	Lecture Planned
1	Section A	Introduction to Molecular Biology	i) Structure and organization of genome. Law of DNA constancy, Cot curve (cot curve), c-value paradox, DNA renaturation kinetics, Determination of T <sub>m</sub> value	02
2		Chemistry of gene	Structure of nucleic acids (A, B, C and Z-DNAs, RL-model of Sasisekharan; supercoiling; genetic and non-genetic RNAs)	03
3		DNA as genetic material	i)DNA Replication - (evidence for semi conservative replication); Prokaryotic and eukaryotic DNA replication, ii)Molecular Mechanisms of DNA replication, Enzymes and accessory Proteins involved in DNA replication. iii)DNA repair (excision repair, mismatch repair and SOS repair), DNA repair and genetic disease in humans and Recombination, iv)Homologous Recombination, Holliday junction, FLP/FRT and Cre/Lox recombination, RecA proteins and recombinases	01 01 01 01
4		Fine structure of gene	i)Organization of typical eukaryotic gene, Benzer's analysis of r-II locus by deletion and complementation mapping; General introduction to complexities of gene regulation in eukaryotes ii)Regulation of Gene expression in Prokaryotes and Eukaryotes: Operon concept ( <i>E. coli</i> lac operon, trp operon, ara operon), iii)DNA methylation, Heterochromatinization, Environmental regulation of gene expression	02 02 02
5	Section B	Mutation	i)Chromosomal aberrations (Numerical and Structural), Gene mutation: different types of mutations, mutagens, Detection of sex linked lethal and visible mutations in <i>Drosophila</i>	02
6		Transcription	i)Prokaryotic and Eukaryotic transcription, RNA polymerase, General and specific transcription factors, transcription signals, promoter sites, rho and sigma factor ii)Regulatory elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional modifications, Reverse transcriptase, RNA processing, Modifications in RNA: 5'-Cap formation, Transcription termination, 3'-end processing and polyadenylation, Splicing, Ribonucleoproteins, RNA editing, Nuclear export of mRNA and stability	01 03
7		Translation	i)Prokaryotic and eukaryotic translation, the translation machinery, Mechanisms of initiation, elongation and termination, Regulation of translation, co-and post-translational modifications of proteins. Genetic code: Properties, codon usage patterns and codon bias (Wobble Hypothesis), new genetic codes in mitochondria and ciliate protozoa	04

8		<b>Nucleic acid sequencing</b>	<p>i)Introduction and landmarks in DNA sequencing, Maxam Gilbert method, Sanger's method, introduction to automated DNA sequencing, Pyro sequencing, Nextgen sequencing</p> <p>ii)Whole genome sequencing. Antisense and Ribozyme Technology- Molecular mechanism of antisense molecules, Biochemistry of ribozyme; hammer- head, hairpin and other ribozymes, strategies for designing ribozymes, Applications of antisense and ribozyme technologies</p>	<p><b>02</b></p> <p><b>03</b></p>
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*Kanika*

# TEACHING PLAN

Government P. G. College, Berinag, S.S.J. University (Almora)

Department of Zoology

M.Sc. II Semester, Session – 2022-2023

Paper I – Concepts in Cell Biology and Genetics

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A  (Dr. Kanchan Bhandari)	Diversity of cell size	(i) Type and shape, cell theory. Structure of prokaryotic and eukaryotic cell. Cellular organelles; Plasma membrane, cell wall and their structural organization.	02
			(ii) Mitochondria, Chloroplast; Nucleus ER, Golgi complex and microbodies, nuclear pore complex.	03
			(iii) Organisation of cytoskeleton; cell microtubules, micro filament and intermediate filament	02
		Molecular aspects of cell division	(i) Cell cycle- molecular events and model system, cell cycle regulation. (ii) Structure and organisation of membranes. (iii) Glycoconjugates & proteins in membrane system, protein localization, import into nucleus. (iv) Mitochondria, chloroplast & peroxisomes, receptor mediated endocytosis transport of nutrients, ions & macromolecules across membranes, passive and active transport $\text{Na}^+ / \text{K}^+$ pump.	01 02 02
		Cellular communication	(i) General principals of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.	03
		Cellular responses to environmental signals in bacteria and animals	(i) Mechanisms of signal transduction; endocrine, exocrine and synaptic signaling, Surface and intracellular receptors. (ii) G proteins and generation of second messengers, mode of action of cAMP and $\text{Ca}^{2+}$ calmodulin, signal transduction pathways, regulation of signaling pathways.	01 02

