MUGBERIA GANGADHAR MAHAVIDYALAYA

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NAAC Re-Accredited B+Level Govt. aided College
CPE (Under UGC XII Plan) & NCTE Approved Institutions
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Report of Syllabus Distribution

Department of Zoology

Mugberia Gangadhar Mahavidyalaya

Session: 2022-2023

Mugberia Gangadhar Mahavidyalaya ★ Bhupatinagar ★ Purba Medinipur ESTD.-1964

Principal
Mugberia Gangadhar Mahavidyalaya

PAPER	Course contents / Syllabus	Alloted Teachers	Credits &Marks	Class Allotted per weeks	Total Class
SEM I					
CC1 T	**NON CHORDATES**				
	Unit 1: Basics of Animal Classification Definitions: Classification, Systematics and Taxonomy; Taxonomic Hierarchy, Taxonomic types. Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Six kingdoms. Concept of classification (Card woese).	KM RM	4	6	15x6=90
	Unit 2: Protista and Metazoa **Protozoa** General characteristics and Classification up to phylum (according to Levine et. al., 1981) Locomotion in Euglena, Paramoecium and Amoeba; Conjugation in Paramoecium. Life cycle and pathogenicity of Plasmodium vivax and Entamoeba histolytica. **Metazoa** Evolution of symmetry and segmentation of Metazoa	SM SDM			
	Unit 3: Porifera General characteristics and Classification up to classes; Canal system and spicules in sponges	SB			
	Unit 4: Cnidaria General characteristics and Classification up to classes Metagenesis in Obelia & Aurelia Metagenesis in Obelia Polymorphism in Cnidaria Corals and coral reef diversity, function & conservation	RM			
	Unit 5: Ctenophora General characteristics	SB			

	Unit 6: Platyhelminthes General characteristics and Classification up to classes Life cycle and pathogenicity and control measures of Fasciola hepatica and Taenia solium	SDM			
	Unit 7: Nematoda General characteristics and Classification up to classes. Life cycle, and pathogenicity and control measures of Ascaris lumbricoides and Wuchereria bancrofti. Parasitic adaptations in helminthes.	PM			
CC1 P	**NON CHORDATES**				
	List of Practical . 1.Study of whole mount of Euglena, Amoeba and Paramoecium 2.Identification of Amoeba, Euglena, Entamoeba, Opalina, Paramecium, Plasmodium vivax and Plasmodium falciparum (from the preparedslides) 3. Identification of Sycon, Neptune's Cup, Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora 4. Identification and significance of adult Fasciola hepatica, Taenia solium and Ascaris lumbricoides 5. Staining/mounting of any protozoa/ from gut of cockroach	KM RM PM SB SDM SM	2	3	15x6=90
CC2 T	**ECOLOGY**				

	Unit 1: Introduction to Ecology History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.	SDM	4	6	15x6=90
	Unit 2: Population Unitary and Modular populations. Unique and group attributes of population: Demographic factors, life tables, fecundity tables. survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns, r and K strategies Population. regulation - density-dependent and independent factors. Population Interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition	SM SB			
	Unit 3: Community Community characteristics: species diversity, abundance, , dominance, richness, Vertical stratification, Ecotone and edge effect. Ecological succession with one example	KM			
	Unit 4: Ecosystem Types of ecosystem with an example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with an example of Nitrogen cycle Human modified ecosystem	PM			

	Unit 5: Applied Ecology Wildlife Conservation (in-situ and ex-situ conservation). Management strategies for tiger conservation; Wild life protection act (1972)	RM			
CC2 P	**ECOLOGY**				
	List of Practical Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided. 1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided 2. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community 3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO2 4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary Note: In field report costal area to be included	RM PM KM SB SM SDM	2	3	15x6=90
GE1 T	**ANIMAL BIOTECHNOLOGY**				
	Unit 1: Introduction Concept and Scope of Biotechnology	RM	4	6	15x6=90

	Unit 2: Techniques in Gene manipulation Recombinant DNA technology, Isolation of genes, Concept of restriction and modification: Restriction endonucleases, DNA modifying enzymes. Cloning Vectors: Plasmids, Phage vectors, Cosmids, Phagemids, BAC, YAC, and HAC. Shuttle and Expression Vectors. Construction of Genomic libraries and cDNA libraries Transformation techniques: microbial, plants and animals: Cloning in mammalian cells, Integration of DNA into mammalian genome-Electroporation and Calcium Phosphate Precipitation method.	KM PM			
	Unit 3: Animal cell Culture Basic techniques in animal cell culture and organ culture, Primary Culture and Cell lines Culture media- Natural and Synthetic, Stem cells, Cryopreservation of cultures. Agarose and Polyacrylamide Gel Electrophoresis, Southern, Northern and Western blotting, DNA sequencing: Sanger method, Polymerase chain reaction, DNA Fingerprinting and DNA microarrays.	SB SM			
	Unit 4: Fermentation Different types of Fermentation: Submerged & Solid state; batch, Fed batch & Continuous; Stirred tank, Air Lift, Fixed Bed and Fluidized Downstream Processing: Filtration, centrifugation, extraction, chromatography, spray drying and lyophilization.	RM			

