Academic Calendar

SCIENCE

2023-2024

Bangabasi Morning College

19, Rajkumar Chakraborty Sarani, kolkata - 700009
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Academic Calendar
2023-2024
Department of Zoology

PART I: SEMESTER 1 (under NEP)		
CORE COURSE-1: Cell Biology Major/Minor/MDC: CC1		
3 Credits	**50 Hours**	
Full Marks 75		
First Semester: July- December		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Plasma Membrane Structure of the Plasma Membrane: Lipid Bilayer (Phospholipids and Cholesterol), Peripheral and Integral Membrane proteins, Glycolipids and Glycoproteins (basic concept of Glycocalyx), Fluid Mosaic Model with special reference to Lipid rafts, Mobility of membrane lipids (FRAP assay) and Mobility of Membrane Proteins (Frye-Edidin Experiment); Cell-cell junctions; Transport through plasma membrane.	**S. Biswas**	**7**
Unit 2: Cytoplasmic organelles I Basic concepts on Ultrastructure of ER, Golgi and Lysosome; Overview of Protein sorting; ER Morphology, Targeting proteins to ER, The Signal hypothesis; Insertion of proteins into ER membrane, Protein folding and processing in ER, Export of proteins and lipids from ER; Golgi Apparatus; Morphology, Protein glycosylation within Golgi, Protein sorting and export from Golgi apparatus; Mechanism of Vesicular Transport: Cargo selection, coat proteins and vesicle budding, Vesicle fusion.; Lysosome: Polymorphism, Lysosomal acid hydrolases, Endocytosis and lysosome formation.	**S. Hansda**	**8**
Unit 3: Cytoplasmic organelles II Mitochondria: Structure, Semi-autonomous nature, Mitochondrial DNA, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemiosmotic hypothesis and Oxidative Phosphorylation with reference to ATP Synthase and ATP synthesis Peroxisomes: Structure and Functions; Centrosome and its organization.	**P. Bhowmick**	**5**
Unit 4: Cytoskeleton Structure and Types: Microtubules, Actin filaments, and	**S. Biswas**	**4**

Intermediate filaments; Basic composition and function of ECM; Cell matrix Interactions (Integrins). **Unit 5: Nucleus** Nuclear envelope, nuclear pore complex (transport not included), Kinetochore and centromeric DNA; Chromatin and levels of its packaging. Euchromatin & Heterochromatin, Position effect variegation. Chromatin remodeling complex. **Unit 6: Cell Cycle** Cell Cycle: Phases of the eukaryotic cell cycle, Protein Kinases and Cell cycle regulation, MPF, Growth factors and regulation of G1-Cdks, S phase and regulation of DNA replication, DNA damage checkpoints; Cell Death: Caspases, Bcl-2 family, Intrinsic (Death receptors) and Extrinsic Pathway (apoptosome); Cancer: Basic Concept of Protooncogene [Ras] & Tumor suppressor genes [Rb and p53] Different ways of activation of a protooncogene to Oncogene. **Unit 7: Cell Signalling** Signalling system: Modes of cell-cell signalling; Types of Signalling molecules Signalling receptors: Types and example with special reference to regulation of G protein, Adenyl cyclase-cAMP, Enzyme linked Receptors: RTK (ras-raf) and JAK/STAT **Unit 8: Tools and Techniques in Cell Biology** • Animal Cell Culture: Primary cell culture and Cell line. • Subcellular fractionation and Ultracentrifugation. • Freeze fracture Replication and Freeze Etching • Principle of Light Microscope: Bright field, Phase contrast microscope, Fluorescence Microscope • with reference to FRET, Principle of SEM & TEM. • Cryofixation and use of frozen specimen; Specimen Preparation for Electron Microscopy	**A. Ray** **A. Ray** **P. Bhowmick** **S. Sarkar, R. Das**	**5** **15** **5** **5**

SEC-1: Applied Entomology		
Major; SEC-1-TH		
3 Credits	**50 Hours**	
Full Marks 75		
First Semester: July- December		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Basics of Entomology Insect diversity and adaptation: Morphological adaptation of insects: Head and antenna; Mouthparts of honey bee and cockroach; Thorax and thoracic appendages- legs and wings [General concept]. Physiological adaptation in cockroach: Digestive system: Alimentary canal and digestive glands, digestion; Respiratory organs and mechanism of gaseous exchange; Sense organs compound eyes, chemoreceptors. General Characteristics of Class Insecta and living orders with examples:Orthoptera, Dictyoptera, Hemiptera, Coleoptera, Lepidoptera, Diptera, Hymenoptera, Anoplura, Siphonaptera(Imms, A.D., 1938); Ticks and Mites: General features; difference between ticks and mites; Soft ticks and Hard ticks.	**S. Sarkar**	**12**
Unit 2: Medical Entomology Concept of Vectors: Mechanical and biological vectors, modes of transmission; Biological vector and disease cycle. Biology of *Anopheles*, *Culex* and *Aedes*: Study of mosquito borne diseases- Malaria, Dengue, and Filariasis; control of mosquitoes. Biology of *Musca domestica*:Disease relationship; control of house fly. Biology and systematics of Bed bug *Cimex lectularius*; disease relationship; Control of Bed Bug. Ticks as Causative agents and Vectors: Rickettsiosis, Tick-borne encephalitis.	**A. Ray**	**8**
Forensic Entomology: General perceptions and status of Forensic entomology; Insects and other arthropods of forensic importance; Pattern of insect succession on carcass; Postmortem Interval (PMI) and its estimation process; Applications and limitations of Forensic Entomology	**S. Sarkar**	**6**
Unit 3: Agricultural Entomology Concept of insect pest; Economic Injury Level (EIL), Economic Threshold Level (ETL), Dynamics of EIL; Pests of major crops (Life cycle, Nature of damage and control measures): Pests of Paddy, Scirpophagaincertulus; Pests of Jute, Anomissabulifera; Pests of brinjal, Leucinodesorbonalis; Stored grain pest: Sitophilusoryzae; Invasive insect pests of India and their	**S. Biswas**	**14**

consequences. Insect Pest control: Chemical, Mechanical, Cultural and Biological control measures; Integrated Pest Management (IPM) Study of appliances used in pest control: Dusters; Sprayers- categories of sprayers, agricultural Aircrafts; Granule applicator; soil injectors. **Unit 4 Sericulture** Types of Silk Moths with special reference to their scientific name, geographical distribution, and host plants. Life cycle of Bombyx mori; Structure of Silk Gland; Voltinism, Rearing of mulberry silkworm; Reeling and extraction of silk; Mulberry cocoon management; Mulberry plant types and cultivation; Common diseases and pests of mulberry silkworm and their control measures; Prospects of Sericulture in West Bengal; employment potential in sericulture **Unit 5 Apiculture** Various domesticated species of Honeybee; Social organization and life cycle of Honeybee; Modern method of Beekeeping: Newton Box and Langstroth Box; extraction of honey and composition of honey; Pests, Parasites and Diseases and their control measures; Bee-economy: Apiculture products and their uses.	**R. Das** **S. Hansda**	**5** **5**
SEC G For MDC		
Applied Zoology		
3 Credits	**50 hours**	
Full Marks 75		
First Semester: July- December		
Topic	**Name of the Teacher**	**No. of Hours**
Unit I: Agricultural Entomology Pest- definition and types (major and minor pests with example); Lifecycle, nature of damage and control of Pests: *Scirpophaga incertulus* of paddy, *Anomis sabulifera* of Jute, Bandicoota– stored house pest; Insect Pest control: Chemical, Mechanical, Cultural and Biological control measures; Integrated Pest Management (IPM). **Unit II: Sericulture** Types of Silkworms with special reference to their scientific name, geographical distribution and host plants; *Bombyx mori*: Silk gland, Composition of silk, Uses of silk; Lifecycle; Rearing, Extraction and Reeling of mulberry silk; Silkworm diseases, pests	**S. Biswas** **R. Das**	**6** **8**

and their control.		
Unit III: Apiculture Various domesticated species of Honeybee; Social organization of Honeybee; Bee keeping: Langstroth Box for rearing of honey bee, Extraction and processing of honey; Composition of honey, apiculture by products and their uses; Pests and Diseases of bees and their control measures	**S. Hansda**	**7**
Unit IV: Vermiculture Scope of Vermiculture; Habit categories of earthworms; methodology of vermicomposting: containers for culturing, raw materials required, preparation of bed, environmental prerequisites, feeding, harvesting and storage of vermicompost; Advantages of vermicomposting; Diseases and pests of earthworms.	**S. Biswas**	**7**
Unit V: Aquaculture Principles, definition and scope; Prawn culture: Penaeid and Palaemonid features with examples; Semi-intensive method of prawn culture; Application of prawn culture; Difference between major and minor carps with examples; Composite fish farming: General concepts, advantages and disadvantages; Induced breeding: method and advantages; Integrated fish farming.	**S. Sarkar**	**8**
Unit VI: Live Stock Management Dairy: Introduction to common dairy animals: Types of Cattle breeds and their distribution in India; Exotic cattle breeds; Artificial insemination and MOET in breeding; Cattle feed: Roughage and Concentrate; dairy by products, preservation and uses. Dairy pathology and vaccination programme. Poultry: Types of breeds (fowl) with features and examples; Rearing method: Deep litter system; feed formulation for chicks; poultry by products with economic importance; Diseases of poultry and their control measures.	**R. Das**	**8**
Unit VII: Lac Culture Life cycle, host plants and strains of Lac insect; Lac cultivation: Local practice, improved practice, propagation of Lac insect, inoculation period, harvesting of Lac; Lac composition, processing, products and uses; Natural enemies of lac insect and their management.	**A. Ray**	**6**

IDC-1: Animal Biology		
3 Credits	**50 hours**	
Full Marks 75		
First Semester: July- December		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Animal Diversity Phylum Characters and example: [Non-chordates-Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nemathelminthes, Annelida, Arthropoda, Mollusca and Echinodermata]; Chordata	**R. Das**	**10**
Unit 2: Genetics 1. Mendelian Principles and Laws of inheritance 2. Linkage and Recombination basic Concepts 3. Sex Determination with reference to Drosophila [only genic balance theory 4. Chromosomal Aberration [Structural and Numerical]	**S. Biswas**	**12**
Unit 3: Biodiversity and Wildlife 1. Biodiversity: Definition, types and value 2. Biodiversity: Indices [Shannon & Simpson] 3. Conservation: in situ and ex situ [outline idea] 4. Conservation Priority: Hotspot, Megadiversity, Sensitive Ecosystem 5. 5. Indigenous Knowledge and PBR: Basic Concepts	**S. Biswas**	**15**
Unit 4: Insect Vectors 1. Concept of Vector: Biological and Mechanical Vectors with examples 2. Disease cycle & Reservoir Concept 3. Major Vectors: Mosquito (Anopheles sp. &Aedes sp.) Life cycle, control, role as vector.	**S. Biswas**	**8**
Unit 5: Laboratory techniques and Instrumentation 1. Basics of Light Microscopy 2. Principles and Application of Colorimetry 3. Principles and application of Ultracentrifugation	**S. Sarkar**	**5**

PART I: SEMESTER 2
(under NEP)

CORE COURSE-2: Biochemistry
Major/Minor/MDC; CC2

3 Credits	**50 Hours**

Full Marks 75

Second Semester: January- June

Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Carbohydrates Structure, classification and properties of Monosaccharides (aldose and ketose), Disaccharides, Polysaccharides; Isomerism of monosaccharides (D and L, optical isomers, furanose and pyranose, α and β anomers, epimers); Reducing and non – reducing sugars. Physiological importance of Monosaccharides, Disaccharides, Polysaccharides	**S. Hansda**	**9**
Unit 2: Proteins Amino acids: Structure, Classification, General and Electro chemical properties of α-amino acids; Essential and non-essential amino acids; Structures of Protein: Primary, secondary, tertiary and quaternary) of protein, Classification of proteins.	**A. Ray**	**9**
Unit 3: Lipids Classification of lipids; Saturated and unsaturated fatty acids, essential and non – essential fatty acids. Structure and formation of Triglyceride.; Iodine number and saponification number of fats.	**P. Bhowmick**	**4**
Unit 4: Enzymes Nomenclature, classification and properties; Cofactors and coenzymes, Effect of Temperature, pH, substrate concentration, enzyme concentration on enzyme action, Isozymes and Proenzyme, Mechanism of enzyme action (Lock and key model, Induced fit model). Enzyme kinetics: Derivation of Michaelis-Menten equation with its significance, Lineweaver-Burk plot and its significance. Enzyme inhibition – competitive, non- competitive, allosteric / feedback and its effect on Vmax and Km.	**S. Sarkar**	**9**

Unit 5: Carbohydrates Metabolism Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis from lactate and glycerate, Glycogenesis and Glycogenolysis. (Pathways with name of enzymes and significance)	**S. Hansda**	**7**
Unit 6: Protein Metabolism Transamination, Deamination and its types (Pathways with name of enzymes and significance) Fate of Cskeleton of Glucogenic and Ketogenic amino acids.	**A. Ray**	**4**
Unit 7: Lipid Metabolism β-oxidation of fatty acids – a. Palmitic acid {saturated (C 16:0)}, b. Linoleic acid {unsaturated (C 18:2)} Fatty acid biosynthesis	**P. Bhowmick**	**4**
Unit 8: Nucleic acid Metabolism Degradation of purine; Purine Salvage pathway and significance	**P. Bhowmick**	**3**
Unit 7: Free radicals and Antioxidants Concepts of free radicals and antioxidants with examples.	**S. Biswas**	**1**
SEC-2 Aquaculture **Major; SEC-2**		
3 Credits	**50 Hours**	
Full Marks 75		
Second Semester: January- June		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Basics of Idea of Fish Biology Qualities of Cultivable fish, Indigenous and Exotic	**S. Biswas**	**3**
Unit 2: Sustainable Aquaculture System Sustainable Aquaculture Culture System: Extensive, Semi intensive, Extensive Water quality in culture ponds and factors controlling water quality. Preparation and Management of Fish Culture Ponds in Composite Fish Culture Cage Culture, Pen Culture, Raceways. Flow through system. Biofloc. Cold water fishery. Jeol Fishery. Sewage fed fishery. Mariculture with special emphasis on sea weed culture.(Basic concept) Induced Breeding of Carps. Synthetic	**S. Biswas**	**17**

Hormones in Hypophysation. Management of Fin Fish Hatcheries. Glass Jar Hatchery, Chinese Hatchery.		
Unit 3: Recent Advancement of Aquaculture Aquarium Fisheries. Preparation and Management of Fish Aquarium. Biology of Common Ornamental Fish: Guppy, Swordtail, Angel, Blue morph fish. Anemone fish, Butterfly fish, Molly. Fish Nutritional Requirements: Feed Formulations and Preparation of Compound Diets. Capture Fishery: Fishing Crafts and Gears, Post harvesting Technology. Fish Transport and Marketing. Fish Preservation and By-products. Fish Biotechnology: Transgenic Fish, Sex Reversal in Fish. Aquaponics, Application of GIS and Remote Sensing in Fisheries, Fishery Laws and Regulations.	**R. Das**	**20**
Unit 4: Fin Fish pathology Name of Infective Disease. Causative Agents, Symptoms, Control. Bacteria- Dropsy, Fin and Tail rot. Protozoa- White Spot Disease; Fungal- Saprolegniasis; Ectoparasite- Gyrodactylosis, Dactylogyrosis. Virus- Rhabdovirus	**S. Biswas**	**5**
Unit 5: Applied Aquaculture Breeding Techniques in Shrimps and Prawns: Eyestalk Ablation in Shrimp and Salinity shock in Prawns. Techniques of Artificial Pearl Culture.	**S. Sarkar**	**5**

PART II: SEMESTER 3 (under CBCS)		
CORE COURSE 5 : Chordata		
ZOOA-CC3-5-TH		
4 Credits	**50 Hours**	
Third Semester : July- December		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Introduction to Chordates General characteristics and outline classification of Phylum Chordata (Young, 1981)	**A. Ray**	**2**
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*	**A. Ray**	**7**
Unit 3: Agnatha General characteristics and classification of cyclostomes up to order (Young, 1981)	**S. Sarkar**	**2**
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.	**S. Hansda**	**7**
Unit 5: Amphibia General characteristics and classification up to living Orders (Young, 1981); Metamorphosis, Paedomorphosis, Parental care in Amphibia.	**S. Sarkar**	**7**
Unit 6: Reptilia General characteristics and classification up to living Orders (Young, 1981); Poison apparatus and Biting mechanism in Snake. Poisonous &Non-Poisonous snake.	**S. Sarkar**	**8**
Unit 7: Aves General characteristics and classification up to living Sub-Classes (Young, 1981); Exoskeleton and migration in Birds; Principles andaerodynamics of flight	**S. Hansda**	**8**

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.	**A. Ray**	**9**

CORE COURSE 6: **Animal Physiology:Controlling and Co-ordinating System**	
ZOOA-CC3-6-TH	
4 Credits	**50 Hours**
Third Semester: July- December	

Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Tissues Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue	**R. Das**	**4**
Unit 2: Bone and Cartilage Structure and types of bones and cartilages, Ossification	**R. Das**	**4**
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	**P.Bhowmic**	**10**
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	**S. Hansda**	**10**
Unit 5: Reproductive System Histology of mammalian testis and ovary; physiology of mammalian reproduction- menstrual and estrous cycle	**S. Biswas**	**6**
Unit 6: Endocrine System Histology and function of thyroid, pancreas and adrenal. Function of pituitary ;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; Placentalhormones.	**S. Biswas** **S. Sarkar**	**16**

CORE COURSE 7: Fundamentals of Biochemistry		
ZOOA-CC3-7-TH		
4 Credits	50 Hours	
Third Semester: July- December		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Carbohydrates Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosaccharides; Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis	**S. Hansda**	**8**
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	**P. Bhowmick**	**7**
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	**A. Ray**	**10**
Unit 4: Nucleic Acids Structure of Purines, Pyrimidines, Nucleosides and Nucleotides; Nucleic Acid Metabolism: Catabolism of adenosine, Guanosine, cytosine and thymine.	**P. Bhowmick**	**10**
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	**S. Sarkar**	**13**

inhibition. **Unit 6: Oxidative Phosphorylation** Redox systems; Mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System	**S. Biswas**	**2**
PART II: SEMESTER 4 (under CBCS)		
CORE COURSE 8.Comparative Anatomy of Vertebrates		
ZOOA-CC4-8-TH		
4 Credits	**50 Hours**	
Fourth Semester: January - June		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Integumentary System Structure, function and derivatives of integument in amphibian, birds and mammals	**S. Sarkar**	**10**
Unit 2: Digestive System Comparative anatomy of stomach; dentition in mammals	**S. Sarkar**	**6**
Unit 3: Respiratory System Respiratory organs in fish, birds and mammals	**S. Hansda**	**6**
Unit 4: Circulatory System General plan of circulation, Comparative account of heart and aortic arches	**S. Hansda**	**7**
Unit 5: Urinogenital System Succession of kidney in different vertebrate groups; evolution of urino-genital ducts	**S. Hansda**	**5**
Unit 6: Nervous system and sense organs Comparative account of brain in vertebrates; cranial nerves; olfactory and auditory receptors in Vertebrates	**A. Ray**	**8**
Unit 7: Skeletal system Overview of axial and appendicular skeleton – limbs, girdles of pigeon; jaw suspension in mammals.	**A. Ray**	**8**

CORE COURSE 9: Animal Physiology: Life Sustaining Systems		
ZOOA-CC4-9-TH		
4 Credits	**50 Hours**	
Fourth Semester: January- June		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Physiology of Digestion Structural organisation and function of gastro-intestinal tract; Mechanical and chemical digestion of food, absorption of Carbohydrates, Lipids and Proteins in Human	**R. Das**	**10**
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	**S. Sarkar**	**10**
Unit 3: Physiology of Circulation Structure and functions of haemoglobin; Blood clotting system; Haematopoiesis; Basic steps and its regulation; Blood groups; ABO and Rh factor	**S. Sarkar**	**8**
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	**S. Hansda**	**8**
Unit 5: Thermoregulation & Osmoregulation Thermal regulation in camel and polar bear, Osmoregulation in aquatic vertebrates	**S. Hansda**	**6**
Unit 6: Renal Physiology Structure of Kidney and its functional unit, Mechanism of urine formation, Regulation of acid-base balance	**S. Hansda**	**8**
CORE COURSE 10: Immunology		
ZOOA-CC4-10-TH		
4 Credits	**50 Hours**	
Fourth Semester: January - June		

Topic	Name of the Teacher	No. of Hours
Unit 1: Overview of Immune System Introduction – concept of health and disease; Cells and organs of theImmune system	**R. Das**	**3**
Unit 2: Innate and Adaptive Immunity Anatomical barriers, Inflammation, Cell and molecules involved ininnate immunity, Adaptive immunity (Cell mediated and humoral).	**R. Das**	**9**
Unit 3: Antigens Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes	**P. Bhowmick**	**6**
Unit 4: Immunoglobulins Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays (ELISA and RIA), Monoclonal antibody production	**A. Ray**	**10**
Unit 5: Major Histocompatibility Complex Structure and functions of MHC molecules. Structure of T cell Receptor and its signalling, T cell development & selection	**A. Ray**	**6**
Unit 6: Cytokines Types, properties and functions of cytokines	**P. Bhowmick**	**3**
Unit 7: Complement System Components and pathways of complement activation.	**P. Bhowmick**	**5**
Unit 8: Hypersensitivity Gell and Coombs' classification and brief description of various types of hypersensitivities.	**P. Bhowmick**	**4**
Unit 9: Vaccines Various types of vaccines. Active & passive immunization (Artificial and natural).	**R. Das**	**4**
CORE COURSE 11: Ecology		
ZOOA-CC5-11-TH		
4 Credits	**50 Hours**	
Fifth Semester: July- December		

Topic	Name of the Teacher	No. of Hours
Unit 1: Introduction to Ecology Autecology and synecology, Levels of organization, Laws of limitingfactors, Study of Physical factors, The Biosphere.	**P. Bhowmick**	**4**
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.	**S. Sarkar**	**18**
Unit 3: Community Community characteristics: species diversity, abundance, dominance,richness, Vertical stratification, Ecotone and edge effect; Ecological succession with one example.	**S. Biswas**	**10**
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.	**A. Ray**	**7**
Unit 5: Applied Ecology Types & level of biodiversity Mega-diversity countries, Biodiversity Hot spot, Flagship species, Keystone species, Wildlife Conservation (in situ and ex situ conservation), concept of protected areas. Red data book, Indian wild life act & Schedule. Concept of corridor, advantagesand problem of corridor. Threats to survival and conservation strategies for Tiger, Olive ridley,White Rumped Vulture.	**S. Hansda**	**6**
CORE COURSE 12.Principle of Genetics		
ZOOA-CC5-12-TH		
4 Credits	**50 Hours**	
Fifth Semester: July- December		

Topic	Name of the Teacher	No. of Hours
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, Lethalalleles, Pleiotropy, Penetrance & Expressivity	**S.Biswas**	**12**
Unit 2: Linkage, Crossing Over and Linkage Mapping Linkage and Crossing, Complete & Incomplete Linkage, MeasuringRecombination frequency andlinkage map construction using three factor crosses, Interference and coincidence Sex linkage in *Drosophila* (White eye locus) & Human (Haemophilia).	**S. Biswas**	**8**
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; Non- disjunction 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.*	**P. Bhowmick**	**12**
Unit 4: Sex Determination Mechanisms of sex determination in *Drosophila* and in man; Dosage compensation in *Drosophila* & Human	**S. Sarkar**	**8**
Unit 5: Extra-chromosomal Inheritance Kappa particle in *Paramoecium,* Shell spiralling in snail	**A. Ray**	**2**
Unit 6: Genetic Fine Structure Complementation test in Bacteriophage (Benzer's experiment on Rii locus)	**A. Ray**	**2**
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	**S. Hansda**	**6**

CORE COURSE 13: Developmental Biology		
ZOOA-CC6-13-TH		
4 Credits	**50 Hours**	
Sixth Semester: January - June		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Early Embryonic Development Gametogenesis: Spermatogenesis, Oogenesis (sea urchin & mammal); Types of eggs, Egg membranes; Fertilization in sea urchin and mammal; Planes and patterns of cleavage; 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)	**S. Sarkar**	**19**
Unit 2: Late Embryonic Development Extra-embryonic membranes in Chick; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)	**S. Hansda**	**10**
Unit 3: Post Embryonic Development Development of brain and Eye in Chick. Molecular Induction in Brain and Eye development.	**A. Ray**	**8**
Unit 4: Implications of Developmental Biology *In vitro* fertilization (IVF), Stem cell: Concept of potency, types, markers and applications of stem cell therapy in bone marrow transplantation and cartilage regeneration	**P. Bhowmick**	**11**

CORE COURSE 14.Evolutionary Biology		
ZOOA-CC6-14-TH		
4 Credits	**50 Hours**	
Sixth Semester: January - June		
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1 Origin of Life (Chemical basis), RNA world hypothesis	**P. Bhowmick**	**5**
Unit 2 Historical review of Evolutionary concepts: Lamarkism, Darwinism and Neo Darwinism	**S. Biswas**	**5**
Unit 3 Geological time scale, Fossil: types and age determination by Carbon dating, Evolution of horse	**A. Ray**	**6**
Unit 4 Natural Selection: Modes with Examples	**S. Sarkar**	**6**
Unit 5 Species concept, Isolating mechanisms, modes of speciation; Speciation by chromosome rearrangement in *Drosophila*. Adaptive radiation/macroevolution (exemplified by Galapagosfinches).	**S. Sarkar**	**9**
Unit 6 Origin and Evolution of Man, Unique Hominid characteristics contrasted with primate characteristic	**S. Biswas**	**2**
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.	**S. Biswas**	**9**
Unit 8 Extinction, back ground and mass extinctions, detailed example of K-T extinction	**A. Ray**	**3**
Unit 9 Phylogenetic trees, construction and interpretation of Phylogenetic tree using parsimony, convergent and divergent evolution.	**S. Biswas**	**5**

PART II: SEMESTER 3 (under CBCS)		
SEC-1 Apiculture **ZOOA-SEC(A)-3-1-TH**		
Third Semester: July- December		
Full Marks 80	**2 Credits**	
Topic	**Name of the Teacher**	**No. of Hours**
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	**S. Sarkar**	**2**
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)	**S. Hansda**	**14**
Unit 3: Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures	**S. Sarkar**	**6**
Unit 4: Bee Economy Products of Apiculture Industry and its Uses – Honey, Bees Wax, Propolis, Pollen etc.	**S. Sarkar**	**2**
Unit 5: Entrepreneurship in Apiculture Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens	**S. Hansda**	**6**

