Principal
City College
Kolkata -09

Supriti Sarkar
Head
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Kolkata -09

DEPARTMENT OF ZOOLOGY
CITY COLLEGE
LESSON PLAN FOR UNDERGRADUATE COURSE
ACADEMIC YEAR 2021-2022

Semester-I:
Tentative Session Duration: September – January

NAME OF THE TEACHER	Semester/ Hons./ General	PAPER	UNIT	TOPIC ALLOTTED	HOURS	Examination
		CC-1-1 TH	UNIT 5	Ctenophora General Characteristics	2	February-March (Tentative)
DR SUPRITI SARKAR (SS)	SEM-I-HONS.	CC-1-2 TH	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 and RNA editing	8	
		CC-1-2 TH	UNIT 7	DNA Repair Mechanisms Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair	2	
	SEM-I-GENERAL	Animal Diversity, ZOOG-CC1-1-P		1. Identification with reasons of the following specimens: *Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides* (Male and female), *Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer, Limulus, Apis, Chiton, Dentalium, Unio, Sepia, Octopus, Echinus, Cucumaria* and *Antedon, Balanoglossus, Branchiostoma, Petromyzon, Torpedo, Labeo rohita, Exocoetus, Salamandra, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja*, Bat, *Funambulus* 2. Key for Identification of poisonous and non-poisonous snakes 4. An "animal album" containing photographs, cut outs, with	40	

				appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose		
DR DEBASISH KARMAKAR (DK)	**SEM-I-HONS.**	**CC-1-1 TH**	**UNIT 2**	Metazoa Evolution of symmetry and segmentation of Metazoa	3	
		CC-1-1 TH	**UNIT 4**	Cnidaria General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.), Metagenesis in *Obelia*; Polymorphism in Cnidaria; Corals and coral reef diversity, Role of symbiotic algae in reef formation. Conservation of coral and coral reefs	10	
	SEM-I-GENERAL	**Animal Diversity, ZOOG-CC1-1-P**		3. Study of anatomy of digestive system, salivary gland, mouth parts of *Periplaneta*, Study of reproductive system of female cockroach 4. An "animal album" containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose	30	
DR ARKADEEP MITRA (AM)	**SEM-I-HONS.**	**CC-1-2**	**UNIT 1**	Nucleic Acids Salient features of DNA, Chargaff's Rule, Hypo and Hyperchromic shift. Watson and Crick Model of DNA. RNA types & Function	3	
		CC-1-2 TH	**UNIT 2**	DNA Replication Mechanism of DNA Replication in Prokaryotes, Prove that replication is Semi-conservative, bidirectional and discontinuous, RNA priming, Replication of telomeres	9	
	SEM-I-GENERAL	**CC-1-1 TH**	**UNIT 3**	Cnidaria General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Metagenesis in *Obelia*	2	
		CC-1-1 TH	**UNIT 6**	Annelida General characters and classification up to classes (Rupert and Barnes, 1994, 6th Ed.); Metamerism in Annelida	4	
		CC-1-1 TH	**UNIT 8**	Mollusca General characters and classification	2	

				up to classes (Ruppert and Barnes, 1994, 6th Ed.); Respiration in *Pila*		
		CC-1-1 TH	**UNIT 9**	Echinodermata General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Water vascular system in Asteroidea	4	
		CC-1-1 TH	**UNIT 11**	Agnatha General features of Agnatha and classification of cyclostomes up to classes (Young, 1981)	2	
		CC-1-1 TH	**UNIT 12**	Pisces General features and Classification up to orders (Young, 1981); Osmoregulation in Fishes	4	
		CC-1-1 TH	**UNIT 15**	Aves General features and Classification up to orders (Young, 1981); Flight adaptations in birds	4	
		Animal Diversity, ZOOG-CC1-1-P		3. Study of anatomy of digestive system, salivary gland, mouth parts of *Periplaneta*, Study of reproductive system of female cockroach		
DR KRISHNENDU DAS (KD)	**SEM-I-HONS.**	**CC-1-1 TH**	**UNIT 3**	Porifera General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Canal system and spicules in sponges	6	
		CC-1-1 TH	**UNIT 7**	Nematoda General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.) Life cycle, and pathogenicity and control measures of *Ascaris-lumbricoides* and *Wuchereriabancrofti* Parasitic adaptations in helminthes	7	
		Non-Chordates I Lab; ZOOA-CC-1-1-P		1. Study of whole mount of *Euglena, Amoeba* and *Paramoecium* 2. Identification with reason & Systematic position of *Amoeba, Euglena, Entamoeba, Paramecium, Plasmodium, Balantidium, Vorticella* (from the prepared slides) 3. Identification with reason & Systematic position of *Sycon, Poterion* (Neptune's Cup), *Obelia, Physalia, Aurelia, Gorgonia,*	60	

				Metridium, Pennatula, Madrepora, Fasciola hepatica, Taenia solium and *Ascaris lumbricoides*. 4. Staining/mounting of any protozoa/helminth from gut of *Periplaneta* sp.		
	SEM-I-GENERAL	**CC-1-1 TH**	**UNIT 1**	Protista General characters and classification up to classes (Levine et. al., 1980); Locomotory Organelles and locomotion in Amoeba and Paramecium	4	
		CC-1-1 TH	**UNIT 4**	Platyhelmithes General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of *Taenia solium*	2	
		CC-1-1 TH	**UNIT 5**	Nemathelmithes General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of *Ascaris lumbricoides* and its adaptation	2	
		CC-1-1 TH	**UNIT 10**	Protochordates General Characters ; Pharynx and feeding mechanism in Amphioxus	2	
		CC-1-1 TH	**UNIT 14**	Reptiles General features and Classification up to orders (Young, 1981); Poisonous and non-poisonous snakes, Biting mechanism	4	
		Animal Diversity, ZOOG-CC1-1-P		1. Identification with reasons of the following specimens: *Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides* (Male and female), *Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer, Limulus, Apis, Chiton, Dentalium, Unio, Sepia, Octopus, Echinus, Cucumaria* and *Antedon, Balanoglossus, Branchiostoma, Petromyzon, Torpedo, Labeo rohita, Exocoetus, Salamandra, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja*, Bat, *Funambulus* 2. Key for Identification of poisonous and non-poisonous snakes 4. An "animal album" containing photographs, cut outs, with appropriate write up about the	40	

				above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose		
DR SAIFUL ANAM MIR (SM)	**SEM-I-HONS.**	**CC-1-1 TH**	**UNIT 6**	Platyhelmithes General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.) Life cycle and pathogenicity and control measures of Fasciola hepatica and Taenia solium.	6	
		CC-1-2 TH	**UNIT 6**	Gene Regulation Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing. Epigenetic Regulation: DNA Methylation, Histone Methylation & Acetylation.Regulation of Transcription in prokaryotes: lac operon and trp operon	7	
		Molecular Biology Lab; ZOOA-CC-1-2-P		1. Demonstration of polytene and lampbrush chromosome from photograph 2. Isolation and quantification of genomic DNA from goat liver. 3. Agarose gel electrophoresis for DNA. 4. Histological staining of DNA and RNA in prepared slides	60	
MS DONA BANERJEE (DB)	**SEM-I-HONS.**	**CC-1-2 TH**	**UNIT 4**	Translation Genetic code, Degeneracy of the genetic code and Wobble Hypothesis. Mechanism of protein synthesis in prokaryotes.	9	
		CC-1-2 TH	**UNIT 8**	Molecular Techniques PCR, Western and Southern Blot, Northern Blot	3	
		Molecular Biology Lab; ZOOA-CC-1-2-P		1. Demonstration of polytene and lampbrush chromosome from photograph 2. Isolation and quantification of genomic DNA from goat liver. 3. Agarose gel electrophoresis for DNA. 4. Histological staining of DNA and RNA in prepared slides	60	
	SEM-I-GENERAL	**Animal Diversity, ZOOG-CC1-1-P**		1. Identification with reasons of the following specimens: *Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris*	30	