	Unit 5: Transgenic Animal Technology Production of transgenic animals: nuclear transplantation, Retroviral method, DNA microinjection method, Dolly and Polly.	SDM			
	Unit 6: Application in Health Development of recombinant Vaccines, Hybridoma technology, Gene Therapy. Production of recombinant Proteins: Insulin and growth hormones	SDM			
	Unit 7: Bio safety Physical and Biological containment Bio safety Physical and Biological containment.	KM			
GE1	**PRACTICAL**				
	List of Practical 1. Packing and sterilization of glass and plastic wares for cell culture. 2. Preparation of culture media. 3. Preparation of genomic DNA from E. coli/animals/ human. 4. Plasmid DNA isolation (p UC 18/19) and DNA quantitation using agarose gel electrophoresis (by using lambda DNA as standard). 5. Restriction digestion of lambda (λ) DNA using EcoR1 and Hind III. 6. Preparation of competent cells and Transformation of E. coli with plasmid DNA using CaCl2, Selection of transformants on X-gal and IPTG (Optional). 7. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting, PCR, DNA Microarrays	KM RM PM SB	2	2	15x2=30
SEM -II					

C3 T	**Non-Chordates**				
	Unit 1: Introduction Evolution of coelom and metamerism	RM	4	6	15x6=90
	Unit 2: Annelida General characteristics and Classification up to classes Excretion in Annelida through nephridia. Metamerism in Annelida	RM			
	Unit3:Arthropoda General characteristics and Classification up to classes Vision in Insecta only. Respiration in Arthropoda (Gills in prawn and trachea in cockroach). Metamorphosis in Lepidopteran Insects. Social life in termite	SB KM			
	Unit 4: Onychophora General characteristics and Evolutionary significance	KM			
	Unit 5: Mollusca General characteristics and Classification up to classes Nervous system and torsion *in Gastropoda Feeding and respiration in* Pila sp.	PM			
	Unit 6: Echinodermata General characteristics and Classification up to classes Water-vascular system in Asteroidea. Larval forms in Echinodermata. Affinities with Chordates.	SM			
	Unit 7: Hemichordata General characteristics of phylum Hemichordata. Relationship with non-chordates and chordates	SDM			
C3 P	**Non-Chordates**				

	List of Practical 1.Study of following specimens: a. Annelids - ***Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria***. b. Arthropods - ***Limulus, Palamnaeus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta, termites and honey bees Onychophora – Peripatus.*** c. Molluscs - ***Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus.*** d. Echinodermates - ***Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and*** e. ***Antedon.*** **2.** Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm. **3.** T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm. **4.** Mount of mouth parts and dissection of digestive system and nervous system of Periplaneta* **5.** To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm)	KM RM SB SDM PM SM	2	3	15x6=90
C4 T	**CELL BIOLOGY**				
	Unit 1: Overview of Cells Basic structure of Prokaryotic and Eukaryotic cells, Viruses, Viroid, Prion and Mycoplasma	PM	4	6	15x6=90

	Unit 2: Plasma Membrane Ultra structure and composition of Plasma membrane: Fluid mosaic model. **Transport across membrane**: Active and Passive transport, Facilitated transport. Cell junctions: Tight junctions, Gap junctions, Desmosomes.	SM			
	Unit 3: Cytoplasmic organelles I Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes. Protein sorting and mechanisms of vesicular transport.	KM			
	Unit 4: Cytoplasmic organelles II Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis. Peroxisomes: Structure and Functions. Centrosome: Structure and Functions	SB			
	Unit 5: Cytoskeleton Type, structure and functions of cytoskeleton. *Accessory proteins of microfilament & microtubule.* A brief idea about molecular motors.	RM			
	Unit 6: Nucleus Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus. Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome).	SDM			

	Unit 7: Cell Division Cell cycle and its regulation, Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma and Ras and APC. Mitosis and Meiosis: Basic process and their significance.	PM			
	Unit 8: Cell Signaling Cell signaling transduction pathways; Types of signaling molecules and receptors GPCR and Role of second messenger (cAMP) Extracellular matrix-Cell interactions. Apoptosis and Necrosis.	SM			
C4 P	**Cell Biology**				
	List of Practical 1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis 2. Study of various stages of meiosis. 3. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells. 4. Preparation of permanent slide to demonstrate: a. DNA by Feulgen reaction b. Cell viability study by Trypan Blue staining c. Mitochondria identification through vital staining	PM RM KM SB	2	3	15x6=90
GE2 T	**Animal Diversity**				