PART II: SEMESTER 4 (under CBCS)		
SEC-1.Aquarium Fish Keeping **ZOOA-SEC(B)-4-1-TH**		
Fourth Semester: January - June		
Full Marks 80	**2 Credits**	
Topic	**Name of the Teacher**	**No. of Hours**
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	**R. Das**	**2**
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	**R. Das**	**10**
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	**S. Biswas**	**8**
Unit 4: Fish Transportation Live fish transport - Fish handling, packing and forwarding techniques.	**S. Biswas**	**5**
Unit 5: Maintenance of Aquarium General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry	**R. Das**	**5**

PART III: SEMESTER 5 (under CBCS)		
DSE1. Parasitology **ZOOA-DSE(A)-5-1- TH**		
Fifth Semester: July- December		
4 **Credits**	**50** **Hours**	
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Introduction to Parasitology Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector); Host parasite relationship	**S. Biswas**	**2**
Unit 2: Parasitic Protists Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani*	**R.Das**	**12**
Unit 3: Parasitic Platyhelminthes Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Schistosoma haematobium*, *Taenia solium*	**S. Sarkar**	**12**
Unit 4: Parasitic Nematodes Study of Morphology, Life Cycle, Prevalence, Epidemiology,Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti*, Nematode plant interaction.	**A. Ray**	**12**
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*). Parasitoid.	**R. Das**	**10**
Unit 6: Parasite Vertebrates Cookicutter Shark, Hood Mocking bird, Vampire bats their parasiticbehaviour and effect on host.	**S. Biswas**	**2**

PART III: SEMESTER 5 (under CBCS)		
DSE1. Endocrinology **ZOOA-DSE(B)-5-1-TH**		
Fifth Semester: July- December		
4 **Credits**	**50** **Hours**	
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Introduction to Endocrinology General idea of Endocrine systems, Classification, Characteristic and Transport of Hormones, Neuro-secretions and Neuro-hormones: Examples and Functions	**S. Sarkar**	**6**
Unit 2: Hypothalamo-Hypophyseal Axis Structure and functions of hypothalamus and Hypothalamic nuclei, Regulation of neuroendocrine glands, Feedback mechanisms, Hypothalamo-Hypophyseal-Gonadal Axis. Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophyseal portal system	**A. Ray**	**12**
Unit 3: Peripheral Endocrine Glands Structure, Hormones and Functions of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovaryand Testis. Disorders of endocrine glands (*Diabetes mellitus* type I & Type II; Graves' Disease).	**A. Ray**	**12**
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.	**S. Hansda**	**12**
Unit 5. Non Mammalian Vertebrate Hormone Functions of Prolactin in Fishes, Amphibia & Birds Function of Melanotropin in Teleost fishes, Amphibians and Reptiles.	**S. Hansda**	**8**

PART III: SEMESTER 6 (under CBCS)		
DSE2. Animal Biotechnology **ZOOA-DSE(A)-6-2-TH**		
Sixth Semester: January - June		
4 **Credits**	**50** **Hours**	
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Introduction Organization of *E.coli* and *Drosophila* genome.	**P. Bhowmick**	**5**
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. Construction of Genomic libraries and cDNA libraries	**P. Bhowmick**	**11**
Transformation techniques: Cloning in bacteria and detection techniqueof clone Agarose and Polyacrylamide Gel Electrophoresis, Southern, Northern and Western blotting,Polymerase chain reaction: Allele specific, RAPD & RT PCR, DNA Fingerprinting	**A. Ray**	**12**
Unit 3: Genetically Modified Organisms Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNAmicroinjection. Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock-out mice.	**S. Biswas**	**12**
Unit 4: Culture Techniques and Applications Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anaemia, Thalassemia). Dolly &Polly cloning Genetically modified economically important animal Gene Therapy	**S. Sarkar**	**10**

PART III: SEMESTER 6 (under CBCS)		
DSE2. Fish and Fisheries **ZOOA-DSE(B)-6-2-TH**		
Sixth Semester: January - June		
4 **Credits**	**50** **Hours**	
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Introduction and Classification Feeding habit, habitat and manner of reproduction. Classification of fish (upto Subclasses) (Romar, 1959)	**R.Das**	**4**
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; Electric organ, Bioluminescence	**R.Das**	**14**
Unit 3: Fisheries Inland Fisheries; Marine Fisheries; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations	**S.Hansda**	**10**
Unit 4: 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	**R.Das**	**16**
Unit 5: Fish in research Transgenic fish Zebra fish as a model organism in research.	**S.Hansda**	**6**

Course: B.Sc. (General) Zoology		
PART II SEMESTER 3 (under CBCS)		
CORE COURSE 3. PHYSIOLOGY AND BIOCHEMISTRY		
ZOOG-CC3-3-TH		
Third Semester : July - December		
Full Marks 50	**4 Credits**	
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Nerve and muscle Structure of a neuron, resting membrane potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction	**S. Hansda**	**8**
Unit 2: Digestion Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids	**R. Das**	**6**
Unit 3: Respiration Pulmonary ventilation, Transport of Oxygen and carbon	**R. Das**	**6**
Unit 4: Cardio-vascular system Composition of blood, Structure of Heart, Origin and conduction of the cardiac impulse, cardiac cycle	**S. Sarkar**	**6**
Unit 5: Excretion Structure of nephron, Mechanism of Urine formation; Counter-current Mechanism	**R. Das**	**6**
Unit 6:Reproduction and Endocrine Glands Physiology of male reproduction: Histology of testis, hormonal control of spermatogenesis; Physiology of female, reproduction: Histology of ovary, hormonal control of menstrual cycle. Structure and function of pituitary, thyroid, pancreas and adrenal.	**S. Sarkar**	**10**
Unit 7: Carbohydrate Metabolism		

Glycolysis, Kreb's cycle, Glycogenesis, Electron Transport Chain.	**A. Ray**	**4**
Unit 8: Lipid metabolism Beta oxidation of Palmitic acid {saturated (C 16:0)} and Linoleic acid {unsaturated (C 18:2)}	**A. Ray**	**4**
Unit 9: Protein Metabolism Transamination, Deamination, Urea cycle	**A. Ray**	**4**
Unit 10. Enzyme Enzyme Classification, factors affecting enzyme action, Inhibition.	**A. Ray**	**2**

PART II: SEMESTER 4.

CORE-COURSE 4.Genetics & Evolutionary Biology

ZOOG-CC4-4-TH

Fourth Semester: January - June

Full Marks 50	**4 Credits**	
Topic	**Name of the Teacher**	**No. of Hours**
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* (White eye locus) & Human (Thalassemia).	**S. Biswas**	**10**
Unit 2: Linkage, Crossing Over Linkage and crossing over, Complete & Incomplete Linkage, Recombination frequency as a measure of linkage intensity. HolidayModel	**S. Biswas**	**8**
Unit 3: Mutation Chromosomal mutation, Deletion, duplication, inversion, translocation,aneuploidy, gene mutation, induced mutation, types & example	**P. Bhowmick**	**8**
Unit 4: Sex determination Genic Balance theory and dosage compensation in *Drosophila*.	**P. Bhowmick**	**8**
Unit 5: Origin of Life Chemical Origin of life	**P. Bhowmick**	**2**
Unit 6: Evolutionary Theories Lamarckism, Darwinism, Neo-Darwinism.	**S. Biswas**	**6**
Unit 7: Process of Evolutionary changes		

Isolating mechanism, Natural Selection.	**S. Sarkar**	**4**
Unit 8: Speciation Sympatric, Allopatric, Parapatric	**S. Sarkar**	**4**

Skill Enhancement Elective Courses (SEC)		
SEMESTER –3 SEC-A		
APICULTURE; ZOOG-SEC-A-3-1-TH		
Third Semester : July - December		
Full Marks 80	**2 Credits**	
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Biology of Bees Classification and Biology of Honey Bees Social Organization of Bee Colony	**S. Sarkar**	**2**
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	**S. Hansda**	**14**
Unit 3: Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures	**S. Sarkar**	**6**
Unit 4: Bee Economy Products of Apiculture Industry and its Uses ;Honey, Bees Wax, Propolis, Pollen etc	**S. Sarkar**	**2**
Unit 5: Entrepreneurship in Apiculture Bee Keeping Industry - Recent Efforts, Modern Methods in employing artificial Beehives for cross	**S. Hansda**	**6**

Discipline specific courses (DSE)
SEMESTER –5 DSE-A

Applied Zoology.ZOOG-DSE-A-5-1-TH		
Fifth Semester : July - December		
Full Marks 50	Credits 4	
Topic	**Name of the Teacher**	**No. of Hours**
Unit I: Host & Parasite Relationship Type of Host, Types of Parasites, Other types of Relations.	**S. Biswas**	**2**
Unit 2: Epidemiology of Diseases Transmission, Prevention and Control of Tuberculosis and Typhoid.	**S. Biswas**	**5**
Unit 3: Parasitic Protozoa Life History and pathogenicity of *Entamoeba histolytica*, *Plasmodium vivax* and *Trypanosoma gambiense.*	**A. Ray**	**7**
Unit 4: Parasitic Helminthes Life History and pathogenicity of *Alcylostoma duodenale, Wuchereria bancrofti*.	**A. Ray**	**8**
Unit 5: Insect of Economic Importance Biology, Control and Damage caused by *Heliocoverpa armigera, Pyrilla perpusilla, Sytophilus oryzae* and *Tribolium casteneum*.	**S. Biswas**	**8**
Unit 6: Insect of Medical Importance Medical Importance and control of *Anopheles*	**S. Biswas**	**2**
Unit 8: Animal Husbandry Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle	**R. Das**	**6**
Unit 9: Poultry Farming Principles of poultry breeding, Management of breeding stock and broilers, Processing andpreservation of eggs	**R. Das**	**6**
Unit 10: Fish Technology Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed	**R. Das**	**6**

Skill Enhancement Elective Courses (SEC)

SEMESTER –6 SEC-B		
Medical diagnosis; ZOOG-SEC-B-6-4-TH		
Sixth Semester: January - June		
Full Marks 80	**2 Credits**	
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Diagnostics Methods Used for Analysis of Blood Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentation Rate (E.S.R)	**S. Biswas**	**8**
Unit 2: Diagnostic Methods Used for Urine Analysis Urine Analysis: Physical characteristics; Abnormal constituents, Urine culture	**S. Biswas**	**4**
Unit 3: Non-infectious Diseases Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II),Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit	**S. Hansda**	**6**
Unit 4: Infectious Diseases Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis, Malarial parasite (Microscope based and ELISA based)	**A. Ray**	**3**
Unit 5: Clinical Biochemistry Lipid profiling, Liver function test. PSA test	**S. Sarkar**	**1**
Unit 6: Clinical Microbiology Antibiotic Sensitivity Test	**S. Sarkar**	**1**
Unit 8: Tumours Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture,	**A. Ray**	**2**
Unit 9: Visit to Pathological Laboratory and Submission of Project	**A. Ray**	**5**
Discipline specific courses (DSE)		

SEMESTER –6 DSE-8		
Ecology& Wild life Biology;ZOOG-DSE-B-6-2-TH		
Sixth Semester: January - June		
Full Marks 50	Credits 4	
Topic	**Name of the Teacher**	**No. of Hours**
Unit 1: Introduction to Ecology Ecosystem, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.	**S. Hansda**	**4**
Unit 2: Population Attributes of population: Life tables, fecundity tables, survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns, Population regulation: density-dependent and independent factors,	**S. Sarkar**	**20**
Unit 3: Community Community characteristics: species diversity, abundance, dominance, richness, Vertical stratification, Ecotone and edge effect.	**P. Bhowmick**	**11**
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	**P. Bhowmick**	**10**
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	**S. Hansda**	**5**

Academic Calendar
2023-2024
Department of Botany

Course Structure-4yr Honours+Research (NEP2020) BOTANY **Course Structure- 3yr MDC (NEP 2020) BOTANY**		
SEMESTER 1		
DSC /CORECOURSE1. PLANT DIVERSITY		
BOTH-CC1-1-TH & MD-CC1-1-Th		
3Credits		
Total marks 75; Class 45 hours		
First Semester:July-December		
Topic	**Name of the Teacher**	**No. of Lectures**
1. Introduction to plant kingdom. (3lectures)		
1.1 Origin of life and evolution of plant cells	**T.Biswas**	1
1.2IImportance of plants as source of food, fuel and their role in ecosystem services (as carbon sink, sequestering etc.	**P. Chatterjee/ R. Bar/ M. Karmakar**	3
2. Algae 2.1. Salient features of Cyanophyceae, Chlorophyceae, Charophyceae, Phaeophyceae, Rhodophyceae and Bacillariophyceae 2.2 Criteria and system of classification (Fritsch, 1935) 2.3. Economic importance of algae in environment, agriculture, biotechnology and industry.	**R. Bar**	6
3. Fungi 3.1 Salient features of Myxomycota, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina. 3.2 System of classification up to Sub-division (Ainsworth, 1973), 3.3 Economic importance of fungi (food, medicine and agriculture), 3.4 Fungal symbioses: Mycorrhiza, Lichen and their importance.	**S. Sengupta**	6
4. Bryophytes		

4.1 Salient features of Hepaticopsida, Anthocerotopsida and Bryopsida, 4.2. System of classification up to Class (Proskauer 1957), 4.3 Amphibian nature of bryophytes, 4.4 Economic and ecological importance.	**P. Chatterjee**	6
5. Pteridophytes 5.1 Salient features of Psilophyta, Lycophyta, Sphenophyta and Filicophyta, 5.2 System of classification up to Division (Gifford & Foster 1989), 5.3 Economic importance (food, medicine & agriculture).	**T. Biswas**	6
6. Gymnosperms 6.1 Salient features of Cycadophyta, Coniferophyta and Gnetophyta, 6.2 Outline classification up to Division: Progymnospermophyta to Gnetophyta (Gifford & Foster 1989), 6.3 Economic importance (wood, resin, essential oil & drugs).	**P. Saha**	6
7. Angiosperms 7.1 Types and morphology of leaf, stem and root, 7.2 Inflorescence types with examples , 7.3 Flower: Different parts and forms of calyx, corolla, androecium and gynoecium; aestivation and placentation, 7.4 Types with examples-fruits and seeds.	**M. Karmakar** **P. Saha** **M. Karmakar** **M. Karmakar**	12

PLANT DIVERSITY (PRACTICAL) **BOT-H-CC1-1-P & BOT-MD-CC1-1-P**		
1 Credit		
Total marks 25; Class 30 hours		
First Semester: July-December		
Topic	**Name of the Teacher**	**No. of Lectures**
1. Flower- dissection, drawing and study a) Different parts, b) Adhesion and cohesion, c) Placentation, d) Aestivation 2. Study of ovules: types (Fresh specimens/	**S.Sengupta** **P. Saha**	

permanent slides/ photographs) 3. Fruits:different types- study from fresh/ preserved specimens 4. Inflorescence types: study from fresh/ preserved specimens 5. Identification on the basis of reproductive and structural features from preserved specimens/ permanent slides: Algae **RB** (*Nostoc*, *Oedogonium* and *Ectocarpus*), Fungi **SS** (*Rhizopus*, *Ascobolus* and *Agaricus*), Bryophytes **PC** (*Marchantia*, *Anthoceros* and *Funaria*), Pteridophytes **TB** (*Selaginella*, *Equisetum* and *Pteris*), Gymnosperms **PS** (male cone and female cone/ megasporophyll of *Cycas*, *Pinus* and *Gnetum*). 6. A field notebook supported with photographs taken during field study to be submitted giving comprehensive idea about different types of inflorescence, flowers and fruits.(**PS & MK**)	**P. Saha** **P. Saha** **R.Bar/ S.Sengupta/ P. Chatterjee/ T. Biswas/ P.Saha P.Saha & M. Karmakar**	**10**

SEC:MUSHROOM CULTIVATION TECHNOLOGY		
BOT-H-SEC-1-TH & BOT-MD-SEC-1-Th		
3 Credits		
Full Marks 75 Class 45 Hours		
First Semester:July-December		
Topic	**Name of the Teacher**	**No. of Lectures**
1. 1.1 Introduction, History of mushroom cultivation,1.2 Current overview of mushroom production in the world, 1.3 Mushroom biology-classification of mushrooms, edible mushrooms in India, poisonous mushrooms,mushroom poisoning.	**T. Biswas**	6
2. 2.1 Infrastructure-structural design and layout of mushroom farm, substrates (locally available),		

2.2 Appliances- weighing balance, autoclave, laminar air flow, incubator,hot air oven, spirit lamp, bunsen burner, pH meter,laboratory heater, low-cost stoves, water bath, humidifier, water sprayer,vessels, inoculation hook and inoculation loop, sieves, culture racks,tray,polythene bags, 2.3 Methods of sterilization.	**R. Bar**	9
3. 3.1 Cultivation technology-overview of cultivation strategies,composting technology in mushroom production, mushroom bed preparation, culture media, pure culture, maintenance and preservation of pure culture, 3.2 (**SS**) Production of spawn- cultivation of oyster mushroom, paddy-straw mushroom, milky mushroom and white button mushroom, 3.3 (**SS**) Cultivation of medicinal mushroom (Cordyceps and Ganoderma).	**P. Chatterjee / S.Sengupta**	12
4. 4.1 Mushroom diseases and management strategies, 4.2 Post-harvest technology-short-term storage (Refrigeration- up to 24 hours), long-term storage (canning, pickles, papads etc.), drying, storage in salt solutions, 4.3 Food preparations from mushrooms.	**P. Saha**	9
5. 5.1 Uses of spent mushroom substrate, 5.2 Strain improvements in cultivated mushroom; Nutritional and medicinal value of edible mushrooms, 5.3 Research centres- National level and regional level, 5.4 Cost-benefit ratio, 5.5 Mushroom based Industry, 5.6 Mushroom market in India and abroad.	M. Karamakar	9

SEC: MUSHROOM CULTIVATION TECHNOLOGY (PRACTICAL)		
BOT-H-SEC-1-P & BOT-MD-SEC-1-P		
1 Credits		
Full Marks 25 Class 30 Hours		
1. Macro and microscopic identification of some common edible mushrooms (*Agaricus*, *Pleurotus*) 2. Media preparation 3. Fungal tissue culture 4. Sub-culturing for maintenance of culture 5. Spawn production 6. Cultivation of Pleurotus / Calocybe	**R. Bar** **T. Biaswas** **P. Chatterjee** **M. Karamakar**	30

Course Structure-4yr Honours+Research (NEP2020) BOTANY & Course Structure- 3yr MDC (NEP 2020) BOTANY		
SEMESTER 2		
DSC /CORE COURSE 2. PLANT SYSTEMATICS (THEORY)		
BOTH-CC2-2-TH & MD-CC2-2-Th		
3Credits		
Total marks 75; Class 45 hours		
Second Semester: January - June		
Topic	**Name of the Teacher**	**No. of Lectures**
1. Introduction: Components of Systematics: Nomenclature, Identification, Classification; 1.2. Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy, 1.3 Nomenclature: Type method, Publication, Rank of taxa, Rules of priority, Retention and rejection of names, Author Citation, Effective and valid publication, Elementary knowledge of ICN- Principles.	M. Karmakar	10
2. Systems of classification: 2.1 Broad outline of Bentham & Hooker (1862-1883) and Takhtajan (1997)- systems of classification with merits and		

demerits. Brief idea of angiosperm phylogeny group (APG IV classification), 2.2 Systematics in Practice: Herbaria and Botanic Gardens – their role in teaching and research; 2.3. Dichotomous keys – indented and bracketed. 2.4 Brief idea on Phenetics and cladistics: Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy; 2.5 Numerical taxonomy- methods and significance; 2.6 Data sources in Taxonomy: Supportive evidences from Phytochemistry, Cytology, Palynology and Molecular biology data (Protein and Nucleic acid homology). (20 lectures)	M. Karmakar	20
3. Systematic study of angiosperm taxa: Diagnostic features, systematic position (Bentham & Hooker) and economically important plants (parts used and uses) of the following families: 3.1.Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae), Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae. 3.2 Dicotyledons: Nymphaeaceae, Magnoliaceae, Ranunculaceae, Leguminosae (subfamilies), Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Cruciferae (Brassicaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).	R. Bar	15
PLANT SYSTEMATICS (PRACTICAL) **BOT-H-CC2-2-P & BOT-MD-CC2-2-P**		
1Credit		
Total marks 25; Class 30 hours		
Second Semester: January - June		
Topic	**Name of the Teacher**	**No. of Lectures**
ANGIOSPERMS **1.** Work out, description, preparation of floral formula and floral diagram, identification up to genus with the help of suitable literature of wild plants and systematic position according to Benthum and Hooker system of classification	R. Bar	

from the following families: Malvaceae, Leguminosae (Papilionaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae), Rubiaceae. **2.** Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus. **FIELD WORK** At least three excursions including one excursion to Acharya Jagadish Chandra Bose Indian Botanic Garden (Shibpur, Howrah) and one to Central National Herbarium (CNH). **FIELD RECORDS** 1. Field Note Book (authenticated) with field notes on the plants of the area of excursion and voucher specimen book. 2. Herbarium specimens: Preparation of 20 angiospermic specimens (identified with author citation, voucher number and arranged following Bentham and Hooker system of classification) to be submitted during examination.	S. Sengupta S. Sengupta R. Bar/ S. Sengupta/ M. Karmakar/ **P. Chatterjee/** **T. Biswas/** **P.Saha**	10 4
SEC **BIOFERTILIZERS AND BIOPESTICIDES (THEORY)** **BOT-H-SEC-2-Th**		
Credits : 3		
Total marks 75; Class 45 hours		
Second Semester: January - June		
Topic	**Name of the Teacher**	**No. of Lectures**
1.1 General account and components of organic farming; microbes used as biofertilizers, general account on mass production of biofertilizers; 1.2 Manure- Green manuring and organic fertilizers;types and methods of composting; vermicompost and field applications; recycling of biodegradable municipal, agricultural and industrial wastes.	R.Bar	6
2. Nitrogen fixing bacteria as biofertilizers: 2.1 Rhizobium-Isolation, identification, mass multiplication, carrier-based inoculant formulation, filed application; 2.2 Azospirillum-	R.Bar	9

Isolation, carrier-based inoculants, mass multiplication, associative effect of different microorganisms; 2.3 Azotobacter- Classification, characteristics, crop response to Azotobacter inoculants, maintenance and mass multiplication.	R.Bar	
3.1 Cyanobacteria (Blue green algae), Azolla and Anabaena azollae association, nitrogen fixation,factors affecting growth, blue green algae and Azolla in rice cultivation. 3.2 Actinorhizal symbiosis- Actinorhizal plants, infection process, isolation of Frankia.	R.Bar	6
4. Mycorrhizal association- 4.1 Types of mycorrhizal association, phosphorus nutrition, growth and yield; 4.2 colonization of VAM – isolation and inoculum production of VAM and its influence on growth and yield of crop plants.	M. Karmakar	6
5.1 Phosphate, Potash and Zinc Solubilizing Microbes- Isolation, characterization, mass production, field application; 5.2 Plant Growth Promoting Rhizobacteria (PGPR) as biofertilizers, mode of action of PGPR.	M. Karmakar	6
6. Biopesticides – 6.1 Introduction; General features of potential biopesticides; Prospect and limitation; 6.2 Trichoderma: Isolation, mass production, formulation, quality control and field application; 6.3 Pseudomonas- Isolation, beneficial Pseudomonas strains in agriculture, mode of action; 6.4 Fungi as bioinsecticide- Metarhizium anisopliae, Beauveria bassiana and Verticillium lecanii- overview, mode of action and use in agriculture; 6.5 Nematophagous fungi-overview, mode of action; 6.6 Bacteria as bioinsecticide- Bacillus thuringiensis - Characterization, mass production and field application; 6.7 Virus as bioinsecticide- Baculovirus- characterization, bioformulation, mass production and field application.	M. Karmakar	12

BIOFERTILIZERS AND BIOPESTICIDES (PRACTICAL)		
BOT-H-SEC-2-P		
Credit 1		
Total marks 25; Class 30 hours		
Second Semester: January - June		
Topic	**Name of the Teacher**	**No. of Lectures**
1. Preparation of selective media for isolation of Azotobacter, phosphate- solubilizing microbes and Trichoderma. 2. Isolation and identification of phosphate-solubilizing fungi. 3. Study of Arbuscular Mycorrhizal fungi. 4. Isolation of Azotobacter and Trichoderma from the soil. 5. Evaluation of in vitro antagonistic activity of Trichoderma species in the dual culture system.	R. Bar S. Sengupta S. Sengupta M. Karmakar M. Karmakar	10

Third Semester: July- December		
CORE COURSE 5. Paleobotany and palynology		
BOTA-CC3-5-TH		
4 Credits		
Full Marks 50		
Topic	**Name of the Teacher**	**No. of Lectures**
1. Geological time scale with dominant plant groups through ages.	**T. Biswas**	4
2. Plant Fossil: 2.1 Types: Body fossil (Micro- and Megafossils), Trace fossil, Chemical fossil, Index fossil, 2.2. Different modes of preservation (Schopf, 1975), 2.3. Conditions favouring fossilization, 2.4. Nomenclature and Reconstruction, 2.5. Principle of fossil dating (a brief idea), 2.6. Importance of fossil study.	**P. Chatterjee**	12
3. Fossil Pteridophytes: Structural features, Geological distribution and Evolutionary significance of 3.1. *Rhynia*, 3.2. *Lepidodendron* (Reconstructed), 3.3. *Calamites* (Reconstructed).	**P. Chatterjee**	10
4. Fossil gymnosperms: Structural features and Geological distribution of reconstructed genera: 4.1. *Lyginopteris*, 4.2.	**T. Biswas**	10

Williamsonia, 4.3. *Cordaites*. **5. Indian Gondwana System** - Three fold division with major megafossil assemblages. **6. Palynology:** 6.1Spore and Pollen, 6.2. Pollen aperture types, 6.3. NPC classification (Erdtman). 6.4. Pollen wall- Sporopollenin, Stratification and Ornamentation (sculpturing). **7. Applied Palynology:** Basic concepts of: 7.1. Palaeopalynology, 7.2. Aeropalynology, 7.3. Forensic palynology, 7.4. Melissopalynology.	**T. Biswas** **P. Chatterjee** **P. Chatterjee**	6 10 **8**
Paleobotany and palynology (Practical)		
BOTA-CC3-5-P		
2 Credits		
Full Marks 30		
Third Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
PALAEOBOTANY AND PALYNOLOGY ***1.*** Morphological study: *Ptilophyllum* and *Glossopteris* leaf fossils. **2.** Study from permanent slides: T.S. of stem of *Rhynia*, *Lepidodendron*, *Calamites*, *Lyginopteris*, *Cordaites*. **3.** Study of Pollen types (colpate, porate and colporate) from permanent slides. Slides may be prepared from specimens: Colpate (*Leonurus sibiricus*/ *Brassica* sp.), Porate (*Hibiscus rosa-sinensis*), Colporate (*Cassia sophera*/ *C. tora*).	**M. Karmakar** **M. Karmakar** **M. Karmakar**	
CORE COURSE 6: Reproductive biology of Angiosperms		
BOTA-CC3-6-TH		
4 Credits		
Full Marks 50		
Third Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
MORPHOLOGY OF ANGIOSPERMS **1.** Inflorescence types with examples. **2.** Flower, induction of flowering, flower development- genetic and molecular aspects. **3.** Fruits and seeds - types with examples. **EMBRYOLOGY** **1. Pre-fertilization changes:**	**T. Biswas** **T. Biswas** **T. Biswas**	8 14 8