		<b>Biology of cancer</b>	(i) Oncogenes & Tumour Suppressor Genes, viral and cellular oncogenes, Tumour Suppressor Genes from humans, structure, function & mechanism of Prb & p53 tumour suppressor proteins, apoptosis & necrosis.	<b>03</b>
		<b>Chromosomal analysis</b>	(ii) Banding techniques, sex chromatin techniques, autoradiography, Chromosomes: structure, chemical composition, classification, folded fibre model and nucleosome model. Karyotype, euchromatin and heterochromatin, Giant chromosomes, B-chromosomes.	<b>03</b>
		<b>Chromosome mapping and Concept of gene</b>	(i) Chromosome mapping in Drosophila (single and double crossing over), human chromosomes (somatic cell genetics), Mutation: Type and mechanism and effects. Allele, multiple alleles, isoallele, pseudoallele.	<b>03</b>
		<b>Mendelian genetics</b>	(i) Dominance, segregation, independent assortment, extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy. (ii) Genomic imprinting, linkage and crossing over. Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes	<b>01</b> <b>02</b>
		<b>Microbial genetics</b>	(i) Methods of genetic transfers-conjugation ( $F^+$ , $F^-$ and HFR strain), transformation, transduction (generalized and specialized transduction) and sexduction, mapping genes by interrupted mating, fine structure analysis of genes.	<b>03</b>
		<b>Plasmids</b>	(i) IS Elements, Transposons and Retro-Elements: Plasmids, inversion sequences of IS- elements, Transposons and controlling elements in prokaryotes and eukaryotes.	<b>02</b>

*Kamran*

**Government P. G. College, Berinag, S.S.J. University (Almora)**

**Department of Zoology**

**M.Sc. II Semester, Session – 2022-2023**

**Paper II–Mammalian Endocrinology**

<b>S. No.</b>	<b>Unit</b>	<b>Topic</b>	<b>Sub-topic</b>	<b>Lecture Period</b>
<b>1.</b>	<b>Section A (Dr. Vandita Kandpal)</b>	<b>Introduction</b>	(i) Brief history and scope of endocrinology, Environmental endocrinology	<b>01</b>
		<b>Hormones</b>	(i)Chemical nature, classification and mode of secretions of hormones, hormonal feedback in homeostasis	<b>02</b>
		<b>Mechanisms of Hormone Action</b>	(i)Generalized mechanism of action of proteins (plasma membrane mediated actions as well as intracellular CAMP mediated actions) and steroid hormones (nuclear ctivity mediated actions)	<b>02</b>
		<b>Hpthalamo-hypophysial System</b>	(i)General organisation, Neuro-hypophysialoctapeptides, Adeno-hypophysial hormones	<b>01</b>
			(ii)Mammalian Pitutary gland and synthesis, storage,control of release, transport, denaturation, physiological actions (iii)Morphological and chemical consequences of excess and deficiency of various pitutary hormones	<b>02</b> <b>01</b>
<b>Endocrine Pancreas</b>	(i)Detailed structure, bio-synthesis and physiological actions of insulin and glucagon	<b>01</b>		
<b>2.</b>	<b>Section B (Dr. Vandita Kandpal)</b>	<b>Thyroid Gland</b>	(i) Detailed structure, Bio-synthesis of Thyroid hormones, control of secretion, transport, denaturation, physiological roles, morphological and chemical consequences of excess and deficiency of various Thyroid hormones	<b>02</b>
		<b>Parathyroid Gland</b>	(i)Syntheis of parathyroid hormones, role of Parathormone, Clacitonin and Vitamin D in calcium homeostasis	<b>02</b>
		<b>Adrenal Gland</b>	(i)Adrenal Cortex: Detailed structure, organisation, physiological roles and control of mineralcorticoids and glucocorticoids secretion.	<b>02</b>
			(ii)Adrenal Medulla: Detailed structure, catecholamine, bio-synthesis, release and its physiological roles	<b>02</b>
<b>Pineal Glands</b>	(i)Detailed structure, physiological actions of	<b>01</b>		