	Unit 1: Protista Protozoa: General characters of Protozoa; Life cycle of Plasmodium	KM	4	6	15x6=90
	Unit 2: Porifera General characters and canal system in Porifera.	RM			
	Unit 3: Radiata General characters of Cnidarians and polymorphism.	KM			
	Unit 4: Aceolomates General characters of Helminthes.	RM			
	Unit 5: Pseudocoelomates. General characters of Nematoda. Parasitic adaptations	PM			
	Unit 6: Annelida General characters of Annelida. Metamerism.	SB			
	Unit 7: Arthropoda General characters. Social life in insects	SB			
	Unit 8: Mollusca General characters of mollusk. Pearl Formation.	PM			
	Unit 9: Echynodermata General characters of Echinodermata. Water Vascular system in Starfish.	SM			
	Unit 10: Protochordata Salient features.	SM			
	Unit 11: Pisces General Characters. Osmoregulation, Migration of Fish	SDM			

	Unit 12: Amphibia General characters, Adaptations for terrestrial life, Parental care	SDM			
	Unit 13: Reptilia General Characters. Amniotes; Origin of reptiles. Terrestrial adaptations in reptiles.	SM			
	Unit 14: Aves General Characters. The origin of birds; Flight adaptations	KM			
	Unit 15: Mammalia General Characters. Early evolution of mammals; Primates; Dentition in mammals	RM			
GE2 P	**Animal Diversity**				

	1.Study of following specimens: **A .Non Chordates:** Euglena, Noctiluca, Paramecium, Sycon, , Physalia, Tubipora, Metridium, Taenia, Ascaris, Nereis, Aphrodite, Leech, Peripatus, Limulus, Hermitcrab, Daphnia, Millipede, Centipede, Beetle, Chiton, Dentalium, Octopus, Asterias, and Antedon. **B . Chordates:** Balanoglossus, Amphioxus, Petromyzon, Pristis, Hippocampus, Labeo, Icthyophis/Uraeotyphlus, Salamander, Rhacophorus, Draco, Uromastix, Naja, Viper, model of Archaeopteryx, any three common birds-(Crow, duck, Owl), Squirrel and Bat **2**.Study of following Permanent Slides: Cross section of Sycon, Sea anemone and Ascaris (male and female). T. S. of Earthworm passing through pharynx, gizzard, and typhlosolar intestine. Bipinnaria and Pluteus larva. **3**.Temporary mounts of: A. Septal & pharyngeal nephridia of earthworm. B. Unstained mounts of Placoid, cycloid and ctenoid scales. **4**. Dissections of: a. Digestive and nervous system of Cockroach. b. Urinogenital system of Rat.	PM RM SB KM SDM SM	2	3	15x6=90
SEM III					
C5T	**Chordates**				
	Unit 1: Introduction to Chordates General characteristics and outline classification of Phylum Chordata.	KM	4	6	15x6=90
	Unit 2: Protochordata General characteristics and classification of sub-phylum Urochordata and Cephalochordata up to Classes. Retrogressive metamorphosis in Ascidia. Chordate Features and Feeding in Branchiostoma	RM			

	Unit 3: Origin of Chordata Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata.	KM			
	Unit 4: Agnatha General characteristics and classification of cyclostomes up to order.	PM			
	Unit 5: Pisces General characteristics and classification of Chondrichthyes and Osteichthyes up to Subclasses. Accessory respiratory organ, migration and parental care in fishes Swim bladder in fishes. Classification up to Sub-Classes.	PM			
	Unit 6: Amphibia General characteristics and classification up to living Orders. Metamorphosis and parental care in Amphibia.	SB			
	Unit 7: Reptilia General characteristics and classification up to living Orders. Poison apparatus and Biting mechanism in Snake.	SB			
	Unit 8: Aves General characteristics and classification up to Sub-Classes Exoskeleton and migration in Birds Principles and aerodynamics of flight.	SDM			

