Academic Calendar

SCIENCE

2021-2022

Bangabasi Morning College

19, Rajkumar Chakraborty Sarani, kolkata - 700009
Phone : 2360 7586, 2350 9210

Academic Calendar
2021-2022
Department of Zoology

Course: B.Sc. (Honours) Zoology		
PART I: SEMESTER 1		
CORE COURSE 1. Non-Chordates I		
ZOOA-CC1-1-TH		
4 Credits	**50 Hours**	
Non-Chordates I: Protists to Pseudocoelomates	**Full Marks 50**	
First Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
Unit 1: Basics of Animal Classification Definitions: Classification, Systematics and Taxonomy; Taxonomic Hierarchy, Taxonomic types Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Concept of classification – three kingdom concept of Carl Woese, 1977 and five kingdom concept of Whittaker, 1969	**S. Sarkar**	**4**
Unit 2: Protista and Metazoa **Protozoa** General characteristics and Classification up to phylum (according to Levine *et. al.*, 1980) Locomotion in *Euglena*, *Paramoecium* and *Amoeba*; Conjugation in *Paramoecium*. Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica* **Metazoa** Evolution of symmetry and segmentation of Metazoa	**S. Hansda**	**15**
Unit 3: Porifera General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Canal system and spicules in sponges	**P. Bhowmick**	**6**
Unit 4: Cnidaria General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.), Metagenesis in *Obelia*; Polymorphism in Cnidaria; Corals and coral reef diversity, Role of symbiotic algae in reef formation. Conservation of coral and coral reefs.	**S. Biswas**	**10**
Unit 5: Ctenophora General characteristics	**R. Das**	**2**

Unit 6: Platyhelminthes General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.) Life cycle and pathogenicity and control measures of *Fasciola hepatica* and *Taenia solium*	**R. Das**	**6**
Unit 7: Nematoda General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.) Life cycle, and pathogenicity and control measures of *Ascaris-lumbricoides* and *Wuchereria bancrofti* Parasitic adaptations in helminthes.	**R. Das**	**7**

CORE COURSE 2: Molecular Biology	
ZOOA-CC1-2-TH	
4 Credits	**50 Hours**
Molecular Biology	**Full Marks 50**
First Semester: July- December	

Topic	Name of the Teacher	**No. of Lectures**
Unit 1: Nucleic Acids Salient features of DNA, Chargaff's Rule, Hypo and Hyperchromic shift. Watson and Crick Model of DNA. RNA types & Function.	**S. Biswas**	**5**
Unit 2: DNA Replication Mechanism of DNA Replication in Prokaryotes, Prove that replication is Semi-conservative, bidirectional and discontinuous, RNA priming, Replication of telomeres.	**S. Sarkar**	**14**
Unit 3: Transcription Mechanism of Transcription in prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription.	**S. Hansda**	**14**
Unit 4: Translation Genetic code, Degeneracy of the genetic code and Wobble Hypothesis. Mechanism of protein synthesis in prokaryotes.	**S. Hansda**	**14**
Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA Capping and Poly A tail formation in mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing and RNA editing	**S. Hansda**	**14**

Unit 6: Gene Regulation Regulation of Transcription in prokaryotes: *lac* operon and *trp* operon; Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing. Epigenetic Regulation: DNA Methylation, Histone Methylation & Acetylation.	**S. Biswas** **P. Bhowmick**	**11**
Unit 7: DNA Repair Mechanisms Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair	**A. Ray**	**3**
Unit 8: Molecular Techniques PCR, Western and Southern blot, Northern Blot	**A. Ray**	**5**

PART I: SEMESTER 2

CORE COURSE 3: Non-Chordates II – Coelomates

ZOOA-CC2-3-TH

4 Credits	**50 hours**	
Second Semester	**January - June**	
Topic	Name of the Teacher	**No. of Lectures**
Unit 1: Introduction Evolution of coelom	**S. Biswas**	**4**
Unit 2: Annelida General characteristics and Classification up to classes (Ruppert and Barnes, 1994) Excretion in Annelida through nephridia; Metamerism in Annelida.	**S. Hansda**	**15**
Unit 3: Arthropoda General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Insect Eye (Cockroach only). Respiration in Prawn and Cockroach; Metamorphosis in Lepidopteran Insects; Social life inTermite	**S. Sarkar**	**24**
Unit 4: Onychophora General characteristics and Evolutionary significance	**S. Biswas**	**3**

Unit 5: Mollusca General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Nervous system in *Pila sp*. Torsion in Gastropoda. Feeding and respiration in *Pila* sp.	**S. Hansda**	**15**
Unit 6: Echinodermata General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Water vascular system in *Asterias*. Echinoderm larva and affinities with chordates	**S.Sarkar**	**12**
Unit 7: Hemichordata General characteristics of phylum Hemichordata. Relationship with non-chordates and chordates	**S. Hansda**	**3**
CORE COURSE 4: Cell Biology		
ZOOA-CC2-4-TH		
4 Credits	**50 hours**	
Second Semester	**January - June**	
Topic	**Name of the Teacher**	**No. of Lectures**
Unit 1: Plasma Membrane Ultra-structure and composition of Plasma membrane: Fluid mosaic model, Transport across membrane - Active and Passive transport, Facilitated transport, Cell junctions: Tight junctions, Gap junctions, Desmosomes	**S. Biswas**	**11**
Unit 2: Cytoplasmic organelles I Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes; Protein sorting and mechanisms of vesicular transport	**S. Hansda**	**8**
Unit 3: Cytoplasmic organelles II Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemiosmotic hypothesis; Peroxisomes: Structure and Functions; Centrosome (Kinetochore and centromeric DNA): Structure and Functions	**P. Bhowmick**	**11**
Unit 4: Cytoskeleton Type, structure and functions of cytoskeleton; Accessory proteins of microfilament & microtubule	**S. Biswas**	**8**
Unit 5: Nucleus Nuclear envelope, Nuclear pore complex, Nucleolus; Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome)	**A. Ray**	**12**

Unit 6: Cell Cycle Cell cycle and its regulation, Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma and Ras. Process of Proto-oncogene activation	**A. Ray**	**15**
Unit 7: Cell Signalling Cell signalling transduction pathways; Types of signalling molecules and receptors (Classification and Example only): RTK & JAK/STAT. Apoptosis	**A. Ray**	**12**