			Pineal hormone	
		<b>Reproductive Endocrinology</b>	(i)Molecular structure, origin, release and transport of sex hormones and their role in reproductive physiology (hormonal regulation of Oestrus and Mestural Cycle and that of lactation).	<b>02</b>



# Government P. G. College, Berinag, S.S.J. University (Almora)

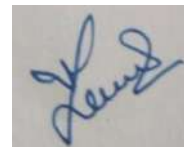
## Department of Zoology

M.Sc. II Semester, Session – 2022-2023

### Paper III–Biochemistry

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A (Dr. Kanchan Bhandari)	<b>The molecular logic of life</b>	(i) Buffering in biological system; pH, pK, acids, bases, buffers, Handerson-Hassel Bach equation, weak bonds, (Ionic, Hydrogen, Hydrophobic, Vander Wall interactions), covalent bonds, water as a universal solvent	02
		<b>Molecular properties</b>	(i) Basic concept and significance of diffusion, Osmosis, Gibb's Donnan equilibrium, Viscosity, Surface tension and Colloidal state	01
		<b>Bioenergetics</b>	(i) Thermodynamics laws as applied to biological system, applications of free energy functions	01
			(ii) High energy compounds with special reference to ATP, Biological oxidation-reduction reactions; Electron transport and Oxidative Phosphorylation	02
		<b>Biomolecules</b>	(i) Classification, chemical structure and sources of biochemically significant carbohydrates, proteins and lipids: Amino acids and their classification (ii) Peptide synthesis, Protein sequencing, Functional diversity, Structure and conformation of protein domains, (protein structural hierarchy, Ramachandran plot, motif and folds)	02 02
<b>Enzymes and Coenzymes</b>	(i) Nomenclature and classification, kinetics, mechanism of enzymes action, factors influencing enzyme activity, Isoenzymes, Chemical structure and significance of coenzymes	02		
2.	Section B (Dr. Aman Verma)	<b>Metabolism of carbohydrates</b>	(i) Basic concept of glycolysis and TCA cycle, Glycogenesis, Glycogenolysis, Gluconeogenesis and the pentose phosphate pathway	02
		<b>Metabolism of proteins</b>	(i) Basic concept of protein metabolism with reference to decarboxylation, transmethylation and deamination of essential and non-essential amino acids, Biosynthesis of urea, creatine and heme	02
		<b>Metabolism of lipids</b>	(i) Basic concept of lipid metabolism with reference to biosynthesis and utilization of fatty acids of lipids, Significance of ketone bodies and cholesterol	02
	(Dr. Vandita)	<b>Integration of metabolism</b>	(i) Concept of metabolic regulations General introduction to metabolic disorders	03

	<b>Kandpal)</b>	<b>Vitamins &amp; Minerals</b>	(i) Chemical structure, sources and deficiency state of fat soluble and water soluble vitamins (ii) Sources and biochemical significance of minerals e.g. Na, K, Ca, Mg, I, Cl, Zn, P and Se	<b>02</b> <b>02</b>
		<b>Basic concept of xenobiotics</b>	Xenobiotics compounds and their metabolism (Phase 1 and phase 2 reactions with examples)	<b>02</b>