				lumbricoides (Male and female), *Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer*, *Limulus, Apis, Chiton, Dentalium, Unio, Sepia, Octopus, Echinus, Cucumaria* and *Antedon, Balanoglossus, Branchiostoma, Petromyzon, Torpedo, Labeo rohita, Exocoetus, Salamandra, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja*, Bat, *Funambulus* 2. Key for Identification of poisonous and non-poisonous snake		
DR INDRANIL ROY (IR)	**SEM-I-HONS.**	**CC-1-1 TH**	**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; Concept of classification – three kingdom concept of Carl Woese, 1977 and five kingdom concept of Whittaker, 1969	4	
		CC-1-2 TH	**UNIT 3**	Transcription Mechanism of Transcription in prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription.	9	
	SEM-I-GENERAL	**CC-1-1 TH**	**UNIT 2**	Porifera General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Canal System in *Sycon*	2	
		CC-1-1 TH	**UNIT 7**	Arthropoda General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Eye in Cockroach, Metamorphosis in Lepidoptera	4	
		CC-1-1 TH	**UNIT 13**	Amphibia General features and Classification up to orders (Young, 1981); Parental care	4	
		CC-1-1 TH	**UNIT 16**	Mammals Classification up to orders (Young, 1981) Hair, Horn & Antler, Nail & claw	4	
		Animal Diversity,		1. Identification with reasons of the following specimens: *Amoeba, Euglena, Paramecium,*	30	

		ZOOG-CC1-1-P		*Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides* (Male and female), *Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer*, *Limulus, Apis, Chiton, Dentalium, Unio, Sepia, Octopus, Echinus, Cucumaria* and *Antedon, Balanoglossus, Branchiostoma, Petromyzon, Torpedo, Labeo rohita, Exocoetus, Salamandra, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja*, Bat, *Funambulus* 2. Key for Identification of poisonous and non-poisonous snake		
MR SOUMEN ROY (SR)		**CC-1-1 TH**	**UNIT 2**	Protista General characteristics and Classification up to phylum (according to Levine et. al., 1980) Locomotion in Euglena, Paramoecium and Amoeba; Conjugation in Paramoecium. Life cycle and pathogenicity of Plasmodium vivax and Entamoeba histolytica	12	
	SEM-I-GENERAL	**Animal Diversity, ZOOG-CC1-1-P**		3. Study of anatomy of digestive system, salivary gland, mouth parts of *Periplaneta*, Study of reproductive system of female cockroach 4. An "animal album" containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose	30	

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Semester-III:
Tentative Session Duration: September – January

NAME OF THE TEACHER	Semester/ Hons./ General	PAPER	UNIT	TOPIC ALLOTTED	HOURS	Examination
DR SUPRITI SARKAR (SS)	Sem-III Hons.	CC-3-6 TH	UNIT 6	Endocrine System 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; Placental Hormones	11	January-February (Tentative)
		CC-3-7 TH	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.	13	
		ZOOA-CC-7-3-P		1. Qualitative tests for carbohydrates, proteins and lipids 2. Qualitative estimation of Urea & Uric acid 3. Paper chromatography of amino acids. 4. Quantitative estimation of water soluble proteins following Lowry Method	60	
	Sem-III General	CC-3-3 TH	UNIT 7	Carbohydrate metabolism Glycolysis, Kreb's cycle, Glycogenesis Electron transport chain	4	
		CC-3-3 TH	UNIT 9	Protein metabolism Transamination, Deamination, Urea cycle	4	

		CC-3-3 TH	UNIT 10	Enzyme Enzyme classification, Factors affecting enzyme action, Inhibition	2	
DR DEBASISH KARMAKAR (DK)	Sem-III Hons.	CC-3-5 TH	UNIT 8	Mammals General characters and classification up to living sub classes (Young, 1981); Exoskeleton derivatives of mammals; Adaptive radiation in mammals with reference to locomotory appendages; Echolocation in Micro chiropterans	9	
		CC-3-6 TH	UNIT 1	Tissues Structure, location, classification and functions of epithelial tissue, and nervous tissue	2	
		CC-3-6 TH	UNIT 5	Reproductive System Physiology of mammalian reproduction – menstrual and oestrous cycle	3	
		SEC (A) 3-1 TH	UNIT 1	Biology of Bees *Apis* and Non-*Apis* Bee species and their identification. General Morphology of *Apis* Honey Bees Social Organization of Bee Colony	2	
		SEC (A) 3-1 TH	UNIT 3	Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures	6	
		SEC (A) 3-1 TH	UNIT 4	Bee Economy Products of Apiculture Industry and its Uses – Honey, Bees Wax, Propolis, Pollen etc.	2	
		ZOOA-CC-3-5-P		2. Dissection of brain and pituitary – ex situ, digestive and Urino-genital system of Tilapia 3. Pecten from Fowl head 4. Power point presentation on study of habit, habitat or behaviour of any one animal by student – for internal assessment only	30	
		ZOOA-CC3-6-P		4. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues		
	Sem-III General	CC-3-3 TH	UNIT 6	Reproduction & Endocrine Glands Physiology of male reproduction, Histology of testis, Hormonal control of spermatogenesis, Physiology of female reproduction, Histology of ovary, Hormonal control of	10	

				menstrual cycle, Structure and function of pituitary, thyroid, pancreas and adrenal		
		CC-3-3 TH	UNIT 1	Muscle Ultrastructure of skeletal muscle, Molecular and chemical basis of muscle contraction	4	
DR ARKADEEP MITRA (AM)	Sem-III Hons.	CC-3-6 TH	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	10	
		CC-3-7 TH	UNIT 2	Lipids Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpinoids. Lipid metabolism: β-oxidation of fatty acids - a. Palmitic acid {saturated (C 16:0)}, b. Linoleic acid {unsaturated (C 18:2)}; Fatty acid biosynthesis	7	
		CC-3-7 TH	UNIT 4	Nucleic Acids Structure of Purines, Pyrimidines, Nucleosides and Nucleotides; Nucleic Acid Metabolism: Catabolism of adenosine, Guanosine, cytosine and thymine.	10	
		ZOOA-CC-7-3-P		1. Qualitative tests for carbohydrates, proteins and lipids 2. Qualitative estimation of Urea & Uric acid 3. Paper chromatography of amino acids. 4. Quantitative estimation of water soluble proteins following Lowry Method	60	
	Sem-III General	ZOOG-CC3-3-P		1. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland. 2. Study of permanent histological sections of mammalian duodenum, liver, lung, kidney. 3. Qualitative test for carbohydrate samples.	60	
DR KRISHNENDU DAS	Sem-III Hons.	CC-3-5 TH	UNIT 6	Reptilia General characteristics and classification up to living Orders	8	

(KD)				(Young, 1981); Poison apparatus and Biting mechanism in Snake. Poisonous & Non-Poisonous snake.		
		CC-3-6 TH	**UNIT 3**	Nervous System Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and non-myelinated nerve fibres; Types of synapse, Synaptic transmission and Neuromuscular junction	10	
		SEC (A) 3-1 TH	**UNIT 5**	Entrepreneurship in Apiculture Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens; Bee Keeping Industry – Recent Efforts	6	
	Sem-III General	**CC-3-3 TH**	**UNIT 1**	Nerve Structure of a neuron, Resting membrane potential, Origin of action potential and its propagation in myelinated and non-myelinated nerve fibers,	**4**	
		CC-3-3 TH	**UNIT 2**	Digestion Physiology of digestion in the alimentary canal, Absorption of carbohydrates, proteins, lipids	**6**	
		CC-3-3 TH	**UNIT 8**	Lipid metabolism Beta oxidation of Palmitic acid {saturated (C 16:0)} and Linoleic acid {unsaturated (C 18 :2)}	**4**	
DR SAIFUL ANAM MIR (SM)	**Sem-III Hons.**	**CC-3-7 TH**	**UNIT 1**	Carbohydrates Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosaccharides; Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis	8	
		CC-3-7 TH	**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:	10	