Course: B.Sc. (Honours) Zoology		
PART II: SEMESTER 3		
CORE COURSE 5 : Chordata		
ZOOA-CC3-5-TH		
4 Credits	**50 Hours**	
Third Semester : July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
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	**R. Das**	**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 and aerodynamics 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 Lectures**
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. Bhowmick**	**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 oestrous cycle	**S. Biswas**	**6**
Unit 6: Endocrine System Histology and function of thyroid, pancreas and adrenal. Function of	**S. Sarkar**	**16**

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; Placental hormones		
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 Lectures**
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		
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 Lectures**
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 Lectures
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	**S. Biswas**	**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 Lectures
Unit 1: Overview of Immune System Introduction – concept of health and disease; Cells and organs of the Immune system	**A. Ray**	**3**
Unit 2: Innate and Adaptive Immunity Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral).	**A. Ray**	**9**

Unit 3: Antigens Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes	**A. Ray**	**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	**P. Bhowmick**	**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).	**P. Bhowmick**	**4**
CORE COURSE 11: Ecology		
ZOOA-CC5-11-TH		
4 Credits	**50 Hours**	
Fifth Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
Unit 1: Introduction to Ecology Autecology and synecology, Levels of organization, Laws of limiting factors, 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, advantages and 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 Lectures**
Unit 1: Mendelian Genetics and its Extension Principles of inheritance, Incomplete dominance and co-dominance, Epistasis, Multiple alleles,Isoallele (White eye mutations), Pseudoallele (Lozenge Locus) & Cis-trans test for allelism, Lethal alleles, Pleiotropy, Penetrance & Expressivity	**S.Biswas** **P. Bhowmick**	**12**
Unit 2: Linkage, Crossing Over and Linkage Mapping Linkage and Crossing, Complete & Incomplete Linkage, Measuring Recombination 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	**P. Bhowmick**	**12**

mutagens. Mutation detection in *Drosophila* by attached X method. Biochemical mutation detection in *Neurospora*.		
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 Lectures**
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 Lectures**
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	**S. Hansda**	**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		
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 Lectures**
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		
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 Lectures**
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	**S. Biswas**	**2**

Unit 2: Biology of Aquarium Fishes Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such asGuppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish	**S. Biswas**	**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	**S. Biswas**	**5**

PART III: SEMESTER 5		
DSE1. Parasitology **ZOOA-DSE(A)-5-1-TH**		
Fifth Semester: July- December		
4 Credits	**50 Hours**	
Topic	**Name of the Teacher**	**No. of Lectures**
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*, *Wuchereriabancrofti*, 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.	**P. Bhowmick**	**10**
Unit 6: Parasite Vertebrates		

Cookicutter Shark, Hood Mocking bird, Vampire bats their parasitic behaviour and effect on host.	**S. Biswas**	**2**

PART III: SEMESTER 5		
DSE1. Endocrinology **ZOOA-DSE(B)-5-1-TH**		
Fifth Semester: July- December		
4 Credits	**50 Hours**	
Topic	**Name of the Teacher**	**No. of Lectures**
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).	**P. Bhowmick**	**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		
DSE2. Animal Biotechnology **ZOOA-DSE(A)-6-2-TH**		
Sixth Semester: January - June		
4 Credits	**50 Hours**	
Topic	**Name of the Teacher**	**No. of Lectures**
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 technique of 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		
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 Lectures**
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, Useof 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 I: SEMESTER 1		
CORE COURSE 1.Animal Diversity		
ZOOG-CC1-1-TH		
Full Marks 50	**4 Credits**	**50 Hours**
First Semester: July- December		

Topic	Name of the Teacher	No. of Lectures
Unit 1: Kingdom Protista General characters and classification up to phyla(Levine et. al., 1980); Locomotory Organelles and locomotion in *Amoeba* and *Paramecium*	**S. Sarkar**	**3**
Unit 2: Phylum Porifera General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Canal System in *Sycon*	**S. Hansda**	**3**
Unit 3: Phylum Cnidaria General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Metagenesis in *Obelia*	**S.Biswas**	**3**
Unit 4: Phylum Platyhelminthes General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of *Taenia solium*	**S.Biswas**	**3**
Unit 5: Phylum Nemathelminthes General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of *Ascaris lumbricoides* and its adaptation	**S.Biswas**	**3**
Unit 6: Phylum Annelida General characters and classification up to classes (Rupert and Barnes, 1994, 6th Ed.); Metamerism in Annelida	**S.Hansda**	**6**
Unit 7: Phylum Arthropoda General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Eye in Cockroach, Metamorphosis in Lepidoptera	**S.Sarkar**	**6**
Unit 8: Phylum Mollusca General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Respiration in *Pila*	**S.Hansda**	**3**
Unit 9: Phylum Echinodermata General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Watervascular system in Asteroidea	**S.Sarkar**	**6**

Unit 10: Protochordates General Characters ; Pharynx and feeding mechanism in *Amphioxus*	**S.Hansda**	**3**
Unit 11: Agnatha General features of Agnatha and classification of cyclostomes up to classes (Young, 1981)	**S.Sarkar**	**3**
Unit 12: Pisces General features and Classification up to subclass (Young, 1981); Osmoregulation in Fishes	**S.Biswas**	**6**
Unit 13: Amphibia General features and Classification up to subclass (Young, 1981); Parental care	**S.Biswas**	**6**
Unit 14: Reptiles General features and Classification up to subclass (Young, 1981); Poisonous and non-poisonous snakes, Biting mechanism	**S.Hansda**	**6**
Unit 15: Aves General features and Classification up to subclass (Young, 1981); Flight adaptations in birds	**S.Hansda**	**6**
Unit 17: Mammals Classification up to subclass (Young, 1981); Hair, Horn & Antler, Nail & claw	**S.Sarkar**	**6**

PART I: SEMESTER 2

CORE COURSE 2.Comparative Anatomy & Developmental Biology

ZOOG-CC2-2-TH

Full Marks 50	**4 Credits**	**50 Hours**

Second Semester: January- June

Topic	Name of the Teacher	No. of Lectures
Unit 1: Integumentary System Derivatives of integument with respect to glands in Birds & Mammals	**S.Biswas**	**6**
Unit 2: Digestive System Stomach and Dentition	**S.Biswas**	**6**
Unit 3: Respiratory System Brief account of Gills, lungs, air sacs and swim bladder	**S.Hansda**	**9**
Unit 4: Circulatory System Evolution of heart and aortic arches	**S.Hansda**	**9**