# Government P. G. College, Berinag, S.S.J. University (Almora)

## Department of Zoology

M.Sc. II Semester, Session – 2022-2023

### Paper IV–Animal Physiology

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A  (Dr. Aman Verma)	Nutrition	A) Stimulation, secretion and action of digestive fluids (including enzymes and hormones)	01
			B) Digestion, absorption and assimilation of various food stuffs	01
		Respiration	A) Different respiratory surfaces in animals and gaseous exchange, Respiratory pigments	01
			B) Transport of oxygen and carbon-dioxide, Control of respiratory activity and respiratory insufficiency	01
		Circulation	A) Haemopoiesis, Heart beat and its regulation, Electrocardiogram, Haemodynamic and cardiac output	02
			B) Blood flow through arteries, veins and capillaries (pulse and blood pressure) including regulation, coronary circulation and occlusion	01
Muscle physiology	A) Structure, kinds and characteristics of muscles, Mechanism of muscle stimulation and contraction	02		
Thermoregulation	A) Introduction, temperature tolerance, Poikilothermy, Homeothermic adaptations and regulatory mechanisms	02		
2.	Section B  (Dr. Aman Verma)	Excretion and Osmoregulation	A) Types of nitrogenous wastes in different groups and their excretion, Structure and functions of kidney	01
			B) Renal excretion in vertebrates, urine formation in mammals	01
			C) Osmoregulation in fish, reptiles, aves and mammals	01
		Sensory physiology	A) Receptors, pathways and physiology of smell	01
B) Receptors, pathways and physiology of taste	01			

		<b>Nervous Coordinati on</b>	A) Structure of neuron, nature, origin and propagation of nerve impulse B) Synapse and synaptic transmission C) Chemistry and functions of neurotransmitters	<b>01</b> <b>01</b> <b>01</b>
		<b>Immune system</b>	A) Immunity and its types, types of Immunoglobulins B) Lymphocytes and lymphatic system, immunological functions of thymus C) Antigens and antibodies, antigen-antibody interaction, Site of antigen trapping, synthesis of antibodies (primary and secondary responses) D) Clonal selection, transplantation immunity, allergy, AIDS	<b>01</b> <b>01</b> <b>02</b> <b>01</b>

# TEACHING PLAN

Government P. G. College, Berinag, S.S.J. University (Almora)

Department of Zoology

M.Sc. III Semester, Session – 2022-2023

## Paper I –Chordata

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A (Dr. Aman Verma)	Chordates	Classification up to orders, habit and habitats and characters	02
		Urochordata , Cephalochordata	Features and Development	01
		Hemichordata, Urochordata , Cephalochordata	Affinities	02
		Cyclostomata	Characters and affinities	01
	(Dr. Vandita Kandpal)	Fishes	Salient features, Comparison between Chondrichthyes and Osteichthyes; Dipnoi	02
		Amphibians	Origin of Amphibians, General organization and affinities of Gymnophiona, Parental care in Amphibians	02
<u>2.</u>	Section B	Reptiles	(i)Origin, General organization, distribution and affinities of Rhynchocephalia and Crocodilia (ii)Skull in Reptiles, Venom and anti-venom in Ophidians	02 02
	Dr. Kanchan Bhandari	Birds	(i) Origin, Flightless birds, Origin and mechanism of flight in birds (ii) Modification of beaks, feet and palate in birds, Distribution, characters and affinities of Ratitae	01 02

		<b>Mammals</b>	(i)Origin, General characters, distribution and affinities of Prototheria and Metatheria. (ii)Dentition in mammals, Stomach in ruminants, Adaptive radiations in mammals (iii) Aquatic, Terrestrial, Aerial, Arboreal and Fossorial	01  02  01
		<b>Adaptation</b>	Aquatic and flying adaptations in mammals	01

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# TEACHING PLAN

Government P. G. College, Berinag, S.S.J. University (Almora)

Department of Zoology

M.Sc. III Semester, Session – 2021-2022

## Paper II –Animal Behaviour

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A (Dr. Kanchan Bhandari)	Animal behaviour	(i) Brief history, introduction, Significance of Study of Animal Behaviour	01
			(ii) Animal Behaviour and Environment, Animal Behaviour and Animal Welfare, Animal Behaviour and Human Society	02
			(iii) Tools and Techniques for the study of animals in wild: Animal Identification	01
		<b>Behaviour patterns</b> (a) Fixed Action Pattern (FAP) or Instinctive Behaviour	Characteristics, modes (Kineses, Taxes, Reflexes, Instincts), Releasers, Innate Releasing Mechanism (IRM)	02
		<b>(b) Learned Behaviour</b> or Acquired Behaviour	(i) Non-associative learning, Associative learning (ii) Latent learning, Insight learning Phase-specific learning	01 01
		<b>Memory</b>	(i) Nature of Memory, Positive and Negative Memory (Reasoning, Remembering, Forgetting and Retention) (ii) Types of Memory (Short-term Memory, Intermediate term Memory, and Long-term Memory)	02 02
		<b>Individual behaviour</b>	(i) Conflicts (Situations, Types of conflicts, Behaviour display as an evidence of	01