				Transamination, Deamination, Urea cycle, Fate of C-skeleton of Glucogenic and Ketogenic amino acids		
		CC-3-7 TH	**UNIT 6**	Oxidative Phosphorylation Redox systems; Mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System	2	
		ZOOA-CC-3-5-P		1. Identification with Reasons a) Protochordata: *Balanoglossus, Branchiostoma* b) Agnatha: *Petromyzon* c) Fishes: *Scoliodon, Sphyrna, Pristis, Torpedo, Mystus, Heteropneustes, Labeo rohita, Exocoetus, Hippocampus, Anabas*, Flat fish d) Amphibia: *Necturus, Bufo (Duttaphrynus) melanostictus, Rana (Hoplobatrachus) tigerinus, Hyla, Tylototriton*, Axolotl larva e) Reptilia: Chelone, *Trionyx, Hemidactylus, Varanus, Calotes, Chamaeleon, Draco, Vipera, Naja, Hydrophis*, f) Mammalia: Bat (Insectivorous and Frugivorous), *Funambulus* (Indian Palm squirrel)	30	
		ZOOA-CC-3-5-P		2. Dissection of brain and pituitary – ex situ, digestive and Urino-genital system of Tilapia 3. Pecten from Fowl head 4. Power point presentation on study of habit, habitat or behaviour of any one animal by student – for internal assessment only	30	
		ZOOA-CC3-6-P		1. Recording of cardiac and simple muscle twitch with electrical stimulation 2. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells 3. Study of permanent slides of Mammalian Skin, Spinal cord, Pancreas, Testis, Ovary, Adrenal, Lung, pyloric stomach, cardiac stomach, Thyroid, small intestine	40	

				and large intestine of mammal (white rat)		
		ZOOA-CC3-6-P		4. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues		
MS DONA BANERJEE (DB)	**Sem-III Hons.**	**CC-3-5 TH**	**UNIT 1**	Introduction to Chordates General characteristics and outline classification of Phylum Chordata (Young, 1981)	2	
		CC-3-5 TH	**UNIT 3**	Agnatha General characteristics and classification of cyclostomes up to order (Young, 1981)	2	
		CC-3-6 TH	**UNIT 1**	Tissues Structure, location, classification and functions of connective tissue, muscular tissue	2	
		CC-3-6 TH	**UNIT 2**	Bone and Cartilage Structure and types of bones and cartilages, Ossification	4	
		CC-3-6 TH	**UNIT 5**	Reproductive System Histology of mammalian testis and ovary	3	
		CC-3-6 TH	**UNIT 6**	Endocrine System Histology and function of thyroid, pancreas and adrenal. Function of pituitary	5	
		ZOOA-CC-3-5-P		1. Identification with Reasons a) Protochordata: *Balanoglossus, Branchiostoma* b) Agnatha: *Petromyzon* c) Fishes: *Scoliodon, Sphyrna, Pristis, Torpedo, Mystus, Heteropneustes, Labeo rohita, Exocoetus, Hippocampus, Anabas*, Flat fish d) Amphibia: *Necturus, Bufo (Duttaphrynus) melanostictus, Rana (Hoplobatrachus) tigerinus, Hyla, Tylototriton*, Axolotl larva e) Reptilia: Chelone, *Trionyx, Hemidactylus,* *Varanus, Calotes, Chamaeleon, Draco, Vipera, Naja, Hydrophis*, f) Mammalia: Bat (Insectivorous and Frugivorous), *Funambulus* (Indian Palm squirrel)	30	
		ZOOA-CC3-6-P		1. Recording of cardiac and simple muscle twitch with electrical stimulation 2. Preparation of temporary	40	

				mounts: Squamous epithelium, Striated muscle fibres and nerve cells 3. Study of permanent slides of Mammalian Skin, Spinal cord, Pancreas, Testis, Ovary, Adrenal, Lung, pyloric stomach, cardiac stomach, Thyroid, small intestine and large intestine of mammal (white rat)		
	Sem-III General	**CC-3-3 TH**	**UNIT 3**	Respiration Pulmonary ventilation, Transport of oxygen and carbon-di-oxide	**6**	
		CC-3-3 TH	**UNIT 4**	Cardio-vascular system Structure of heart, Origin and conduction of cardiac impulse, Cardiac cycle Composition of blood	**6**	
		CC-3-3 TH	**UNIT 5**	Excretion Structure of nephron, Mechanism of urine formation, Counter-current mechanism	**6**	
		ZOOG-CC3-3-P		1. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland. 2. Study of permanent histological sections of mammalian duodenum, liver, lung, kidney. 3.Qualitative test for carbohydrate samples.	60	
DR INDRANIL ROY (IR)	**Sem-III Hons.**	**CC-3-5 TH**	**UNIT 2**	Protochordata General characteristics and classification of sub-phylum Urochordata and Cephalochordata up to Classes (Young, 1981). Metamorphosis in Ascidia. Chordate Features, structure of pharynx and feeding in Branchiostoma	7	
		SEC (A) 3-1 TH	**UNIT 2**	Rearing of Bees Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth box Bee Pasturage Selection of Bee Species for Apiculture; Modern Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)	14	
	Sem-III General	**SEC-A-3-1-TH**	**UNIT 2**	Rearing of Bees Bee Pasturage; Selection of	**10**	

				Bee Species for Apiculture; Bee Keeping Equipment; Methods of Extraction of Honey; Indigenous and Modern		
		SEC-A-3-1-TH	**UNIT 2**	Rearing of Bees Artificial Bee rearing; Apiary, Beehives - Newton and Langstroth	**4**	
MR SOUMEN ROY (SR)	**Sem-III Hons.**	**CC-3-5 TH**	**UNIT 4**	Pisces General characteristics and classification up to living sub classes (Young, 1981); Accessory respiratory organ, Migration in fishes; Parental care in fishes; Swim bladder in fishes.	7	
		CC-3-5 TH	**UNIT 5**	Amphibia General characteristics and classification up to living Orders (Young, 1981); Metamorphosis, Paedomorphosis, Parental care in Amphibia	7	
		CC-3-5 TH	**UNIT 7**	Aves General characteristics and classification up to living Sub-Classes (Young, 1981); Exoskeleton and migration in Birds; Principles and aerodynamics of flight	8	
	Sem-III General	**SEC-A-3-1-TH**	**UNIT 1**	Biology of Bees Classification and Biology of Honey Bees Social Organization of Bee Colony	**2**	
		SEC-A-3-1-TH	**UNIT 3**	Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures	**6**	
		SEC-A-3-1-TH	**UNIT 4**	Bee Economy Products of Apiculture Industry and its Uses ;Honey, Bees Wax, Propolis, Pollen etc	**2**	
		SEC-A-3-1-TH	**UNIT 5**	Entrepreneurship in Apiculture Bee Keeping Industry - Recent Efforts, Modern Methods in employing artificial Beehives for cross	**6**	
		ZOOG-CC3-3-P		1. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland. 2. Study of permanent histological sections of mammalian duodenum, liver, lung, kidney. 3.Qualitative test for carbohydrate samples.	60	

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Semester-V:
Tentative Session Duration: September – January