Unit 5: Urino-genital System Succession of kidney, Evolution of urino-genital ducts	**S.Hansda**	**9**
Unit 6: Early Embryonic Development Gametogenesis: Spermatogenesis and oogenesis with respect to mammals. Fertilization: Sea-Urchin; Early development of frog; structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula; types of morphogenetic movements; Fate of germ layers	**S.Sarkar**	**21**
Unit 7: Late Embryonic Development Placenta types and function; Metamorphic events in frog life cycle and its hormonal regulation	**S.Sarkar**	**15**

Course: B.Sc. (General) Zoology		
PART II SEMESTER 3.		
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 Lectures**
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 Lectures**
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. Holiday Model	**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.	**P. Bhowmick**	**4**
Unit 8: Speciation Sympatric, Allopatric, Parapatric	**P. Bhowmick**	**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 Lectures**
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 Lectures**
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 *Trypanosomagambiense.*	**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, Sytophilusoryzae* 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 synchronizationof 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 Lectures**
Unit 1: Diagnostics Methods Used for Analysis of Blood Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) usingLeishman'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,	**S. Hansda**	**2**
Unit 9: Visit to Pathological Laboratory and Submission of Project	**S. Hansda**	**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 Lectures**
Unit 1: Introduction to Ecology Ecosystem, Autecology and synecology, Levels of organization, Laws of limiting factors, Study ofPhysical factors, The Biosphere.	**R. Das**	**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, Verticalstratification, Ecotone and edge effect.	**A. Ray**	**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, Ecologicalpyramids and Ecological efficiencies	**R. Das**	**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	**R. Das**	**5**

Academic Calendar
2021-2022
Department of Botany

Course: B.Sc. (Honours) Botany		
SEMESTER 1		
CORE COURSE 1. Phycology and Microbiology		
BOTA-CC1-1-TH		
4 Credits		
Phycology and Microbiology		**Full Marks 50**
First Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
PHYCOLOGY **1. General account :** 1.1. Thallus organization, Structure of algal cell, 1.2. Ultrastructure of Plastids and Flagella, 1.3. Origin and evolution of sex, 1.4. Life cycle patterns, 1.5. Significant contributions of important phycologists (Fritsch, Smith, R. N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar)	**R. Bar**	5
2. Classification: 2.1. Criteria and basis of Fritsch's classification 2.2. Classification by Lee (2008) upto phylum with examples 2.3. Salient features of Cyanobacteria, Rhodophyta, Chlorophyta , Charophyta, Bacillariophyta, Xanthophyta, Phaeophyta, Heterokantophyta.	**R. Bar**	5
3. Cyanobacteria: 3.1. Ultrastructure of cell, 3.2. Heterocyst - structure and function.	**R. Bar**	4
4. Bacillariophyta: 4.1. Cell structure, 4.2. Cell division, 4.3. Auxospore formation in Centrales and Pennales.	**R. Bar**	6
5. Life History: 5.1. Chlamydomonas, 5.2. Oedogonium, 5.3. Chara, 5.4. Ectocarpus, 5.5. Polysiphonia, 5.6. Evolutionary significance of Prochloron.	**R. Bar**	10
MICROBIOLOGY **1. Virus:** 1.1. Discovery, 1.2. Plant virus- types, 1.3. Transmission and translocation of Plant virus, 1.4. TMV- Physicochemical characteristics and Multiplication, 1.5.	**P. Saha**	10

One step growth curve, 1.6. Lytic cycle (T4 phage) and Lysogenic cycle (Lambda phage), Significance of lysogeny, 1.7. Viroids and Prions. **2. Bacteria:** 2.1. Discovery, .2.2. Distinguishing features of Archaea and Bacteria, 2.3. Characteristics of some major groups: Proteobacteria (Enterobacteria), Firmicutes, Mollicutes, Actinobacteria, Spirochaetes, Chlamydiae, 2.4. Bacterial growth curve and generation time, 2.5.Flagella (ultrastructure) & Pilli, 2.6. Cell wall – chemical structure and differences between Gram +ve & Gram – ve bacteria, 2.7. Bacterial genome and plasmid, 2.8. Endospore – formation, structure and function, 2.9. Genetic Recombination (a) Transformation – with special emphasis on Natural and Induced competence and DNA uptake, (b) Conjugation– F– factor, F+ X F–, Hfr X F–, concept of F', chromosome mobilization, (c) Transduction– Generalized and specialized.	**P. Saha**	20
BOTA-CC1-1-P		
2 Credits		
Phycology and Microbiology	**Full Marks 30**	
First Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**

ALGAE 1. Work out of the following algae with reproductive structure (Free hand drawing and drawing under drawing prism with magnification): Oedogonium, Chara, Ectocarpus. 2. Study of (a) Permanent slides : Gloeotrichia, Volvox, Vaucheria, Coleochaete, Polysiphonia, Centric and Pennate diatom; (b) Macroscopic specimens : Laminaria, Sargassum. **MICROBIOLOGY** 1. Preparation of bacterial media – (a) Nutrient agar and nutrient broth, (b) Preparation of slants and pouring Petri-plates. 2. Sub-culturing of bacterial culture. 3. Gram staining from bacterial culture. 4. Microscopic examination of bacteria from natural habitat (curd) by simple staining. **FIELD WORK**	**R. Bar** **R. Bar** **P. Saha** **-**	-

CORE COURSE 2: Mycology and Phyto-Pathology		
BOTA-CC1-2-TH		
4 Credits		
Mycology and Phyto-Pathology	**Full Marks 50**	
First Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
MYCOLOGY **1. General Account:** 1.1. Hyphal forms, 1.2. Fungal spore forms and mode of liberation, 1.3. Sexual reproduction and degeneration of sex, 1.4. Parasexuality and sexual compatibility, 1.5. Life cycle patterns.	**S. Sengupta**	6
2. Classification: 2.1. Classification of Fungi (Ainsworth, 1973) upto sub-division with diagnostic characters and examples. 2.2. General characteristics of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota.	**S. Sengupta**	6
3. Life history: 3.1. Synchytrium, 3.2. Rhizopus, 3.3. Ascobolus, 3.4. Agaricus.	**S. Sengupta**	10
4. Mycorrhiza: 4.1. Types with salient features, 4.2. Role in Agriculture & Forestry.	**T. Biswas**	4
5. Lichen: 5.1. Types, 6.2. Reproduction, 6.3. Economic and ecological importance	**T. Biswas**	4
PHYTO-PATHOLOGY **1. Terms and Definitions:** 1.1. Disease concept, 1.2. Symptoms, 1.3. Etiology & causal complex, 1.4. Primary and secondary inocula, 1.5. Infection, 1.6. Pathogenecity and pathogenesis, 1.7. Necrotroph and Biotroph, 1.8. Koch's Postulates, 1.9. Endemic, Epidemic, Pandemic and Sporadic disease, 1.10. Disease triangle, 1.11. Disease cycle (monocyclic, polycyclic and polyetic).	**P. Chatterjee**	6
2. Host – Parasite Interaction: 2.1. Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), 2.2. Pathotoxin (Definition, criteria and example), 2.3. Defense mechanism with special reference to	**P. Chatterjee**	6