	Unit 9: Mammals General characters and classification up to living orders Affinities of Prototheria. Exoskeleton derivatives of mammals Adaptive radiation in mammals with reference to locomotory appendages Echolocation in Micro chiropterans and Cetaceans.	SM			
	Unit 10: Zoogeography Zoogeographical realms, Plate tectonic and Continental drift theory, distribution of birds and mammals in different realms.	RM			
C5 P	**Chordates**				
	List of Practical 1. **Protochordata** Balanoglossus, Herdmania, Branchiostoma. 2.**Agnatha** Petromyzon, Myxine. 3.**Fishes** Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish. 4.**Amphibia** Necturus, Bufo, Hyla, Alytes, Axolotl, Tylototriton. 5.**Reptilia** Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus. Key for Identification of poisonous and non-poisonous snakes. 6.**Mammalia**: Bat (Insectivorous and Frugivorous), Funambulus. 7. **Pecten from Fowl head**. 8.Dissection of brain and pituitary of ***Tilapia***	KM RM PM SB SDM SM	2	3	15x6=90

C6P	**Animal Physiology**				
	Unit 1: Tissues Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue and, fixation and staining of tissues.	PM	4	6	15x6=90
	Unit2: Bone and Cartilage Structure and types of bones and cartilages, Ossification.	SDM			
	Unit 3: Nervous System Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and Neuromuscular junction; Reflex action and its types.	RM			
	Unit 4: Muscular system Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle fibre.	SM			
	Unit 5: Reproductive System Histology of testis and ovary Physiology of Reproduction.	KM			

	Unit 6: Endocrine System Histology and function of pituitary, thyroid, pancreas and adrenal Classification of hormones; Mechanism of Hormone action. Signal transduction pathways for Steroidal and Non steroidal hormones. Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system. Placental hormones	SB SDM			
C6P	**Animal Physiology**				
	List of Practical 1 .Recording of simple muscle twitch with electrical stimulation (or Virtual) 2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex) 3 .Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells 4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid 5. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues	SM SB RM KM SDM PM	2	3	15x6=90
C7T	**Fundamentals of Biochemistry**				

	Unit 1: Carbohydrates Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosachharides Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis.	SM	4	6	15x6=90
	Unit 2: Lipids Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpinoids. Lipid metabolism: β-oxidation of fatty acids; Fatty acid biosynthesis.	RM			
	Unit 3: Proteins Amino acids Structure, Classification, General and Electro chemical properties of α-amino acids; Physiological importance of essential and non-essential amino acids **Proteins** Bonds stabilizing protein structure; Levels of organization Protein metabolism: Transamination, Deamination, Urea cycle, Fate of C-skeleton of Glucogenic and Ketogenic amino acids	SB			
	Unit 4: Nucleic Acids Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids. Types of DNA and RNA, Complementarity of DNA, Hypo- Hyperchromaticity of DNA Basic concept of nucleotide metabolism	PM			

	Unit 5: Enzymes Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menten equation, Lineweaver-Burk plot; Factors affecting rate of enzyme-catalyzed reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Strategy of enzyme action- Catalytic and Regulatory (Basic concept with one example each).	SDM			
	Unit 6: Oxidative Phosphorylation Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System.	KM			
C7P	**Fundamentals of Biochemistry**				
	List of Practical 1. Qualitative tests of functional groups in carbohydrates, proteins and lipids. 2. Paper chromatography of amino acids. 3. Quantitative estimation of Lowry Methods. 4. Demonstration of proteins separation by SDS-PAGE. 5. To study the enzymatic activity of Trypsin and Lipase. 6. To perform the Acid and Alkaline phosphatase assay from serum/ tissue.	PM SB RM SDM	2	3	15x3=45
SEC1 T	**Apiculture**				
	Unit 1: Biology of Bees History, Classification and Biology of Honey Bees Social Organization of Bee Colony.	SM	4	5	15x5=75

	Unit 2: Rearing of Bees Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)	SB			
	Unit 3: Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures.	PM			
	Unit 4: Bee Economy Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.	RM			
	Unit 5: Entrepreneurship in Apiculture Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens.	SDM			
GE T-3	**Aquatic Biology**				
	Unit 1: Aquatic Biomes Brief introduction to the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.	PM	4	6	15x6=90

	Unit 2: Freshwater Biology Lakes: Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico–chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity, dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes (Nitrogen, Sulphur and Phosphorous). Streams: Different stages of stream development, Physico-chemical environment, Adaptation of hill- stream fishes.	RM KM			
	Unit 3: Marine Biology Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.	SB			
	Unit 4: Management of Aquatic Resources Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment Water quality assessment- BOD and COD .	SM SDM			
GE3 P	**Aquatic Biology Lab**				

	List of Practical 1. Determine the area of a lake using graphimetric and gravimetric method. 2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem. 3. Determine the amount of Turbidity/transparency, Dissolved Oxygen, and Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake / water body. 4. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance. 5. A Project Report on a visit to a Sewage treatment plant/Marine bio-reserve/Fisheries Institute.	PM RM KM SM SB SDM	2	2	15x2=30
SEM IV					
C8T:	**Comparative Anatomy of Vertebrates**				
	Unit 1: Integumentary System Structure, function and derivatives of integument in amphibian, birds and mammals.	PM	4	6	15x6=90
	Unit 2: Skeletal System Overview of axial and appendicular skeleton; Jaw suspension; Visceral arches	SM			
	Unit 3: Digestive System Comparative anatomy of stomach; dentition in mammals.	PM			
	Unit 4: Respiratory System Respiratory organs in fish, amphibian, birds and mammals.	SB			