NAME OF THE TEACHER	Sem/ Hons./ General	PAPER	UNIT	TOPIC ALLOTTED	HOURS	Examination
DR SUPRITI SARKAR (SS)	**Sem-V Hons.**	**CC-5-12 TH**	**UNIT 7**	Transposable Genetic Elements IS element in bacteria, Ac-Ds elements in maize and P elements in *Drosophila,* LINE, SINE, Alu elements in humans	6	January-February (Tentative)
		DSE (B) - 5 – 1 TH	**UNIT 1**	Introduction to Endocrinology General idea of Endocrine systems, Classification, Characteristic and Transport of Hormones, Neuro-secretions and Neuro-hormones: Examples and Functions	6	
		DSE (B) - 5 – 1 TH	**UNIT 3**	Peripheral Endocrine Glands Disorders of endocrine glands (*Diabetes mellitus* type I & Type II; Graves' Disease)	2	
		DSE (B) - 5 – 1 TH	**UNIT 4**	Regulation of Hormone Action Mechanism of action of steroidal, non-steroidal hormones with receptors (cAMP, IP3-DAG), Calcium and Glucose homeostasis in mammals. Bioassays of hormones using RIA & ELISA; Estrous cycle in rat and menstrual cycle in human	12	
		ZOOA-DSE(B)-5-1-P		1. Dissect and display of Endocrine glands in laboratory bred rat. 2. Study of the permanent slides of all the endocrine glands 3. Tissue fixation, embedding in paraffin, microtomy and slide preparation of any endocrine gland. 4. H-E staining of Histological slides.	60	
	Sem-V General	**DSE-A5-2 TH**	**Unit I:**	Aquatic Bionics Brief introduction of the aquatic biomes: Freshwater ecosystem; lakes, wetlands, streams and	10	

				rivers, estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.		
DR DEBASISH KARMAKAR (DK)		**CC-5-11 TH**	**UNIT 1**	Introduction to Ecology Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere	4	
		CC-5-11 TH	**UNIT 2**	Population 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	8	
		CC-5-11 TH	**UNIT 3**	Community Community characteristics: species diversity, abundance, dominance, richness, Vertical stratification, Ecotone and edge effect; Ecological succession with one example	11	
		DSE (A) - 5 – 1 TH	**UNIT 4**	Parasitic Nematodes Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ancylostoma-duodenale*	2	
		DSE (A) - 5 – 1 TH	**UNIT 6**	Parasite Vertebrates Cookicutter Shark, Hood Mocking bird, Vampire bats their parasitic behaviour and effect on host	2	
		ZOOA-CC5-11-P		1. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community 2. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO2 3. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary/ any place of ecological interest/ ecological uniqueness/ Zoological garden	60	
	Sem-V	**DSE-A5-**	**Unit 2:**	Freshwater Biology	15	

	General	**2 TH**		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.		
		ZOOG-DSE-A-5-2-P		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 dissolved Oxygen, and free Carbon dioxide, in water collected from a nearby lake / water body. 4. Visit to any aquatic Ecosystem and preparation and submission of report	60	
DR ARKADEEP MITRA (AM)	**Sem-V Hons.**	**CC-5-12 TH**	**UNIT 2**	Linkage, Crossing Over and Linkage Mapping Linkage and Crossing, Complete & Incomplete Linkage, Measuring Recombination frequency and linkage map construction using three factor crosses, Interference and coincidence Sex linkage in *Drosophila* (White eye locus) & Human (Haemophilia)	8	
		CC-5-12 TH	**UNIT 5**	Extra-chromosomal Inheritance Kappa particle in *Paramoecium,* Shell spiralling in snail	2	
		CC-5-12 TH	**UNIT 6**	Genetic Fine Structure Complementation test in Bacteriophage (Benzer's experiment on rII locus)	2	
		DSE (B)	**UNIT 2**	Hypothalamo-Hypophyseal Axis	6	

		- 5 – 1 TH		Structure and functions of hypothalamus and Hypothalamic nuclei, Regulation of neuroendocrine glands, Feedback mechanisms,		
		DSE (B) - 5 – 1 TH	**UNIT 5**	Non Mammalian Vertebrate Hormone Functions of Prolactin in Fishes, Amphibia & Birds Function of Melanotropin in Teleost fishes, Amphibians and Reptiles	8	
		ZooA-CC5-12-P		1. Chi-square analyses for genetic ratio test 2. Identification of chromosomal aberration in *Drosophila* and man from photograph 3. Pedigree analysis of some inherited traits in animals	60	
DR KRISHNENDU DAS (KD)		**CC-5-11 TH**	**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	12	
		DSE (A) - 5 – 1 TH	**UNIT 1**	Introduction to Parasitology Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector); Host parasite relationship	2	
		DSE (A) - 5 – 1 TH	**UNIT 4**	Parasitic Nematodes Nematode plant interaction; Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris-lumbricoides*, *Wuchereria bancrofti*	9	
		ZOOA-DSE(A)-5-1-P		1. Study of life stages of *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani,* *Plasmodium vivax, Plasmodium falciparum* through permanent slides/micro photographs 2. Study of adult and life stages of *Schistosoma haematobium*,	60	

				Taenia solium through permanent slides/micro photographs 3. Study of adult and life stages of *Ancylostoma duodenale* through permanent slides/micro photographs. 4. Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry] 5. Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a by-product] & Goat		
DR SAIFUL ANAM MIR (SM)		**CC-5-12 TH**	**UNIT 3**	Mutations Types of gene mutations (Classification), Types of chromosomal aberrations (Classification with one suitable example from *Drosophila* and Human of each), variation in chromosome number; Nondisjunction of X chromosome in *Drosophila*; Non-disjunction of Human Chromosome 21. Molecular basis of mutations in relation to UV light and chemical mutagens. Mutation detection in *Drosophila* by attached X method. Biochemical mutation detection in *Neurospora*	12	
		DSE (B) - 5 – 1 TH	**UNIT 2**	Hypothalamo-Hypophyseal Axis Hypothalamo-Hypophyseal-Gonadal Axis. Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophyseal portal system	6	
		DSE (B) - 5 – 1 TH	**UNIT 3**	Peripheral Endocrine Glands Structure, Hormones and Functions of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis	10 **TOTAL 28**	
		ZOOA-DSE(A)-5-1-P		1. Study of life stages of *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani*, *Plasmodium vivax, Plasmodium*	60	

				falciparum through permanent slides/micro photographs 2. Study of adult and life stages of *Schistosoma haematobium*, *Taenia solium* through permanent slides/micro photographs 3. Study of adult and life stages of *Ancylostoma duodenale* through permanent slides/micro photographs. 4. Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry] 5. Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a by-product] & Goat		
	Sem-V General	**DSE-A5-2 TH**	**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	15	
		ZOOG-DSE-A-5-2-P		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 dissolved Oxygen, and free Carbon dioxide, in water collected from a nearby lake / water body. 4. Visit to any aquatic Ecosystem and preparation and submission of report	60	
MS DONA BANERJEE (DB)		**CC-5-11 TH**	**UNIT 5**	Applied Ecology Types & level of biodiversity Mega-diversity countries, Biodiversity Hot spot, Flagship species, Keystone species,	8	

				Wildlife Conservation (*in situ* and *ex situ* conservation), concept of protected Areas. Red data book, Indian wild life act & Schedule. Concept of corridor, advantages and Problem of corridor. Threats to survival and conservation strategies for Tiger, Olive ridley, White Rumped Vulture		
		CC-5-12 TH	**UNIT 4**	Sex Determination Mechanisms of sex determination in *Drosophila* and in man; Dosage compensation in *Drosophila* & Human	8	
		DSE (A) - 5 – 1 TH	**UNIT 3**	Parasitic Platyhelminthes Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Schistosoma haematobium*, *Taenia-solium*	12	
DR INDRANIL ROY (IR)		**CC-5-12 TH**	**UNIT 1**	Mendelian Genetics and its Extension Principles of inheritance, Incomplete dominance and co-dominance, Epistasis, Multiple alleles, Isoallele (White eye mutations), Pseudoallele (Lozenge Locus) & Cis-trans test for allelism, Lethal alleles, Pleiotropy, Penetrance & Expressivity	12	
		DSE (A) - 5 – 1 TH	**UNIT 5**	Parasitic Arthropods Biology, importance and control of ticks: Soft tick (*Ornithodoros),* Hard tick (*Ixodes*), mites (*Sarcoptes*), Lice (*Pediculus*); Biology, importance and control of Flea (*Xenopsylla*) and Bug (*Cimex*). Parasitoid	10	
		ZOOA-CC5-11-P		1. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community 2. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical	60	