Phytoalexin, 2.4. Resistance- Systemic acquired and Induced systemic. **3. Plant Disease Management:**		

3.1. Quarantine, 3.2. Chemical, 3.3. Biological, 3.4. Integrated. **4. Symptoms, Causal organism, Disease cycle and Control measures of:** 4.1. Late blight of Potato, 4.2. Brown spot of rice, 4.3. Black stem rust of wheat, 4.4. Stem rot of jute.	**P. Chatterjee** **T. Biswas**	8 10
BOTA-CC1-2-P		
2 Credits		
Mycology and Phyto-Pathology	**Full Marks 30**	
First Semester: July- December		
Topic	**Name of the Teacher**	**No. of Lectures**
MYCOLOGY 1. Work out of the following fungi with reproductive structures (including microscopic measurement of Reproductive structures): Rhizopus (asexual), Ascobolus, Agaricus. 2. Study from permanent slides: Zygospore of Rhizopus, Conidia of Fusarium, Conidiophore of Penicillium. 3. Morphological study of Fungi (fruit body of Polyporus, Cyathus), Lichens (fruticose and foliose). **PHYTO- PATHOLOGY** 1. Preparation of fungal media (PDA). 2. Sterilization process. 3. Isolation of pathogen from diseased leaf. 4. Inoculation of fruit and subculturing. 5. Identification: Pathological specimens of Brown spot of rice, Bacterial blight of rice, Loose smut of wheat, Stem rot of jute, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of Puccinia graminis. **FIELD WORK**	**T. Biswas** **P. Chatterjee**	
SEMESTER 2		
CORE COURSE 3: PLANT ANATOMY		
BOTA-CC2-3-TH		
4 Credits		
Plant Anatomy	**Full marks 50**	
Second Semester : January - June		
Topic	**Name of the Teacher**	**No. of Lectures**

1. Cell wall: 1.1. Ultrastructure & Chemical constituents, 1.2. Plasmodesmata- ultrastructure, 1.3. Concept of Apoplast and Symplast, 1.4. Growth and Thickening of cell wall.	**S. Sengupta**	8
2. Stomata: 2.1. Types (Metcalfe and Chalk, Stebbins and Khush).	**S. Sengupta**	4
3. Stele: 3.1 Leaf-trace and leaf-gap, 3.2. Stelar types & evolution	**S. Sengupta**	4
4. Primary structure of stem and root- Monocot and Dicot. Leaf- dorsiventral and isobilateral.	**R. Bar**	8
5. Secondary growth: 5.1. Normal (intra- & extra-stelar), 5.2. Anomalous (stem of *Bignonia*, *Boerhavia*, *Tecoma*, *Dracaena* and root of *Tinospora*).	**R. Bar**	12
6. Mechanical tissues and the Principles governing their distribution in plants.	**R. Bar**	8
7. Developmental Anatomy: 7.1. Organisation of shoot apex (Tunica–Corpus) and Root apex (Korper-Kappe), 7.2. Plastochrone.	**R. Bar**	8
8. Ecological Anatomy: Adaptive anatomical features of 8.1. Hydrophytes, 8.2. Xerophytes.	**S. Sengupta**	4
9. Scope of plant anatomy: application in systematics, forensics and pharmacognosy.	**M. Karmakar**	4
BOTA-CC2-3-P		
2 Credits		
Plant Anatomy	**Full Marks 30**	
Second Semester: January - June		
Topic	**Name of the Teacher**	**No. of Lectures**
PLANT ANATOMY 1. Microscopic studies on: Types of stomata, sclereids, raphides (*Colocasia*), cystolith (*Ficus* leaf) starch grains, aleurone grains, laticiferous ducts, oil glands.	**T. Biswas**	
2. Study of anatomical details through permanent slides/ temporary stained mounts- a) Root-Monocot and dicot, b) Stem- Monocot and dicot, c) Leaf-Monocot and dicot.	**T. Biswas**	
3. Study of anomalous secondary structure in stem of *Bignonia*, *Boerhaavia*, *Tecoma*, *Dracaena* and root of *Tinospora*	**T. Biswas**	
4. Study of adaptive anatomical features: Hydrophytes (*Nymphaea* – petiole) and Xerophytes (*Nerium* –leaf).	**T. Biswas**	

CORE COURSE 4: ARCHAEGONIATE		
BOTA-CC2-4-TH		
4 Credits		
Archaegoniate	**Full marks 50**	
Second Semester: January - June		
Topic	**Name of the Teacher**	**No. of Lectures**

BRYOPHYTES **1. General Account :** 1.1. General characteristics and adaptations to land habit, 1.2. Classification (Strotler and Crandle Strotler, 2009) upto class with diagnostic characters and examples.	**T. Biswas**	4
2. Life History: Gametophyte structure and Reproduction, Development and Structure of sporophyte, Spore dispersal in: 2.1. *Marchantia*, 2.2. *Anthoceros*, 2.3. *Funaria.*	**T. Biswas**	6
3. Phylogeny: 3.1. Unifying features of archaegoneates; transition to land habit, 3.2. Origin of Alternation of Generations (Homologous and Antithetic theory), 3.3. Evolution of Sporophytes (Progressive and Regressive concept), 3.4. Origin of Bryophytes.	**T. Biswas**	4
4. Importance: Role of bryophytes in: 4.1. Plant succession, 4.2. Pollution Monitoring, 4.3. Economic importance of bryophytes with special reference to *Sphagnum*.	**T. Biswas**	2
PTERIDOPHYTES **1. General Account:**	**P. Chatterjee**	4
1.1. Colonisation and rise of early land plants, 1.2. Classification of vascular plants by Gifford & Foster (1989) upto division (Rhyniophyta to Filicophyta) with diagnostic characters and examples.	**P. Chatterjee**	8
2. Life History: Sporophyte structure, Reproduction and Structure of gametophyte in 2.1. *Psilotum*, 2.2. *Selaginella*, 2.3. *Equisetum*, 2.4. *Pteris*.	**P. Chatterjee**	4
3. Telome concept and its significance in the origin of different groups of Pteridophytes.	**P. Chatterjee**	4
4. Heterospory and Origin of Seed habit.	**P. Chatterjee**	2
5. Economic importance as food, medicine and Agriculture.		
GYMNOSPERMS **1.** Classification of vascular plants by Gifford & Foster (1989) upto division (Progymnospermophyta to Gnetophyta) with diagnostic characters and examples.	**M. Karmakar**	4