1.1. Microsporogenesis and Microgametogenesis, 1.2.	**P. Saha**	6
Megasporogenesis and Megagametogenesis (monosporic, bisporic and tetrasporic). **2. Fertilization:** **2.1.** Pollen germination, 2.2. Pollen tube- growth, entry into ovule and discharge, 2.3. Double fertilization. **3. Post-fertilization changes:** **3.1.** Embryogenesis in Capsella, 3.2. Development of Endosperm (3 types). **4. Apomixis & Polyembryony:** **4.1.** Apomixis- Apospory and Apogamy, **4.2**. Polyembryony- different types.	**P. Saha** **P. Saha** **P. Saha**	6 10 8
Reproductive biology of Angiosperms (Practical) **BOTA-CC3-6-P**		
2 Credits		
Full Marks 30		
Third Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
REPRODUCTIVE BIOLOGY OF ANGIOSPERMS **1.** Inflorescence types- study from fresh/ preserved specimens **2.** Flowers- study of different types from fresh/ preserved specimens **3.** Fruits- study from different types from fresh/preserved specimens **4.** Study of ovules (permanent slides/ specimens/photographs)- types (anatropous, orthotropous, amphitropous and campylotropous) **5.** Field study desirable **6.** A project supported along with photographs taken during field study to be submitted giving comprehensive idea about different types of inflorescence, flowers and fruits.	**P. Saha** **P. Saha** **P. Saha** **P. Saha** **P. Saha**	

CORE COURSE 7: Plant Systematics		
BOTA-CC3-7-TH		
4 Credits		
Plant Systematics	**Full Marks 50**	
Third Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
TAXONOMY OF ANGIOSPERMS **1 Introduction:** 1.1. Components of Systematic: Nomenclature, Identification, Classification; 1.2. Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy. **2 Nomenclature:** Type method, Publication, Rank of taxa, Rules of priority, Retention and rejection of names, Author Citation, Effective and valid publication, Elementary knowledge of ICN- Principles.	**S. Sengupta**	6 6
3. Systems of classification: Broad outline of Bentham & Hooker (1862-1883), Cronquist (1988), Takhatajan (1991) - system of classification with merits and demerits. Brief reference of angiosperm phylogeny group (APG III) classification. 3.1. Systematics in Practice: Herbaria and Botanical Gardens – their role in teaching and research; important Herbaria and Botanical Gardens of India and world (3 each); 3.2. Dichotomous keys – indented and bracketed.	**M. Karmakar**	20
4. Phenetics and Cladistics: Brief idea on Phenetics, Numerical taxonomy- methods and significance; Cladistics- construction of dendrogram and primary analysis; Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy. …….8 lectures	**M. Karmakar**	8
5. Data sources in Taxonomy: Supportive evidences from: 5.1. Phytochemistry, 5.2. Cytology, 5.3. Palynology and 5.4. Molecular biology data (Protein and Nucleic acid homology). …….8 lectures	**S. Sengupta**	8
6. Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses) of the following	**R. Bar**	12

families: 6.1 Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae), Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae. 6.2 Dicotyledons: Nymphaeaceae, Magnoliaceae, Leguminosae (subfamilies), Polygonaceae, Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).	**R. Bar**	

BOTA-CC3-7-P		
2 Credits		
Plant systematics		**Full Marks 30**
Third Semester : July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
ANGIOSPERMS **1.** Work out, description, preparation of floral formula and floral diagram, identification up to genus with the help of suitable literature of wild plants and systematic position according to Benthum Hooker system of classification from the following families: Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae), Rubiaceae. **2.** Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus (list to be provided). **FIELD WORK** At least three excursions including one excursion to Acharya Jagadish Chandra Bose Indian Botanic Garden (Shibpur, Howrah) and Central National Herbarium (CNH).	**S. Sengupta**	10

SEC A-BOT-A-SEC-A-3-2		
BIOFERTILIZERS (SEC-A-3-2) THEORITICAL		
2 Credits		
Biofertilizres	**Full marks 100**	
Third Semester : July – December		
Topic	**Name of the Teacher**	**No. of Lectures**
1.General account about the microbes used as biofertilizers- *Rhizobium*- isolation, identification, mass multiplication, carrier based inoculants, actinorrhizal symbiosis. **P. *Azospirillum*:** isolation and mass multiplication- carrier based inoculants, associative effect of different microorganisms. **P. *Azotobacter*:** classification, characteristics- crop response to *Azetobacter* inoculants, maintenance and mass multiplication. **5. Cyanobacteria** (Blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation. Factors affecting growth, blue green algae and *Azolla* in rice cultivation. **6. Mycorrhizal** association, types of mycorrhizal association, phosphorus nutrition, growth and yield- teridophyte of VAM – isolation and teridoph production of VAM and its influence on	**R. Bar** **P. Saha** **P. Chatterjee** **M. Karmakar** **S. Sengupta**	4 4 4 4 8
SEMESTER 4		
CORE COURSE 8: Plant Geography, Ecology and Evolution		
BOTA-CC4-8-TH		
4 Credit		
Plant Geography, Ecology and Evolution **Full marks 50**		
Fourth Semester : January - June		
Topic	**Name of the Teacher**	**No. of Lectures**
PLANT GEOGRAPHY **1. Phytogeographical regions:** 1.1. Phytogeographical regions of India (Chatterjee 1960); 1.2. Dominant flora of Eastern Himalaya, Western Himalaya and Sunderban. **2. Endemism:** 2.1 Endemic types and Factors; 2.2. Age & Area hypothesis and Epibiotic theory; 2.3. Endemism in Indian flora.	**R. Bar** **R. Bar**	**8** **6**

ECOLOGY **1. Preliminary idea on:** 1.1. Habitat and Niche, 1.2. Ecotone and edge–effect, 1.3. Microclimate, 1.4. Ecads, ecotype and ecoclines, 1.5. Carrying capacity.	**S. Sengupta**	**4**
2. Community ecology: 2.1. Community- Characteristics and diversity, 2.2. Ecological succession –Primary and secondary, Seral stages (with reference to Hydrosere), autogenic and allogenic succession.	**S. Sengupta**	**6**
3.1. Plant indicators (metallophytes); 3.2. Phytoremediation.	**S. Sengupta**	**4**
4. Conservation of Biodiversity: 4.1. Level of Biodiversity: genetic, species & ecosystem diversity, 4.2. Biodiversity hot spots- criteri Indian hotspots, 4.3. *In- situ* and *ex-situ* conservation, 4.4. Seed-banks, 4.5. Cryopreservation growth and yield of crop plants.	**S. Sengupta**	**16**
6. Organic farming- green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and industrial wastes- bio compost making methods, types and methods of vermicomposting- field application.	**T. Biswas**	6
EVOLUTION Introduction, 1.2. Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, 1.3. Phyletic gradualism, Punctuated equilibrium and Stasis	**S. Sengupta**	**6**
2.1 Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation	**R. Bar**	**6**
3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, Pteridophytes and gymnosperm, 3.2. Phylogenetic tree.	**T. Biswas**	**4**

BOTA-CC4-8-P		
2 Credits		
Plant Geography, Ecology and Evolution **Full marks 30**		
Topic	**Name of the Teacher**	**No. of Lectures**
PLANT GEOGRAPHY 1. Field visit- at least one long excursion at different phytogeographical region of India. 2. Study of local flora and submission of a project report highlighting phytogeographical characteristics of the region. **ECOLOGY** Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Frequency, density and abundance of components (to be done during excursion/ field visit). 1. Comparative anatomical studies of leaves form polluted and less polluted areas. 2. Measurement of dissolved O2 by azide modification of Winkler's method. 3. Comparison of free CO2 from different sources.	**S. Sengupta** **S. Sengupta** **S. Sengupta** **S. Sengupta** **S. Sengupta**	10
CORE COURSE 9: Economic Botany		
BOTA-CC4-9-TH		
4 Credits		
Economic Botany **Full marks 50**		
Fourth Semester: January - June		
Topic	**Name of the Teacher**	**Number of Lectures**
7. Origin of cultivated crops: Concepts of centre of origin, their importance with reference to Vavilov's work. Examples of major plant introductions; crop domestication and loss of genetic diversity; evolution of new crops/ varieties, importance of germplasm diversity.	**P. Chatterjee**	**6**
8. Cereals: Rice and wheat (origin, morphology, processing and uses).	**P. Chatterjee**	**6**
9. Legumes: Origin, morphology and uses of gram and mung bean. Importance to man and environment.	**P. Chatterjee**	**6**

4. Sugar and starches: Morphology and processing of sugarcane, products and byproducts of sugarcane industry. Potato- morphology, propagation and uses.	**P. Chatterjee**	**5**
5. Spices: Listing of important spices, their family and part used.	**P. Chatterjee**	**6**
6. Beverages: Tea (morphology, processing and uses).		
7. Oil and fats: General description, classification, extraction, their uses and health implications of	**P. Chatterjee**	**5**
mustard, soybean, coconut (Botanical name, family and uses). Essential oils- general account, extraction methods, comparison with fatty oils and their uses.	**P. Chatterjee**	**10**
8. Drug-yielding plants: Therapeutic and habit forming drugs with special reference to Cinchona, Digitalis, Papavar, Cannabis and Tobacco	**M. Karmakar**	**8**
(morphology, processing, uses and health hazards).	**M. Karmakar**	**4**
9. Timber: general account with special reference to Sal and Teak.		
10. Fibers: Cotton and Jute (Morphology, extraction and uses).	**M. Karmakar**	**4**

BOTA-CC4-9-P

2 Credits

Economic Botany **Full marks 30**

Topic	Name of the Teacher	Number of Lectures
1. Cereals: Wheat (habit sketch, L.S./T.S. of grain, starch grains, micro-chemical tests); rice (habit sketch, study of paddy and grain, starch grains, micro- chemical tests)	**R. Bar**	
2. Legume: Soybean, ground nut (habit, fruit, seed structure, micro-chemical tests)	**R. Bar**	
3. Source of sugars and starches: Sugarcane (habit sketch; cane juice- micro-chemical tests); potato (habit sketch, tuber morphology, T.S. of tuber to show localization of starch grains, W.M. of starch grains, micro-chemical tests.	**R. Bar**	**10**
4. Tea- tea leaves, tests for tannin	**R. Bar**	
5. Mustard- plant specimen, seeds, tests for fat in crushed seeds	**R. Bar**	
6. Habit sketch of *Digitalis*, *Papaver* and *Cannabis*.	**R. Bar**	
7. Sal, Teak- section of young stem.		
8. Jute- specimen, transverse section of stem, tests for lignin on T.S. of stem and study of fibre following maceration technique.	**R. Bar**	

CORE COURSE 10: Genetics		
BOTA-CC4-10-TH		
4 Credi		
Genetics	**Full marks 50**	
Fourth Semester: January - June		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Introduction: Mendelian genetics and its extension …….6 lectures	**T. Biswas**	**6**
2. Linkage, Crossing over and Gene Mapping: 2.1.Complete and incomplete linkage (example), linked gene does not assort independently (example), linkage group, 2.2. Crossing over, crossing over produces recombination (example), detection of crossing over (McClintock's experiment), and 2.3.Molecular mechanism of crossing over (Holliday model), 2.4. Gene mapping with three point test cross, detection of middle gene in three point test cross, calculation of recombination frequencies, 2.5. Co-efficient of coincidence and 3.Classroom performance: (Lab records, permanent slides) 4. Field visit desirable to give an idea about cultivation of any crop (viz. rice, jute, mustard, tea, potato) 5. Field record of the visit, properly authenticated by escorting teacher interference, mapping function, 2.6. Problems on gene mapping, 2.7. Molecular mapping – ISH, FISH (brief idea).	**T. Biswas**	**16**
3. Epistasis and Polygenic inheritance in plants. **4.** Aneuploidy and Polyploidy: Types, examples, meiotic behaviour and importance of: 4.1.	**T. Biswas**	**4**
Aneuploidy, 4.2. Polyploidy, 4.3. Speciation and evolution through polyploidy.	**P. Saha**	**8**
5. Chromosomal aberration: Types and meiotic behaviour of: 5.1. Deletion, 5.2. Duplication, 5.3. Translocation, and 5.4. Inversion.	**P. Saha**	**6**
6. Mutation : 6.1. Point mutation-Transition, Transversion and Frame shift mutation, 6.2. Molecular mechanisms (tautomerisation, alkylation, deamination, base analogue incorporation, dimerisation), 6.3. DNA repair (brief idea).	**P. Saha**	**8**
7. Structural organisation of Gene:		

7.1. One Gene–one polypeptide concept, 7.2. Split gene, 7.3. Overlapping gene, 7.4. Repetitive DNA tandem and interspersed, 7.5. Transposon (Ac-Ds system), 7.6. Homoeotic gene in plants (ABCE Quartet model of flowering).	**P. Saha**	**12**
BOTA-CC4-10-P		
2 Credits		
Genetics	**Full marks 30**	
Topic	**Name of the Teacher**	**Number of Lectures**
6. Introduction to chromosome preparation: Pre- treatment, Fixation, Staining, Squash and Smear preparation, Preparation of permanent slides. **7.** Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of *Allium cepa*. **8.** Study of mitotic chromosome: Metaphase chromosome preparation, free hand drawing under high power objective, drawing with drawing prism under oil immersion lens, determination of 2n number, and comment on chromosome morphology of the following specimens from root tips: *Allium cepa*, *Aloe vera*, *Lens esculenta*. **9.** Study of chromosomal aberrations developed due to exposure to any two pollutants/ pesticides etc. **10.** Study of meiotic chromosome: Smear preparation of meiotic cells, identification of different stages and free hand drawing of the following specimens from flower buds: *Allium cepa* and *Setcreasea* sp. **11.** Identification from permanent slides: Meiosis – (i) normal stages (ii) abnormal stages – laggard, anaphase bridge, ring chromosome (*Rhoeo discolor*); Mitosis – (i) normal stages, (ii) abnormal stages early separation, late separation, multipolarity, sticky bridge, laggard, fragmentation, (ii) pollen mitosis.	**P. Saha** **P. Saha** **P. Saha** **P. Saha** **P. Saha** **P. Saha**	10

SEC B-BOTA-SEC-B-4-4	
MUSHROOM CULTURE TECHNOLOGY (SEC-B-4-4) TEORITICAL	
2 Credits	
Mushroom culture Technology	**Full marks 50**

Fourth Semester: January - June		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Introduction, nutritional and medicinal value of edible mushrooms; poisonous mushrooms, types of edible mushrooms available in India- *Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus*	**P. Saha**	**5**
2. Cultivation technology: infrastructure: substrates (locally available), polythene bags, vessels, inoculation hook, inoculation loop, low cost stoves, sieves, culture racks, mushroom unit (thatched house), water sprayer, tray, small polythene bag. Pure culture: medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation- paddy straw, sugarcane trash, maize straw, banana leaves,. Factors affecting the mushroom bed preparation- low cost technology, composting technology in mushroom production.	**P. Chatterjee**	**12**
3. Storage and nutrition: short term storage (Refrigeration- upto 24 hours), long term storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition- proteins- amino acids, mineral elements nutrition- carbohydrates, crude fibre content- vitamins.	**M. Karmakar**	**8**
4. Food preparation: type of foods prepared from mushroom. Research centres- National level and regional level. Cost benefit ratio- marketing in India and abroad. Export value.	**T. Biswas**	**5**

SEMESTER 5		
CORE COURSE 11: Cell and Molecular biology		
BOTA-CC5-11-TH		
4 Credits		
Cell and Molecular biology	**Full marks 50**	
Fifth Semester: July-December		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Origin and Evolution of Cells: 1.1. Evolution of nucleic acid (from PNA to DNA), Concept of RNA world, Ribozymes, First cell, 1.2. Origin of eukaryotic cell (endosymbiotic theory), 1.3.	**T. Biswas**	**6**
Small RNA- riboswitch, RNA interference, si RNA, mi RNA- brief idea, 1.4.Organellar DNA (cp- and mt- DNA). **2. Nucleus and Chromosome:** 2.1. Nuclear envelope, Nuclear lamina and Nuclear pore complex, 2.2. Nucleolus-ultrastructure and ribosome biogenesis, 2.3. Chromatin ultrastructure and DNA packaging in eukaryotic chromosome, 2.4. Centromere: types, structure and function. **3. Cell cycle and its regulation:** 3.1. Kinetochore and spindle apparatus-structural organization and functions, 3.2.Microtubulesstructure, organization and function, 3.3. Mechanism of cell cycle control in Yeast (checkpoints and role of MPF), Apoptosis (Brief idea). **MOLECULAR BIOLOGY** **1. DNA Replication, Transcription and Translation (Prokaryotes & Eukaryotes):** 1.1. Central Dogma, 1.2. Semiconservative DNA replication – mechanism, enzymes involved in DNA replication- DNA polymerase, DNA gyrase, Helicase, Ligase, primase and other accessory proteins, 1.3. Eukaryotic replication with special reference to replication licensing factor, assembly of new nucleosome, replication at the end chromosome telomere, telomerase concept, 1.4. Fidelity of DNA replication- prokaryote: nucleotide selection,	**T. Biswas** **T. Biswas** **P. Saha**	**6** **6** **20**
proof reading, mismatch repair; eukaryote: through selection of error prone DNA polymerase, 1.5.Transcription, 1.6 RNA processing, 1.7. Aminoacylation of tRNA, 1.8. Translation. **2. Gene Regulation:** 2.1 Concept of Lac-operon, 2.2. Positive and negative	**P. Saha**	**4**

control. **3. Genetic Code:** **3.1** Properties-evidences & exceptions, 3.2. Decipherence of codon (Binding technique). **4. Recombinant DNA Technology:** 4.1. Restriction endonuclease, - types and roles, 4.2. Vector (plasmid pBR 322), 4.3. Marker gene, 4.4. Steps of cloning technique, 4.5. PCR and its application, 4.6. Genomic DNA and cDNA library. **5.** Development and causes of Cancer (in general and brief), tumor suppressor gene and oncogene.	**P. Saha** **P. Saha** **P. Chatterjee**	**4** **10** **4**
BOTA-CC5-11-P		
2 Credits		
Cell and Molecular biology	**Full marks 30**	
Topic	**Name of the Teacher**	**Number of Lectures**
CELL BIOLOGY ***3.*** Study of plant cell structure with the help of epidermal peal mount of Onion/*Rhoeo*/*Crinum* **4.** Measurement of cell size by the technique of micrometry. **5.** Counting cells per unit volume with the help of haemocytometer (Yeast/pollengrains) **6.** Cytochemical staining of DNA- Pyronine-methyl green staining. 27 **7.** Estimation of DNA content through DPA staining. **8.** Estimation of RNA through orcinol method. **9.** Study of nucleolus through hematoxylin/ orcin staining and determination of nucleolar frequency. **10.** Preparation of models/ charts: rolling circle, theta replication, semi-discontinuous replication, prokaryotic RNA polymerase and eukaryotic RNA polymerase II, assembly of spliceosome mechinary, splicing mechanism in group I and group II introns, ribozyme and alternative splicing.	**T. Biswas** **T. Biswas** **T. Biswas** **T. Biswas** **T. Biswas** **T. Biswas** **M. Karmakar**	10

CORE COURSE 12: Biochemistry		
BOTA-CC5-12-TH		
4 Credits		
Biochemistry	**Full marks 50**	
Fifth Semester: July-December		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Biochemical Foundations: 1.1. Covalent and non-covalent bonds; hydrogen bond; Van der Waal's forces; 1.2. Structure and properties of water; 1.3. pH and buffer (inorganic and organic); 1.4. Handerson-Hasselbalch equation; 1.5. Isoelectric point.	**P. Chatterjee**	**6**
2. Molecules of life: 2.1. Nucleic Acids – structure of nucleosides and nucleotides ; oligo- and poly nucleotides , B & Z form of DNA, RNA- different forms; nucleotide derivatives (ATP, NADP), 2.2. Proteins – structure and classification of amino acids; primary, secondary, tertiary and quaternary structure of proteins; 2.3. Carbohydrates - structure of mono-, di- and polysaccharide; stereoisomers, enantiomers and epimers; 2.4. Lipids - structure of simple lipid and compound lipid (phospholipids and glycolipids), fatty acids- saturated and unsaturated.	**P. Chatterjee**	**24**
3. Energy flow and enzymology: 3.1. Bioenergetics-Thermodynamic principles; free energy; energy rich bonds- phosphoryl group transfer and ATP; redox potentials and Biological redox reactions, 3.2. Enzymes – classification and nomenclature (IUBMB); Co-factors and co-enzymes; isozymes, 3.3. Mechanism of enzyme action; enzyme inhibition; 3.4. Enzyme kinetics (Michaelis-Menten equation) and simple problems.	**P. Chatterjee**	**18**
4. Cell membrane: 4.1. Membrane chemistry, 4.2. Membrane transport (uniport, symport, antiport), mechanism of ion uptake.	**S. Sengupta**	**6**
5. Phosphorylation: ATP Synthesis- Chemiosmotic model, Oxidative and Photophosphorylation- Mechanism and differences	**S. Sengupta**	**6**

BOTA-CC5-12-P		
2 Credits		
Biochemistry	**Full marks 30**	
Topic	**Name of the Teacher**	**Number of Lectures**
Qualitative: **1.** Detection of organic acids: citric, tartaric, oxalic and malic from laboratory samples. **2.** Detection of carbohydrate and protein from plant samples. **3.** Detection of the nature of carbohydrate – glucose, fructose , sucrose and starch from laboratory samples. **4.** Detection of Ca, Mg, Fe, S from plant ash sample. **Quantitative:** **1.** Preparation of solutions and buffers. **2.** Estimation of amino-nitrogen by formol titration method (glycine) . **3.** Estimation of glucose by Benedicts quantitative reagent. **4.** Estimation of titratable acidity from lemon. **5.** Estimation of catalase activity in plant samples and effect of substrate, enzyme concentration and pH on enzyme activity. **6.** Estimation of urease activity in plant samples. **7.** Colorimetric estimation of protein by Folin phenol reagent.	**P. Chatterjee** **P. Chatterjee** **P. Chatterjee** **P. Chatterjee** **S. Sengupta** **S. Sengupta** **S. Sengupta** **S. Sengupta** **S. Sengupta** **S. Sengupta** **S. Sengupta**	10
DSE A:BOT-A-DSE-A-5-1-TH & P		
BIOSTATISTICS (DSE-A-5-1-TH)		
4 Credits		
Biostatistics	**Full marks 50**	
Fifth Semester : January - June		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Biostatistics: Definition, statistical methods, basic principles, variables- measurements, functions, limitations and uses of statistics. **2. Biometry:** Data, Sample, Population, Random sampling, Frequency distribution- definition only. **3. Central tendency–** Arithmetic Mean, Mode and Median; Measurement of dispersion– Coefficient of variation, Standard Deviation, Standard error of Mean.	**R. Bar** **R. Bar** **R. Bar**	**12** **12** **10**

4. Test of significance: chi- square test for goodness of fit. **5. Probability-** multiplicative and additive rules of probability: application and importance. **6. Measurement of gene frequency:** Hardy-Weinberg equilibrium- conditions applied for its implications (simple problems to calculate genotypic and allelic frequencies).	**R. Bar** **R. Bar** **R. Bar**	**6** **6** **14**
BIOSTATISTICS (DSE-A-5-1-P)		
2 Credits		
Biostatistics		
Topic	**Name of the Teacher**	**Number of Lectures**
7. Univariate analysis of statistical data: Statistical tables, mean, mode, median, standard deviation and standard error (using seedling population / leaflet size). 8. Calculation of correlation coefficient values and finding out the probability. 9. Determination of goodness of fit in Mendellian and modified mono-and dihybrid ratios (3:1, 1:1, 9:3:3:1, 1:1:1:1, 9:7, 13:3, 15:1) by Chi-square analysis and comment on the nature of inheritance. 10. Calculation of 'F' value and finding out the probability value for the F value 11. Basic idea of computer programme for statistical analysis of correlation coefficient,'t' test, standard error, standard deviation.	**R. Bar** **R. Bar** **R. Bar** **R. Bar** **R. Bar**	15
DSE B:BOT-A-DSE-B-5-5-TH & P		
PLANT BIOTECHNOLOGY (DSE-A-5-5-TH)		
4 Credits		
Plant Biotechnology	**Full marks 50**	
Fifth Semester : January - June		
Topic	**Name of the Teacher**	**Number of Lectures**
4. Plant tissue culture –Introduction: • Basic concept and milestones, 1.2. Cellular totipotency, 1.3. Tissue culture media, 1.4. Aseptic manipulation, 1.5. Cyto-differentiation and dedifferentiation. **1. Callus culture:** • Callus induction, maintenance and application,	**T. Biswas**	**10**

2.2. Suspension culture- introductory idea. **1. Plant regeneration:** 1.1 Organogenesis (direct and indirect), 3.2. Somatic embryogenesis, 3.3. Significance of organogenesis and somatic embryogenesis, 3.4. Artificial seed.	**T. Biswas**	**6**
4. Haploid Culture: 4.1. Anther and Pollen culture methods, 4.2. Applications. **5. Protoplast Culture:** 5.1. Protoplast isolation and culture, 5.2. Protoplast fusion (somatic hybridization), 5.3. Significance. **6. Plant Genetic Engineering:** 6.1. Brief concept of different gene transfer methods, special emphasis on *Agrobacterium* mediated gene transfer, Role of Reporter gene, 6.2. Achievements in crop biotechnology, environment and industry (suitable example)- pest resistant plants (BT cotton), herbicide resistance, disease and stress tolerance, transgenic crop with improved quality (flavr tomato, golden rice), role of transgenic in population degradation (super-bug), leaching of minerals, production of industrial enzymes, oil, edible vaccine.	**T. Biswas** **T. Biswas** **T. Biswas** **M. Karmakar**	**8** **6** **6** **24**

PLANT BIOTECHNOLOGY (DSE-A-5-5-P)

2 Credits

Plant Biotechnology **Full marks 30**

Topic	Name of the Teacher	Number of Lectures
PLANT BIOTECHNOLOGY 1. Familiarization of basic equipments in plant tissue culture 2. Study through photographs/ charts/ models of anther culture, somatic embyogenesis, endosperm and embryo culture, micropropagation. 3. Preparation of basal media. Sterilization techniques. 4. Demonstration of any tissue culture technique during visit in a plant tissue culture lab.	**T. Biswas** **T. Biswas** **T. Biswas** **T. Biswas**	10