			Conflict) (ii) Aggression (Forms and causes of aggression), Territoriality (Indiviterritories, Pair territories, Group territories (iii) Use of scent, urine and faeces, and special glands dual such as anal and salivary glands in marking territories by Mammals	<b>01</b>  <b>02</b>
		<b>Feeding strategies</b>	(i)Non-selective and Selective feeding, Food begging, Courtship feeding (ii) Predatory and Anti-predatory feeding mechanisms, Food sharing in insect societies, Parental feeding, Coprophagy	<b>01</b>  <b>02</b>
<b><u>2.</u></b>	<b>Section B (Dr. Kanchan Bhandari)</b>	<b>Social behaviour</b>	(i)Costs and benefits of group living, Types of Social Acts, Social Organizations in Termites and Primates (ii)Parental Care with emphasis on Insects, Fishes, Amphibians, Birds and Mammals	<b>02</b>  <b>02</b>
			(i)Visual and Auditory communication, Infrasonnd communication in Elephants and Whales (ii)Tactile communication (Dance language of honey bees), Electric communication, (iii)Echolocation in Bats, Postures and Gestures in Mammals	<b>01</b>  <b>01</b>  <b>01</b>

		<b>Migratory behavior</b> (a) Bird Migration:	Types, causes and advantages of Migration, Methods of Studying of Migration, Orientation and Navigation	<b>02</b>
		(b) Fish Migration:	Homing, Causes of Migration, Factors influencing Migration, Fish migration, Migration of Hilsa	<b>02</b>
		<b>Biological Rhythm</b>	Circa annual Clocks, Circa tidal Clocks, Circa lunar or Circa syndic Clocks	<b>02</b>

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# TEACHING PLAN

Government P. G. College, Berinag, S.S.J. University (Almora)

Department of Zoology

M.Sc. III Semester, Session – 2022-2023

Paper III – Developmental Biology

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A (Dr. Aman Verma)	Fertilization	Mechanism of fertilization, early and late changes in egg organisation, molecular events during fertilization	01
		Cleavage and Blastulation	(I) Patterns of cleavage, determinate and indeterminate cleavage, influence of yolk on cleavage, metabolic changes during cleavage (iii) Morulation and blastulation in frog, chick and rabbit, types of blastulae	02 01
		Gastrulation	Fate maps, morphogenetic movements in frog, chick and rabbit, significance of Gastrulation, exogastrulation	02
		Development	Development and functions of the foetal membranes in mammals	02
		Organogenesis	Development of brain, eye and heart in chick	02
2.	Section B (Dr. Aman Verma)	Organizer Concept	(i) Embryonic induction, Primary organiser and its morphological differentiation, origin of primary organizer (ii) Inductive interactions, nature of inductive signal (Possible mechanism of neural induction), competence	02 02
		Regeneration and Metaplasia	(i) Distribution of regenerative ability, polarity in regeneration	01

			(ii)mechanism of regeneration of amphibian limb and lens, metaplasia, super-regeneration and heteromorphosis	<b>02</b>
		<b>Metamorphosis</b>	(i)Kinds of metamorphosis, metamorphosis in Amphibians (ii)Physiological and biochemical changes during metamorphosis, hormonal control of metamorphosis.	<b>01</b> <b>02</b>
		<b>Teratogenesis</b>	Genetic and environmental Teratogenesis, phenocopies, developmental mechanisms of teratogenesis	<b>02</b>
		<b>Ageing</b>	(i)Theories of Ageing (Quantative Changes in Nucleic Acids, Changes in Information Content, Changes in Protection Regulatory Mechanisms, Free Radical Theory of Ageing) (ii) Ageing and Immunological Surveillance (Somatic Mutation Hypothesis, Function of Thymus, Immune Surveillance) (iii) Ageing of Connective Tissue; Mental Aspects of Ageing	<b>02</b> <b>02</b> <b>02</b>

## TEACHING PLAN

Government P. G. College, Berinag, S.S.J. University (Almora)