2. Progymnosperms: Diagnostic characters of the group, 2.2. Vegetative and reproductive features of Archeopteris, 2.3.Phylogenetic importance.	**M. Karmakar**	6
3. Life History: Distribution in India; Vegetative and Reproductive structure of sporophyte, Development of gametophyte in : 3.1. *Cycas*, 3.2. *Pinus* and 3.3. *Gnetum*.	**P. Saha**	8
4. Economic Importance with reference to Wood, Resins, Essential oils, and Drugs.	**M. Karmakar**	4
BOTA-CC2-4-P		
2 Credits		
Archaegoniate	**Full Marks 30**	
Second Semester: January - June		
Topic	**Name of the Teacher**	**No. of Lectures**
BRYOPHYTES 1. Morphological study of the plant body: Genera as mentioned in theoretical syllabus and *Riccia, Porella*. 2. Study from permanent slides: *Riccia* (V.S. of thallus with sporophyte), *Marchantia* (L.S. through gemma cup, antheridiophore , archegoniophore) , *Anthoceros* (L.S. of sporophyte) , *Funaria* (L.S. of capsule).	**P. Saha**	
PTERIDOPHYTES **1.** Morphological study of the sporophytic plant body: Genera as mentioned in the theoretical syllabus and *Lycopodium, Ophioglossum* and *Marsilea*.	**P. Saha**	
2. Workout of the reproductive structures: *Selaginella, Equisetum, Pteris*.	**P. Saha**	
3. Study from permanent slides: *Psilotum* (T.S. of synangium), *Lycopodium* (L.S. of strobilus), *Ophioglossum* (L.S. of spike), *Dryopteris* (gametophyte), *Marsilea* (L.S. of sporocarp).	**P. Saha**	
GYMNOSPERMS **1.** Morphological study: *Cycas* (microsporophyll and megasporophyll), *Pinus* (female and male cone), *Gnetum* (female and male cone).	**P. Saha**	
2. Study from permanent slides: *Cycas* (L.S. of ovule), *Pinus* (L.S. of male and female cone), *Ginkgo* (L.S. of female strobilus), *Gnetum* (L.S. of male cone and ovule).		
FIELD STUDY	-	

Course: B.Sc. (Honours) Botany

SEMESTER 3		
CORE COURSE 5. Paleobotany and palynology		
BOTA-CC3-5-TH		
4 Credits		
Paleobotany and palynology		**Full Marks 50**
Third Semester: July- December		
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. *Williamsonia*, 4.3. *Cordaites*.	**T. Biswas**	10
5. Indian Gondwana System - Three fold division with major megafossil assemblages.	**T. Biswas**	6
6. Palynology: 6.1. Spore and Pollen, 6.2. Pollen aperture types, 6.3. NPC classification (Erdtman). 6.4. Pollen wall- Sporopollenin, Stratification and Ornamentation (sculpturing).	**P. Chatterjee**	10
7. Applied Palynology: Basic concepts of: 7.1. Palaeopalynology, 7.2. Aeropalynology, 7.3. Forensic palynology, 7.4. Melissopalynology.	**P. Chatterjee**	8
BOTA-CC3-5-P		
2 Credits		
Paleobotany and palynology		**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		
Reproductive biology of Angiosperms	**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:** **1.1.** Microsporogenesis and Microgametogenesis, 1.2. 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.	**T. Biswas** **T. Biswas** **T. Biswas** **P. Saha** **P. Saha** **P. Saha** **P. Saha**	8 14 8 6 6 10 8

BOTA-CC3-6-P		
2 Credits		
Reproductive biology of Angiosperms		**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. **3. Systems of classification:** Broad outline of Bentham & Hooker (1862-1883), Cronquist (1988), Takhatajan (1991) - system of	**S. Sengupta** **S. Sengupta** **M. Karmakar**	6 6 20

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. …….20 lectures **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 **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 **6.** Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses) of the following 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).	**M. Karmakar** **S. Sengupta** **R. Bar**	8 8 12
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	**S. Sengupta**	

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** -	
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. **4. Cyanobacteria** (Blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation. Factors affecting growth, blue green algae and *Azolla* in rice cultivation. **5. 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 Credi		
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.	**R. Bar**	**8**
2. Endemism: 2.1 Endemic types and Factors; 2.2. Age & Area hypothesis and Epibiotic theory; 2.3. Endemism in Indian flora.	**R. Bar**	**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	**S. Sengupta**	**6**

Introduction, 1.2. Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, 1.3. Phyletic gradualism, Punctuated equilibrium and Stasis	**R. Bar**	**6**
2.1 Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation,	**T. Biswas**	**4**
Reproductive isolation 3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, Pteridophytes and gymnosperm, 3.2. Phylogenetic tree.		
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.	**S. Sengupta**	
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).	**S. Sengupta**	
2. Comparative anatomical studies of leaves form polluted and less polluted areas.	**S. Sengupta**	
3. Measurement of dissolved O2 by azide modification of Winkler's method.	**S. Sengupta**	
4. Comparison of free CO2 from different sources.		
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**

1. 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**
2. Cereals: Rice and wheat (origin, morphology, processing and uses).	**P. Chatterjee**	**6**
3. 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).	**P. Chatterjee**	**5**
7. Oil and fats: General description, classification, extraction, their uses and health implications of 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 (morphology, processing, uses and health hazards).	**M. Karmakar**	**8**
9. Timber: general account with special reference to Sal and Teak.	**M. Karmakar**	**4**
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**	
4. Tea- tea leaves, tests for tannin		
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.	**R. Bar**	
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	**P. Saha**	**8**

repair (brief idea). **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**
1. Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Smear preparation, Preparation of permanent slides.	**P. Saha**	
2. Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of *Allium cepa*.	**P. Saha**	
3. 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*.	**P. Saha**	
4. Study of chromosomal aberrations developed due to exposure to any two pollutants/ pesticides etc.	**P. Saha**	
5. 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.	**P. Saha**	
6. 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**	
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**