SEMESTER 6		
CORE COURSE 13: Plant physiology		
BOTA-CC6-13-TH		
4 Credits		
Plant physiology	**Full marks 50**	
Sixth Semester : July-December		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Plant-water relations: 1.1 Concept of water potential, components of water potential in plant system, 1.2. Soil-plant-Atmosphere continuum concept, Cavitation in xylem and embolism, 1.3. Stomatal physiologymechanism of opening and closing, Role of carbon di-oxide, potassium ion, abscisic acid and blue light in stomatal movement, Antitranspirants.	**P. Chatterjee**	**6**
2. Mineral nutrition: essential and beneficial elements, macro- and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents.	**P. Chatterjee**	**6**
3. Organic Translocation: 3.1. Phloem sap, P-protein, 3.2. Phloem loading and unloading, 3.3. Mass-flow (pressure flow) hypothesis and its critical evaluation.	**P. Chatterjee**	**6**
4. Plant Growth Regulators: 4.1. Physiological roles of Auxin, Gibberellin, Cytokinin, Abscisic acid, Ethylene, 4.2. Chemical nature – IAA, GA3, Kinetin, 4.3. Biosynthesis and bioassay of IAA, 4.4. Mode of action of IAA, 4.5. Brassinosteroids and Polyamines as PGRs (brief idea).	**P. Chatterjee**	**18**
5. Photomorphogenesis: 5.1. Concept of photomorphogenesis, 5.2. Photoperiodism and plant types, 5.3. Perception of photoperiodic stimulus, 5.4. Critical day length, concept of light monitoring, 5.5. Phytochrome, cryptochrome and phototropins- chemical nature and role in photomorphogenesis, 5.6. Role of GA in flowering, 5.7. Vernalisation – role of low temperature in flowering, 5.8. Concept of biological clock and biorhythm.	**P. Saha**	**12**
6. Seed dormancy: 6.1. Types, Causes and Methods of breaking seed dormancy, 6.2. Biochemistry of seed germination.	**P. Saha**	**6**
7. Physiology of Senescence and Ageing.	**P. Saha**	**6**

BOTA-CC6-13-P		
2 Credits		
Plant physiology	**Full marks 30**	
Topic	**Name of the Teacher**	**Number of Lectures**
1. Determination of loss of water per stoma per hour. 2. Relationship between transpiration and evaporation. 3. Measurement of osmotic pressure of storage tissue by weighing method. 4. Measurement of osmotic pressure of *Rhoeo* leaf by plasmolytic method. 5. Effect of temperature on absorption of water by storage tissue and determination of Q10. 6. Rate of imbibition of water by starchy, proteinaceous and fatty seeds and effect of seed coat. 7. To study the phenomenon of seed germination (effect of light). 8. To study the induction of amylase activity in germinating grains. 9. To study the effect of different concentrations of IAA on *Avena* coleopotile elongation (IAA bioassay)	**P. Chatterjee**	10
CORE COURSE 14: Plant metabolism		
BOTA-CC6-14-TH		
4 Credits		
Plant metabolism	**Full marks 50**	
Sixth Semester : July-December		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Concept of metabolism: Introduction, Anabolic and catabolic metabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and isozymes)	**S. Sengupta**	**4**
2. Photosynthesis: 2.1 Chemical structure of chlorophyll a and b, absorption and action spectra, biological significance of carotenoid pigments, 2.2. Red drop and Emerson effect, Components of photosystems (light harvesting complex), photochemical reaction centres, Cyclic and noncyclic electron transport, Water splitting mechanism, 2.3. Calvin cycle – Biochemical reactions & stoichiometry, 2.4. HSK Pathway– three variants of the pathway, 2.5. Photosynthetic efficiency of C3 and C4 plants and crop productivity, 2.6 Photorespiration – mechanism and significance, 2.7 Crassulacean Acid Metabolism– mechanism and ecological significance.	**S. Sengupta**	**16**

3. Respiration: 3.1 EMP pathway, regulation and its anabolic role, 3.2. Conversion of Pyruvic acid to Acetyl CoA, 3.3. TCA-cycle and its amphibolic role, 3.4. Oxidative pentose phosphate pathway and its significance, 3.5. Mitochondrial electron transport system, uncouplers, 3.6. Oxidation of cytosolic NADH+H+ , 3.7. Stoichiometry of glucose oxidation (aerobic).	**S. Sengupta**	**12**
6. Nitrogen Metabolism: 6.1 Assimilation of nitrate by plants, 4.2. Biochemistry of dinitrogen fixation in Rhizobium, 4.3. General principle of amino acid biosynthesis (including GS and GOGAT enzyme system).	**S. Sengupta**	**10**
i) Lipid metabolism: • synthesis and breakdown of triglycerides, ß-oxidation, glyoxalate cycle, gluconeogenesis and its role in mobilization of the lipids during seed germinbations, α- oxidation.	**M. Karmakar**	**10**
6. Mechanism of signal transduction: receptor-ligand interactions, second messenger concept, calcium-calmodilin, G protein, MAP-kinase cascade.	-	

BOTA-CC5-14-P		
2 Credits		
Plant metabolism	**Full marks 30**	
Topic	**Name of the Teacher**	**Number of Lectures**
4. A basic idea of chromatography: Principle, paper chromatography and column chromatography; demonstration of column chromatography.	**S. Sengupta** **S. Sengupta**	10
5. Separation of plastidial pigments by solvent and paper chromatography.	**S. Sengupta**	
6. Estimation of total chlorophyll content from different chronologically aged leaves (young, mature and senescence) by Arnon method.	**S. Sengupta**	
7. Effect of HCO3 concentration on oxygen evolution during photosynthesis in an aquatic plant and to find out the optimum and toxic concentration (either by volume measurement or bubble counting).	**S. Sengupta**	
8. Measurement of oxygen uptake by respiring tissue (per g/hr.) 6.. Determination of the RQ of germinating seeds. 7. Test of seed viability by TTC method.	**S. Sengupta**	

DSE A:BOT-A-DSE-A-6-1-TH & P		
MEDICINAL AND ETHNOBOTANY (DSE-A-6-3-TH)		
4 Credits		
Medicinal and ethnobotany	**Full marks 50**	
Sixth Semester : January - June		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Medicinal botany: History, scope and importance of medicinal plant, a brief idea about indigenous medicinal sciences- ayurveda, siddha and unani. Polyherbal formulations.	**R. Bar**	**14**
2. Pharmacognosy- General account : 2.1 Pharmacognosy and its importance in modern medicine, 2.2 Crude drugs, 2.3 Classification of drugs- chemical and pharmacological, 2.4 Drug evaluation– organoleptic, microscopic, chemical, physical and biological, 2.5. Major pharmacological groups of plant drugs and their uses.	**R. Bar**	**12**
3. Secondary metabolites: 3.1 Definition of secondary metabolites and difference with primary metabolites , 3.2 Interrelationship of basic metabolic pathways with secondary metabolite biosynthesis (outlines only), 3.3 Major types–terpenoids, phenolics, flavonoids, alkaloids and their protective action against pathogenic microbes and herbivores.	**R. Bar**	**14**
4. Pharmacologically active constituents: Source plants (one example) parts used and uses of: 3.1 Steroids (Solasodin, Diosgenin, Digitoxin), 3.2 Tannin (Catechin), 3.3 Resins (Gingerol, Curcuminoids), 3.4 Alkaloids (Quinine, Atropine. Pilocarpine, Strychnine, Reserpine, Vinblastine), 3.5. Phenols (Sennocide and Capsaicin).	**P. Saha**	**4**
5. Ethnobotany and folk medicine: Definition, methods of study, application, Indian scenario, national interacts, Palaeo-ethnobotany, folk medicines in ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India, application of natural products to certain diseases- Jaudice, cardiac, infertility, diabetics, blood pressure and skin diseases.	**P. Saha**	**16**

MEDICINAL AND ETHNOBOTANY (DSE-A-6-3-P)		
2 Credits		
Medicinal and ethnobotany	**Full marks 30**	
Topic	**Name of the Teacher**	**Number of Lectures**
1. Chemical tests for (a) Tannin (*Camellia sinensis* / *Terminalia chebula*), (b) Alkaloid (*Catharanthus roseus*) . 2. Powder microscopy – *Zingiber* and *Holarrhena* . 3. Histochemical tests of (a) Curcumin (*Curcuma longa*), (b) Starch in non-lignified vessel (*Zingiber*), (c) Alkaloid (stem of *Catharanthus* and bark of *Holarrhena*).	**R. Bar** **R. Bar** **R. Bar**	10
DSE B:BOT-A-DSE-B-6-7-TH & P		
RESEARCH METHODOLOGY (DSE-A-6-7-TH)		
4 Credits		
Research methodology	**Full marks 50**	
Sixth Semester : January - June		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Basic concepts of research: research- definition and types of research (Descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs. emperical), research methods vs. methodology; literature- review and its consolidation; library research; field research; laboratory research.	**T. Biswas**	**10**
2. General laboratory techniques: common calculations in botany laboratories; understanding the details on the label of reagent bottles; molarity and normality of common amino acids and bases; preparation of solutions. Dilution, percentage, molar, molal and normal solutions. Techniques of handling micropipettes; knowledge about common toxic chemicals and safety measures in their handling.	**M. Karmakar**	**12**
3. Data collection and documentation of observations. Maintaining of laboratory records, tabulation and generation of graphs. Imaging of tissue specimens and application of scale bars. The art of field photography.	**T. Biswas**	**6**
4. Overview of biological problems: plant science research key areas, model organisms in research.	**M. Karmakar**	**6**

5. Methods to study plant cells/ tissue structure: whole mounts, peal mounts, squash preparations, clearing, maceration and sectioning, tissue preparation- fixation, dehydration etc., paraffin and plastic infiltration, preparation of thin and ultra-thin sections.	**T. Biswas**	**6**
6. Plant micro-techniques: staining procedures, classification and chemistry of stains, staining equipments. Cytogenetic techniques with squashed plant materials. **7.** The art of scientific writing and its presentation: numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Power point presentation. Poster presentation. Scientific writing ethics. Introduction to copy write- academic misconduct/ plagiarism.	**T. Biswas** **T. Biswas**	**12** **8**

RESEARCH METHODOLOGY (DSE-A-6-7-P)		
2 Credits		
Research methodology	**Full marks 30**	
Topic	**Name of the Teacher**	**Number of Lectures**
1. Experiments based on calculations 2. Plant microtechnique experiments 3. The art of imaging of samples through photomicrography and field photography 4. Poster/ power point presentation on defined topics 5. Technical writing on topics assigned.	**T. Biswas** **T. Biswas** **T. Biswas** **T. Biswas** **T. Biswas**	10

Academic Calendar 2023-2024
Course: B.Sc. (General)
Anthropology Minor: 2023: NEP

Semester I
Core Course: ANT-G-CC-I-TH
First Semester: July to December

	Topic	Name of the Teacher
	ANTA-G-CC-1-TH: Introduction to Anthropology	
	Unit-I: Concept of Anthropology, history, divergence (sub-disciplines/sub-fields), flexibility, holism of Anthropology. Anthropology in relation to other disciplines of Physical and/or Natural sciences, Social sciences, Arts and humanities. **Unit-II:** i. Introduction to archaeological anthropology, its relation to anthropology, palaeoanthropology, history, prehistory and historical archaeology. ii. A history of archaeology, mentioning only the stages of antiquarianism, Three age Paradigm, Culture history Processual and Post-processual archaeology. iii. A brief idea of palaeo-environment: Glacial, inter-glacial and pluvial, inter-pluvial in high and low latitudes. iv. Methods for reconstructing the past-environmental archaeology, experimental archaeology, Ethno-archaeology, Primate-ethology.	A. Majumdar
	Unit-III: a. Biological Anthropology: concept, aim, scope, branches and applications of Biological Anthropology. b. Morphology of human: External morphology; Skeletal morphology-Definition and function of human skeleton. Types and definition of the types of bones. Name, number and position of bones on human skeleton. ii. Modifications of human skeleton as consequences of evolution-erect posture and bipedal gail. iii. Human Dentition (Types and salient features)	Dr. P. Sarkar
	Unit-IV: i. History of Social-cultural anthropology, The ideas of Holism; Social and Cultural Anthropology in relation to other allied disciplines, Interdisciplinary and multidisciplinary for Anthropology. a. Society: (i). kinship, group (ii) Evolution, Descent, Exchange, and	C. Sherpa

	Transaction; (iii) Social structure, (Structural-Functionalism and Structuralism), Social Organisation (Firth). b. Culture: General and particular, (ii) Set of Assumptions (e.g. Keesing 1974) ii. Kinship and Other dimensions of society: a. Classical Kinship Theories, (ii) Types and Terminology of kinship in simple society; Clan, Lineage, Segmentary Lineage System, Phratry and Moiety (iii) Relationship of Kinship to inheritance and residence rules. iii. Early ideas of Marriage and Family: Features, Types, Rules, (e.g. Marriage, marital transactions, dowry and bride price, incest taboo) functions and changes	
	ANTA-G-CC-I-P (Practical)	
	UNIT-I. Biological Anthropology **A. Study of Human skeleton (Original or Cast material)** i). Identification of bones-skull bones; Frontal, Parietal, Occipital, Temporal, Maxilla, Sphenoid, Zygoma, and Mandible. ii). Long bones with side determination (Humerus, Radius, Ulna, Femur, Tibia, Fibula), Scapula, Clavicle, Os innominatum iii). Determination of sex from skull and pelvis B. **Craniometry**: (on two skulls): Students should know the landmarks, instruments related to it. 1. Maximum cranial length, 2. Maximum Cranial breadth, 3. Least Frontal Breadth, 4. Maximum bi-zygomatic , 5. Nasal length, 6. Nasal breadth, 7. Superior Facial length	Dr. P. Sarkar And C. Sherpa

Anthropology MDC: 2023: NEP
Semester I
Course: ANTA-MD-CC-I-TH
First Semester: July to December

	Topic	**Name of the Teacher**
	ANTA-MD-CC-1-TH: Introduction to Anthropology	
	Unit-I: Concept of Anthropology, history, divergence (sub-disciplines/sub-fields), flexibility, holism of Anthropology. Anthropology in relation to other disciplines of Physical and/or Natural sciences, Social sciences, Arts and humanities. **Unit-II:**	A. Majumdar

	i. Introduction to archaeological anthropology, its relation to anthropology, palaeoanthropology, history, prehistory and historical archaeology. ii. A history of archaeology, mentioning only the stages of antiquarianism, Three age Paradigm, Culture history Processual and Post-processual archaeology. iii. A brief idea of palaeo-environment: Glacial, inter-glacial and pluvial, inter-pluvial in high and low latitudes. iv. Methods for reconstructing the past-environmental archaeology, experimental archaeology, Ethno-archaeology, Primate-ethology.	
	Unit-III: **a. Biological Anthropology**: concept, aim, scope, branches and applications of Biological Anthropology. **b. Morphology of human:** External morphology; Skeletal morphology-Definition and function of human skeleton. Types and definition of the types of bones. Name, number and position of bones on human skeleton. ii. Modifications of human skeleton as consequences of evolution-erect posture and bipedal gait. iii. Human Dentition (Types and salient features)	Dr. P. Sarkar
	Unit-IV: i. History of Social-cultural anthropology, The ideas of Holism; Social and Cultural Anthropology in relation to other allied disciplines, Interdisciplinary and multidisciplinary for Anthropology. **a. Society**: (i). kinship, group (ii) Evolution, Descent, Exchange, and Transaction; (iii) Social structure, (Structural-Functionalism and Structuralism), Social Organisation (Firth). **b. Culture**: General and particular, (ii) Set of Assumptions (e.g. Keesing 1974) ii. Kinship and Other dimensions of society: a. Classical Kinship Theories, (ii) Types and Terminology of kinship in simple society; Clan, Lineage, Segmentary Lineage System, Phratry and Moiety (iii) Relationship of Kinship to inheritance and residence rules. iii. Early ideas of Marriage and Family: Features, Types, Rules, (e.g. Marriage, marital transactions, dowry and bride price, incest taboo) functions and changes	C. Sherpa
	ANTA-MD-CC-I-P (Practical)	
	UNIT-I. Biological Anthropology **A. Study of Human skeleton (Original or Cast material)**	

	i). Identification of bones-skull bones; Frontal, Parietal, Occipital, Temporal, Maxilla, Sphenoid, Zygoma, and Mandible. ii). Long bones with side determination (Humerus, Radius, Ulna, Femur, Tibia, Fibula), Scapula, Clavicle, Os innominatum iii). Determination of sex from skull and pelvis B. **Craniometry**: (on two skulls): Students should know the landmarks, instruments related to it. 1. Maximum cranial length, 2. Maximum Cranial breadth, 3. Least Frontal Breadth, 4. Maximum bi-zygomatic , 5. Nasal length, 6. Nasal breadth, 7. Superior Facial length	Dr. P. Sarkar And C. Sherpa

Anthropology SEC : 2023: NEP
Semester I
Core Course: Anthropology SEC, 2023: NEP
First Semester: July to December

	Topic	**Name of the Teacher**
ANTA-SEC-1-Th		
	Media and Anthropology **I. Media Anthropology** 1. Media, Mass and Anthropology 2. Definition , Actors, Fields, Methods, Strategies and taboo, Case of Illustration 3. Media Effects tradition 4. Controversies 5. Examples of use of anthropology in communication **II. Communication: The Approaches**: a) Chicago School and Basic Principles, b) The Mediation of Social Relations, c) Political economy, d) Reception, Globalization and Media **iii) Media Approaches and Themes**: a) Behaviourism and media effects (Lasswell, Cultivation theory, b) Uses and Gratification theory, c) Interactionism , Structuralism and semiotics (Encoding/Decoding), d) ideology and hegemony, The ideology of news, Self-presentation, f) Post-modernity and information society (hyper-reality and simulation)	C. Sherpa & Dr. P. Sarkar

Anthropology IDC: 2023: NEP
Semester I
Course: IDC-TH
First Semester: July to December

	Topic	Name of the Teacher
	Anthropology IDC Theory	
	Unit – I : Concept of Anthropology, history, development and sub-disciplines/sub-fields, holism of Anthropology. Anthropology in relation to the disciplines of Physical and / or Natural Sciences, Social Sciences, Arts and Humanities. **Unit- II:** i. Introduction to Archeological Anthropology, its relation to anthropology, palaeoanthropology,history, prehistory and historical archeology. ii. A brief history of archeology, mentioning only the stages of Antiquarianism, Three Age Paradigm, Culture history, Processual and Post-processual archeology. iii. A brief idea of geological time scale and palaeo-environment: Glacial, inter-glacial and Pluvial, inter-pluvial in high and low latitudes. iv. Methods for reconstructing the past- environmental archeology, experimental archeology,Ethno-archeology, Primate ethology. v. Reconstructing the past lifestyle/cultures from the archaeological record: Brief introduction to the methods of exploration and excavation.	**Dr. P. Sarkar**
	Unit III **Biological Anthropology**: concept, aim, scope, branches and application of Biological Anthropology. i) Concept of population diversity: UNESCO statement of race (1950, 1952), Paradigm shift from the concept of Race to Ethnic Group. Typological, Populational and Clinal Models. Racial / ethnic composition of the population of undivided India by H.H. Risley, B.S. Guha and S. S. Sarkar.; Relevance of studying population diversity. ii) Human Adaptation: Ecological rules, Adaptation to hot, cold and altitude. iii) Human Evolution: Geological Time scale, Evolution of anatomically modern Homo sapiens from protohominoids [Aegyptopithecus, Proconsul, Dryopithecus, Sivapithecus, Ramapithecus and Gygantopithecus, Australopithecus (gracile and robustus), Homo erectus, Homo neanderthalensis, Archaic Homo	**Dr. P. Sarkar**

	sapiens and Anatomically Modern sapiens] [N.B.- For the above fossil specimens, their chronology, environmental background, distribution, salient anatomical features, and phylogeny to be known as outlines of the whole process of evolution.]	
	UNIT IV: Social and Cultural Anthropology a) **History** of social and cultural anthropology, b) **Society** : (i) General and particular (ii) Kinship: Evolution, Descent, Exchange and Transaction; (i) Classical Kinship Theories: (e,g, Evolution, Descent and Alliance) Kinship in Simple Society; Clan, Lineage, Segmentary Lineage System, Phratry and Moiety c) **Culture**: (i) General and particular, (ii) Set of Assumptions [e.g. Keesing 1974] d) **Religion**: Forms accor ding to E. B. T ylo r (Animism, Animatism, Manaism, Polytheism, Monotheism), Shaman, Totem, Taboo: e) **Early ideas of Marriage and Family**: Features, Types, Rules (e.g. Marital transactions, dowry and bride price, incest taboo) f) **Economic Aspects**: Reciprocity, redistribution and market exchange (Substantivism) Informal Economy (Keith Hart) g) Early Ideas of **Political Organisation** for stateless and state societies h) **Social stratification** : Egalitarian societies, peasant society,, rank society (i.e. tribe, chiefdom, state), class, caste i) **The Processes of Change**: Diffusion, Innovation, Acculturation, Evolution, Planned Change, Social Movement, Transformation, Hybridization	**C. Sherpa**
	Anthropology IDC Practical	Dr. P. Sarkar & C. Sherpa
	A project report based on any one of the topics from Unit I to IV	

Part-II: Semester III
Core Course: ANT-G-3-CC/GE-3-TH
First Semester: July to December

	Topic	Name of the Teacher
A	**PRIMATE EVOLUTION** **UNIT – I**: THEORIES OF EVOLUTION Lamarckism, Darwinism, Synthetic theory **UNIT –II**: Living primates a. Definition (Mivart) and general characteristic features of order Primates. b. Evolutionary trends of the Primates. c. Classification of the order Primates –G.G. Simpson (1945) and modified by Simons (1972) with features and example up to family. d. Platyrrhine and Catarrhine monkeys- distribution, characteristics anddifferences. Anthropoid apes: Features, classification, distribution, and social 7ehavior of the anthropoid apes. e. Skeletal comparison of anthropoid apes with that of man. **UNIT – III**: Fossil Primates (chronology, features and phylogeny). a. Dryopithecus, Sivapithecus, Ramapithecus b. Earlier hominid-A. afarensis, and A. africanus c. Emergence of genius Homo- H. habilis, H. erectus, (Java and Peking variety). d. Emergence of Archaic Homo sapiens- Neanderthal (La chapelle-aux–saints and Tabun) e. Anatomically Modern Homo sapiens- Cro-Magnon	Dr. P. Sarkar
B	**ARCHAEOLOGICAL ANTHROPOLOGY** Prehistory of India (to be studied on a regional basis). **UNIT – I**: A brief history of Indian prehistory. The classifications and nomenclatures of the prehistoric cultural periods of India. Study of prehistoric cultures from the earliest evidences up to the beginning of historical times on a regional basis. **UNIT – II** Palaeolithic India: brief outlines of the following	A. Mazumdar

	regional cultures –a) north India-a) Sohan river valley, Beas-Banganga river valley; b) Central India-Narmada valley; c) Eastern India- Subarnarekha, Tarafeni, Gandheswari river valleys, Mayurbhanj, Keonjhar; d)South India- Kortalayar river valley; e) Western India- Nevasa **UNIT – III** Microlithic cultures of India: brief outlines of the following regional cultures: a) Eastern India b) Central India c) Western India d) southern India. With reference to teaching the microlithic cultures, focus is to be given more on regional variability and environmental adaptability rather than being site specific. Where ever available, the dates are also to be given.	
C	**SOCIAL CULTURAL ANTHROPOLOGY** Political Anthropology: The major theoretical approaches of political anthropology and or anthropology of power and politics; Political processes, such as factionalism, styles of leadership, political rituals. Comparative study of political institutions in simple and complex cultures; race, regional and/ or linguistic groups, state/nationhood, religions and ethnicity and(inter-) ethnic relations, social movements. Anthropology and Contemporary Social Issues: population growth; poverty, inequality and justice; Issues of gender and sexuality; warfare (nuclear, biological, imperial) and peace; terror; marginalization and exclusion; epidemic diseases and disaster; social movements; Regional Anthropology: South Asia: a) Religion, functions of religion, animism, animatism, nature worship, Regionalism, nationalism in India. B) Varna, Jati/caste, caste system in India, Jajmani system, Caste system and inequalities in India. C) Peasant village: Feature, habitation, economy and changes	C. Sherpa
	ANT-G-CC/GE-3-P(Practical)	
	Archaeological Anthropology 1. A basic idea of flint knapping techniques 2. Understanding the significance of selection of raw materials 3. Identification of forms of raw materials, i.e. core, flake, blade……... 4. Learning the procedure of drawing tools in the laboratory. 5. Drawing of core tool, flake tool, blade tool, micro blade and polished tool (Hand axe, cleaver chopper, scraper, point,	A. Mazumdar

	burin, laurel leaf point, baton-de commandment, harpoon (uni-barbed/ multi-barbed), lunate, adze, celt, ring stone) along with their features, cultural stages, hafting techniques and probable uses. 6. Understanding the development of stone tools in the context through study of their typo - technology. Drawing on graph paper 2 typical tools from each stages - lower, middle, upper Paleolithic and microlithic. 7. Comparative analyses of these tools both on the bases of their morphological attributes (e.g.shape, no. of primary and secondary flake scars, shapes and depth of the flake scars, amount of retouching, backing, continuity of working edge.) as well as their metric attributes (length, breadth, cross sections, dorsal and ventral view) Finally trying to mark rough indicators of techno- typological development of stone tools in India by inductive codification from the above analyses. **Study of topo-sheets** for understanding the geophysical, political, socio-economic, population density, rural, urban, suburban, developmental and any other relevant information/features of an area.	Dr. P. Sarkar

Part-III: Semester V
Core Course: ANT-G-5-DSE-5-1A
Fourth Semester: July to December

	Topic	Name of the Teacher
ANT-G-5-DSE-1A Human Growth and Development		
	ANT-G-5-DSE-1A –TH Introduction to human growth and development. Prenatal growth. Post natal growth. Factors affecting growth. Methods of studying growth: Cross sectional, longitudinal, and mix cross sectional, Growth curves. Human nutrition: food, diet, nutrition and metabolism (definitions only); the basic nutrients- micro and macro nutrients, their sources, and utility, Malnutrition: over and under nutrition.	C. Sherpa and Dr. P. Sarkar
	ANT-G-5-DSE-1A-P Project/ Report on any chosen topic from ANT-G-DSE-1A –TH	
ANT-G-5-DSE-2A Contribution to Archaeological Anthropology in India		
	ANT-G-5-DSE-2A –TH Classification of Indian Archaeology (Verma, 1997) Period-I (1840-1940) Pre Sankalia era Period-II (1940—1990) Sankalia era Period-III (1990 onwards) Post Sankalia era Contribution of Meadows Taylor, Robert Bruce Foote, Sir Martin Wheller, DeTerra and Patterson, H.D. Sankalia.	A. Mazumder &
	ANT-G-5-DSE-2A –P Project / Report on any chosen topic from ANT-G-DSE-2A –TH	Dr. P. Sarkar
ANT-G-5-DSE-3A Environment and Anthropology		C. Sherpa
	ANT-G-5-DSE-3A-TH Introduction to environmental anthropology, History and development of environmental anthropology. Basic concepts of ecology. Human adaptability, Environment/Habitat, Ecology, Culture environment relationship.Health and environment.Forest policies in India.Movements related to the protection of Environment in India, Environmental justice.	&
	ANT-G-5-DSE-3A-P Project / Report on any chosen topic from ANT-G-DSE-3A-TH	Dr. P. Sarkar

Part II: Semester III
Ability Enhancement Elective (Skill Based) Course: ANT-G-3-SEC-A (1)
Third Semester: July to December

<table>
<tr><th></th><th>Topic</th><th>Name of the Teacher</th></tr>
<tr><td colspan="2">ANT-G-3-SEC-A (1)</td><td rowspan="2"></td></tr>
<tr><td></td><td>ANT-G-SEC-A (1) – 1:Public health and epidemiology

Unit I: Principles of Epidemiology in Public Health: Overview of epidemiology methods used in research studies to address disease patterns in community and clinic-based populations, distribution and determinants of health-related states or events in specific populations, and strategies to control health problems.