				Oxygen Demand and free CO2 3. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary/ any place of ecological interest/ ecological uniqueness/ Zoological garden		
MR SOUMEN ROY (SR)	**Sem-V Hons.**	**CC-5-11 TH**	**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, Ecological pyramids and Ecological efficiencies; Nitrogen cycle	8	
		DSE (A) - 5 – 1 TH	**UNIT 2**	Parasitic Protists Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania-donovani*	12 **TOTAL 20**	
		ZOOA-DSE(B)-5-1-P		1. Dissect and display of Endocrine glands in laboratory bred rat. 2. Study of the permanent slides of all the endocrine glands 3. Tissue fixation, embedding in paraffin, microtomy and slide preparation of any endocrine gland. 4. H-E staining of Histological slides.	60	
	Sem-V General	**DSE-A5-2 TH**	**Unit 3**	Marine Biology Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.	10	

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DEPARTMENT OF ZOOLOGY
CITY COLLEGE
LESSON PLAN FOR UNDERGRADUATE COURSE
ACADEMIC YEAR 2021-2022

Semester-II:
Tentative Session Duration: March – July

NAME OF THE TEACHER	Sem/ Hons./ General	PAPER	UNIT	TOPIC ALLOTTED	HOURS	Examination
DR. SUPRITI SARKAR (SS)	**Sem-II Hons.**	**CC-2-3 PR**	**UNIT 1a, 1b, 1c & 1d**	1. Study of following specimens: a. Annelids - *Aphrodite, Nereis, Chaetopterus,* Earthworm, *Hirudinaria* b. Arthropods - *Limulus, Palaemon, Balanus, Eupagurus, Scolopendra, Peripatus*, Silkworm – life history stages, Termite – members of a colony and Honey bee – members of the colony c. Molluscs - *Dentalium, Patella, Chiton, Pila, Achatina, Pinctada, Sepia, Octopus, Nautilus* d. Echinoderms - *Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon*	30	July-August (Tentative)
DR DEBASISH KARMAKAR (DK)	**Sem-II Hons.**	**CC-2-3 TH**	**UNIT 3**	Arthropoda Respiration in Prawn and Cockroach; Metamorphosis in Lepidopteran Insects; Social life in Termite	10	
		CC-2-3 TH	**UNIT 4**	Onychophora General characteristics and Evolutionary significance	2	
		CC-2-3 PR	**UNITS 2**	2. Anatomy study: Nervours system, Reproductive system (Male & female), Mouth parts & Salivary apparatus in Periplaneta sp.		
	SEM-II General	**CC-2-2 TH**	**UNIT 2**	Digestive System Stomach and Dentition	4	
		CC-2-2 TH	**UNIT 3**	Respiratory System Brief account of Gills, lungs, air sacs and swim bladder	6	

		CC-2-2 TH	**UNIT 4**	Circulatory System Evolution of heart	3	
DR ARKADEEP MITRA (AM)	**Sem-II Hons.**	**CC-2-3 TH**	**UNIT 5**	Mollusca Feeding in Pila sp.	2	
		CC-2-4 TH	**UNIT 5**	Nucleus Nuclear envelope, Nuclear pore complex, Nucleolus; Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome)	8	
		CC-2-4 TH	**UNIT 7**	Cell Signalling Apoptosis	2	
		CC-2-4 PR	**UNITS 1 & 4**	1. Preparation of temporary stained squash of onion/arum root tip to study various stages of mitosis 4. Preparation of permanent slide to demonstrate: a. DNA by Feulgen reaction b. Cell viability study by Trypan Blue staining		
DR KRISHNENDU DAS (KD)	**Sem-II Hons.**	**CC-2-3 TH**	**UNIT 5**	Mollusca Nervous system in Pila sp. Torsion in Gastropoda.	4	
		CC-2-3 TH	**UNIT 6**	Echinodermata General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Watervascular system in Asterias. Echinoderm larva and affinities with chordates	8	
		CC-2-3	**UNIT 7**	Hemichordata General characteristics of phylum Hemichordata. Relationship with non-chordates and chordates	2	
		CC-2-3 PR	**UNITS 2**	2. Anatomy study: Nervours system, Reproductive system (Male & female), Mouth parts & Salivary apparatus in Periplaneta sp.		
	Sem-II General	**CC-2-2 TH**	**UNIT 6**	Early Embryonic Development Fertilization: Sea-Urchin; Early development of frog; structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula; types of morphogenetic movements; Fate of germ layers	10	
		CC-2-2 TH	**UNIT 7**	Late Embryonic Development Placenta types and function	2	
		CC-2-2 PR	**ALL UNITS**	1. Osteology: Limb bones, girdle and vertebra of Pigeon & Guineapig, Mammalian skulls: One herbivorous; Guinea pig and one carnivorous;	60	

				Dog. 2. Larval stages: Veliger, Nauplius, Trochophore, Mysis. 3. Study of the different types of placenta- histological sections through photomicrographs. 4. Developmental stages of chick embryo: 24 Hrs., 48 Hrs, 72 Hrs., 96 Hrs		
DR SAIFUL ANAM MIR (SM)	**Sem-II Hons.**	**CC-2-4 TH**	**UNIT 1**	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	7	
		CC-2-4 TH	**UNIT 3**	Cytoplasmic Organelles II Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemiosmotic hypothesis; Peroxisomes: Structure and Functions; Centrosome (Kinetochore and Centromeric DNA): Structure and Function	7	
		CC-2-4 PR	**UNIT 2 & 3**	2. Study of various stages of meiosis from grasshopper testis 3. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.		
	Sem-II General	**CC-2-2 TH**	**UNIT 6**	Early Embryonic Development Gametogenesis: Spermatogenesis and oogenesis with respect to mammals	4	
		CC-2-2 TH	**UNIT 7**	Late Embryonic Development Metamorphic events in frog life cycle and its hormonal regulation	8	
MS DONA BANERJEE (DB)	**Sem-II Hons.**	**CC-2-3 TH**	**UNIT 1**	Introduction Evolution of Coelom	2	
		CC-2-4 TH	**UNIT 2**	Cytoplasmic Organelles I Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes; Protein sorting and mechanisms of vesicular transport	5	
		CC-2-4 TH	**UNIT 6**	Cell Cycle Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma	4	