Course: B.Sc. (Honours) Botany

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. Small RNA- riboswitch, RNA interference, si RNA, mi RNA- brief idea, 1.4.Organellar DNA (cp- and mt- DNA).	**T. Biswas**	**6**
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.	**T. Biswas**	**6**
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).	**T. Biswas**	**6**
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,	**P. Saha**	**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 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. Saha** **P. Chatterjee**	**4** **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 ***1.*** Study of plant cell structure with the help of epidermal peal mount of Onion/*Rhoeo*/*Crinum* **2.** Measurement of cell size by the technique of micrometry. **3.** Counting cells per unit volume with the help of haemocytometer (Yeast/pollengrains) **4.** Cytochemical staining of DNA- Pyronine-methyl green staining. 27 **5.** Estimation of DNA content through DPA staining. **6.** Estimation of RNA through orcinol method. **7.** Study of nucleolus through hematoxylin/ orcin staining and determination of nucleolar frequency. **8.** 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**	
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** **S. Sengupta**	**18** **6**
4. Cell membrane: 4.1. Membrane chemistry, 4.2. Membrane transport (uniport, symport, antiport), mechanism of ion uptake.		
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**	
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.	**R. Bar**	**12**
2. Biometry: Data, Sample, Population, Random sampling, Frequency distribution- definition only.	**R. Bar**	**12**
3. Central tendency– Arithmetic Mean, Mode and Median; Measurement of dispersion– Coefficient of variation, Standard Deviation, Standard error of Mean.	**R. Bar**	**10**
4. Test of significance: chi- square test for goodness of fit.	**R. Bar**	**6**
5. Probability- multiplicative and additive rules of		

probability: application and importance. **6. Measurement of gene frequency:** Hardy-Weinberg	**R. Bar**	**6**

equilibrium- conditions applied for its implications (simple problems to calculate genotypic and allelic frequencies).	**R. Bar**	**14**
BIOSTATISTICS (DSE-A-5-1-P)		
2 Credits		
Biostatistics		
Topic	**Name of the Teacher**	**Number of Lectures**
1. Univariate analysis of statistical data: Statistical tables, mean, mode, median, standard deviation and standard error (using seedling population / leaflet size). **2.** Calculation of correlation coefficient values and finding out the probability. **3.** 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. **4.** Calculation of 'F' value and finding out the probability value for the F value **5.** 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**	
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**

1. Plant tissue culture –Introduction: 1.1. Basic concept and milestones, 1.2. Cellular totipotency, 1.3. Tissue culture media, 1.4. Aseptic manipulation, 1.5. Cyto-differentiation and dedifferentiation.	**T. Biswas**	**10**
2. Callus culture: 2.1. Callus induction, maintenance and application, 2.2. Suspension culture- introductory idea.	**T. Biswas**	**6**
3. Plant regeneration: 3.1. Organogenesis (direct and indirect), 3.2. Somatic embryogenesis, 3.3. Significance of organogenesis and somatic embryogenesis, 3.4. Artificial seed.		

4. Haploid Culture: 4.1. Anther and Pollen culture methods, 4.2. Applications.	**T. Biswas**	**8**
5. Protoplast Culture: 5.1. Protoplast isolation and culture, 5.2. Protoplast fusion (somatic hybridization), 5.3. Significance.	**T. Biswas**	**6**
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** **M. Karmakar**	**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	**T. Biswas**	
2. Study through photographs/ charts/ models of anther culture, somatic embyogenesis, endosperm and embryo culture, micropropagation.	**T. Biswas**	
3. Preparation of basal media. Sterilization techniques.	**T. Biswas**	
4. Demonstration of any tissue culture technique during visit in a plant tissue culture lab.	**T. Biswas**	

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	**P. Saha**	**6**

germination. **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**	
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,	**S. Sengupta**	**12**
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).		
4. Nitrogen Metabolism: 4.1. 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**
5. Lipid metabolism: 5.1. 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**	**Number of Lectures**

	Teacher	
1. A basic idea of chromatography: Principle, paper chromatography and column chromatography; demonstration of column chromatography. 2. Separation of plastidial pigments by solvent and paper chromatography. 3. Estimation of total chlorophyll content from different chronologically aged leaves (young, mature and senescence) by Arnon method. 4. 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). 5. 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** **S. Sengupta** **S. Sengupta** **S. Sengupta** **S. Sengupta** **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*) .	**R. Bar**	
2. Powder microscopy – *Zingiber* and *Holarrhena* .	**R. Bar**	
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**	

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.	**T. Biswas**	**12**
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**	**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	**T. Biswas**	
2. Plant microtechnique experiments	**T. Biswas**	
3. The art of imaging of samples through photomicrography and field photography	**T. Biswas**	
4. Poster/ power point presentation on defined topics	**T. Biswas**	
5. Technical writing on topics assigned.	**T. Biswas**	

Academic Calendar 2021-2022
Course: B.Sc. (General) Anthropology

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

	Topic	Name of the Teacher
A	**INTRODUCTION TO BIOLOGICAL ANTHROPOLOGY** **UNIT I**: Emergence, history, divergence (sub-disciplines/sub-fields), flexibility, holism of Anthropology. Anthropology in relation to the disciplines of Physical and / or Natural sciences, Social Sciences, Arts and Humanities. **UNIT II:** **I.** Definition of Anthropology, aim, scope, branches and applied areas of Biological Anthropology. **II. Morphology of man** (External and Skeletal Morphology) a. External morphology – Features of man. b. Skeletal morphology – Definition and function of human skeleton. Types and definition of the types of bones. Name, number, and position of bones of human skeleton. c. Modifications of human skeleton as consequences of evolution- erect posture& bipedal gait. d. Human Dentition (Types and salient Features) e. Dental Formula (Deciduous and Permanent) **III. Cell : Unit of Life** i) Structure and function of animal (**eukaryotic**) cells. ii) The cell cycle: cell division – **meiosis** and its significance.	Dr. P. Sarkar
B	**INTRODUCTION TO ARCHAEOLOGYCAL ANTHROPOLOGY** **UNIT – I** **1.** Introduction to archeological anthropology, its relation to anthropology, palaeoanthropology, history, prehistory an historical archeology. **2.** A brief history of archeology, mentioning only the stages of Antiquarianism, Three Age Paradigm, Culture history, Processual and Post-processual archeology. **3.** A brief idea of palaeo-environment in high and low latitudes and altitudes. **4.** Methods for reconstructing the past- environmental archeology, experimental archeology, Ethno-archeology, Primate ethology. **5.** Field techniques- exploration, excavation, data analysis and	A. Mazumdar