	Unit 5: Circulatory System General plan of circulation, Comparative account of heart and aortic arches.	RM			
	Unit 6: Urinogenital System Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri.	RM			
	Unit 7: Nervous System Comparative account of brain, Cranial nerves in mammals.	KM			
	Unit 8: Sense Organs Classification of receptors, Brief account of olfactory and auditory receptors in vertebrate.	SDM			
C8P	**Comparative Anatomy of Vertebrates**				
	List of Practical 1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs. 2. Study of disarticulated skeleton of Toad, Pigeon and Guineapig. 3. Demonstration of Carapace and plastron of turtle. 4. Identification of mammalian skulls: One herbivorous (Guineapig) and one carnivorous (Dog) animal. 5. Dissection of Tilapia: Circulatory system, Brain, pituitary, urinogenital system.	PM RM SB	2	3	15x6=90
C9T	**Animal Physiology**				

	Unit 1: Physiology of Digestion Structural organisation and functions of Gastrointestinal tract and Associated glands; Mechanical and chemical digestion of food, absorption of Carbohydrates, Lipids, Proteins and Nucleic Acids; Digestive enzymes.	PM	4	6	15x6=90
	Unit 2: Physiology of Respiration Mechanism of Respiration, Respiratory volumes and capacities, transport of Oxygen and Carbon dioxide in blood, Dissociation curves and the factors influencing it, respiratory pigments; Carbon monoxide poisoning.	SB			
	Unit 3: Physiology of Circulation Components of Blood and their functions; Structure and functions of hemoglobin Haemostasis; Blood clotting system, Fibrinolytic system Haemopoiesis; Basic steps and its regulation Blood groups; ABO and Rh factor.	SM			
	Unit 4: Physiology of Heart Structure of mammalian heart, Coronary Circulation, Structure and working of *conducting myocardial fibres, Origin and* conduction of cardiac impulses Cardiac Cycle and cardiac output Blood pressure and its regulation.	RM			
	Unit 5: Thermoregulation & Osmoregulation Physiological classification based on thermal biology. Thermal biology of endotherms. Osmoregulation in aquatic vertebrates. Extrarenal osmoregulatory organs in vertebrates.	KM			

	Unit 6: Renal Physiology Structure of Kidney and its functional unit, Mechanism of urine formation, Regulation of acid- base balance.	SDM			
C9P	**Animal Physiology**				
	List of Practical 1. Determination of ABO Blood group. 2. Enumeration of red blood cells and white blood cells using haemocytometer 3. Estimation of haemoglobin using Sahli's haemoglobinometer. 4. Preparation of haemin and haemochromogen crystals. 5. Recording of blood pressure using a sphygmomanometer.	KM RM PM SB	2	3	15x6=90
C10T:	**Immunology**				
	Unit 1: Overview of Immune System Basic concepts of health and diseases, Historical perspective of Immunology, Cells and organs of the Immune system.	KM	4	6	15x6=90
	Unit 2: Innate and Adaptive Immunity Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral).	PM			
	Unit 3: Antigens Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes.	SM			
	Unit 4: Immunoglobulins Structure and functions of different classes of immunoglobulins, Antigen- antibody interactions, Immunoassays (ELISA and RIA), Hybridoma technology, Monoclonal antibody production.	RM			

	Unit 5: Major Histocompatibility Complex Structure and functions of MHC molecules. Structure of T cell Receptor and its signalling, T cell development & selection	SB			
	Unit 6: Cytokines Types, properties and functions of cytokines.	RM			
	Unit 7: Complement System Components and pathways of complement activation.	SM			
	Unit 8: Hypersensitivity Gell and Coombs' classification and brief description of various types of hypersensitivities.	KM			
	Unit 9: Immunology of diseases Malaria, Filariasis, Dengue and Tuberculosis	SDM			
	Unit 10: Vaccines Various types of vaccines. Active & passive immunization (Artificial and natural).	SDM			
C10P	**Immunology Lab**				
	List of Practical **1.** Demonstration of lymphoid organs. 2. Histological study of spleen, thymus and lymph nodes through slides/ photographs 3. Preparation of stained blood film to study various types of blood cells. 4. ABO blood group determination. 5. Demonstration of ELISA	PM RM SB SM	2	3	15x6=90
SEC2T	: **Sericulture**				