				and Ras		
	Sem-II General	**CC-2-2 PR**	**ALL UNITS**	1. Osteology: Limb bones, girdle and vertebra of Pigeon & Guineapig, Mammalian skulls: One herbivorous; Guinea pig and one carnivorous; Dog. 2. Larval stages: Veliger, Nauplius, Trochophore, Mysis. 3. Study of the different types of placenta- histological sections through photomicrographs. 4. Developmental stages of chick embryo: 24 Hrs., 48 Hrs, 72 Hrs., 96 Hrs	60	
DR INDRANIL ROY (IR)	**Sem-II Hons.**	**CC-2-3 TH**	**UNIT 3**	Arthropoda General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Insect Eye (Cockroach only)	6	
		CC-2-3 TH	**UNIT 5**	Mollusca Respiration in Pila sp.	2	
		CC-2-4 TH	**UNIT 6**	Cell Cycle Cell cycle and its regulation	3	
	Sem-II General	**CC-2-2 TH**	**UNIT 1**	Integumentary System Derivatives of integument with respect to glands in Birds & Mammals	4	
		CC-2-2 TH	**UNIT 4**	Circulatory System Evolution aortic arches	3	
		CC-2-2 TH	**UNIT 5**	Urino-genital System Succession of kidney, Evolution of urino-genital ducts	6	
		CC-2-2 PR	**ALL UNITS**	1. Osteology: Limb bones, girdle and vertebra of Pigeon & Guineapig, Mammalian skulls: One herbivorous; Guinea pig and one carnivorous; Dog. 2. Larval stages: Veliger, Nauplius, Trochophore, Mysis. 3. Study of the different types of placenta- histological sections through photomicrographs. 4. Developmental stages of chick embryo: 24 Hrs., 48 Hrs, 72 Hrs., 96 Hrs	60	
DR SOUMEN ROY (SR)	**Sem-II Hons.**	**CC-2-3 TH**	**UNIT 2**	Annelida General characteristics and Classification up to classes (Ruppert and Barnes, 1994)	10	

				Excretion in Annelida through nephridia; Metamerism in Annelida.		
		CC-2-3 TH	**UNIT 5**	Mollusca General characteristics and Classification up to classes (Ruppert and Barnes, 1994);	2	
	Sem-II General	**CC-2-2 PR**	**ALL UNITS**	1. Osteology: Limb bones, girdle and vertebra of Pigeon & Guineapig, Mammalian skulls: One herbivorous; Guinea pig and one carnivorous; Dog. 2. Larval stages: Veliger, Nauplius, Trochophore, Mysis. 3. Study of the different types of placenta- histological sections through photomicrographs. 4. Developmental stages of chick embryo: 24 Hrs., 48 Hrs, 72 Hrs., 96 Hrs	60	
DR INDRANATH GHOSAL (IG)	**Sem-II Hons.**	**CC-2-4 TH**	**UNIT 4**	Cytoskeleton Type, structure and functions of cytoskeleton; Accessory proteins of microfilament & microtubule	5	
		CC-2-4 TH	**UNIT 7**	Cell Signalling Cell signalling transduction pathways; Types of signalling molecules and receptors (Classification and Example only): RTK & JAK/STAT	6	
		CC-2-4 TH	**UNIT 6**	Cell Cycle Process of Proto-oncogene activation	3	
	Sem-II General	**CC-2-2 PR**	**ALL UNITS**	1. Osteology: Limb bones, girdle and vertebra of Pigeon & Guineapig, Mammalian skulls: One herbivorous; Guinea pig and one carnivorous; Dog. 2. Larval stages: Veliger, Nauplius, Trochophore, Mysis. 3. Study of the different types of placenta- histological sections through photomicrographs. 4. Developmental stages of chick embryo: 24 Hrs., 48 Hrs, 72 Hrs., 96 Hrs	60	

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Semester-IV:
Tentative Session Duration: March – July

NAME OF THE TEACHER	Sem/ Hons./ General	PAPER	UNIT	TOPIC ALLOTTED	HOURS	Examination
DR SUPRITI SARKAR (SS)	Sem-IV Hons.	CC-4-9 TH	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	8	June-July (Tentative)
		CC-4-10 TH	UNIT 1	Overview of Immune System Introduction – concept of health and disease; Cells and organs of the Immune system	3	
		CC-4-10	UNIT 2	Innate and Adaptive Immunity Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity	4	
		CC-4-10	UNIT 5	Major Histocompatibility Complex Structure and functions of MHC molecules; Structure of T cell Receptor and its signalling, T cell development & selection	6	
		CC-4-9 PR	UNIT 3	Identification of blood cells from human blood	2	
		CC-4-10 PR	UNIT 1	Demonstration of lymphoid organs (by picture).	2	
		CC-4-10 PR	UNIT 2	Histological study of Bursa fabricius, spleen, thymus and lymph nodes through slides/ photographs	4	
		CC-4-9 PR	UNIT 1	Determination of ABO Blood group	2	
		CC-4-9 PR	UNIT 2	Estimation of haemoglobin using Sahli's haemoglobin meter	2	
		CC-4-10 PR	UNIT 3	Demonstration of ELISA	2	
DR DEBASISH KARMAKAR (DK)	Sem-IV Hons.	CC-4-8 TH	UNIT 2	Digestive System Comparative anatomy of Stomach Dentition in mammals	6	
		CC-4-8 TH	UNIT 6	Nervous System and Sense Organs	6	

				Comparative account of Brain in vertebrates (only Cerebellum and Cerebrum); Comparative account of cranial nerves (only Origin and distribution);		
		SEC (B) 4-1 TH	**UNIT 2**	Biology of Aquarium Fishes Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish	10	
		SEC (B) 4-1 TH	**UNIT 4**	Fish Transportation Live fish transport - Fish handling, packing and forwarding techniques	5	
		CC-4-9 PR	**UNIT 4**	Preparation of haemin crystals and haemochromogen crystals		
		CC-4-9 PR	**UNIT 5**	Identification of blood cells from cockroach haemolymph		
		CC-4-9 PR	**UNIT 6**	Demonstration of blood pressure by digital meter		
	Sem-IV General	**SEC-B-4-2 TH**	**UNIT 3**	**Food and Feeding of Aquarium Fishes** Use of live fish feed organisms	4	
		SEC-B-4-2 TH	**UNIT 4**	**Fish Transportation** Live fish transport - Fish handling, packing and forwarding techniques	**5**	
		SEC-B-4-2 TH	**UNIT 5**	**Maintenance of Aquarium** General Aquarium maintenance - budget for setting up an Aquarium Fish Farm as a Cottage Industry	**5**	
DR ARKADEEP MITRA (AM)	**Sem-IV Hons.**	**CC-4-8 TH**	**UNIT 4**	Circulatory system General plan of circulation, comparative account on heart and aortic arches	7	
		CC-4-9 TH	**UNIT 4**	Physiology of Heart Coronary Circulation, Structure and working of conducting myocardial fibres, Origin and conduction of cardiac impulses; Cardiac Cycle and cardiac output	8	
		CC-4-10 TH	**UNIT 4**	Immunoglobulins Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays (ELISA and RIA), Monoclonal antibody production.	10	
		CC-4-9 PR	**UNIT 4**	Preparation of haemin crystals and haemochromogen crystals		

		CC-4-9 PR	**UNIT 5**	Identification of blood cells from cockroach haemolymph		
		CC-4-9 PR	**UNIT 6**	Demonstration of blood pressure by digital meter		
	Sem-IV General	**CC-4-4 TH**	**UNIT 2**	**Linkage, Crossing Over** Linkage and crossing over, Complete & Incomplete Linkage, Recombination frequency as a measure of linkage intensity. Holiday Model	**8**	
		CC-4-4 TH	**UNIT 7**	**Process of Evolutionary Changes** Isolating mechanism, Natural Selection	**4**	
		CC-4-4 TH	**UNIT 8**	**Speciation** Sympatric, Allopatric, Parapatric	**4**	
		CC-4-4 PR		1. Verification of Mendelian Ratio using Chi square test. 2. Identification of Human Aneuploidy using photo graph of karyotype.		
DR KRISHNENDU DAS (KD)	**Sem-IV Hons.**	**CC-4-8 TH**	**UNIT 5**	Urino-genital System Succession of kidney in different vertebrate groups, evolution of urino-genital ducts	5	
		CC-4-9 TH	**UNIT 1**	Physiology of Digestion Mechanical and chemical digestion of food, absorption of Carbohydrates, Lipids and Proteins in Human	7	
		CC-4-9 TH	**UNIT 6**	Renal Physiology Structure of Kidney and its functional unit, Mechanism of urine formation, Regulation of acid base balance in human.	8	
		CC-4-10 TH	**UNIT 2**	Innate and Adaptive Immunity Adaptive immunity (Cell mediated and humoral)	5	
		CC-4-10 TH	**UNIT 9**	Vaccines Various types of vaccines. Active & passive immunization (Artificial and natural)	4	
		CC-4-8 PR	**UNIT 1**	Preparation and staining of placoid, Cycloid and Ctenoid scales.		
		CC-4-8 PR	**UNIT 2**	Study of disarticulated skeleton of toad, Pigeon, Guineapig (limb bones, vertebrae, limb and girdle)		
		CC-4-8 PR	**UNIT 3**	Comparative study of brain in Shark, Channa, Toad, calotes, Pigeon and Rat/Guinea pig with the help of model/picture.		