	publication of report. **6.** Dating methods- concept and importance of chronology in archeology, absolute and relative methods. Only the following methods are to be briefly outlined: C14, TL, FUN, Archeo-magnetism, K/Ar, stratigraphy and river terraces. **7**. Identification and description of stone and bone tools 8. Different tool making technologies….	
C	**INTRODUCTION TO SOCIAL CULTURAL ANTHROPOLOGY** (A) The holistic nature of Anthropology and integration of the anthropological sub-disciplines; The Scope and Objective of Social and Cultural Anthropology; (B) The Theories: Evolutionism, Historical Particularism; Diffusionism (including Concepts, like universals, diffusion, acculturation), Structural-functionalism, Cultural Materialism, Culture and Personality, Structuralism, Symbolic Anthropology, Cultural Ecology and Political Economy. **CONCEPT OF CULTURE**: Defining culture, features of culture, socialization, culture shock, ethnocentrism, theories of culture (e.g. evolution, diffusion, patterns of culture, cultural configurations, Structure functionalism, cognitive anthropology, cultural ecology), subculture, cultural relativism, functions of culture, . **CONCEPT OF SOCIETY** **(A) S**ociety, group, community, structure, organization, system, institution, process/interaction, B. Social function, Status, Role, Diaspora, Social networkand Social Capital **(C)** Concept of Tribe: Indian tribes, distribution – geographical Social organization: Garo, Santal, Chenchu, Toda **SOCIAL STRATIFCATION** Egalitarian societies, rank society (band, tribe, peasant), division of labour, class society, caste society in India, dynamics of caste, racism and inequality, **POLITICAL SYSTEM AND SOCIAL CONTROL** Political organization, types, band, tribe, kinship organization, age-grade organization, chiefdom, leadership, social control and conflict resolution, state, law and codified law, functions of law, violence and terror, religion and politics	C. Sherpa
	ANT-G-CC/GE-P (Practical)	

	UNIT-I. Biological Anthropology **A. Study of human skeleton (Original or caste material)** i) Identification of bones- skull bones: Frontal, Parietal, Occipital, Temporal, Maxilla, Sphenoid, Zygoma, and Mandible. ii) Vertebra (Atlas. Axis, typical cervical, typical thoracic, lumber, sacrum). Long bones with side determination (Humerus, Radius, Ulna, Femur, Tibia, Fibula), Scapula, Clavicle, Os Innominatum iii). Determination of age and sex from skull and pelvis. **B. Craniometry: (on three skulls):** Students should know the landmarks, instruments related to it. 1. Maximum cranial length, 2. Maximum crania breadth, 3.Least Frontal breadth, 4.Maximum Bi-zygomatic breadth, 5. Nasal length, 6. Nasal breadth, 7. Superior Facial Length	Dr. P. Sarkar & C. Shere pa

Part-I: Semester II
Core Course: ANT-G-2-CC/GE-2-TH
First Semester: January to June

	Topic	**Name of the Teacher**
A	**HUMAN GENETICS AND POPULATION VARIATION** a. Definition and application of knowledge of genetics. b Gametogenesis: Spermatogenesis and Oogenesis, stages and differences. c. Normal chromosomal constitution of man. Brief outline of Karyotype and Denver system of human chromosome classification d. Basic structure of DNA and RNA With comparison e. Brief concept of Aneuploidy and Poluploidy; Numerical chromosomal aberration in man; Causes and manifestation (Down'sSyndrome, Turner's Syndrome and Klinefelter's Syndrome). f. Mendelian principles : its explanation and application in man. g. Mendelian Inheritance in Man- autosomal dominant (PTC) autosomal recessive(albinism) sex chromosomal- dominant (Vitamin-D resistance rickets), recessive (colour blindness). h. Multiple allele and Polymorphic character in man (ABO	A. Mazumdar Dr. P. Sarkar

	Blood group system.) **UNIT-II. Peoples / Population of World** a. Concept of Race (Ethnic Group). b. UNESCO statement of race (1950,1952) c. Geographical distribution and features of major races/population of mankind (Caucasoid, Negroid and Mongoloid). d. Racial concept - Garn - geographical, local and micro races. e. Criteria for population/racial classification: (Skin colour, Scalp hair and ABO blood groups). f. Racial / ethnic composition of the population of undivided India by H.H. Risley, B.S. Guha and S. S. Sarkar. g. Human adaptation: Hot, cold, altitude, infectious disease and stress.	
B	**Ecology and Culture in the Past** **UNIT – I** **I.** Development of prehistoric cultures from the earliest evidences up to the beginning of historical times; on a regional basis – Africa and Europe. I. Earliest Pleistocene cultures of Africa, and their subsequent development with special emphasis to east Africa Lake Turkana basin (sites – Olduvai Gorge, Omo, Hadar, Laetoli, Koobi-Fora, Olorgesaile). Only relevant brief sketches are to be given. **II.** Earliest Pleistocene cultures of Europe and their subsequent development with special emphasis on western Europe are to be dealt with. The justifications of lower, middle and Upper Palaeolithic, Mesolithic and Neolithic classifications and nomenclatures are to be ratified. Cultures are to be studied in the following format: 3 type sites/ important sites of each cultural stage, the characterizing evidences, dates, general cultural life with growing varieties of 9 evidences of the prehistoric people up to Neolithic times and linking them with the preceding and succeeding cultural phases as well as the mention of associated fossil finds, if any.	A. Mazumdar
C	**SOCIAL CULTURAL ANTHROPOLOGY** **1.MARRIAGE AND FAMILY** Concept of Marriage, definition. Is marriage universal? Incest taboos, types and variations of marriage systems, regulations of marriage, preferential marriage, marital transactions, dowry	C. Sherpa