Department of Zoology

M.Sc. III Semester, Session – 2022-2023

### Paper IV – Biotechnology

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A (Dr. Vandita Kandpal)	Introduction	(i)Origin, definition, scope and importance of biotechnology	01
			Biotechnology.	
			(ii)Recombinant DNA Technology (Tools and techniques), Restriction and modification enzymes	02
			(iii)Vectors, plasmid, bacteriophage and other viral vectors, cosmids, Tiplasmid, yeast artificial chromosome	02
		(iv)Polymerase chain reactions, DNA fingerprinting, Southern, western and northern blotting, In-situ hybridization and Molecular markers	02	
		<b>Gene therapy and Gene Delivery methods</b>	(i)Background, types of gene therapy (ex vivo & in vivo), choosing targets for gene therapy, vectors in gene therapy, retroviruses, adenoviruses, adeno-associated viruses.	02
			(ii)Viral delivery (Retroviral vectors and Adenoviral vectors), Non-viral delivery. Vaccines – nucleic acid vaccines, biopharming and edible vaccines, immuno-enhancing technology	02
		<b>Transplantation</b>	Terminology, technology	02

		<b>biology</b>	behind it, organ donors, social & ethical issues, Xenotransplantation and tissue engineering	
		<b>Stem cell cultures</b>	Human ES cell culture, cryopreservation of Umbilical cord stem cells and their potential use	<b>02</b>
<b>2.</b>	<b>Section B (Dr. Vandita Kandpal)</b>	<b>Genetic engineering in animals</b>	(i) Transgenic animals and their applications. Introduction to various transgenic animal models. (ii) Therapeutic products produced by genetic engineering blood proteins, human hormones, immune modulators and vaccines, (iii) Embryo transfer technology and artificial insemination	<b>01</b>  <b>02</b>
		<b>Social issues of transgenics &amp; IPR</b>	Public opinions against the molecular technologies. Legal issues – legal actions taken by countries for use of the molecular technologies	<b>02</b>
		<b>Ethical issues</b>	(i) Ethical issues against the molecular technologies. Bioethics – Necessity of Bioethics, different paradigms of Bioethics (ii) National & International. Intellectual Property Rights – Why IPR is necessary, TRIPS & IPR, IPR – national & international scenario, IPR protection of life forms	<b>02</b>  <b>02</b>
		<b>Bioremediation</b>	(i) Petroleum prospecting and formation of oil spills, chemical degradation (ii) Heavy Metals. Introduction to Bioreactor: types & operation of Bioreactors, physico-chemical standards used in bioreactors, limitations of bioreactors	<b>01</b>  <b>02</b>

# TEACHING PLAN

Government P. G. College, Berinag, S.S.J. University (Almora)

Department of Zoology

M.Sc. III Semester, Session – 2022-2023

Paper IV – Bio-Instrumentation, Biostatistics and Computational Biology

S.N	Unit	Topics	Sub Topics	Lecture Period
1	Section A (Dr. Vandita Kandpal)	<b>Principles and techniques of Microscopy</b>	Magnification and resolution parameters of light, fluorescent phase contrast scanning, transmission electron microscopy, tunneling microscopy and Inverted microscope, Micrometry, Colony counting, Microtomy. Laboratory safety guidelines	02
		<b>Centrifugation</b>	Basic principles of sedimentation, types of centrifuges, ultracentrifugation, differential and rate zonal separations, Organellar separation and Flow cytometry	01
		<b>Principle &amp; applications of pH meter</b>	Spectroscopy: UV- Vis, Mass Spectrometry (MS), X-ray Crystallography	02
		<b>Chromatographic techniques</b>	Paper Chromatography, Partition Cchromatography, Column Chromatography, Thin Layer Chromatography, Gas Chromatography, Ion Exchange Chromatography, Affinity Chromatography, Introduction to HPLC	03
		<b>Electrophoresis</b>	Capillary, Agarose, SDS & Native PAGE, pulse field, immuno-electrophoresis, paper electrophoresis	02
			PCR & Thermal cyclers, Autoradiography, ELISA	01
1	Section B (Dr. Aman Verma)	<b>Introduction to computers</b>	Computer fundamentals (Hardware & Software), Input, Output devices and Storage devices, Web Browsers , Search Engines, Flow charts, Methods and types of networks, Intra and Internet, Introduction to MS-office	03
		<b>Introduction to Bioinformatics</b>	Scope and application of Bioinformatics, NCBI Data model, DNA and Protein Sequence database, Motif analysis, structural database, Structural Viewers (RasMol, RasTop, Cn3D, CSHF Chimera, Swiss PDB Viewer, PyMOL), Sequence submission to database, Literature database (PubMed, Biomed Central, Medline), Internet and biologist. Online study <i>E. coli</i> , <i>D. melanogaster</i> ,	04