	Unit 1: Introduction Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture	KM	4	6	15x6=90
	Unit 2: Biology of Silkworm Life cycle of Bombyx mori Structure of silk gland and secretion of silK	SB			
	Unit 3: Rearing of Silkworms Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing appliances. Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types of mountages Spinning, harvesting and storage of cocoons.	PM SM			
	Unit 4: Pests and Diseases Pests of silkworm: Uzi fly, dermestid beetles and vertebrates Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases	RM			
	Unit 5: Entrepreneurship in Sericulture Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture Visit to various sericulture centres.	SDM			
GE4T	**: Environment and Public Health**				

	Unit 1: Introduction Sources of Environmental hazards, Hazard identification and accounting, Fate of toxic and persistent substances in the environment, Dose response evaluation, Exposure assessment.	RM	4	6	15x6=90
	Unit 2: Climate Change Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health	SM			
	Unit 3: Pollution Air, water, noise pollution sources and effects, Pollution control	SB			
	Unit 4: Waste Management Technologies Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants.	KM SDM			
	Unit 5: Diseases Causes, symptoms and control of *tuberculosis*, Asthma, Cholera, Minamata disease, typhoid, filariasis	PM			
GE4P:	**Environment and Public Health Lab**				
	List of Practical To determine pH, Cl, SO4, NO3 in soil and water samples from different locations.	KM PM	2	3	15x3=45
SEM V					
C11T	**Molecular Biology**				
	Unit 1: Nucleic Acids Salient features of DNA and RNA. Watson and Crick Model of DNA	RM	4	6	15x6=90

	Unit 2: DNA Replication Mechanism of DNA Replication in Prokaryotes, Semi-conservative, bidirectional and discontinuous Replication, RNA priming, Replication of telomeres	PM			
	Unit 3: Transcription Mechanism of Transcription in prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription.	SB			
	Unit 4: Translation Mechanism of protein synthesis in prokaryotes, Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in *initiation, elongation and termination of* polypeptide chain; Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation	SM			
	Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA Capping and Poly A tail formation in mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA	SM			
	Unit 6: Gene Regulation Regulation of Transcription in prokaryotes: lac operon and trp operon; Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing, Genetic imprinting	KM			

	Unit 7: DNA Repair Mechanisms Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair	SDM			
	Unit 8: Molecular Techniques PCR, Western and Southern blot, Northern Blot, Sanger DNA sequencing	RM			
C11P	**Molecular Biology (Lab)**				
	List of Practical 1. Demonstration of polytene and lampbrush chromosome from photograph 2. Isolation and quantification of genomic DNA using spectrophotometer (A260 measurement) 3. Agarose gel electrophoresis for DNA	RM KM	2	3	15x6=90
C12T:	**Genetics**				
	Unit 1: Mendelian Genetics and its Extension Principles of inheritance, Incomplete dominance and co-dominance, Epistasis Multiple alleles, Lethal alleles, Pleiotropy, Sex-linked, sex- influenced and sex-limited inheritance, Polygenic Inheritance.	KM	4	6	15x6=90
	Unit 2: Linkage, Crossing Over and Chromosomal Mapping Linkage and Crossing Over, molecular basis of crossing over, Measuring Recombination frequency and linkage intensity using three factor crosses, Interference and coincidence	SB SDM			
	Unit 3: Mutations Types of gene mutations (Classification), Types of chromosomal aberrations (Classification with one suitable example of each), Non-disjunction and variation in chromosome number; Molecular basis of mutations in relation to UV light and chemical mutagens	RM			

	Unit 4: Sex Determination Mechanisms of sex determination in Drosophila Sex determination in mammals Dosage compensation in Drosophila & Human	SM			
	Unit 5: Extra-chromosomal Inheritance Criteria for extra chromosomal inheritance, Antibiotic resistance in Chlamyadomonas, Kappa particle in Paramoecium Shell spiralling in snail	SB			
	Unit 6: Recombination in Bacteria and Viruses Conjugation, Transformation, Transduction, Complementation test in Bacteriophage	PM			
	Unit 7: Transposable Genetic Elements Transposons in bacteria, Ac-Ds elements in maize and P elements in Drosophila, LINE, SINE, Alu elements in humans	KM			
C12P	**Genetics (Lab)**				
	List of Practical 1. Chi-square analyses 2. Linkage maps based on conjugation 3. Identification of chromosomal *aberration in Drosophila and man from* photograph 4. Pedigree analysis of some human inherited traits	RM SB SM	2	3	15x6=90
DSE1T	**Fish and Fisheries**				
	Unit 1: Introduction and Classification General description of fish Feeding habit, habitat and manner of reproduction Classification of fish (up to Subclasses)	PM	4	6	15x6=90