		CC-4-8 PR	**UNIT 4**	Identification of skulls: Pigeon, one herbivore (Guineapig) and one carnivore (Dog) animal		
		CC-4-9 PR	**UNIT 3**	Identification of blood cells from human blood		
		CC-4-10 PR	**UNIT 1**	Demonstration of lymphoid organs (by picture).		
		CC-4-10 PR	**UNIT 2**	Histological study of Bursa fabricius, spleen, thymus and lymph nodes through slides/ photographs		
DR SAIFUL ANAM MIR (SM)	**Sem-IV Hons.**	**CC-4-9 TH**	**UNIT 5**	Thermoregulation & Osmoregulation Thermal regulation in camel and polar bear, Osmoregulation in aquatic vertebrates	6	
		CC-4-10 TH	**UNIT 8**	Hypersensitivity Gell and Coombs' classification and brief description of various types of hypersensitivities	4	
		SEC (B) 4-1 TH	**UNIT 1**	Introduction to Aquarium Fish Keeping The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes	2	
		SEC (B) 4-1 TH	**UNIT 3**	Food and Feeding of Aquarium Fishes Use of live fish feed organisms. Preparation and composition of formulated fish feeds, Aquarium fish as larval predator	8	
		SEC (B) 4-1 TH	**UNIT 5**	Maintenance of Aquarium General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry	5	
		CC-4-9 PR	**UNIT 1**	Determination of ABO Blood group		
		CC-4-9 PR	**UNIT 2**	Estimation of haemoglobin using Sahli's haemoglobin meter		
		CC-4-10 PR	**UNIT 3**	Demonstration of ELISA		
	Sem-IV General	**CC-4-4 TH**	**UNIT 1**	**Mendelian Genetics and its Extension** Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, lethal alleles, sex linked inheritance in Drosophila	**10**	

				(White eye locus) & Human (Thalassemia)		
MS DONA BANERJEE (DB)	**Sem-IV Hons.**	**CC-4-8 TH**	**UNIT 7**	Skeletal System Jaw suspension in mammals	4	
		CC-4-10 TH	**UNIT 3**	Antigens Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes	6	
		CC-4-10 TH	**UNIT 7**	Complement System Components and pathways of complement activation	5	
		CC-4-8 PR	**UNIT 1**	Preparation and staining of placoid, Cycloid and Ctenoid scales.		
		CC-4-8 PR	**UNIT 2**	Study of disarticulated skeleton of toad, Pigeon, Guineapig (limb bones, vertebrae, limb and girdle)		
		CC-4-8 PR	**UNIT 3**	Comparative study of brain in Shark, Channa, Toad, calotes, Pigeon and Rat/Guinea pig with the help of model/picture.		
		CC-4-8 PR	**UNIT 4**	Identification of skulls: Pigeon, one herbivore (Guineapig) and one carnivore (Dog) animal		
	Sem-IV General	**CC-4-4 TH**	**UNIT 3**	**Mutation** Chromosomal mutation, Deletion, duplication, inversion, translocation, aneuploidy, gene mutation, induced mutation, types & example	**8**	
		CC-4-4 TH	**UNIT 4**	**Sex Determination** Genic Balance theory and dosage compensation in *Drosophila*	**8**	
DR INDRANIL ROY (IR)	**Sem-IV Hons.**	**CC-4-8 TH**	**UNIT 7**	Skeletal System Overview of axial and appendicular skeleton – limbs, girdles of pigeon	4	
		CC-4-9 TH	**UNIT 3**	Physiology of Circulation Structure of haemoglobin; Blood clotting system; Haematopoiesis; Basic steps and its regulation; Blood groups; ABO and Rh factor	8	
DR SOUMEN ROY (SR)	**Sem-IV Hons.**	**CC-4-8 TH**	**UNIT 3**	Respiratory System Respiratory organs-Gill morphology in fish, Air sacs in birds and Lungs in mammals.	6	
		CC-4-8 TH	**UNIT 6**	Nervous System and Sense Organs Olfactory receptors in fish and Auditory receptors in man.	2	
		CC-4-9	**UNIT 1**	Physiology of Digestion	3	

				Physiological zonation and function of gastro-intestinal tract.		
		CC-4-9 TH	**UNIT 2**	Physiology of Respiration Respiratory pigments; Carbon monoxide poisoning	2	
	Sem-IV General	**SEC-B-4-2 TH**	**UNIT 2**	**Biology of Aquarium Fishes** Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish	**10**	
		SEC-B-4-2 TH	**UNIT 3**	**Food and Feeding of Aquarium Fishes** Preparation and composition of formulated fish feeds.	**4**	
		CC-4-4 PR		3. Phylogeny of horse with diagram of limb and skull. 4. Study and identification of Darwin Finches from photographs. 5. Visit to natural history museum and submission of report.		
DR INDRANATH GHOSAL (IG)	**Sem-IV Hons.**	**CC-4-8 TH**	**UNIT 1**	Integumentary System Structure, function and derivatives of integument in Birds and Mammals	10	
		CC-4-10 TH	**UNIT 6**	Cytokines Types, properties and functions of cytokines	3	
		CC-4-4 PR		3. Phylogeny of horse with diagram of limb and skull. 4. Study and identification of Darwin Finches from photographs. 5. Visit to natural history museum and submission of report.		

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Semester-VI:
Tentative Session Duration: March – July

NAME OF THE TEACHER	Sem/ Hons/ General	PAPER	UNIT	TOPIC ALLOTTED	HOURS	Examination
DR SUPRITI SARKAR (SS)	Sem-VI Hons.	CC-6-13 TH	UNIT 3	Post Embryonic Development Development of brain and Eye in Chick. Molecular Induction in Brain and Eye development	8	June- July (Tentative)
		DSE (A) - 6 – 2 TH	UNIT 2	Molecular Techniques in Gene manipulation Construction of Genomic libraries and cDNA libraries Transformation techniques: Cloning in bacteria and detection technique of clone	6	
		DSE (A) - 6 – 2 TH	UNIT 3	Genetically Modified Organisms Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock-out mice	6	
		DSE (B) - 6 – 1 TH	UNIT 3	Chronobiology and Biological Rhythm Role of melatonin. Biological clock and its adaptive significance; Photic and non-photic zeitgebers;	7	
DR DEBASISH KARMAKAR (DK)	Sem-VI Hons.	CC-6-14 TH	UNIT 5	Species concept, Isolating mechanisms, modes of speciation; Adaptive radiation/macroevolution (exemplified by Galapagos finches)	7	
		CC-6-14 TH	UNIT 6	Origin and Evolution of Man, Unique Hominid characteristics contrasted with primate characteristic	2	
		CC-6-14 TH	UNIT 8	Extinction, back ground and mass extinctions, detailed example of K-T extinction	3	
		DSE (B) - 6 – 1 TH	UNIT 2	Social and Sexual Behaviour Sexual Behaviour: Sexual dimorphism, Mate choice in peacock, Intra-sexual selection (male rivalry in red deer) Kinship theory: Relatedness &	10	