			Human genome, Mice genome. DNA Chips and their replications	
		<b>Introduction to Biostatistics</b>	Terminology and symbols, applications of statistics in biological research, collection and representation of data, measures of central tendency(Mean, Median, Mode), Coefficient of variation, Standard Deviation, Analysis of variation (ANOVA), measures of dispersion, distribution patterns (Binomial, Poisson & normal), tests of significance('t' test, 'f' test & chi-square test), probability, correlation and regression analysis, Introduction to statistical software and handling	<b>06</b>



# TEACHING PLAN

Government P. G. College, Berinag, S.S.J. University (Almora)

Department of Zoology

M.Sc. IV Semester, Session – 2022-2023

Paper I (b): Systematics and Applied Entomology

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A (Dr. Aman Verma)	Basics in entomology	A) Classification, ancestry and evolution of insects	02
			B) Principles of construction and use of dichotomous keys in insect identification	01
			C) Methods of collection, preservation and culture of insects	01
			D) Parental care in insects	01
		Insect orders and families	A) Habit, habitats and general characters of Thysanura (Machilidae, Lepismatidae), Collembola, Odonata	01
			B) Habit, habitats and general characters of Orthoptera (Acrididae, Tettigonidae, Gryllidae), Phase theory in locusts	02
			C) Habit, habitats and general characters of Phthiraptera (Anoplura, Mallophaga), Isoptera and Thysanoptera	02
			D) Habit, habitats and general characters of Heteroptera (Pentatomidae, Belostomatidae), Homoptera (Aphidae, Coccidae)	01
			E) Habit, habitats and general characters of Coleoptera (Coccinellidae, Curculionidae, Scarabaeidae), Lepidoptera (Noctuidae, Nymphalidae, Papilionidae)	02
			F) Habit, habitats and general characters of Hymenoptera (Ichneumonidae, Chalcididae,	02

			Formicidae), Diptera (Culicidae, Muscidae, Syrphidae)	
2.	Section B  (Dr. Kanchan Bhandari)	Principles and practices of pest control	A) Pests defined: Categories of crop pests (key pests, occasional pests, potential pests and migratory pests)	01
			B) Pest control procedures: natural and applied control (cultural, biological and insecticidal methods)	01
			C) Modes of action of insecticides, factors affecting toxicity of insecticides	01
			D) Non-insecticidal methods: antifeedants, attractants, repellents, deterrents, chemosterilants, pheromones and insect growth regulators	01
			E) Integrated pest management	01
			F) Insecticide application equipment: sprayers, dusters, granule applicators	01
(Dr. Vandita Kandpal)	Knowledge on different insect pests	A) Distribution, habit and habitats, life-cycle, nature of damage and control of pests of stored grains ( <i>Sitophilus oryzae</i> , <i>Callosobruchus chinensis</i> )	01	
		B) Distribution, habit and habitats, life-cycle, nature of damage and control of pests of sugarcane ( <i>Pyrilla perpusilla</i> , <i>Chilo infuscatellus</i> )	01	
		C) Distribution, habit and habitats, life-cycle, nature of damage and control of pests of paddy ( <i>Leptocorisa acuta</i> , <i>Hieroglyphus banian/nigrorepletus</i> )	01	
		D) Distribution, habit and habitats, life-cycle, nature of damage and control of pests of cotton ( <i>Dysdercus koenigii</i> , <i>Pectinophora gossypiella</i> )	01	
		E) Distribution, habit and habitats, life-cycle, nature of damage and control of pests of cereals ( <i>Helicoverpa armigera</i> , <i>Agrotis ypsilon</i> )	01	
		F) Distribution, habit and habitats, life-cycle, nature of damage and control of pests of vegetables ( <i>Aulacophora foveicollis</i> , <i>Pieris brassicae</i> )	01	
		G) Distribution, habit and habitats, life-cycle, nature of damage and control of pests of fruits ( <i>Dacus cucurbitae</i> ,	01	