	Unit 2: Morphology and Physiology Types of fins and their modifications; Locomotion in fish; Hydrodynamics; Types of Scales, Use of scales in Classification and determination of age of fish; Gills and gas exchange; Swim Bladder: Types and role in Respiration, buoyancy; Osmoregulation in Elasmobranchs; Reproductive strategies (special reference to Indian fish); Electric organ, Bioluminescence	PM			
	Unit 3: Fisheries Inland Fisheries; Marine Fisheries; Environmental factors influencing the seasonal variations in fish catches in the Arabian Sea and the Bay of Bengal; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations	SDM			
	Unit 4: Aquaculture Sustainable Aquaculture; Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish, Fishery by-products	SDM			
	Unit 5: Fish in research Transgenic fish Zebrafish as a model organism in research	SM			
DSE1P	**Fish and Fisheries (Lab)**				

	List of Practical **1**. Morphometric and meristic characters of fishes 2. Study of Petromyzon, Myxine, Pristis, Chimaera, Exocoetus, Hippocampus, Gambusia, Labeo, Heteropneustes, Anabas 3. Study of different types of scales (through permanent slides/ photographs). 4. Study of crafts and gears used in Fisheries 5. Water quality criteria for Aquaculture: Assessment of pH, conductivity, Total solids, Total dissolved solids 6. Study of air breathing organs in Channa, Heteropneustes, Anabas and Clarias 7. Project Report on a visit to any fish farm/ pisciculture unit/Zebrafish rearing Lab.	KM PM SDM	2	3	15x6=90
DSE2T:	**Animal Biotechnology**				
	Unit 1: Introduction Organization of prokaryotic and eukaryotic genome, Concept of genomics	SDM	4	6	15x6=90

	Unit 2: Molecular Techniques in Gene manipulation Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics).Restriction enzymes: Nomenclature, detailed study of Type II. Transformation techniques: Calcium chloride method and electroporation. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization Southern, Northern and Western blotting DNA sequencing: Sanger method Polymerase Chain Reaction, DNA Finger Printing and DNA micro array	SM RM			
	Unit 3: Genetically Modified Organisms Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection. Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock out mice	SB SDM			
	Unit 4: Culture Techniques and Applications Animal cell culture, expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)	KM			
DSE2P:	***Animal Biotechnology (Lab)***				

	List of Practical **1.** Genomic DNA isolation from E. coli 2. Plasmid DNA isolation (pUC 18/19) from E. coli 3. Restriction digestion of plasmid DNA. 4. Construction of circular and linear restriction map from the data provided. 5. Calculation of transformation efficiency from the data provided. 6. To study following techniques through photographs a. Southern Blotting b. Northern Blotting c. Western Blotting d. DNA Sequencing (Sanger's Method) e. PCR f. DNA fingerprinting 7. Project report on animal cell culture	KM RM PM SB SDM SM	2	3	15x6=90
SEM VI					
C13T	**Developmental Biology**				
	Unit 1: Introduction Basic concepts: Phases of Development, Cell cell interaction, Differentiation and growth, Differential gene expression.	RM	4	6	15x6=90
	Unit 2: Early Embryonic Development Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers.	SM SB			
	Unit 3: Late Embryonic Development Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta).	PM			

	Unit 4: Post Embryonic Development Development of brain and Eye in Vertebrate. Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each).	KM			
	Unit 5: Implications of Developmental Biology 8 Class Teratogenesis: Teratogenic agents and their effects on embryonic development; In vitro fertilization, Stem cell (ESC), Amniocentesis.	SDM			
C13P:	**Developmental Biology Lab**				
	List of Practical **1. S**tudy of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and *Hamburger stages*). 2. Study of the developmental stages and life cycle of Drosophila from stock culture. 3. Study of different sections of placenta (photomicropgraph/ slides). 4. Project report on Drosophila culture/chick embryo development.	SB KM RM	2	3	15x6=90
C14T	**Evolutionary Biology**				
	Unit-1: Life's Beginnings: Chemogeny, RNA world, Biogeny, Origin of photosynthesis, volution of eukaryotes.	RM	4	6	15x6=90
	Unit-2: Historical review of Evolutionary concepts, Lamarkism, Darwinism and Neo Darwinism	SM			