Unit II: Psychological, Behavioural, and Social Issues in Public Health; Cultural, social, behavioural, psychological and economic factors that influence health and illness.</td><td>C. Sherpa

&

Dr. P. Sarkar</td></tr>
<tr><td colspan="3">Or</td></tr>
<tr><td colspan="2">ANT-G-3-SEC-A (1)- 2:Anthropology and Development</td><td rowspan="2"></td></tr>
<tr><td></td><td>Anthropology and Development: The Pros and Cons of the Relationship
1. Anthropology in Development: Cardoso
2. The World of Development and Anthropology: Bouju
3. The Uneasy Relationship: Lewis, Gow.
4. Development Anthropology: The Aspects, Phases, Actions, Debates: Grammig. 2nd Chap.; Gow; Edelman and Haugerud: Introduction
5. Speaking on behalf of ‘those’ Others: Cardoso
6. Anthropology of Development and Development Anthropology: Edelman and Haugerud: Introduction, Escobar</td><td>C. Sherpa

&

Dr. P. Sarkar</td></tr>
</table>

Part III: Semester V
Ability Enhancement Elective (skill based) Course: ANT-G-5-SEC-A (2)
Fifth Semester: July to December

	Topic	Name of the Teacher
ANT-G-5-SEC-A (2)		
	ANT-G-5-SEC-A (2) -5.: Physiological Anthropology **Unit I** Fundamentals of work physiology- homeostasis; metabolism and energy and systems; exercise, respiratory system and haemodynamics (blood pressure, pulse rate, heart rate and oxygen- transporting system, blood flow, Hb) **Unit II** Cardio-vascular and respiratory endurance, physical working capacity and physical fitness- evaluation of response and assessment; aerobic and anaerobic exercise training, health related fitness in gender and ethnic group. Impact of smoking, alcohol, drug, pollution and occupation on cardio-respiratory functions; physical performance and environmental stress, chronic diseases, malnutrition, lifestyle disease/disorders.	C. Sherpa & Dr. P. Sarkar
Or		
	ANT-G-5-SEC-A (2)-6.: MEDICAL ANTHROPOLOGY **Unit – 1** a) **Medical Anthropology**: Definition and major areas of study; Goals and basic premises b) **Anthropology in Medicine** and Anthropology of Medicine c) **Clinical Anthropology** and Medical Anthropology d) **Ethnomedicinal Anthropology**: Disease aetiology, disease classification, diagnosis and healing in folk societies; Culture bound syndromes, Traditional Medicine in India	

ACADEMIC CALENDAR FOR ODD SEMESTERS 2023
PHYSICS (PHSA)

Academic Calender (ODD SEM 2023)

PRACTICALS	THEORY
SEM 1H+G: **DSC-1/Minor-1: Practical (AS)** **SEC1: (MR+SP)**	**SEM 1H+G:** **DSC-1/Minor-1:** **Mathematical Physics** **1. Preliminaries (NB)** **2. ODE (NB)** **3. Vectors (LD)** **4. Curvilinear Coordinates (LD)** **Classical Mechanics** **1. Review of Newton's Laws (AS)** **2. Work K.E Theorem (AS)** **3. Dynamics of a system of particles (LD)** **4. Central Force (LD)** **5. Scattering (NB)** **6. Mechanics of Continuum (NB)**
SEM 3H: **CC5: Mathematical Physics II (SP)** **CC6: Thermal Physics (NB)** **CC7: Modern Physics (SP)**	**SEM 3H:** **CC5: Mathematical Physics II** **1. Fourier Series (NB)** **2. Frobenius Method and Special Functions (NB)** **3. Some special Integrals (NB)** **4. Integral Transforms (MR)** **5. Introduction to probability (MR)** **6. PDE (MR)** **CC6: Thermal Physics (LD)** **CC7: Modern Physics** **1. Radiation and its Nature (AS)** **2. Basics of Quantum Mechanics (AS)** **3. Nuclear structure (SP)** **4. Interaction within the nucleus (SP)**

	5. Lasers (SP)
SEM 5H: **CC11: EM Theory (AS)** **CC12: Statistical Physics (SP)**	**SEM 5H:** **CC11: EM Theory (NB)** **CC12: Statistical Physics** 1. Classical Stat Mech (AS) 2. Systems of Identical particles (AS) 3. BE Stat (AS) 4. Radiation (LD) 5. FD Stat (LD) **DSE A1 (b) Laser and Fiber Optics** 1. Einstein coefficients and Rate equations (MR) 2. Basic properties of laser (MR) 3. Resonantors (MR) 4. Transient effect (MR) 5. Basic Laser Systems (NB) 6. Practical properties and uses of laser (NB) 7. Fiber Optics (NB) 8. Holography (NB) 9. Introductory Non-linear Optics (MR) **or** **DSE B1:** **b) Nuclear and Particle Physics** **1. Introduction (AS)** **2. Nuclear Reactions (AS)** **3. Interaction of Nuclear Radiation with matter (AS)** **4. Detector for Nuclear Radiations (SP)** **5. Particle Accelerators (SP)** **6. Particle Physics (SP)**

SEM 3G: **CC3/GE3: Thermal Physics and Statistical Mechanics (NB)** **SECA1: Scientific Writing (SP)**	**SEM 3G:** **CC3/GE3: Thermal Physics and Statistical Mechanics** **1. Laws of Thermodynamics (LD)** **2. Thermodynamical Potentials (LD)** **3. Kinetic Theory of Gases (AS)** **4. Theory of Radiation (AS)** **5. Statistical Mechanics (MR)**
SEM 5G: **SECA1: Scientific Writing (SP)** **DSE A1: Analog Electronics (LD)**	**SEM 5G:** **DSE A1: Analog Electronics** **1. Circuits and Network (MR)** **2. Semiconductor Devices (MR)** **3. Regulated Power Supply (MR)** **4. Field Effect transistors (AS)** **5. Feedback Amplifiers (AS)** **6. Operational Amplifiers (AS)**

Academic calendar and distribution of syllabus (even semester 2023)

PRACTICALS	THEORY
SEM 2H: **CC3: Electricity and Magnetism (NB)** **CC4: Waves and Optics (AS)**	**SEM 2H:** **CC3: Electricity and Magnetism** **CC4: Waves and Optics**
SEM 4H: **CC8: Mathematical Physics III (SP)** **CC9: Analog Electronics (LD)** **CC10: Quantum Mechanics (MR)** **SECB1: Arduino Project (SP)**	**SEM 4H:** **CC8: Mathematical Physics III** **CC9: Analog Electronics** **CC10: Quantum Mechanics** **SECB1: Arduino**
SEM 6H: **CC13: Digital Electronics (SP)** **CC14: Solid State Physics (AS)** **DSE A2: Tutorial (NB)** **DSE B2: Tutorial (LD)**	**SEM 6H:** **CC13: Digital Electronics** **CC14: Solid State Physics** **DSE A2: Nanomaterials** **DSE B2: Communication electronics**
SEM 2G: **CC2/GE2: Elect and Mag (NB)**	**SEM 2G:** **CC2/GE2: Electricity and Magnetism**
SEM 4G: **CC4/GE4: Waves and Optics (MR)** **SECB1: Arduino Project (SP)**	**SEM 4G:** **CC4/GE4: Waves and Optics** **SECB1: Arduino**
SEM 6G: **DSE B1: Digital Electronics (LD)**	**SEM 6G:** **DSE B1: Digital Electronics**

NAME OF THE TEACHER		TOPICS
LD	SEM2H Elec & Mag	1. Dirac delta function and it's properties 2. Electrostatics 3. Dielectric properties of matter
MR	SEM2H Elec & Mag	4. Method of Images 5. Electrostatic Energy 9. Electrical circuits
NB	SEM2H Elec & Mag	6. The Magnetostatic Field 7. Magnetic properties of matter 8. Electro-magnetic induction
SP	SEM2H Waves and Optics	1. Oscillations 2. Superposition of Harmonic Oscillations 3. Wave motion 4. Superposition of Harmonic Waves
AS	SEM2H Waves and Optics	5. Wave optics 6. Interference 7. Interferometers 8. Diffraction
NB	SEM4H Mathematical Physics III	1. Complex Analysis 2. Variational calculus in Physics
SP	SEM4H Mathematical Physics III SEM4H Analog Electronics	3. Special theory of Relativity Regulated power supply
MR	SEM4H Analog Electronics	Circuits and Network Semiconductor Diodes and application Bipolar Junction transistors and biasing Field Effect transistors
AS	SEM4H Analog Electronics	1. Amplifiers 2. Feedback amplifiers and OPAMP 3. Multivibrator 4. Oscillator
NB	SEM4H Quantum Mechanics	1. Wavepacket description 2. General discussion of bound states in an arbitrary potential

		3. Quantum mechanics of simple harmonic oscillator 4. Quantum theory of hydrogen-like atoms
LD	SEM4H Quantum Mechanics	5. Generalized Angular Momenta and Spin 6. Spectra of Hydrogen atom and its fine structure 7. Atoms in Electric & Magnetic Fields 8. Many electron atoms
SP	SEM6H Digital systems and applications SEM6H Communication Electronics	1. Integrated Circuits 2. Number System 3. Digital Circuits 4. Implementation of different circuits 1. Electronic communication 2. Analog Modulation 3. Analog Pulse Modulation
LD	SEM6H Digital systems and applications SEM6H Communication Electronics	5. Data processing circuits 6. Sequential Circuits 7. Registers and Counters 8. Computer Organization 9. Data Conversion 4. Digital Pulse Modulation 5. Introduction to Communication and Navigation systems
NB	SEM6H Solid State Physics SEM6H DSEA2: Nanomaterials	1. Crystal Structure 2. Elementary Lattice Dynamics 3. Magnetic Properties of Matter 1. Nanoscale Systems 2. Synthesis of Nanostructure Materials
AS	SEM6H Solid State Physics SEM6H DSEA2: Nanomaterials	4. Dielectric Properties of Materials 5. Drude's theory 6. Elementary band theory 7. Superconductivity 3. Characterization
GL	SEM6H DSEA2: Nanomaterials	4. Optical Properties 5. Electron Transport 6. Applications

AS	SEM2G Elect and Mag	1. Essential Vector Analysis 2. Electrostatics 3. Magnetism 4. EM induction 5. Electrodynamics
AS	SEM4G Waves and Optics	1. Acoustics 2. Superposition of vibrations 3. Vibrations in String
GL	SEM4G Waves and Optics	4. Introduction to wave Optics 5. Interference 6. Diffraction 7. Polarization
AS	SEM6G DSEB2: Digital Electronics	1. Integrated Circuits 2. Number System
LD	SEM6G DSEB2: Digital Electronics	3. Digital circuits 4. Data Processing circuits
SP	SEM6G DSEB2: Digital Electronics	5. Sequential Circuits 6. Registers and Counters

Chemistry Odd SEM Academic Calendar 2023-24

Four-year Chemistry Major

SEMESTER-1

PAPER : CHEM-H-CC1-1-Th
Fundamentals of Chemistry – I Theory: (45 Lectures)
Module : I

Extra nuclear structure of atoms: (15 Lectures) **Dr. Satadal Paul**

and Periodicity **Dr. Amit Kumar Dutta**

Module : II

Basics of Organic Chemistry Bonding and Physical Properties: (10 Lectures)

Valence Bond Theory **Dr. Atreyee Basu**

Electronic displacement:

MO Theory **Soumyajit Sett**

Physical properties

Stereochemistry – I: (5 Lectures)

Module : III

Thermodynamics -I : (9 Lectures) **Utpal Pradhan**

Chemical Kinetics-I: (6 Lectures) **Dr. Satadal Paul**

Practical : (30 Lectures)
PAPER : CHEM-H-CC1-1-P

(1) Calibration and use of apparatus. **Dr. Satadal Paul**

(2) Preparation of primary standard solutions (Oxalic Acid and $K_2Cr_2O_7$) **Dr. Atreyee Basu**

Acid-Base Titrations:

Oxidation-Reduction Titrimetry: **Dr. Amit Kumar Dutta**

SKILL ENHANCEMENT COURSE
CHEMISTRY

Paper: CHEM-H-SEC1-1-Th

Quantitative Analysis and Basic Laboratory Practices Theory: (45 Lectures)

Module : I **Dr. Satadal Paul**

Introduction to Quantitative analysis and its interdisciplinary nature: (15 Lectures)

Numerical problems are to be solved wherever applicable.

Module : II **Soumyajit Sett/ Utpal Pradhan**

Titrimetric analysis: (15 Lectures)

Numerical problems are to be solved wherever applicable.

Acid-base titrimetry:

Numerical problems are to be solved wherever applicable.

Redox titrimetry:

Numerical problems are to be solved wherever applicable.

Precipitation titrimetry:

Numerical problems are to be solved wherever applicable.

Complexometric titrimetry:

Numerical problems are to be solved wherever applicable.

Gravimetric Analysis:

Module : III (15 Lectures) **Dr. Amit Kumar Dutta**

Water analysis:

Water treatment technologies:

Numerical problems are to be solved wherever required

Basic laboratory practices:

Tutorial: (15 hours)

PAPER: CHEM-H-SEC1-1-Tu **Dr. Satadal Paul/ Utpal Pradhan**

1. Safety Practices in the Chemistry Laboratory, knowledge about common toxic chemicals and safety measures
2. Calibration of glassware, pipette, burette and volumetric flask.
3. Preparation of TLC plates and separation of amino acids
4. Calibration of instruments like colorimeter, pH-meter, conductivity meter.
5. Conductometric titration between HCl and NaOH.
6. Determination of alkali present in soaps/detergents.

Chemistry Hons (CBCS)

SEMESTER-3

CEMA-CC-3-5-TH :
PHYSICAL CHEMISTRY-2

Dr. Satadal Paul

Theory: 60 Lectures
Chemical Thermodynamics I (10 Lectures)
Chemical Thermodynamics II (20 Lectures)
Systems of Variable Composition:
Applications of Thermodynamics – I (06 Lectures)

ELECTROCHEMISTRY: (24 Lectures) **Utpal Pradhan**
(i) Conductance and transport number
(ii) Ionic equilibrium:
(iii) Electromotive Force

CEMA-CC-3-5-P:(45 Lectures) **Utpal Pradhan**

Experiment 1: Conductometric titration of an acid (strong, weak/ monobasic, dibasic, and acid mixture) against strong base.
Experiment 2: Study of saponification reaction conductometrically
Experiment 3: Verification of Ostwald's dilution law and determination of K_a of weak acid
Experiment 4: Potentiometric titration of Mohr's salt solution against standard $K_2Cr_2O_7$ and $KMnO_4$solution
Experiment 5: Determination of K_{sp} for AgCl by potentiometric titration of $AgNO_3$ solution against standard KCl solution
Experiment 6: Determination of heat of neutralization of a strong acid by a strong base

CEMA-CC-3-6-TH :
INORGANIC CHEMISTRY-3

Theory: 60 Lectures **Dr. Amit Kumar Dutta**
Chemical periodicity (15 Lectures)
Chemistry of *s* and *p* Block Elements (30 Lectures)
Noble Gases:
Inorganic Polymers:
Coordination Chemistry-I (15 Lectures)

CEMA-CC-3-6-P:(45 Lectures)

Dr. Amit Kumar Dutta

Complexometric titration
Chromatography of metal ions
Gravimetry

CEMA-CC-3-7-TH :

ORGANIC CHEMISTRY-3 — **Soumyajit Sett**

Theory: 60 Lectures
Chemistry of alkenes and alkynes (15 Lectures)
Addition to C=C
Addition to C≡C (in comparison to C=C
Aromatic Substitution (10 Lectures)
Electrophilic aromatic substitution
Nucleophilic aromatic substitution
Carbonyl and Related Compounds (30 Lectures) — **Dr. Atreyee Basu**

Exploitation of acidity of α-**H of C=O**

Nucleophilic addition to α,β-**unsaturated carbonyl system**:

Organometallics(5 Lectures)

CEMA-CC-3-7-P:(45 Lectures) — Dr. Atreyee Basu

A. Identification of a Pure Organic Compound
B. Quantitative Estimations:

SEC 2 – ANALYTICAL CLINICAL BIOCHEMISTRY

Carbohydrates — **Dr. Atreyee Basu**
Proteins
Enzymes

Dr. Amit Kumar Dutta

Lipids:
Lipoproteins
Biochemistry of disease: A diagnostic approach by blood/ urine analysis.

Chemistry Hons (CBCS)

SEMESTER-5

CEMA-CC-5-11-TH :
PHYSICAL CHEMISTRY – 4 — Dr. Satadal Paul

Theory: 60 Lectures
Quantum Chemistry II (30 Lectures)
Simple Harmonic Oscillator:
Angular momentum:
Hydrogen atom and hydrogen-like ions:
Statistical Thermodynamics (20 Lectures) — **Utpal Pradhan**
Numerical Analysis (10 Lectures)

CEMA-CC-5-11-P :(45 Lectures) — **Utpal Pradhan**
Computer programs(Using FORTRAN or C or C ++) based on numerical methods :

CEMA-CC-5-12-TH :
ORGANIC CHEMISTRY – 5 — Soumyajit Sett

Theory: 60 Lectures
Carbocyles and Heterocycles (16 lectures)
Cyclic Stereochemistry (10 Lectures)
Pericyclic reactions (08 Lectures)

Carbohydrates (14 Lectures) — **Dr. Atreyee Basu**
Biomolecules (12 Lectures)

CEMA-CC-5-12-P:(45 Lectures) — **Soumyajit Sett**
A. Chromatographic Separations
B. **Spectroscopic Analysis of Organic Compounds**

DSE-A-2: APPLICATIONS OF COMPUTERS IN CHEMISTRY

Utpal Pradhan

Theory: 60 Lectures
Computer Programming Basics (FORTRAN): (Lectures: 20)
Introduction to Spreadsheet Software(MS Excel): (Lectures 25)
Statistical Analysis: (Lectures: 15)

PRACTICALS **Utpal Pradhan**
(45 Lectures)

1. Plotting of Graphs using a spreadsheet. (Planck's Distribution Law, Maxwell Boltzmann Distribution Curves as a function of temperature and molecular weight)
2. Determination of vapour pressure from Van der Waals Equation of State.
3. Determination of rate constant from Concentration-time data using **LINEST** function.
4. Determination of Molar Extinction Coefficient from Absorbent's data
5. Determination of concentration simultaneously using Excel **SOLVER** Function
6. Simultaneous Solution of Chemical Equilibrium Problems
7. Determination of Molar Enthalpy of Vaporization
8. Calculation and Plotting of a Precipitation Titration Curve with MS Excel.
9. Acid-Base Titration Curve using Excel **Goal Seek** Function.
10. Plotting of First and Second Derivative Curve for pH metric titration.
11. Use of spreadsheet to solve the 1D Schrodinger Equation
12. Michaelis-Menten Kinetics for Enzyme Catalysis

DSE-B

DSE-B-1: INORGANIC MATERIALS OF INDUSTRIALIMPORTANCE

Theory: 60 Lectures

Silicate Industries: (16 Lectures) **Dr. Amit Kumar Dutta**

Glass
Ceramics:
Cements:
Fertilizers: (8 Lectures)
Surface Coatings: (10 Lectures)
Batteries: (6 Lectures)
Alloys: (10 Lectures)
Catalysis: (6 Lectures)
Chemical explosives: (4 Lectures)

PRACTICALS (45 Lectures) **Dr. Amit Kumar Dutta/ Dr. Satadal Paul**

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Electroless metallic coatings on ceramic and plastic material.
5. Determination of composition of dolomite (by complexometric titration).
6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
7. Analysis of Cement.

Three-year MULTIDISCIPLINARY Studies Chemistry (CC1)
CHEMISTRY MDC

PAPER : CHEM-MD-CC1-1-Th /CHEM-MD-CC1-3-Th

Theory: (45 Lectures)

Module : I (15 Lectures)

Extra nuclear structure of atoms — **Dr. Satadal Paul**

and Periodicity: — **Dr. Amit Kumar Dutta**

Module : II

Basics of Organic Chemistry Bonding and Physical Properties: (10 Lectures)

Valence Bond Theory — **Dr. Atreyee Basu**

Electronic displacements — **Soumyajit Sett**

MO Theory

Physical properties

Stereochemistry – I (05 Lectures)

Module : III

Thermodynamics -I : (9 Lectures) — **Utpal Pradhan**

Chemical Kinetics-I: (6 Lectures) — **Dr. Satadal Paul**

Practical : (30 Lectures)

PAPER: CHEM-MD-CC1-1-P / CHEM-MD-CC1-3-P

(1) Calibration and use of apparatus. — **Dr. Satadal Paul**

(2) Preparation of primary standard solutions (Oxalic Acid and $K_2Cr_2O_7$)

Acid-Base Titrations: — **Dr. Atreyee Basu**

Oxidation-Reduction Titrimetry: — **Dr. Amit Kumar Dutta**

SKILL ENHANCEMENT COURSE

CHEMISTRY

PAPER : CHEM-MD-SEC-Th

Theory: (45 Lectures)

CHEMISTRY IN DAILY LIFE

Module : I (15 Lectures)

Dairy Products:

Food additives, adulterants, and contaminants:

Artificial food colorants:

Module : II (15 Lectures)

Vitamins:

Oils and fats:

Soaps & Detergents:

Module : III (15 Lectures)

Chemical and Renewable Energy Sources:

Polymers:

Tutorial: (15 hours)

PAPER: CHEM-MD-SEC-Tu

1. Estimation of Vitamin C

2. Determination of Iodine number of oil.

3. Determination of saponification number of oil.

4. Determination of methyl alcohol in alcoholic beverages.

Chemistry General (CBCS)

SEMESTER-3

CC3/GE 3:

Theory: 60 Lectures

Chemical Bonding and Molecular Structure — **Dr. Satadal Paul**

Comparative study of p-block elements: — **Dr. Amit Kumar Dutta**

Transition Elements (3*d* series)

Coordination Chemistry

ELECTROCHEMISTRY — **Utpal Pradhan**

1) Ionic Equilibria

2) Conductance

3) Electromotive force

Aromatic Hydrocarbons — **Dr. Atreyee Basu**

Organometallic Compounds

Aryl Halides

CC3/GE 3 Practical: 45 Lectures — Dr. Amit Kumar Dutta

Qualitative semimicro analysis of mixtures containing two radicals. Emphasis should be given to the understanding of the chemistry of different reactions.

Chemistry General (CBCS)

SEMESTER-5

DSE-A-2: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

Theory: 60 Lectures

Silicate Industries: (16 Lectures) Dr. Amit Kumar Dutta

Fertilizers: (8 Lectures)

Surface Coatings: (10 Lectures)

Batteries: (6 Lectures)

Alloys: (10 Lectures)

Catalysis: (6 Lectures)

Chemical explosives: (4 Lectures)

PRACTICALS

(45 Lectures) Dr. Amit Kumar Dutta / Dr. Satadal Paul

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Electroless metallic coatings on ceramic and plastic material.
5. Determination of composition of dolomite (by complexometric titration).
6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
7. Analysis of Cement.
8. Preparation of pigment (zinc oxide).

Chemistry Even SEM Academic Calendar 2023-24

Four-year Chemistry Major

SEMESTER-2

PAPER : CHEM-H-CC2-2-Th

Fundamentals of Chemistry – II Theory: (45 Lectures)

Module : I

Kinetic Theory and Gaseous state: (8 Lectures) **Utpal Pradhan**

Real gas and Virial equation: (7 Lectures) **Dr. Satadal Paul**

Module : II

Chemical Bonding – I: (15 Lectures) **Dr. Amit Kumar Dutta**

Module : III

Stereochemistry – II: (8 Lectures) **Soumyajit Sett**

General Treatment of Reaction Mechanism –I: (7 Lectures) **Dr. Atreyee Basu**

Reactive intermediates

Reaction thermodynamics

Reaction kinetics

Substitution Reaction

Practical : (30 Lectures)

PAPER: CHEM-H-CC2-2-P **Dr. Satadal Paul/ Dr. Amit Kumar Dutta**

(1) Standardization of $Na_2S_2O_3$ solution against standard $K_2Cr_2O_7$ solution.

Iodo-/ Iodimetric Titrations

Estimation of metal content in some selective samples

SKILL ENHANCEMENT COURSE
CHEMISTRY

Paper : CHEM-H-SEC2-2-Th Theory: (45 Lectures)

AI for Everyone

Module I

Introduction to Artificial Intelligence, Subfields and Technologies: (15 Lectures)

Module II

Applications of AI and Ethical and Social Implications of AI : (15 Lectures)

Module III

Other Important Issues: (15 Lectures)

SEMESTER-4 (CBCS)

CEMA-CC-4-8-TH :

Organic Chemistry-4

Nitrogen compounds (12 Lectures) **Soumyajit Sett**

Rearrangements(14 Lectures)

The Logic of Organic Synthesis (14 Lectures)

Organic Spectroscopy (20 Lectures)

CEMA-CC-4-8-P:(45 Lectures) **Dr. Atreyee Basu**

Experiment: Qualitative Analysis of Single Solid Organic Compounds

CEMA-CC-4-9-TH :

Physical Chemistry 3 Theory: 60 Lectures

Application of Thermodynamics – II (20 lectures) **Utpal Pradhan**

Foundation of Quantum Mechanics (25 Lectures) **Dr. Satadal Paul**

Crystal Structure (15 Lectures)

CEMA-CC-4-9-P :(45 Lectures) **Utpal Pradhan**

Experiment 1: Kinetic study of inversion of cane sugar using a Polarimeter

Experiment 2: Study of Phase diagram of Phenol-Water system.

Experiment 3: Determination of partition coefficient

Experiment 4: Determination of pH of unknown solution

Experiment 5: pH-metric titration of acid (mono- and di-basic) against strong base

Experiment 6 : pH-metric titration of a tribasic acidagainst strong base.