			<i>Papilio demoleus</i> )	
			H) Distribution, habit and habitats, life-cycle, nature of damage and control of pests of forest trees ( <i>Antheraea paphia</i> , <i>Tingis beesoni</i> , <i>Aeolesthes holosericea</i> )	<b>01</b>
			I) Distribution, habit and habitats, life-cycle, nature of damage and control of polyphagous pests (Locusts, termites)	<b>01</b>
		<b>Lac industry</b>	A) Introduction, strains of lac insects, lac cultivation, composition and uses of silk	<b>01</b>
		<b>Apiculture</b>	A) Introduction, kinds of honey bees, social organization and the language of bees, bee keeping methods, economic importance and diseases of honey bees	<b>01</b>
		<b>Sericulture</b>	A) Introduction, mulberry and non-mulberry sericulture, composition and uses of silk	<b>01</b>
		<b>Insects of medical importance</b>	A) Life-cycle and control of houseflies, mosquitoes, sand fly and horse fly	<b>01</b>

*Kanika*

*Prerna*

*Sam*

# Government P. G. College, Berinag, S.S.J. University (Almora)

## Department of Zoology

M.Sc. IV Semester, Session – 2022-2023

### Paper II (b): Biology of Insects - Morphology, Physiology & Development

S. No.	Unit	Topic	Sub-topic	Lecture Period
1.	Section A  (Dr. Aman Verma)	<b>Integument</b>	A) Structure, functions and modifications of insect cuticle, moulting and sclerotization	<b>02</b>
		<b>General plan of insect body</b>	A) Structure of an insect head, thorax and abdomen, different mouthparts, antennae, and legs	<b>03</b>
			B) Structure of an insect wing, different types of wings, hypothetical wing venation, wing-coupling and flight mechanisms	<b>02</b>
			C) Structure and modifications of male and female genitalia in insects	<b>01</b>
		<b>Digestive System</b>	A) Structure and modifications of alimentary canal, food and feeding mechanism of a generalized insect with special reference to physiology of digestion in different insects	<b>01</b>
		<b>Circulatory System</b>	A) Structure and functions of blood and mode of circulation in insects	<b>01</b>
		<b>Excretory System</b>	A) Principal organs of excretion in insects of different habitats, physiology of excretion and osmoregulation in insects	<b>01</b>
		<b>Respiratory System</b>	A) Structure and functions of respiratory organs, modes of respiration, physiology of respiration in terrestrial, aquatic and endoparasitic insects	<b>01</b>
		Section B  (Dr.	<b>Nervous System</b>	A) Generalized plan of nervous system in insects and its modifications

<b>Kanchan Bhandari)</b>			
	<b>Neuroendocrine System</b>	A) Introduction and the role of neurosecretion in various metabolic activities, metamorphosis and development of insects	<b>01</b>
	<b>Visual and sound producing organs in insects</b>	A) Structure and functions of different types of visual and sound producing organs in insects	<b>02</b>
	<b>Receptors in insects</b>	A) Structure, function and physiology of mechano-receptors and chemo-receptors in insects	<b>02</b>
	<b>Bioluminescence</b>	A) Light producing organs, mechanism and significance of light production in insects	<b>01</b>
	<b>Pheromones</b>	A) Structure of pheromone producing glands, different types of pheromones and their chemical nature	<b>01</b>
	<b>Reproductive System</b>	A) Structure and modification of male and female reproductive systems in insects	<b>01</b>
	<b>Development</b>	A) Structure of egg, maturation, cleavage, blastokinesis, formation of germ layers and segmentation, different types of larvae and pupae	<b>01</b>
		B) Polyembryony and parthenogenesis in insects	<b>01</b>

*Kanchan*

*Prerna*