	Unit-3: Geological time scale, Fossil records of Hominids (from Australopithacus to Homo sapiens), evolution of horse. Neutral theory of molecular evolution, Molecular clock.	RM			
	Unit-4: Sources of variations: Heritable variations and their role in evolution	SM			
	Unit-5: Population genetics: Hardy-Weinberg Law (statement and derivation of equation, application Of law to biallelic Population); Evolutionary forces upsetting H-W equilibrium; Natural selection (concept of fitness, types of selection, selection coefficient, mode of selection heterozygous superiority).Genetic Drift mechanism (founder's effect, bottleneck phenomenon). Role of Migration and Mutation in changing allele frequencies.	SB			
	Unit-6: Species concept, Isolating mechanisms, modes of speciation. Adaptive radiation /macroevolution (exemplified by Galapagos finches).				
	Unit-7: Extinctions, Back ground and mass extinctions (causes and effects), detailed example of K-T extinction.	KM			
	Unit-8: Origin and Evolution of Man, Unique Hominin characteristics contrasted with primate characteristic Molecular analysis of human origin.	PM			
	Unit-9: Phylogenetic trees, Construction & interpretation of Phylogenetic tree using parsimony, Convergent & Divergent evolution.	SDM			
C14P	**Evolutionary Biology Lab**				

	List of Practical **1.** Study of fossils from models/ pictures 2. Study of homology and analogy from suitable specimens 3. Study and verification of Hardy-Weinberg Law by chi square analysis 4. Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to their age and sex.	RM SM SB PM	2	3	15x6=90
DSE3T:	**Parasitology**				
	Unit-1: Introduction to Parasitology Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector Host parasite relationship	KM	4	6	15x6=90
	Unit-2: Parasitic Protists Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of Giardia intestinalis, Trypanosoma gambiense, Leishmania donovani.	SM			
	Unit-3: Parasitic Platyhelminthes Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of Schistosoma haematobium, Taenia sajinata	PM			
	Unit-4: Parasitic Nematodes Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of Ascaris lumbricoides, Ancylostoma duodenale, Wuchereria bancrofti and Trichinella spiralis, Brugia malayi; Nematode plant interaction; Gall formation.	RM			

	Unit-5: Parasitic Arthropods Biology, importance and control of ticks (Soft tick Ornithodoros, Hard tick Ixodes), mites (Sarcoptes), Lice (Pediculus), Flea (Xenopsylla) and Bug (Cimex).	SB			
	Unit-6: Parasite Vertebrates Brief account of Cookicutter Shark, Hood Mocking bird, Vampire bat.	SDM			
DSE3P	**Parasitology Lab**				
	List of Practical: **1.** Study of life stages of Giardia intestinalis, Trypanosoma gambiense, Leishmania donovani through permanent slides/micro photographs. 2. Study of adult and life stages of Schistosoma haematobium, Taenia sajinata through permanent slides/micro photographs. 3. Study of adult and life stages of Ancylostoma duodenale, Brugia malayi and Trichinella spiralis through permanent slides/micro photographs. 4. Study of plant parasitic root knot nematode, Meloidogyne from the soil sample. 5. Study of *Pediculus humanus*, Xenopsylla cheopis and Cimex lectularius through permanent slides/ photographs. 6. Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry]. 7. Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a by-product. **Submission of a brief report on parasitic vertebrates.**	KM RM PM SB SDM SM	2	3	15x6=90
DSE4T:	**Wild Life Conservation and Management**				

	Unit-1: Introduction to Wild Life Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.	RM	4	6	15x6=90
	Unit-2: Evaluation and management of wild life Habitat analysis, Physical parameters: Topography, Geology, Soil and water Biological Parameters: food, cover, forage, browse and cover estimation. Standard evaluation procedures: remote sensing and GIS.	SM			
	Unit-3: Management of habitats Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity Restoration of degraded habitats	PM			
	Unit-4: Population estimation Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores; Pug marks and census method.	SB			
	Unit-5: Aims and objectives of wildlife conservation Wildlife conservation in India – through ages; different approaches of wildlife conservation; modes of conservation; in-situ conservation and ex-situ conservation: necessity for wildlife conservation.	KM			
	Unit-6: Management planning of wild life in protected areas Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbence.	SDM			

	Unit-7: Man and Wildlife Causes and consequences of human-wildlife conflicts; mitigation of conflict – an overview; Management of excess population.	SB+PM			
	Unit-8: Protected areas National parks & sanctuaries, Community reserve; Important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.	RM+SM			
DSE4P	**Wild Life Conservation and Management Lab**				
	List of Practical **1.** Identification of flora, mammalian fauna, avian fauna, herpeto-fauna. 2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses). 3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers, etc. 4. Demonstration of different field techniques for flora and fauna. 5. PCQ, ten tree method, Circular, Square & rectangular plots, Parker's 2 Step and other methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment. 6. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences).	KM RM PM SB SDM SM	2	2	15x4=60

Mugberia Gangadhar Mahavidyalaya ESTD.-1964 Purba Medinipur Bhupatinagar

8.08.2025

Principal
Mugberia Gangadhar Mahavidyalaya