				inclusive fitness; parental care in fishes (Nest Building & coast benefit), conflict within families: parent offspring conflict and sibling rivalry		
	Sem-VI General	DSE-B6-2 TH	**Unit 2**	Population dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns,	8	
		DSE-B6-2 TH	**Unit 5**	Wild Life Wildlife Conservation (in-situ and ex-situ conservation): Necessity for wildlife conservation; National parks & sanctuaries, Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve	5	
		DSE-B6-2 PR	**ALL UNITS**	1. Identification of flora, mammalian fauna, avian 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. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical OxygenDemand and free CO2		
DR ARKADEEP MITRA (AM)	**Sem-VI Hons.**	**CC-6-14 TH**	**UNIT 7**	Population genetics: Hardy-Weinberg Law; factors disrupting H-W equilibrium (Genetic Drift, Migration and Mutation and Selection in changing allele frequencies (only derivations required). Simple problems related to estimation of allelic and gene frequencies	9	
		CC-6-14 TH	**UNIT 9**	Phylogenetic trees, construction and interpretation of Phylogenetic tree using parsimony,	5	

				convergent and divergent evolution		
		DSE (A) - 6 – 2 TH	**UNIT 2**	Molecular Techniques in Gene manipulation Recombinant DNA technology, Restriction endonucleases. Cloning Vectors & their features: Plasmids, Phage vectors, Cosmids, Phagemids, BAC, YAC, and HAC. Shuttle and Expression Vectors	10	
		DSE (A) - 6 – 2 TH	**UNIT 3**	Culture Techniques and Applications Dolly &Polly cloning Genetically modified economically important animal Gene Therapy	5	
		DSE-A-6-2 PR	**UNIT 1**	Genomic DNA isolation from E. coli and Plasmid DNA isolation (pUC 18/19) from E. coli		
		CC-6-13 PR	**UNIT 3**	Study of different sections of placenta (photomicropgraph/ slides)		
		CC-6-14 PR	**UNIT 3**	Phylogenetic trees, Construction & interpretation of Phylogenetic tree using parsimony, Construction of dendrogram following principles of phenetics & cladistics from a data table.		
	Sem-VI General	**DSE-B6-2 PR**	**ALL UNITS**	1. Identification of flora, mammalian fauna, avian 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. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical OxygenDemand and free CO2		
DR KRISHNENDU DAS (KD)	**Sem-VI Hons.**	**CC-6-13 TH**	**UNIT 1**	Early Embryonic Development Gametogenesis: Spermatogenesis, Oogenesis (sea urchin & mammal); Types of eggs, Egg membranes; Fertilization in sea	10	

				urchin and mammal; Planes and patterns of cleavage		
		DSE (A) - 6 – 2 TH	**UNIT 3**	Culture Techniques and Applications Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anaemia, Thalassemia)	5	
		DSE (B) - 6 – 1 TH	**UNIT 3**	Chronobiology and Biological Rhythm Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms, Circannual rhythms	10	
DR SAIFUL ANAM MIR (SM)	**Sem-VI Hons.**	**CC-6-13 TH**	**UNIT 1**	Early Embryonic Development Types of Blastula [frog and chick]; Fate map in chick embryo, fate mapping using vital dye and radioactive technique; Gastrulation in frog and chick; Embryonic induction and organizers in *Xenopus* (Spemann & Mangold's experiment)	10	
		CC-6-14 TH	**UNIT 1**	Origin of Life (Chemical basis), RNA world hypothesis	5	
		CC-6-14 TH	**UNIT 5**	Speciation by chromosome rearrangement in *Drosophila*	2	
		DSE (A) - 6 – 2 TH	**UNIT 2**	Agarose and Polyacrylamide Gel Electrophoresis, Southern, Northern and Western blotting, Polymerase chain reaction: Allele specific, RAPD & RT PCR, DNA Fingerprinting	7	
		CC-6-13 PR	**UNIT 2**	Study of the developmental stages and life cycle of Drosophila		
		CC-6-13 PR	**UNIT 4**	Identification of Invertebrate larva through slides/ photographs of Phylum Annelida, Arthropoda, Mollusca and Echinodermata		
		DSE-A-6-2 PR	**UNIT 2**	To study following techniques through photographs - Southern Blotting, Northern Blotting, Western Blotting, PCR, DNA fingerprinting		
	Sem-VI General	DSE-B6-2 TH	**Unit 1**	Introduction to Ecology Ecosystem, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of	4	

				Physical factors, The Biosphere		
		DSE-B6-2 TH	**Unit 2**	Population regulation: density-dependent and independent factors	2	
		DSE-B6-2 TH	**Unit 4**	Ecosystem Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies	5	
		DSE-B6-2 PR	**ALL UNITS**	1. Identification of flora, mammalian fauna, avian 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. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical OxygenDemand and free CO2		
MS DONA BANERJEE (DB)	**Sem-VI Hons.**	**CC-6-13 TH**	**UNIT 4**	Implications of Developmental Biology Stem cell: Concept of potency, types, markers and applications of stem cell therapy in bone marrow transplantation and cartilage regeneration	8	
		DSE (B) - 6 – 1 TH	**UNIT 2**	Social and Sexual Behaviour Social organisation in termites; Communication (dance & pheromones in Bees) Social behaviour: Altruism (Hamilton's rule and concept of haplodiploidy); Cooperation and Selfishness	10	
DR INDRANIL ROY (IR)	**Sem-VI Hons.**	**CC-6-14 TH**	**UNIT 2**	Historical review of Evolutionary concepts: Lamarkism, Darwinism and Neo Darwinism	5	
		CC-6-14 TH	**UNIT 3**	Geological time scale, Fossil: types and age determination by Carbon dating, Evolution of horse	6	
		CC-6-14	**UNIT 4**	Natural Selection: Modes with	6	

		TH		Examples		
		DSE (A) - 6 – 2 TH	**UNIT 1**	Introduction Organization of *E. coli* and *Drosophila* genome	5	
		DSE (B) - 6 – 1 TH	**UNIT 3**	Chronobiology and Biological Rhythm Circannual rhythm in bird migration.	3	
	Sem-VI General	DSE-B6-2 TH	**Unit 4**	Ecosystem Types of ecosystem with an example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains,	5	
		DSE-B6-2 TH	**Unit 2**	Population Attributes of population: Life tables, fecundity tables, survivorship curves,	10	
DR SOUMEN ROY (SR)	**Sem-VI Hons.**	**CC-6-13 TH**	**UNIT 2**	Late Embryonic Development Extra-embryonic membranes in Chick; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)	10	
		CC-6-13 TH	**UNIT 4**	Implications of Developmental Biology *In vitro* fertilization (IVF)	4	
DR INDRANATH GHOSAL (IG)	**Sem-VI Hons.**	**DSE (A) - 6 – 2 TH**	**UNIT 3**	Genetically Modified Organisms Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection	6	
		DSE (B) - 6 – 1 TH	**UNIT 1**	Patterns of Behaviour Stereotyped Behaviours (Orientation, Reflex); Individual Behavioural patterns; Instinct vs. Learned Behaviour; FAP, Associative learning, classical and operant conditioning, Habituation, Imprinting.	10	
	Sem-VI General	DSE-B6-2 TH	**Unit 3**	Community Community characteristics: species diversity, abundance, dominance, richness, Vertical stratification, Ecotone and edge effect	11	
		DSE-B6-2 PR	**ALL UNITS**	1. Identification of flora, mammalian fauna, avian 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. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO_2		

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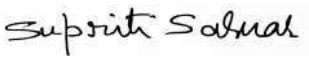

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