CEMA-CC-4-10-TH

Inorganic Chemistry-4 Theory: 60 Lectures

Coordination Chemistry-II (30 Lectures) **Dr. Amit Kumar Dutta**

Chemistry of d- and f- block elements (15 Lectures)

Reaction Kinetics and Mechanism (15 Lectures)

CEMA-CC-4-10-P (45 Lectures)

Inorganic preparations **Dr. Amit Kumar Dutta**

Instrumental Techniques

1. Measurement of 10Dq by spectrophotometric method.

2. Determination ofλmax of [Mn(acac)3] and [Fe(acac)3] complexes.

SEMESTER- 6 (CBCS)

CEMA-CC-6-13-TH:

Inorganic Chemistry-5 Theory: 60 Lectures

Theoretical Principles in Qualitative Analysis (10 Lectures) **Dr. Amit Kumar Dutta**

Bioinorganic Chemistry (25 Lectures)

Organometallic Chemistry (25 Lectures)

CEMA-CC-6-13-P: (45 Lectures) Dr. Amit Kumar Dutta

Qualitative semimicro analysis of mixtures containing not more than three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.

CEMA-CC-6-14-TH:

Physical Chemistry-5 Theory: 60 Lectures

Molecular Spectroscopy (25 Lectures) **Dr. Satadal Paul**

Photochemistry and Theory of reaction rate: (15 Lectures)

Surface phenomenon (15 Lectures) **Utpal Pradhan**

Dipole moment and polarizability: (05 Lectures)

CEMA-CC-6-14-P: (45 Lectures) Utpal Pradhan

Experiment 1: Determination of surface tension of a liquid using Stalagmometer

Experiment 2: Determination of the indicator constant of an acid base indicator

Experiment 3: Verification of Beer and Lambert's Law for $KMnO_4$ and $K_2Cr_2O_7$

Experiment 4: Study of kinetics of $K_2S_2O_8$ + KI reaction, spectrophotometrically

Experiment 5: Determination of pH of unknown buffer, spectrophotometrically

Experiment 6: Determination of CMC of a micelle from Surface Tension Measurement.

DSE-A

DSE A-1: MOLECULAR MODELLING AND DRUG DESIGN	**Dr. Satadal Paul**
DSE-A-2: APPLICATIONS OF COMPUTERS IN CHEMISTRY	**Utpal Pradhan**
DSE-A-3: GREEN CHEMISTRY AND CHEMISTRY OF NATURAL PRODUCTS	**Soumyajit Sett**
DSE-A4: ANALYTICAL METHODS IN CHEMISTRY	**Dr. Amit Kumar Dutta**

DSE-B

DSE-B-1: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	**Dr. Amit Kumar Dutta**
DSE B-2: NOVEL INORGANIC SOLIDS	**Dr. Amit Kumar Dutta**
DSE-B-3: POLYMER CHEMISTRY	**Dr. Atreyee Basu**
DSE B-4 : Dissertation	**Dr. Atreyee Basu/ Dr. Amit Kumar Dutta/ Dr. Satadal Paul/ Soumyajit Sett/ Utpal Pradhan**

SKILL ENHANCEMENT COURSES

SEC-B [SEMESTER 4]

SEC 3 – PHARMACEUTICALS CHEMISTRY	**Dr. Atreyee Basu**
SEC-4 PESTICIDE CHEMISTRY	**Dr. Atreyee Basu**

Three-year MULTIDISCIPLINARY Studies Chemistry (CC2 or Minor)

CHEMISTRY MDC

PAPER : CHEM-MD-CC2-2-Th / CHEM-MD-CC2-4-Th

Chemistry MDC- II Theory: (45 Lectures)

Module : I

Kinetic Theory and Gaseous state: (8 Lectures) Utpal Pradhan

Real gas and Virial equation: (7 Lectures) Dr. Satadal Paul

Module : II

Chemical Bonding – I: (15 Lectures) Dr. Amit Kumar Dutta

Module : III

Stereochemistry – II : (8 Lectures) Soumyajit Sett

General Treatment of Reaction Mechanism –I: (7 Lectures) Dr. Atreyee Basu

Reactive intermediates

Reaction thermodynamics

Reaction kinetics

Substitution Reaction

Practical : (30 Lectures)

PAPER: CHEM-MD-CC2-2-P / CHEM-MD-CC2-4-P Dr. Satadal Paul/ Dr. Amit Kumar Dutta

(1) Standardization of $Na_2S_2O_3$ solution against standard $K_2Cr_2O_7$ solution.

Iodo-/ Iodimetric Titrations

Estimation of metal content in some selective samples

SEMESTER- 4 (Gen) CBCS

CC4/GE 4: Theory: 60 Lectures

Alcohols, Phenols and Ethers — **Soumyajit Sett**

Carbonyl Compounds

Carboxylic Acids and Their Derivatives

Amines and Diazonium Salts

Amino Acids and Carbohydrates — **Dr. Atreyee Basu**

Crystal Field Theory — **Dr. Amit Kumar Dutta**

Quantum Chemistry & Spectroscopy — **Dr. Satadal Paul**

CC4/GE 4 Practical: 45 Lectures

1. Qualitative Analysis of Single Solid Organic Compound(s) — **Dr. Atreyee Basu**
2. Identification of a pure organic compound

SEMESTER- 6 (Gen) CBCS

DSE (A)

Any one from the following

DSE A-1: NOVEL INORGANIC SOLIDS — **Dr. Amit Kumar Dutta**

DSE-A-2: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

DSE(B)

Any one from the following

DSE-B1: GREEN CHEMISTRY AND CHEMISTRY OF NATURAL PRODUCTS — **Soumyajit Sett**

DSE-B2: ANALYTICAL METHODS IN CHEMISTRY — **Dr. Amit Kumar Dutta**

SKILL ENHANCEMENT COURSES

SEC-B [SEMESTER 4 or 6]

SEC 3 – PHARMACEUTICALS CHEMISTRY — **Dr. Atreyee Basu**

SEC-4 PESTICIDE CHEMISTRY — **Dr. Atreyee Basu**

Academic calendar: 2023-24

Bangabasi Morning College
Department of Mathematics

Under CCF(NEP-2020) system:

Course	Commencement of classes	Tentative date of University Examination	
		Tutorial(25)	Theoretical(75)
Semester-I	July	1st week of December	3rd week of December
Semester-II	Within 7 days from the completion of previous semester	3rd week of May	2nd week of June

Under CBCS system:

Course	Commencement of classes	Tentative date of University Examination		
		Internal Assessment(20)	Tutorial(15)	Theoretical(65)
Semester-III	Within 7 days from the completion of previous semester	3rd week of November	4th week of November	2nd week of December
Semester-IV	Within 7 days from the completion of previous semester	2nd week of May	4th week of May	2nd week of June
Semester-V	Within 7 days from the completion of previous semester	3rd week of November	4th week of November	2nd week of December
Semester-VI	Within 7 days from the completion of previous semester	2nd week of May	4th week of May	2nd week of June

ODD SEMESTER

(July - December)

Syllabus Distribution(under CCF-NEP 2020 system):

SEMESTER- 1		
Course (Code)	**Course Details**	**Teacher**
DSC/CORE: MATH-H-CC1-1-Th Minor: MATH-H-MC 1-1-Th MDC: MATH-MD-CC 1-1-Th Co-Ordinator: Partha Bhattacharya	Unit-1: Calculus	PH
	Unit-2: Geometry	PB
	Unit-3: Vector Analysis	BCM
SEC: MATH-H-SEC1-1-Th Co-ordinator: Md. Mahatab Uddin Molla	C Language with Mathematical Applications	MM
IDC: MATH-H-IDC-1-Th Co-ordinator: Bikash Chandra Mandal	Mathematics in Daily Life	BCM

Syllabus Distribution(under CBCS system):

SEMESTER- 3		
MTMA(CC-5) Co-ordinator: Prithwiraj Halder	Theory of Real Functions	PH
MTMA(CC-6) Co-ordinator: Md. Mahatab Uddin Molla	Ring Theory & Linear Algebra-I	MM
MTMA(CC-7) Co-ordinator: Bikash Ch. Mandal	ODE & Multivariate Calculus-I	BCM
MTMA(SEC-A) Co-ordinator: Md. Mahatab Uddin Molla	C Programming Language	MM
MTMG(GE-3/CC-3) Co-ordinator: Partha Bhattacharya	Unit-1: Integral Calculus	PH
	Unit-2: Numerical Method	PB
	Unit-3: Linear Programming	BCM
MTMG(SEC-A) Co-ordinator: Md. Mahatab Uddin Molla	C- Programming Language	MM
SEMESTER- 5		
MTMA(CC-11) Co-ordinator: Partha Bhattarchya	Probability & Statistics	PB
MTMA(CC-12) Co-ordinator: Md. Mahatab Uddin Molla	Group Theory-II	PH
	Linear Algebra-II	MM
MTMA(DSE – A(1)) Co-ordinator: Prithwiraj Halder	Advanced Algebra	PH
MTMA-DSE – B(1) Co-ordinator: Bikash Ch. Mandal	Optional Paper	PB, BCM
MTMG-DSE(1A) Co-ordinator: Partha Bhattacharya	Graph Theory/ Particle Dynamics	PB

EVEN SEMESTER

(January - June)

Syllabus Distribution(under CCF-NEP 2020 system):

SEMESTER- 2		
Course (Code)	**Course Details**	**Teacher**
DSC/CORE: MATH-H-CC2-2-Th Minor: MATH-H-MC 2-2-Th MDC: MATH-MD-CC 2-2-Th (Basic Algebra) Co-Ordinator: Prithwiraj Halder	Group-A: Classical Algebra	BCM
	Group-B: Modern Algebra	PH
	Group-C: Linear Algebra	MM
SEC: MATH-H-SEC2-2-Th Co-ordinator: Md. Mahatab Uddin Molla	Python and Latex / A. I	MM
IDC: MATH-H-IDC-2-Th Co-ordinator: Bikash Chandra Mandal	Mathematics in Daily Life	BCM

Syllabus Distribution(under CBCS system):

Course	Course Details	Teacher
SEMESTER- 4		
MTMA(CC-8) Co-ordinator: Prithwiraj Halder	Riemann Integration	PH
	Series of Functions	
MTMA(CC-9) Co-ordinator: Bikash Ch. Mandal	PDE & Multivariate Calculus-II	BCM
MTMA(CC-10) Co-ordinator: Partha Bhattarchya	Mechanics	PB
MTMA(SEC-B) Co-ordinator: Md. Mahatab Uddin Molla	Sage- R / Mathematical Logic	MM
MTMG(GE-4/CC-4) Co-ordinator: Prithwiraj Halder	Unit-1: Algebra-II	PH
	Unit-2: Computer Science & Programming	MM
	Unit-3: Probability & Statistics	PB
MTMG(SEC- B) Co-ordinator: Md. Mahatab Uddin Molla	Mathematical Logic	MM
SEMESTER- 6		
MTMA(CC-13) Co-ordinator: Md. Mahatab Uddin Molla	U1: Metric Space	MM
	U2: Complex Analysis	
MTMA(CC-14) Co-ordinator: Partha Bhattacharya	Numerical Methods	PB
DSE A(2) Co-ordinator: Bikash Ch. Mandal	Optional Paper	BCM
DSE B(2) Co-ordinator: Prithwiraj Halder	Point Set Topology	PH
MTMG- DSE(1B) Co-ordinator: Bikash Ch. Mandal	Advanced Calculus / Mathematical Finance	PH, BCM, PB

Bangabasi Morning College
Department of Computer Science

Academic Calendar 2023-24

Computer Science Honours

Course Structure

Semester-I and II

Sem	Courses	Title	Credits
I	DSC/CC-1 TH (Core Course-1) Theory	Computer Fundamental & Digital Logic(MKB)	3
	DSC/CC-1-P (Core Course-1) Practical	Computer Fundamental & Digital Logic Lab(MKB)	1
	SEC-1 Theory	Data visualization using spreadsheet(SG)	3
	SEC-1 Practical	Data visualization using spreadsheet Lab(SG)	1
II	CMS-A-CC-2-3-TH (Core Course – 3) Theory	Data Structure(SK)	4
	CMS-A-CC-2-3-P (Core Course – 3) Practical	Data Structure Lab.(SK)	2
	CMS-A-CC-2-4-TH (Core Course – 4) Theory	Basic Electronic Devices and Circuits(MKB)	4
	CMS-A-CC-2-4-P (Core Course – 4) Practical	Basic Electronic Devices and Circuits Lab.(MKB)	2

Semester-III and IV

Sem	Courses	Title	Credits
III	CMS-A-CC-3-5-TH (Core Course-5) Theory	Computer Architecture and Organization(BPR)	4
	CMS-A-CC-3-5-P (Core Course-5) Practical	Computer Organization Lab(MKB)	2

	CMS-A-CC-3-6-TH (Core Course-6) Theory	Computational Mathematics(PR)	4
	CMS-A-CC-3-6-P (Core Course-6) Practical	Computational Mathematics Lab(PR)	2
	CMS-A-CC-3-7-TH(Core Course-7)Theory	Operating Systems(SK)	4
	CMS-A-CC-3-7-P(Core Course-7) Practical	Operating Systems Lab(SK)	2
	SEC-A-1(Theory) CMS-A-SEC-A-3-1-TH	Computer Graphics(BPR)	2
IV	CMS-A-CC-4-8-TH (Core Course – 8) Theory	Data Communication, Networking and Internet technology(BPR)	4
	CMS-A-CC-4-8-P (Core Course – 8) Practical	Computer Networking and Web Design Lab(BPR)	2
	CMS-A-CC-4-9-TH (Core Course – 9) Theory	Introduction to Algorithms and its Applications(SG+SK)	4
	CMS-A-CC-4-9-P (Core Course – 9) Practical	Algorithms Lab(SG+SK)	2
	CMS-A-CC-4-10-TH(Core Course-10)Theory	Microprocessor and Its Applications(MKB)	4
	CMS-A-CC-4-10-P(Core Course-10)Practical	Programming with Microprocessor 8085(MKB)	2
	SEC-B-1(Theory) CMS-A-SEC-B-4-1-TH	Information Security(PR)	2

Semester-V and VI

Sem	Courses	Title	Credits
V	CMS-A-CC-5-11-TH (Core Course-11) Theory	Database Management system (SG)	4
	CMS-A-CC-5-11-P (Core Course-11) Practical	RDBMS lab using My SQL & PHP (SG)	2
	CMS-A-CC-5-12-TH (Core Course-12) Theory	Object Oriented Programming (PR)	4
	CMS-A-CC-5-12-P (Core Course-12) Practical	OOPs lab using JAVA (PR)	2
	CMS-A-DSE-A-2-TH (DSE-A-2 Theory)	Data Mining & its Application (SG)	4
	CMS-A-DSE-A-2-P (DSE-A-2 Practical)	Data Mining Lab (SG)	2
	CMS-A-DSE-B-2-TH (DSE-B-2 Theory)	Programming using Python (BPR)	4
	CMS-A-DSE-B-2-P (DES-B-2-Practical)	Programming in Python Lab(BPR)	2
VI	CMS-A-CC-6-13-TH (Core Course – 13) Theory	Software Engineering(SG)	4
	CMS-A-CC-6-14-TH (Core Course – 14) Theory	Theory of Computation(PR)	4
	CMS-A-CC-6-14-P (Core Course – 14) Practical	Project(SG,MKB,BPR,PR,SK)	4
	CMS-A-DSE-A-4-TH (DSE-A-4-Theory)	Multimedia and its Application(BPR)	4
	CMS-A-DSE-A-4-P (DSE-A-4 Practical)	Multimedia and its Application Lab(BPR)	2
	CMS-A-DSE-B-4-TH (DSE-B-4 Theory)	Introduction to Computational Intelligence(SG+PR)	4
	CMS-A-DSE-B-	Computational Intelligence Lab(SG+PR)	2

	4-P (DES-B-4-Practical)		

Semester-I

DSC/CC-1 : Computer Fundamental and Digital Logic
Theory: 03 Credits: 45 hours

- **Computer Fundamentals: (02 hours)**
- **Number Systems: (03 hours)**
- **Boolean Algebra: (04 hours)**
- **Combinational Circuits: (19 hours)**
- **Sequential Circuits: (17 hours)**
- **Integrated Circuits (Concept only): (04 hours)**

Practical: 01 Credits: 30 hours

- **Combinational Circuits**
- **Sequential Circuits**

CMSA-SEC-1: Data visualization using spreadsheet
Theory: 03 Credits: 45 hours

- **Introduction to spreadsheet: (02 hours)**
- **Working with Data and Tables: (02 hours)**
- **Performing Calculations on Data: (02 hours)**
- **Changing Workbook Appearance: (02hours)**
- **Data analysis and Manipulation: (04 hours)**
- **Advanced Spreadsheet features: (04hours)**
- **Statistical functions and analysis: (05 hours)**
- **Pivot tables and data aggregation: (04 hours)**
- **Advanced data visualization: (05hours)**
- **Exploratory data analysis: (04 hours)**
- **Advanced analysis technique: (04 hours)**
- **Reporting and presentation of results: (03 hours)**
- **Collaborating and sharing: (04 hours)**

Practical: 01 Credits: 30 hours

Semester-II

CMS-A-CC-2-3-TH: Data Structure
Core Course-3: Theory: 04 Credits: 60 hours

- **Introduction to Data Structure: (01 hour)**
- **Arrays: (05 hours)**
- **Linked Lists: (09 hours)**
- **Stacks: (05 hours)**
- **Queues: (05 hours)**
- **Recursion: (05 hours)**
- **Trees: (15 hours)**
- **Searching and Sorting: (10 hours)**
- **Hashing: (05 hours)**

CMS-A-CC-2-3-P: Data Structure Lab.
Core Course- 3: Practical: 02 Credits: 40 hours

CMS-A-CC-2-4-TH: Basic Electronic Devices and Circuits
Core Course-4: Theory: 04 Credits: 60 hours

- **Basics of Circuit Theory: (04 hours)**
- **Theory of Semiconductor devices: (03 hours)**
- **Diode and its applications: (09 hours)**
- **Bipolar Junction Transistor: (08 hours)**
- **Unipolar Junction Transistor: (08 hours)**
- **PNPN Devices: (08 hours)**
- **Operational Amplifiers (OPAMP): (12 hours)**
- **Timer: (04 hours)**
- **Data Acquisition: (04 hours)**

CMS-A-CC-2-4-P: Basic Electronic Devices and Circuits Lab.
Core Course-4: Practical: 02 Credits: 40 hours

Semester-III

CMS-A-CC-3-5-TH: Computer Organization and Architecture
Core Course- 5: Theory, Credits:04, Contact hours: 60.

- **Basic Structure of Computers (Qualitative Discussion)** (5 hours)
- **Register Transfer and Micro-operation(5 hours)**
- **Basic Computer Organization and Design(05 hours)**
- **CPU Organization(06 hours)**
- **Control Unit(07 hours)**
- **CPU Registers(06 hours)**
- **Instructions.(3 hours)**
- **CISC and RISC processors(03 hours)**
- **Computer Peripherals(08 hours)**
- **Input / Output Organization(02 hours)**
- **Memory(10 hours)**

CMS-A-CC-3-5-P: Computer Organization Lab.
Core Course-5, Practical, Credits: 02, Contact hours:40.

CMS-A-CC-3-6-TH: Computational Mathematics
Core Course- 6: Theory, Credits: 04, Contact hours: 60.

- **Introduction(10 hours)**
- **Introduction to Probability(10 hours)**
- **Growth of Functions(4 hours)**
- **Recurrences(6 hours)**
- **Numerical Methods (Algorithmic Approach)(20 hours)**
- **Graph Theory(10 hours)**

CMS-A-CC-3-6-P: Computational Mathematics Lab.
Core Course- 6: Practical, Credits:02, Contact hours: 40.

Lab. based on Numerical Methods using C.

CMS-A-CC-3-7-TH: Operating Systems
Core Course- 7: Theory, Credit: 04, Contact hours: 60.

- **Introduction(6 hours)**
- **Operating System Organization(6 hours)**
- **Process(18 hours)**
- **Deadlock(9 hours)**
- **Memory Management(14 hours)**
- **File and I/O Management(5 hours)**
- **Protection and Security(2 hours)**

CMS-A-CC-3-7-P: Operating Systems Lab.
Core Course- 7: Practical, Credit: 02, Contact hours: 40.

- **Shell programming in LINUX**

CMS-A-SEC-A-3-1-TH: Computer Graphics
Skill Enhancement Course: SEC-A: Choice -1: Theory, Credit:02, Contact hours: 40.

- **Introduction(05 hours)**
- **Basic geometrical shapes formation algorithms(05 hours)**
- **Two and Three Dimensional Transformations(14 hours)**
- **Two Dimensional Clipping(08 hours)**
- **Projection(06 hours)**
- **Applications(02 hours)**

Semester-IV

CMS-A-CC-4-8-TH: Data Communication, Networking and Internet Technology.
Core Course- 8: Theory, Credit: 04, Contact hours: 60.

- **Overview of Data Communication and Networking(04hours)**
- **Physical Layer(12hours)**
- **Bandwidth Utilization Techniques(4 hours)**
- **Transmission Medium(06hours)**
- **Switching and Telephone network(04hours)**
- **Data link Layer(04hours)**
- **Medium Access sub layer(08hours)**
- **Network layer(11 hours)**
- **Transport layer(03 hours)**
- **Application Layer(04hours)**

CMS-A-CC-4-8-P: Computer Networking and Web Design Lab
Core Course- 8: Practical, Credit: 02, Contact hour: 40.

- **Computer Networks: Practical(05 hours)**
- **Web Design: Practical(20 hours)**
- **Array(15 hours)**

CMS-A-CC-4-9-TH: Introduction to Algorithms & its Applications
Core Course- 9: Theory, Credit: 04, Contact hours: 60.

- **Introduction to Algorithms(05 hours)**
- **Asymptotic Complexity Analysis of Algorithms(10 hours)**
- **Algorithm Design Techniques(15 hours)**
- **Graph Representation and Algorithm(25 hours)**
- **Classification of Problems(05 hours)**

CMS-A-CC-4-9-P: Algorithms Lab.
Core Course- 9: Practical, Credit:02, Contact hour: 40.

Lab. based on Graph Theory using C

- **Graph Algorithms:**

CMS-A-CC-4-10-TH: Microprocessor and its Applications
Core Course- 7: Theory, Credits:04, Contact hours: 60.

- **Introduction to Microcomputer based system(03 hours)**
- **Microprocessor Architecture and Memory Interfacing(14 hours)**
- **Interfacing I/O Devices(10 hours)**
- **Programming 8085(10 hours)**
- **Interfacing Peripheral Devices and Applications(13 hours)**
- **Microprocessor 8086(10 hours)**

CMS-A-CC-4-10-P:Programming with Microprocessor 8085
Core Course- 10: Practical, Credits:02, Contact hours: 40.

Skill Enhancement Course: SEC-B: Information Security/ E-Commerce
CMS-A-SEC-B-4-1-TH: Information Security
Skill Enhancement Course: SEC-B: Choice-1: Theory, Credit:02, Contact Hours: 40.

- **Overview(05 hours)**
- **Cryptography(10 hours)**
- **Finite Field and Number Theory(03 hours)**
- **Hash Functions and Digital Signatures(05 hours)**
- **Internet Firewalls for Trusted System(02 hours)**
- **E-Mail, IP & Web Security (Qualitative study)(05 hours)**
- **Attacks, Secure Electronic Transaction (SET).(10 hours)**

Semester-V

CMS-A-CC-5-11-TH: Database Management System (DBMS).
Core Course- 11: Theory, Credit: 04, Contact hour: 60 hours.

- **Introduction (04hours)**
- **Entity Relationship(ER) Modeling (04hours)**
- **Relational Model (08hours)**
- **Integrity Constraints (04hours)**
- **Relational Database Design (16hours)**

- **SQL(16hours)**
- **Record Storage and File Organization (Concepts only) (08hours)**

CMS-A-CC-5-11-P: Relational Database Management System
Core Course- 11, Practical, Credit:02, Contact hours: 40 hours.

- **RDBMS Lab using My SQL & PHP**

CMS-A-CC-5-12-TH: Object Oriented Programming System (OOPs)
Core Course- 12: Theory, Credit:04, Contact hours: 60.

- **Concept of OOPs(02hours)**
- **Introduction to Java(04hours)**
- **Arrays, Strings and I/O(08hours)**
- **Object-Oriented Programming Overview(04hours)**
- **Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata.(14hours)**
- **Exception Handling, Threading, Networking and Database Connectivity(15hours)**
- **Applets (13hours)**

CMS-A-CC-5-12-P: Object Oriented Programming Lab.
Core Course- 12: Practical, Credit: 02, Contact hours: 40 hours.

- **OOPs Lab Using JAVA**

CMS-A-DSE-A-2-TH: Data Mining and its Applications
DSE-A: Choice-2: Theory, Credit:04, Contact hours: 60.

- **Introduction(15hours)**
- **Classification and Prediction(30hours)**
- **Data Warehousing (DWH)(15hours)**

CMS-A-DSE-A--2-P: Data Mining Lab.
DSE-A: Choice-2: Practical, Credit:02, Contact hours: 40.

- **Data mining using PYTHON/C**

CMS-A-DSE-B--2-TH: Programming using Python 3
DSE-B: Choice-2: Theory, Credit: 04, Contact hour: 60.

- **Introduction to the Python (04 hours)**
- **Strings, Lists, Tuples (06 hours)**
- **Conditionals, Iterators, and Generators(15 hours)**
- **User-defined Functions and Recursion(10 hours)**
- **File Handling and Exception Handling(05 hours)**
- **Unordered data types - Sets and Dictionaries(05 hours)**
  - **Basic concepts of hashing**
  - **Sets and frozensets**
  - **Dictionaries**
- **Intro to Object Oriented Programming (15 hours)**

CMS-A-DSE-B--2-P: Python 3 Programming Lab.
DSE-B: Choice-2, Practical, Credit: 02, Contact hours: 40 hours.

Use Python 3.6 or above. Use a text editor sensitive to whitespace like Notepad++, gedit, vim, Sublime Text, and NOT Notepad / WordPad. The following exercises are suggestive in nature.

Semester-VI

CMS-A-CC-6-13-TH: Software Engineering.
Core Course-13: Theory, Credit:04, Contact hours 60.

- **Introduction(03 hours)**
- **Software Life Cycle(07 hours)**
- **Software Requirement and Specification Analysis(23 hours)**
- **Software Testing(17 hours)**
- **Software Quality Assurances(10 hours)**

CMS-A-CC-6-14-TH: Theory of Computation.
Core Course-14: Theory, Credit:04, Contact hours: 60.

- **Finite Automata (15 hours)**
- **Formal Languages and Grammar (15 hours)**
- **Regular Expression (15 hours)**
- **Turing Machine (15 hours)**

CMS-A-CC-6-14-P: ProjectWork
Core Course-14, Practical, Credit:04, Contact hours: 60.

Candidates have to do their project in any relevant topic, under the supervision of teachers.

CMS-A-DSE-A--4-TH: Multimedia and its Applications
DSE-A: Choice-4, Theory, Credit:04, Contact hours: 60.

- **Multimedia (04 hours)**
- **Making Multimedia (06 hours)**
- **Text (04 hours)**
- **Images (06 hours)**
- **Sound (06 hours)**
- **Video (06 hours)**
- **Animation (08 hours)**
- **Multimedia System (10 hours)**
- **Multi-modal Communication (10 hours)**

CMS-A-DSE-A-4-P: Multimedia and its Applications Lab.
DSE-A: Choice-4: Practical, Credit:02, Contact hour: 40.

Sample practical problems can be included related to theory.

CMS-A-DSE-B-3-TH: Introduction to Computational Intelligence
DSE-B: Choice-3, Theory, Credit:04, Contact hours: 60.

- **Introduction: (20 hours)**

- **Neural network: (20 hours)**
- **Rough sets: (02 hours)**
- **Fuzzy logic and application: (18 hours)**

CMS-A-DSE-B-4-P: Computational Intelligence Laboratory
DSE-B: Choice 4, Practical, Credit:02, Contact hours: 40.

Computer Science General

Course Structure

Semester	Courses	Title	Credits
SEM- I	DSC/CC-1 TH (Core Course-1) Theory	Computer Fundamental & Digital Logic(MKB)	03
	DSC/CC-1-P (Core Course-1) Practical	Computer Fundamental & Digital Logic Lab(MKB)	01
	SEC-1 Theory	Data visualization using spreadsheet(SG)	03
	SEC-1 Practical	Data visualization using spreadsheet Lab(SG)	01
	IDC	Fundamental of Computer Science and applications(PR+SK)	03
SEM - II	CMS-G-CC-2-2-TH Sem-2-Core Course-2 Theory	Algorithms and Data Structure(BPR)	04
	CMS-G-CC-2-2-P Sem-2-Core Course-2 Practical	Programming with C(BPR)	02
SEM - III	CMS-G-CC-3-3-TH Sem-3-Core Course-3 Theory	Computer Organization (PR)	04
	CMS-G-CC-3-3-P Sem-3-Core Course-3 Practical	Programming using Python (PR)	02
SEM - IV	CMS-G-CC-4-4-TH Sem-4-Core Course-4 Theory	Operating Systems (SK)	04
	CMS-G-CC-4-4-P Sem-4-Core Course-4 Practical	Shell Programming (Unix/ Linux) (SK)	02
SEM - V	CMS-G-DSE-A-5-1-TH	Data base Management System (DBMS) (SK+BPR)	04
	CMS-G-DSE-A-5-1-P	DBMS Lab using SQL(SK+BPR)	02
	CMS-G-SEC-A-2	Software Engineering(SK)	02
SEM - VI	CMS-G-DSE-B-6-3-TH	Computational Mathematics (PR)	04
	CMS-G-DSE-B-6-2-P	Computational Mathematics Lab using C (PR)	02
	CMS-G-SEC-B-6-1-TH	Multimedia and its Applications (BPR)	02

Semester-I

DSC/CC-1 : Computer Fundamental and Digital Logic
Theory: 03 Credits: 45 hours

- **Computer Fundamentals: (02 hours)**
- **Number Systems: (03 hours)**
- **Boolean Algebra: (04 hours)**
- **Combinational Circuits: (19 hours)**
- **Sequential Circuits: (17 hours)**
- **Integrated Circuits (Concept only): (04 hours)**

Practical: 01 Credits: 30 hours

- **Combinational Circuits**
- **Sequential Circuits**

CMSA-SEC-1: Data visualization using spreadsheet
Theory: 03 Credits: 45 hours

- **Introduction to spreadsheet: (02 hours)**
- **Working with Data and Tables: (02 hours)**
- **Performing Calculations on Data: (02 hours)**
- **Changing Workbook Appearance: (02hours)**
- **Data analysis and Manipulation: (04 hours)**
- **Advanced Spreadsheet features: (04hours)**
- **Statistical functions and analysis: (05 hours)**
- **Pivot tables and data aggregation: (04 hours)**
- **Advanced data visualization: (05hours)**
- **Exploratory data analysis: (04 hours)**
- **Advanced analysis technique: (04 hours)**
- **Reporting and presentation of results: (03 hours)**
- **Collaborating and sharing: (04 hours)**

Practical: 01 Credits: 30 hours

IDC: Fundamental of Computer Science and its application
Credit: 03 Hours: 45

- **Introduction to computer and computing: 08 hours**
- **Data representation and number system: 04 hours**
- **Algorithms and data structure: 06 hours**
- **Office suite: 08 hours**
- **Programming language: 08 hours**
- **Networking: 05hours**
- **Artificial intelligence: 05 hours**
- **ICT (Information and Computations Tools): 01 hours**

Semester-II

CMS-G-CC-2-2-TH: Algorithms& Data Structure
Core Course- 2: Theory: 60 hours

- **Introduction: (04 hours)**

- **Arrays: (10 hours)**
- **Linked List: (16 hours)**
- **Stacks and Queues: (16 hours)**
- **Searching: (04 hours)**
- **Sorting: (10 hours)**

CMS-G-CC-2-2-P: Programming with C
Core Course- 2: Practical: 40 hours

- **Basic Structure**
- **Operators**
- **Branching and Looping:**if, if-else, while, do-while, for.
- **Arrays**
- **User defined functions**
- **Structures**
- **Pointers**
- **File handling**
- **Other Feature**

Semester-III

CMS-G-CC-3-3-TH: Computer Organization
Core Course- 3: Theory: 60 hours

- **Basic Computer Organization (15 hours)**
- **Instruction (02 hours)**
- **Control Unit (05 hours)**
- **ALU (10 hours)**
- **Memory (15 hours)**
- **I/O (08 hours)**
- **Computer Peripherals: (05 hours)**

CMS-G-CC-3-3-P: Programming using Python
Core Course- 3: Practical: 40 hours

Open Source Computer Programming Language Python 3

- **Introduction to the Python** (2 hours)
- **Ordered Datatypes - Strings, Lists and Tuples (**6 hours)
- **Conditionals and Iterators** (12 hours)
- **User-defined Functions and Recursion (10 hours)**
- **File Handling and Exception Handling** (5 hours)
- **Unordered data types - Sets and Dictionaries** (5 hours)

` Suggested lab exercises
Use Python 3.6 or above. Use a text editor sensitive to whitespace like Notepad++, gedit, vim, Sublime Text, and NOT Notepad / WordPad.

Semester-IV

CMS-G-CC-4-4-TH: Operating Systems
Core Course- 4: Theory: 60 hours

- **System Software** (04 hours)
- **Introduction** (08 hours)

- **Operating System Organization** (02 hours)
- **Process** (18 hours)
- **Deadlock** (09 hours)
- **Memory Management** (14 hours)
- **File and I/O Management** (05 hours)

CMS-G-CC-4-4-P: Shell Programming (Linux)
Core Course- 4: Practical: 40 hours

Semester-V

CMS-G-DSE-A-5-1-TH: Database Management System
Discipline Specific Elective Course – A (DSE-A-1): Choice-1: Theory: 60 hours

Introduction: (12 hours)
ER Model: (12 hours)
Relational Model: (14 hours)
Relational Database Design: (22 hours)

CMS-G-DSE-A-5-1-P: DBMS Lab using SQL
Discipline Specific Elective Course – A (DSE-A-1): Choice-1: Practical: 40 hours

CMS-G-SEC-A-5-2-TH: Software Engineering
Skill Enhancement Course – A (SEC-A-1): Choice-1: Theory: 40 hours

- **Introduction: (12 hours)**
- **Software Requirement and Specification Analysis: (07 hours)**
- **Software Design Analysis: (12 hours)**
- **Software Testing: (07 hours)**
- **Software Quality Assurances: (02 hours)**

Semester-VI

CMS-G-DSE-B-6-3-TH: Computational Mathematics
Discipline Specific Elective Course – B (DSE-B-2): Choice-2: Theory: 60 hours

- **Errors: (05 hours)**
- **Interpolation: (05 hours)**
- **System of Linear Equations: (10 hours)**
- **Solution of Non-linear Equations: (10 hours)**
- **Integration: (10 hours)**
- **Graph Theory: (concept only) (20 hours)**

CMS-G-DSE-B-6-3-P: Computational Mathematics Lab using C
Discipline Specific Elective Course – B (DSE-B-2): Choice-2: Practical: 40 hours

CMS-G-SEC-B-6-1-TH: Multimedia and its Applications
Skill Enhancement Course – B (SEC-B-1): Choice-1: Theory: 40 hours

- **Multimedia System:** (10 hours)
- **Multi-modal Communication:** (10 hours)
- **Multimedia OS:** (20 hours)

ACADEMIC CALENDAR
July 2023-June 2024

DEPARTMENT OF ECONOMICS
BANGABASI MORNING COLLEGE

Course: B.Com, Semester-1 (Hons./ General) July-Dec, 2023

Paper- IDC/MDC: Microeconomics

(Tutorial exam: 25 marks; Semester-end Exam: 50 marks; Total: 75 marks)

Topic	Teacher	Month
Unit-I: **Introduction** Definition of Microeconomics, Macroeconomics; positive and normative economics—Basic concepts--scarcity and choice; Production Possibility Curve; Central Problem of the Economy; concept of slope	PP, NP	Jul-Aug
Unit-II: **Theory of Demand and Supply** (A) Demand and Supply--Concepts of Demand—derived demand; Demand function—Determinants of demand; Law of Demand & its expectations; Movement along the Demand curve and shift of the Demand curve; Concepts of Supply and Supply function—Law of Supply; Movement along the supply curve and shift of the supply curve; Market equilibrium and Determination of price; Effect of change in the Demand and Supply on Equilibrium price (B) Elasticity of Demand and Supply—Price elasticity of demand; Determinants and Measurement of price elasticity; Relationship between slope and price elasticity of demand; Income elasticity of demand; Cross price Elasticity of Demand; Elasticity of Supply	PP, NP	Aug-Sep
Unit-III: **Theory of Consumer Behaviour** Concept of Utility and Marginal utility—The Law of Diminishing marginal Utility; Cardinal Utility theory—Concept and significance of Consumer Surplus; Consumer's Equilibrium in case of single and two commodities; Concept of Ordinal utility theory—Indifference curve and its properties; Marginal Rate of Substitution; Budget Line and Budget equation; Consumer's Equilibrium	PP, NP	Sep-Oct
Unit-IV: **Theory of Production and Cost** Concept of Production Function—Fixed and Variable inputs; Short run and Long run; Relation among Total, Average and Marginal Product; Law of Variable Proportion; Return to Scale; Isoquants, Isocosts and Producer's equilibrium (Graphical Explanation); Concepts of Economic Cost and Opportunity Cost; Short Run and Long run Cost Functions—Relation among Average Cost, Average Variable Cost and Marginal Cost; Long run Average Cost Curve from Short Run Average Cost curves	BS	Jul-Nov
Unit-V: **Revenue and Market** Definition and different forms of Market—Revenue under Different Market Structure; Relation among Total Revenue, Average revenue and Marginal Revenue; Perfect Competition and Monopoly—Features, Equilibrium of the firm (Short Run and Long Run); Short run supply curve of a firm under perfect competition; Price discrimination under monopoly; concepts and conditions	BS, NP, PP	Nov-Dec

Course: B.Com, Semester-2 (Hons./ General) Jan-June, 2024

Paper- IDC/MDC: Macroeconomics

(Tutorial exam: 25 marks; Semester-end Exam: 50 marks; Total: 75 marks)

Topic	Teacher	Month
Unit-I: **Basic Concepts** Macroeconomics, Concepts, Scope, macroeconomic variables, objectives, differences with microeconomics.	PP	Jul-Sep
Unit-II: **National Income** National income accounting, Concepts and measurement of GDP, GNP, NNP, NDP, PI, DPI, Circular flow of income (2 sectors & 3 sectors economy), Real and Nominal GDP and GDP Deflator.	PP	Jul-Sep
Unit-III: **Determination of equilibrium income in Simple Keynesian Model** Theory of Income determination-Simple Keynesian model; Consumption, Saving, Investment functions; National Income determination; Investment multiplier, Government expenditure multiplier (Graphical Analysis), Tax multiplier and Balanced budget multiplier (concepts).	NP	Jul-Sep
Unit-IV: **Money and Inflation** Concept of demand for money and supply of money, Measures of supply of money, High powered money, money multiplier, Concept of Inflation, Demand pull and Cost push Inflation. Inflationary gap. Monetary and fiscal measures to control inflation.	BS	Jul-Sep
Unit-V: **Public Finance** Government budget—meaning and components, Classifications of receipts—revenue and capital receipts; Classification of expenditure—revenue and capital expenditure. Measures of Government deficit—Revenue deficit, Fiscal deficit, Primary deficit.	BS, NP, PP	Oct-Dec

Course: B.Com, Semester-3 (Hons) July-Dec, 2023

CC 3.2 Ch....Indian Financial System

(Internal Assessment: 20 marks; Semester-end Exam: 80 marks; Total: 100 marks)

Topic	Teacher	Month
Unit-I: Financial System and Its Components Meaning, Significance and Role of the Financial System; Components of the Financial System; The structure of Indian Financial System. [L-10/ Marks: 10]	PP	Jul-Aug
Unit-II: Financial Markets (a) Money Market: Functions and Instruments; Role of Central Bank; Indian Money Market: An Overview, Call Money Market, Treasury Bills Market, Commercial Paper (CP) Market, Certificate of Deposit (CD) Market; Concepts— Repo, Reverse Repo; Recent trends in the Indian money market. [L-10/ Marks 10] (b) Capital Market: Functions and Instruments; Primary and Secondary Markets- Functions and inter-relationship, Methods of New Issues; Indian debt market and equity market; Market Intermediaries- Brokers, Sub-Brokers; Role of Stock Exchanges in India; Recent trends in the Indian capital market. [L-20/ Marks: 20]	PP	Aug-Sep
Unit-III: Financial Institutions Commercial banking: Functions of Commercial Banks, Credit creation by commercial banks and its limitations; Reserve bank of India: Functions, Credit Control and Monetary Policy; Development Financial Institutions in India: NABARD, EXIM Bank, SIDBI; Life Insurance and General Insurance Companies in India: Functions; Mutual Funds: Concept of Mutual Fund, Types of Mutual Funds (open ended and close ended); Role of Mutual Funds in Indian capital market; Non-Banking Financial Companies (NBFCs): Definition, Functions, Regulations of RBI over NBFCs. [L-20/ Marks: 20]	PP	Oct-Nov
Unit-IV: Financial Services Merchant Banks: Functions and Role, SEBI Regulations; Credit Rating: Objectives and Limitations, SEBI Regulations; Credit Rating Institutions and their functions. [L-10/ Marks: 10]	PP	Nov-Dec
Unit-V: Investors' Protection Concept of investors' protection; Grievances regarding new issue market and Stock Exchange transactions, and the Grievance Redressal Mechanism; Role of SEBI, judiciary and the media. [L-10/ Marks: 10]	PP	Dec

Course: B.Com, Semester-4 (Hons./ General) Jan-June, 2024

Paper- GE 4.1 Chg ….. Microeconomics II & Indian Economy

(Internal Assessment: 20 marks; Semester-end Exam: 80 marks; Total: 100 marks

Module I: Microeconomics II

Topic	Teacher	Month
Unit-I: Monopoly Concept of Monopoly: Sources of monopoly power; Short-run and Long-run equilibrium of a monopoly firm; Price discrimination; Social Cost of Monopoly (concept only). [L-10/Marks: 10]	NP	Jan-Feb
Unit-II: Imperfect Competition Concept of Imperfectly Competitive market; Monopolistic Competition: Features and examples; Oligopoly: Non-Collusive Oligopoly: Sweezy's Kinked demand Curve Model, Collusive Oligopoly: Cartel (concept with example). [L-15/ Marks: 15]	NP	Feb-Mar
Unit: III Factor Price Determination Introduction; Marginal Productivity Theory of Distribution; Marginal Productivity Theory of Wage, Demand Curve of Labour, Supply Curve of Labour; Wage Determination in an Imperfectly Competitive Labour Market: Case of Collective Bargaining, Factors determining the power of trade unions to raise wages; Theory of Rent: Ricardian Theory of Rent, Modern Theory of Rent, Quasi-rent; Theory of Profit: Gross Profit and Net Profit, Accounting Profit and Normal Profit, Different Theories of Determination of Profit; Concept of Interest: Gross Interest and Net Interest, Classic Theory of Interest Rate Determination. [L-15/ Marks: 15]	BS	Feb-May

Module II: Indian Economy

Topic	Teacher	Month
Unit-I: Basic Issues in Economic Development Concepts and measures of development and underdevelopment; Concept of national income: GDP, GNP, NDP, NNP, NI (concepts only). [L 5/ Marks: 5]	PP	Jan
Unit-II: Basic Features of Indian Economy Sectoral distribution of National Income and Occupational Structure; Structural Change in Indian Economy, issue of Service-led Growth. [L 10/ Marks: 10]	PP	Feb
Unit-III: Sectoral Trends and Issues (a) Agricultural Sector: Problem of low productivity; Green Revolution and its impact; Land Reforms; Problems of rural credit and marketing. (b) Industry and Service Sector: An overview of industrial growth during pre-reform and post- reform period; Role of Public Sector: its performance and the issue of disinvestment; Role of MSME sector, problems faced by the MSME Sector; Role of the Service Sector: growth of banking and insurance sector during the post-reform period. (c) External Sector: Problem of unfavourable balance of payments and policy measures. [L 15/ Marks: 15]	PP	Mar-Apr
Unit-IV: Social Issues in Indian Economy Problem of Poverty, Poverty alleviation measures; Problem of Unemployment and the policy Measure. [L 10/ Marks: 10]	PP	Apr-May

Course: B.Com, Semester-5 (Hons.) July-Dec, 2023

DSE 5.1 A: Economics II & Advanced Business Mathematics

Module I: Economics II/ Macroeconomics

(Internal Assessment: 10 marks; Semester-end Exam: 40 marks; Total: 50 marks

Topic	Teacher	Month
Unit-I: Introduction Concepts and variables of Macroeconomics. [L 2 / Marks: 2]	BS/NP	Jul
Unit-II: National Income Accounting Concepts and measurement of National Income (numerical examples preferred); Circular flow of income – Real and Nominal GDP –Implicit deflator. [L 6 / Marks: 6]	BS/NP	Aug
Unit – III: Determination of Equilibrium Level of National Income Simple Keynesian Model; Consumption, saving and investment functions – National income determination; Investment multiplier, Government expenditure multiplier, Tax multiplier, Balanced Budget multiplier. [L 10 / Marks: 10]	BS/NP	Sep
Unit-IV: Commodity market and Money market equilibrium Concept of demand for Money: Liquidity Preference Approach; Derivation of IS and LM curves –Shifts of IS and LM curves—equilibrium in IS-LM model – Effectiveness of monetary and fiscal policies. [L 10 / Marks: 10]	BS/NP	Oct-Nov
Unit-V: Money, Inflation and Unemployment Concept of supply of money; Measures of money supply – High powered money – Money multiplier. Concept of Inflation– Demand-pull and Cost-push theories of inflation – Monetary and fiscal policies to control inflation; Unemployment: Voluntary and Involuntary, Frictional and Natural Rate of Unemployment (Concepts only). [L 12 / Marks: 12]	BS/NP	Nov-Dec

Course: B.A/ B.Sc, Semester-1 (General) July-Dec, 2023

Paper- ECON-MD-CC1

Name of the Course: Microeconomics (I)

Total Marks: 100 [Theory 75 + Tutorial 25]

Topic	Teacher	Month
Unit 1: Exploring the subject matter of Economics **5 lecture hours** 1.1 Scope and Method of Economics: Wants, Scarcity, Competing Ends and Choice - Defining Economics, Thinking like an economist: Basic Economics Questions, Households and firms, Demand and Supply, Basic concepts of Utility, basic concepts of production-Production function, Definition of Average and Marginal Product, Microeconomics and Macroeconomics, Normative Economics and Positive Economics 1.2 Principles of Microeconomics–principles of individual decision making and principles of economic interactions–trade off, opportunity cost, efficiency, marginal changes and cost-benefit, trade, market economy, property rights, market failure, externality and market power. 1.3 Interdependence and the Gains from Trade- production possibilities frontier and increasing costs, absolute and comparative advantage, comparative advantage and gains from trade.	PP	Jul-Aug
Unit 2: Utility Theory **20 lecture hours** *(Focus on intuitive explanation and diagrams. Learning to analyze without using calculus a must)* 2.1 Cardinal and Ordinal Approach. 2.2 Utility in Cardinal Approach- Utility and choice, Total Utility and Marginal Utility, Utility and choice maximization, marginal utility, theory of demand 2.3 Ordinal utility: Assumptions on preference ordering, Indifference curve (IC), Marginal rate of substitution and convexity of IC, Budget constraint, Consumers equilibrium—interior and corner	NP	Jul-Oct
Unit 3: Demand and Supply: How Markets Work **8 lecture hours** 3.1 Elementary theory of Demand: Factors influencing household demand and market demand, the demand curve, movement along and shift of the demand curve 3.2 Elementary theory of Supply: factors influencing supply, the supply curve, movement along and shift of the supply curve 3.3 The Elementary theory of market price: Determination of equilibrium price in a competitive market.	PP	Sep-Oct
Unit 4: Market and Adjustments **4 lecture hours** 4.1 The Evolution of Market Economies, Price System and the Invisible Hand 4.2 The Decision-takers - households, firms and central authorities 4.3 The Concepts of Markets- individual market, separation of individual markets, interlinking of individual markets. Difference among markets- competitiveness, goods and factor markets, free and controlled markets. Market and non-market sectors, public and private sectors, economies- free market, command and mixed. 4.4 Different goods: Public goods, Private goods, Common resources and Natural Monopolies.	BS	Jul-Sep
Unit 5: Market Sensitivity and Elasticity **8 lecture hours** 5.1 Importance of Elasticity in Choice-Decisions 5.2 Method of Calculation- Arc Elasticity, Point Elasticity-definition 5.3 Demand and supply Elasticities—types of elasticity and factors affecting elasticity, Demand Elasticity and Revenue, Long run and Short run elasticities of Demand and Supply 5.4 Income and Cross Price Elasticity 5.5 Applications: Case studies—OPEC and Oil Price	BS	Oct

Mode of tutorial Examination: Viva or Presentation plus viva

Course: B.A/ B.Sc, Semester-2 (General) Jan-June, 2024

Paper- ECON-MD-CC2

Name of the Course: Macroeconomics (I)

Total Marks: 100 [Theory 75 + Tutorial 25]

Topic	Teacher	Month
1.National Income Accounting **Lecture hours 12** 1.1 Macroeconomic data- Basic concepts of National Income accounting. The circular flow (three sector). 1.2 Concepts of GNP, GDP, NNP, and NDP at market price and at factor cost- Real and Nominal, - Implicit deflator. 1.3 The measurement of National Income. The problem of double counting. 1.4 The role of Government. Concepts of Corporate Income, Corporate Savings, Personal Income, Personal Disposable Income and Personal Savings. 1.5 Saving-Investment gap and its relation with budget deficit and trade surplus. National Income accounting and cost of living.	PP	Jan-Mar
2. Income Determination in the Short Run (Part-I): **The Simple Keynesian Model in a Closed Economy** **Lecture hours 12** 2.1 Consumption Function; the Keynesian Saving Function; stability of equilibrium; the concept of effective demand- the concept of demand-determined output 2.2 Equilibrium Income determination in SKM; the Simple Keynesian Multiplier ; the paradox of thrift; the SKM in a Closed Economy with Government; Government expenditure and Tax 2.3 Balanced Budget Multiplier	NP	Jan-Mar
3. Basic theory of Investment **Lecture hour 3** 3.1 Investment function: Determinants of investment. Concepts of Marginal productivity of capital 3.2 Marginal efficiency of capital (MEC) and Marginal efficiency of investment (MEI).	PP	Mar-Apr
4. The Classical system **Lecture hours 12** 4.1 Basic ideas of Classical Macroeconomics; Say's Law and Quantity Theory of Money 4.2 Loanable fund theory 4.3 The Classical Theory of Income and Employment determination 4.4 Full Employment and wage-price flexibility; Neutrality of Money 4.5 Classical Dichotomy (Basic Concept).	BS	Jan-Mar
5. Inflation **Lecture hours 6** 5.1 Concepts and types - Inflationary Gap, Demand pull vs. Cost push inflation, 5.2 Anti-inflationary policy	BS	Apr

Mode of tutorial Examination: Viva or Presentation plus viva

Course: B.A/ B.Sc, Semester-3 (General) July-Dec, 2023

Core Course 3 (CC 3) BA/BSc (General) / Generic Elective Course III (GE-III) for BA/BSc (Hons)

Paper- ECO-G-CC-3-3-TH-TU/ ECO--GE-3-3-TH-TU

Name of the Course: Issues in Economic Development and India

Total Marks: 100 [Theory 65 + Tutorial 15 + Internal Assessment 10 + Attendance 10]

Topic	Teacher	Month
1. Meaning of Economic Development 25 lecture hours Meaning of economic development; growth vs. development; concept of human development and its measurement, population and human development; education and health sectors in India; features and causes of underdevelopment of the Indian economy; growth and development of Indian economy under different policy regimes.	BS	Jul-Aug
2. Poverty , Inequality and Development 20 lecture hours Basic issues of poverty and inequality; basic ideas about measurement of poverty and inequality- the poverty line; trends and policies to eradicate poverty and income inequality in India	NP	Aug-Sep
3. Development of the Dual Economy and Development Strategies 15 lecture hours • Surplus labour and disguised unemployment-basic concepts; the Lewis model of economic development with unlimited supply of labour. • Balanced and unbalanced growth as development strategies	PP	Sep-Oct
4. International Organizations and Economic Development 15 lecture hours • Functions of IMF and World Bank and their roles in economic development • The World Trade Organization (WTO) and its functions. India and the WTO	BS/NP	Nov-Dec

Course: B.A/ B.Sc, Semester-4 (General) Jan-June, 2024

Core Course 4 (CC 4) BA/BSc (General) / Generic Elective Course IV (GE-IV) for BA/BSc (Hons)

Paper-ECO-G-CC-4-4-TH-TU/ ECO--GE-4-4-TH-TU

Name of the Course: Indian Economic Policies

Total Marks: 100 [Theory 65 + Tutorial 15 + Internal Assessment 10 + Attendance 10]

Topic	Teacher	Month
1. Macroeconomic Policies and their Impact 15 lecture hours Fiscal Policy; trade and investment policy; financial and monetary policies; labour regulation.	BS/NP	Jan-Feb
2. Policies and Performance in Agriculture 21 lecture hours Growth; productivity; agrarian structure and technology; capital formation; trade; pricing and procurement.	BS/NP	Feb-Mar
3. Policies and Performance in Industry 21 lecture hours Growth; productivity; diversification; small scale industries; public sector; competition policy; foreign investment	BS/NP	Mar-Apr
4. Policies and Performance of Indian Foreign Trade 18 lecture hours India‘s foreign trade: change in volume and direction of India‘s foreign trade in the post-liberalization period; Balance of Payments position of India in recent years; India‘s export and import policies.	PP	Apr-May

Course: B.A/ B.Sc, Semester-3/5 (General) July-Dec, 2023

Skill Enhancement Course [Economics] -A Group (SEC-A) BA/BSc (General)
Paper: ECO-G-SEC-3-1A-TH/ECO-G-SEC-5-2A-TH
Name of the Course: Elementary Rural Development (ERD)
Total Marks: 100 [Theory 80 + Internal Assessment 10 + Attendance 10]

Topic		Teacher	Month
1. **Basic Issues in Rural Development** • Rural Development vs. Agricultural Development • Decentralized Planning and Participatory Development-the role of Panchayats • Panchayat and Rural Development in West Bengal • Role of NGOs in Rural Development	12 lecture hours	BS	Jul-Nov
2. **Rural Credit and Self Help Groups (SHGs)** • Constraints of micro-enterprises in rural areas • The rural non-farm sector –credit needs for rural non-farm sector. • Concept of micro credit and the role of Grameen Bank • Need for SHG for formation-features of SHG • SHGs in India	12 lecture hours	NP	Jul-Nov
3. **Selected Government Programmes and Rural Development** • Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) • Mid-day Meal • Pradhan Mantri Gram Sadak Yojana (PMGSY)	6 lecture hours	PP	Jul-Nov

Course: B.A/ B.Sc, Semester-4/6 (General) Jan-June, 2024

Skill Enhancement Course [Economics] -B -Group (SEC-B) BA/BSc (General)
Name of the Course: Entrepreneurship and Development (ED)
Paper: ECO-G-SEC-4-1B-TH/ECO-G-SEC-6-2B-TH
Total Marks: 100 [Theory 80 + Internal Assessment 10 + Attendance 10]

Topic		Teacher	Month
1. **Basic issues of Entrepreneurship and Economic Development** • Basic features of Entrepreneurship • Entrepreneurship and its linkages with economic development • Growth of entrepreneurship in India—Role of Entrepreneurship in Economic Development. • Planning Commission's guidelines for formulating a project report by an entrepreneur • Problem of Rural entrepreneurship in India	10 lecture hours	NP	Jan-May
2. **Financial resources for new ventures of an entrepreneur** • Sources of finance---capital structure. • Institutional support to enterprises—national small industries board – state small industries development corporation--- district industries center--- industrial estates-Indian experience	7 lecture hours	BS	Jan-May
3. **Growth strategies in small business** • Stages of growth, • Types of growth strategies-Expansion, Diversification, Joint Venture, Merger and Subcontracting	7 lecture hours	BS/NP /PP	Jan-May
4. **Sickness in Small Business** • Concept of industrial sickness • Symptoms of sickness in small business • Causes and consequences of sickness in small business	6 lecture hours	PP	Jan-May

Course: B.A/ B.Sc, Semester-5 (General) July-Dec, 2023

Discipline Specific Elective Course [Economics] (DSE-A) BA/BSc (General)
Name of the Course: Sustainable Development (SD)
Paper: ECO-G-DSE-5-1A/2A-TH-TU
Total Marks: 100 [Theory 65 + Tutorial 15 + Internal Assessment 10+Attendance 10]

Topic	Teacher	Month
1. **The Approach Towards Sustainability-Introductory ideas** 15 lecture hours Key environmental issues and problems, economic way of thinking about these problems, circular flow of environmental pollutants and waste recycling-laws of thermodynamics, renewable and non-renewable resources-the issue of sustainability	BS	Jul-Nov
2. **The meaning of Sustainable Development** 25 lecture hours Different definitions of sustainable development, rules of sustainable development, measures of sustainable development, sustainable management of resources-the role of property rights, stakeholders associated with sustainable management of different types of renewable resources fishery, forestry and water, the concept of sustainable livelihood in the context of sustainable resource management.	NP	Jul-Nov
3. **Trans-boundary pollution, climate change and sustainable development** 15 lecture hours Implementation of environmental policies in developing countries and international experience; transboundary environmental problems-international meetings, protocols and treaties; economics of climate change-basic ideas of the carbon credit market-clean development mechanism and international emission trading.	PP	Jul-Nov
4. **Sustainable Resource Management Policies in India** 20 lecture hours Water policy, forestry policy and fishery policy of India. Basic objectives of the policies along with goals and visions.	BS/PP /NP	Jul-Nov

Course: B.A/ B.Sc, Semester-6 (General) Jan-June, 2024

Discipline Specific Elective Course [Economics] (DSE-B) BA/BSc (General)
Name of the Course: Economic History of India (1857-1947) (EHI)
Paper: ECO-G-DSE-6-1B/2B-TH-TU
Total Marks: 100 [Theory 65+ Tutorial 15 + Internal Assessment 10+Attendance 10]

Topic	Teacher	Month
1. **Colonial India: Background and Introduction** 10 lecture hours Overview of the colonial economy	PP	Jan-May
2. **Macro Trends** 13 lecture hours National Income; population; occupational structure.	BS	Jan-May
3. **Agriculture** 17 lecture hours Agrarian structure and land relations; agricultural markets and institutions – credit, commerce and technology; trends in performance and productivity; famines.	NP	Jan-May
4. **Railways and Industry** 20 lecture hours Railways; the de-industrialisation debate; evolution of entrepreneurial and industrial structure; nature of industrialisation in the interwar period; constraints to industrial breakthrough; labour relations.	BS/PP	Jan-May
5. **Economy and State in the Imperial Context** 15 lecture hours The imperial priorities and the Indian economy; drain of wealth; international trade, capital flows and the colonial economy – changes and continuities; government and fiscal policy.	NP/PP	Jan-May

This is a tentative distribution for successful completion of the syllabus. The Department, although has responsibility towards the successful completion of the syllabus, however, holds that the distribution of Month and syllabus is subject to modification under unavoidable circumstances within the bounded time-frame.

Dr. Nilanjan Patra
(Head, Department of Economics)
Bangabasi Morning College

***Dept. comprises of: BS: Dr. Bimal Sarkar; NP: Dr. Nilanjan Patra; PP: Pallabi Paul**

ACADEMIC CALENDER 2023 - 2024

JULY - DECEMBER

GEOGRAPHY GENERAL (THEORY)

SEMESTER – 1/3 (for H & MD)

GEOG-H-CC01/MD-CC01-1/3-Th-Physical Geography – 75 Marks / 3 Credits

UNIT	TOPIC	TEACHER	PERIOD
1	**Cartography** : Concept and applications of scale and projections:Components and classification of maps	RR	AUGUST
2	**Geotectonics** : Seismic waves and internal structure of the earth	AD	AUGUST
3	**Geomorphology** : 1. Classification of weathering and agents of erosion. 2. Fluvial processes and landforms	RR	SEPTEMBER
4	**Climatology** : 1. Nature,composition,and layering of the atmosphere. 2. Circulation in the atmosphere :Planetary wind,jet streams and index cycle	AD	SEPTEMBER
5	**Soil Geography** : Factors of soil formation, evolution of an soil profile	RR	OCTOBER
6	**Biogeography** : Plant adaptation and distribution in relation to water availability	AD	OCTOBER
7	**Geography of Hazards** : Nature and classification of Hazards and disasters in indian context.	AD	NOVEMBER

GEOG-H-CC01/MD-CC01-1/3-P- Physical Geography Lab – 25Marks/ 1 Credit

SL NO.	TOPIC	TEACHER	PERIOD
1	**Graphical construction of scales** : Plain,Comparative,Diagonal and Vernier	RR	AUG-SEP
2	Delineation of drainage basins on Survey of India 1:50k topographical maps.Determining stream ordering (Strahler),and bifurcation ratio in a drainage basin (c.5' x 5')	AD	AUG-SEP
3	Identification of drainage and channel patterns from survey of india 1:50k topographical maps	RR	OCT-NOV
4	Construction and interpretation of wind rose diagram	AD	OCT-NOV
5	Viva voce based on labroratory notebook	RR & AD	AUG-NOV

SEMESTER III

GEO-G-CC-3-03-TH – HUMAN GEOGRAPHY (60 MARKS / 4 CREDITS)

TOPIC	TEACHER	PERIOD
UNIT I: ECONOMIC GEOGRAPHY 1. SECTORS OF ECONOMY: PRIMARY, SECONDARY, TERTIARY, AND QUATERNARY. FACTORS AFFECTING LOCATION OF ECONOMIC ACTIVITIES 2. LOCATION OF ECONOMIC ACTIVITIES: THEORIES OF VON-THUNEN, LOSH, WEBER 3. LOACTION OF INDUSTRIES WITH SPECIAL REFERENCE TO INDIA: CCOTTON, IRON AND STEEL 4. GLOLALISATION AND INTERGRATION OF WORLD ECONOMIES	RR	SEP-NOV
UNIT II:SOCIAL GEOGRAPHY 5. HUMAN SOCIETY: STRUCTURE, FUNCTIONS, SOCIAL SYSTEMS. POPULATION AND MIGRATION: OVERVIEW, CAUSES AND AFFECTS 6. TYPES AND CHARACTERISTICS OF SOCIAL ORGANISATIONS:PRIMITIVE, HUNTING-GATHERING, AGRARIAN, INDUSTRIAL 7. RACE, LANGUAGE AND RELIGION:ORIGIN, CHARACTERISRICS AND SPACIAL VARIATIONS 8. SOCIAL ISSUES: DIVERSITY, CONFLICT AND TRANSFORMATION	AD	SEP-OCT
UNIT III: CULTURAL GEOGRAPHY 1. CARL SAUER: CULTURAL LANDSCAPE AND ITS ELEMENTS 2. RURAL AND URBAN SETTLEMENTS: DIFFERENTIATION IN CULTURAL LANDSCAPES 3. CULTURAL REGIONS AND CULTURAL REALMS 4. DIFFUSION OF CULTURE AND INNOVATIONS	AD	OCT-NOV

GEO-G-CC-3-03-P – HUMAN GEOGRAPHY LAB (30 MARKS / 2 CREDITS)

TOPIC	TEACHER	PERIOD
1. STATE-WISE VARIATION IN OCCUPATIONAL STRUCTURE BY PROPORTIONAL DIVIDED CIRCLES	AD	SEP - OCT
2. TIME SERIES ANALYSIS OF INDUSTRIAL PRODUCTION USING ANY TWO MANUFACTURED GOODS FROM INDIA	AD	NOV
3. MEASURING ARITHMETIC GROWTH RATE OF POPULATION OF DEVELOPED AND DEVELOPING COUNTRIES COMPARING TWO DATASETS OF 2 DECADES OF 2 COUNTRIES	RR	SEP - OCT
4. NEAREST NEIGHBOUR ANALYSIS: RURAL EXAMPLE FROM SURVEY OF INDIA 1:50K TOPOGRAPHICAL MAPS .	RR	NOV
5. VICE-VOCE BASED ON LABORATORY NOTEBOOK	AD & RR	SEP-NOV

GEO-G-SEC-A-3/4-01-TH – COASTAL MANAGEMENT (90 MARKS / 2 CREDITS)

TOPIC	TEACHER	PERIOD
COMPONENTS OF COASTAL ZONE: COASTAL MORPHODYNAMIC VARIABLES AND THEIR ROLE IN EVOLUTION OF COASTAL FORMS	RR	SEP - OCT
ENVIRONMENTAL IMPACTS AND MANAGEMENT OF MINING, OIL EXPLORATION,SALT MANUFACTURING, LND RECLAMATION AND TOURISM	RR	NOV
COASTAL HAZARDS AND THEIR MANAGEMENT USING SRUCTURAL AND NON STRUCTUTAL MEASURES: EROSION, FLOOD,SAND ENCROACHMENT, DUNE DEGRADATION,ESTURINE SEDIMENTATION AND POLLUTION	AD	SEP - OCT
PRINCIPLES OF COASTAL ZONE MANAGEMENT. EXCLUSIVE ECONOMIC ZONEAND COASTAL REGULATION ZONE WITH REFERENCE TO INDIA	AD	NOV

SEMESTER – V

GEO-G-DSE-A-5-01-TH-REGIONAL DEVELOPMENT (60MARKS/4 CREDITS)

SL NO.	TOPIC	TEACHER	PERIOD
1	DEFINITION OF REGION: TYPES AND NEED OF REGIONAL PLANNING.	RR	SEP
2	CHOICE OF REGION FOR PLANNING: CHARACTERISTICS OF IDEAL PLANNING REGION; DELINIATION OF PLANNING REGION.	RR	SEP
3	REGIONALIZATION OF INDIAFOR PLANNING (AGRO-ECOLOGICAL ZONES).	RR	OCT
4	STATEGIES/MODELS FOR REGIONAL PLANNING: GROWTH POLE MODEL OF PERROUX.	RR	NOV
5	GROWTH CENTRE MODEL IN INDIAN CONTEXT; CONCEPT OF VILLAGE CLUSTER.	RR	NOV
6	PROBLEM REGIONSAND REGIONAL PLANNING; BACKWARD REGIONS AND REGIONAL PLANS: SPECIAL AREA PLANS IN INDIA. DVC: SUCCESS AND FAILURE.	RR	NOV
7	CHANGING CONCEPT OF DEVELOPMENT AND UNDERDEVELOPMENT; EFFICIENCY-EQUITY DATA BASED.	AD	SEP
8	INDICATORS OF DEVELOPMENT: ECONOMIC, SOCIAL AND ENVIRONMENTAL. CONCEPTS OF HUMAN DEVELOPMENT.	AD	SEP
9	REGIONAL DEVELOPMENTIN INDIA, REGIONAL INEQUALITY, DISPARITY AND DIVERSITY.	AD	OCT
10	DEVELOPMENT AND REGIONAL DISPARITIES IN INDIA SINCE INDEPENDENCE: DISPARITIES IN AGRICULTURAL DEVELOPMENT.	AD	NOV
11	DEVELOPMENT AND REGIONAL DISPARITIES IN INDIA SINCE INDEPENDENCE: DISPARITIES IN INDUSTRIAL DEVELOPMENT.	AD	NOV
12	DEVELOPMENT AND REGIONAL DISPARITIES IN INDIA SINCE INDEPENDENCE: DISPARITIES IN HUMAN RESOURCE DEVELOPMENT IN TERMS OF EDUCATION AND HEALTH.	AD	NOV

GEO-G-DSE-A-5-01-P-REGIONAL DEVELOPMENT LAB(30 MARKS/2 CREDITS)

SL NO.	TOPIC	TEACHER	PERIOD
1	DELINIATION OF REGIONS ACCORDING TO GIVEN CRITERIA USING WEAVER'S METHOD	RR	SEP - OCT
2	DETERMINATION OF SPHERE OF INFLUNCE BY GRAVITY MODEL	RR	NOV
3	MEASUREMENT OF INEQALITY BY LORENZ CURVE AND LOCATION QUOTIENT	AD	SEP - OCT
4	PREPARATION OF Z SCORE AND COMPOSITE INDEX FROM SUITABLE DATA	AD	NOV
5	VIVA VOCE BASED ON LABORATORY NOTE BOOK	AD+RR	SEP - NOV

GEO-G-SEC-A-3/5-02-TH- FOREST AND WILDLIFE MANAGEMENT (90 MARKS/2 CREDITS)

SL NO	TOPIC	TEACHER	PERIOD
1	FOREST AND WILDLIFE MANAGEMENT: IMPORTANCE AND STRATEGIES. ROLE AND SIGNIFICANCE OF STAKEHOLDERS. TANGIBLE AND INTANGIBLE BENEFITSOF FOREST AND WILDLIFE MANAGEMENT.	RR	SEP - OCT
2	LEGAL FRAMEWORK OF FOREST AND WILDLIFE PROTECTION IN INDIA. THE INDIAN FOREST ACT 1927,FOREST CONSERVATION ACT 1980, WILDLIFE PROTECTION ACT1972,BIODIVERSIY ACT 2002	AD	SEP - OCT
3	FOREST AS COMMON PROPERTY RESOURCES. FOREST RIGTS: TRIBALS AND FORSTS. GENDER DIMENTIONOF FOREST MANAGEMENT. MANAGEMENT OF POACHING AND ILLEGAL LOGGING.	RR	NOV
4	PRINCIPLES OF COMMUNITY PARTICIPATION AND JOINT FOREST MANAGEMENT. CAUSES AND MANAGEMENT OF HUMAN WILDLIFE CONFLICTS WITH SPECIAL REFERENCE TO JANGAL MAHAL, SUNDARBAN, DUARS.	AD	NOV

ACADEMIC CALENDER 2023 – 2024

JANUARY – JUNE

GEOGRAPHY GENERAL (THEORY)

DISCIPLINE SPECIFIC COURSE (CC): HONOURS & MULTIDISCIPLINARY

SEMESTER – 2/4 (for H&MD)

GEOG-H-CC02/MD-CC02-2/4Th – Physical Geography – 75Marks/3 Credits

UNIT	TOPIC	TEACHER	PERIOD
1	**Scope and Approaches** : 1.Elements of human geography : Nature,scope and recent trends 2.Human geography schools of thought: Resource,locational,landscape,envieonment	RR	JANUARY
2	**Social Geography** : 1.Evolution of human societies: Hunting and food gathering,pastoral nomadism,subsistence farming and industrial society 2.Human adaptation to the environment : Chenchu ,Toda, and Gond 3.Evolution and characteristics of post-industrial urban societies	AD	JAN-FEB
3	**Population Geography** : 1.Demographic transition. Significance of demographic dividend 2.Distribution,density, and growth of population in india	RR	FEBRUARY
4	**Settlement Geography** : 1.Characteristics of settlements : Urban and rural 2.Site, situation,types and patterns of rural settlements	RR	MARCH
5	**Urban Geography** : Size-class classification of urban settlements after Census of India	AD	MARCH

GEOG-H-CC02/MD-CC02-2/4-P- Human Geography Lab – 25 Marks/1 Credit

SL NO.	TOPIC	TEACHER	PERIOD
1	**Growth rate of population** : Arithmetic growth comparing two decadal datasets	RR	JAN-FEB
2	Representation and interpretation of population density of indian states or West Bengal districts by Choropleth method	RR	MAR-APR
3	Identification of types of settlements according to sites from Survey of India 1:50k topographical maps	AD	JAN-FEB
4	Construction of proportional squares depicting number of houses	AD	MAR-APR
5	viva voce based on laboratory notebook	RR & AD	JAN-MAY

SEMESTER IV

GEO-G-CC-4-04-TH – CARTOGRAPHY (60 MARKS / 4 CREDITS)

TOPIC	TEACHER	PERIOD
UNIT I: SCALES AND PROJECTIONS 1. MAPS: CLASSIFICATION AND TYPES. SCALES : TYPES SIGNIFICANCE AND APPLICATIONS 2. COORDINATE SYSTEMS: POLAR AND RECTANGULAR. BEARING:MAGNETIC AND TRUE, WHOLE-CIRCLE AND REDUCED 3. MAP PROJECTIONS: CLASSIFICATION, PRPERTIES AND USES. CONCEPT AND SIGNIFICANCE OF UTM PROJECTION	RR	JAN- FEB-MAR
UNIT II: TOPOGRAPHIC AND THEMATIC MAPS 4. SURVEY OF INDIAN TOPOGRAPHIC MAPS: REFERENCE SCHEME OF OLD AND OPEN SERIES. INFORMATION ON THE MARGIN OF MAPS 5. REPRESENTATION OF DATA BY DOTS AND PROPORTIONAL CIRCLES 6. REPRESENTATION OF DATA BY ISOPLETH AND CHOROPLETH 7. PRINCIPAL NATIONAL AGENCIES PRODUCING THEMATIC MAPS IN INDIA: GSI,NBSSLUP,NHO,NRSC, ETC. ACQUINTANCE WITH BHUVAN PLATFORM	AD	JAN- FEB-MAR
UNIT III: REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM 8. BASICS OF REMOTE SENSING: TYPES OF SATELLITE , SENSORS, BANDS AND RESOLUTIONS WITH SPECIAL REFERNCE TO THE ISRO MISSIONS 9. PRINCIPLES OF PREPARING STANDARD FCC AND CLASSIFIED RASTER IMAGES 10. PRINCIPLES OF GEOGRAPHICAL INFORMATION SYSTEM: CONCEPTS OF VECTOR TYPES, ATTRIBUTE TABLES,BUFFERS AND OVERLAY ANALYSIS	AD	MAR-APR-MAY
UNIT IV:SURVEYING 11. BASIC CONCEPTS OF SURVEYING AND SURVEY EQIPMENTS: PRISMATIC COMPASS 12. BASIC CONCEPTS OF SURVEYING AND SURVEY EQIPMENTS: DUMPY LEVEL	RR	MAR-APR-MAY

GEO-G-CC-4-04-P – CARTOGRAPHY (30 MARKS / 2 CREDITS)

SL NO.	TOPIC	TEACHER	PERIOD
1.	GRAPHICAL CONSTRUCTION OF SCALES: PLAIN AND COMPARATIVE	RR	JAN-FEB
2.	CONSTRUCTION OF PROJECTIONS:SIMPLE CONICAL WITH ONE STANDARD PARALLEL, CYLINDRICAL EQUAL AREA PROJECTION AND POLAR ZENITHAL STEREOGRAPHIC	RR	MAR-APR
3.	CONSTRUCTION OF THEMATIC MAPS: PROPORTIONAL SQUARES, PROPOTIONAL CIRCLES, CHOROPLETHS AND ISOPLETHS	AD	JAN-FEB
4.	PREPARATION OF ANNOTATED THEMATIC OVERLAYS FROM SATELLITE STANDARD FCCS OF 1:50000	AD	MAR-APR
5.	VIVA- VOCE BASED ON LABORATORY NOTE BOOK	AD & RR	JAN-APR

GEO-G-SEC-B-4/6-02-TH- RURAL DEVELOPMENT(90 MARKS /2CREDITS)

SL NO.	TOPIC	TEACHER	PERIOD
1.	RURAL DEVELOPMENT:CONCEPT, BASIC ELEMENTS, MEASURING THE LEVEL OF RURAL DEVELOPMENT	RR	JAN-FEB
2.	PARADIGMS OF RURAL DEVELOPMENT: CUMULATIVE CAUSATION MODEL, CORE PEREPHERY MODEL, GANDHIAN APPROACH TO RURAL DEVELOPMENT.	RR	MAR-APR
3.	AREA BASED APPROACH TO RURAL DEVELOPMENT: DROUGHT PRONE AREA PROGRAMMES, PMSGY, SJSY, MGNREGA, JAN DHAN YOJONA.	AD	JAN-FEB
4.	RURAL GOVERNANCE: PANCHAYATI RAJ SYSTEM, RURAL DEVELOPMENT POLICIES AND PROGRAMMES IN INDIA-AN OVERVIEW.	AD	MAR-APR

SEMESTER – VI

GEO-G-DSE-A-6-04-TH-POPULATION GEOGRAPHY (60MARKS/4 CREDITS)

SL NO.	TOPIC	TEACHERS	PERIOD
	UNIT : I POPULATION DYNAMICS		
1	DEVELOPMENT OF POPULATION GEOGRAPHY AS AFIELD OF SPECILIZATION. RELATION BETWEEN POPULATION GEOGRAPHY AND DEMOGRAPHY. SOURCES OF POPULATION DATA, THEIR LEVEL OF RELIABILITY AND PROBLEMS OF MAPPING.	RR	SEP
2	POPULATION DISTRIBUTION: DENSITY AND GROWTH.CLASSICAL AND MODERN THEORIES OF POPULATION DISTRIBUTION AND GROWTH, DEMOGRAPHIC TRANSITION MODEL.	RR	OCT
3	WORLD PATTERN DETEMINANTS OF POPULATIONDISTRIBUTION AND GROWTH. CONCEPT OF OPTIMUM POPULATION.	RR	NOV
4	POPULATION DISTRIBUTION, DENSITY AND GROWTH PROFILE IN INDIA.	RR	NOV
	UNIT : II POPULATION AND DEVELOPMENT		
5	CONCEPTS OF AGE SEX COMPOSITION;RURAL AND URABAN COMPOSITION;LITERACY AND EDUCATION.	AD	SEP
6	MEASUREMENT OF FERTILITY AMD MORTALITY.CONCEPTS OF COHORT AND LIFE TABLE.	AD	OCT
7	POPULATION COMPOSITION OF INDIA: URBANISATION AND OCCUPATIONAL STRUCTURE.	AD	NOV
8	MIGRATION: TYPES AND CAUSES	AD	NOV
9	NATIONAL AND INTERNATIONALPATTERNS OF MIGRATION WITH SPECIAL REFERENCE TO INDIA	AD	NOV
10	POPULATION AND DEVELOPMENT: POPULATION-RESOURCE REGIONS.CONCEPTS OF HDI AND ITS COMPONENTS	AD	NOV
11	POPULATION POLICIES IN DEVELOPED AND LESS DEVELOPED COUNTRIES. INDIA'S POPULATION POLICIES. POPULATION AND ENVIRONMENT, IMPLICATION FOR THE FUTURE.	RR	NOV
12	CONTEMPORARY ISSUES: AGEING OF POPULATION,DECLINIG SEX RATIO, POPULATION AND ENVIRONMENT DICHOTOMY, IMPACT OF HIV/AIDS	RR	NOV

GEO-G-DSE-A-6-04-P-POPULATION GEOGRAPHY LAB (30 MARKS/2 CREDITS)

SL NO.	TOPIC	TEACHER	PERIOD
1	POPULATION PROJECTIONBY ARITHMERIC METHOD.	RR	SEP - OCT
2	POPULATION DENSITY MAPPING: STATE WISE FOR INDIA.	RR	NOV
3	ANALYSIS OF WORK PARTICIPATION RATE: TOTAL AND GENDER –WISE FOR INDIA.	AD	SEP - OCT
4	ANALYSIS OCCUPATION STRUCTURE BY DOMINANTAND DISTINCTIVEFUNCTIONS: DISTRICTS OF WEST BENGAL.	AD	NOV
5	VIVA VOCE BASED ON LABORATORY NOTE BOOK.	AD+RR	SEP - NOV

GEO-G-SEC-B-4/6-04-TH-SUSTAINABLE DEVELOPMENT (90 MARKS/2 CREDITS)

SL NO.	TOPIC	TEACHER	PERIOD
1	SUSTAINABLE DEVELOPMENT: CONCEPT, HISTORICAL BACKGROUND, COMPONENTS LIMITATION.	RR	SEP - OCT
2	CHALLENGES OF SUSTAINABLE DEVELOPMENT: DETERMINANTS, LINKAGES AMONG SUSTAINABLE DEVELOPMENT, ENVIRONMENT AND POVERTY.	RR	NOV
3	GLOBAL ENVIRONMENTAL ISSUES: POPULATION, INCOME AND URBNIZATION, HEALTH CARE, FOREST AND WATER RESOURCES.	AD	SEP - OCT
4	GLOBAL GOALS FOR SUSTAINABLE DEVELOPMENT: DOMAIN, CONFLICT, CRISIS AND COMPROMISE.	AD	NOV

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