	and bride price, emerging issues of marriage including same-sex marriages. The family, Nuclear family, extended family **2.MARITAL RESIDENCE, KINSHIP AND ASSOCIATION** Patterns of marital residence, kinship, structure of kinship, bilateral kinship, unilateral kinship, Ambilineal systems, classification of kin, kinship terminology, Non kin associations (group based on age, association based on sex) **3.SOME IMPORTANT AREAS OF ANTHROPOLOGY (brief notes on the tenets):** Medical Anthropology, Urban Anthropology, Development and Anthropology, Applied Anthropology, Cognitive Anthropology, Visual Anthropology, Economic Anthropology (Subsistence Strategies: Hunting and Gathering, Horticulture, Pastoralism, Shifting Cultivation, production, distribution and redistribution, Agriculture and Peasants, Informal Economy, Poverty, Sustainable, Livelihood and Sustainable Development; exchange, and consumption of goods and services in complex societies.)	Dr. P. Sarkar
	ANT-G-2-CC/GE-2-P-(Practical)	
	Biological Anthropology 1. **Somatology**: Scalp Hair, Nose, Eye (on three subjects) a) Measurement on head and face (Cephalometry) 1. Maximum head length, 2. Maximum head breadth, 3. Least frontal breadth, 4. Bi-zygomatic breadth, 5. Bi-gonial breadth, 6. Nasal length, 7. Nasal breadth, 8. Nasal depth, 9. Morphological superior facial length, 10. Morphological total facial length. **2. Measurements on trunk and limbs** 1. Height vertex, 2. Height tragus, 3.Height acromion, 4.Height radiale, 5.Height stylion, 6.Height dactylion, 7.Sitting height Vertex,	Dr. P. Sarkar & C. Sherpa

	8.Bi-acromial diameter, 9. Hand length, 10. Hand breadth, 11. Foot length, 12.Foot breadth, 13. Body weight **3. Genetic tests (On three subjects): Following standard technique** (i). ABO and Rh (D) blood group systems (ii) Test for colour blindness (iii) PTC / PTU tasting ability **4. Indices** 1. Cephalic index, 2. Nasal index, 3. Facial index, 4.Jugo-frontal index, 5. Body mass index (BMI)	

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 6ehavior of the anthropoid apes. e. Skeletal comparison of anthropoid apes with that of man.	Dr. P. Sarkar

	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	
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 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.	A. Mazumdar
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)	C. Sherpa

	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	
	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, 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.	A. Mazumdar Dr. P. Sarkar

Part-II: Semester IV
Core Course: ANT-G-4-CC/GE-4-TH
First Semester: January to June

A	**BIOLOGICAL ANTHROPOLOGY** a. Forensic anthropology: Personal identification from blood groups and skeleton. Paternity diagnosis b. Genetic counseling: definition, aim and methods. Genetic counseling for autosomal (thalassemia) and X chromosomal (haemophilia) inheritance c. Birth defects: Teratogens, substance abuse, Alcohol, Smoking, Occupational Hazards d. Biostatistics: Measure of central tendency- mean, median, mode, standard deviation, standard error of mean.	Dr. P. Sarkar
B	**ARCHAEOLOGICAL ANTHROPOLOGY II** **UNIT – I.** Neolithic cultures of India: brief outlines of the following regional cultures: a) Eastern India b) Central India c) Western India d) Southern India e) Northern India f)North- east India. In dealing with Neolithic India, emphasis is to be given on regional features and variability. **UNIT – II.** Earliest Civilizations: Concept/ features of civilization according to Braidwood and Childe. Mesopotamian, Egyptian civilizations- brief ideas. Harappan civilizations – to be studied in details. Chalcolitihic India- classification and characters.	A. Mazumdar
C	**SOCIAL CULTURAL ANTHROPOLOGY III** **Anthropology of Religion** Indigenous Religions: Topics (concepts and / or definition) include myth and ritual, sorcery, witchcraft and divination; animism, animatism, totem and taboo, magic, and shamanism, sacrifice, spirit possession, initiation rituals, witchcraft and other institutionalized principal religions of the **World Backward Communities in India and Development** Indian tribes: an outline of anthropological studies, distribution according to linguistic groups, economy, geographical region. Sectors, Problems, plans and agencies of development, welfare of the tribes, S.C. and O.B.C. in India, Constitutional provisions and safeguards of the S.C., S.T. and O.B.C. Panchayati raj, with special emphases in West Bengal.	C. Sherpa
	ANT-G-4-CC/GE-4-P(Practical)	

	TRAINING IN FIELD WORK **Research Approaches:** Overview of Quantitative, Qualitative and Mixed Research, Methodologies and Types of research. Respective Methods and techniques of data 15 Collection and Modes of Analysis; Types of data; Ethical Issues; Styles of Fieldwork. The students are expected to learn how do they apply them in their training. **The training for the fieldwork (with / without camp life) is to be undertaken on any previously less known / unknown community or group or settlement or network or problem.** • Not more than 7 DAYS of fieldwork • The students are expected to reflect on learning from the participation in and guidance of the supervisor/s training them for fieldwork • The supervisor/s in the setting will help the students making out the issues of research approaches mentioned above. • The report must contain updated and relevant understanding of methodology and its relation with the present work. There must be references of the relevant works in that area or its related ones. • Suitable and contextually proper presentation of the qualitative and quantitative data are expected in the report. • The report on the methodology, field diary / experience and the concluding chapter are supposed to maintain individuality and meaningful intensity. • The report also must contain the followings: a. Introduction and field techniques b. About the region under study c. Description of the village including layout d. Population analysis including tables, analysis and diagrams e. Economic pursuits of the villagers (general description as well as at least one case study of any one economic pursuit) including material culture. f. Developmental aspects g. General observation & conclusion • The report needs to contain their learning of Research Approaches and the applications in their fieldwork	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	C. Sherpa & Dr. P. Sarkar
	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.	
	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		A. Mazumdar & Dr. P. Sarkar
	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.	
	ANT-G-5-DSE-2A –P Project / Report on any chosen topic from ANT-G-DSE-2A –TH	
ANT-G-5-DSE-3A Environment and Anthropology		C. Sherpa & Dr. P. Sarkar
	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	

Part-III: Semester VI
Core Course: ANT-G-6-DSE-1B
Fourth Semester: January to June

	Topic	Name of the Teacher
ANT-G-6-DSE-1B Food and Anthropology		
	ANT-G-6-DSE-1B-TH What is food? I. Classic Ethnographies II. Anthropological Perspectives on Diet III. Classification of Food IV. Food and a. Eating and Cuisine b. Identity c. Tables and Table Manners d. Social Change e. Religion and Rituals f. Security g. Globalization V. Disorders of food and eating VI. Specific Food Cultures a. Food Culture: Any Indian Case Study	C. Sherpa & Dr. P. Sarkar
	ANT-G-6-DSE-1B-P Practical Credit Project/ Report on any chosen topic from ANT-G-DSE-1B-TH	
ANT-G-6-DSE-2B Advanced Human Genetics		
	ANT-G-6-DSE-2B-TH History of Genetics, Paradigms of Human Genetics; Mendelian genetics, , DNA and RNA structure and DNA replication, DNA repair, and recombination, gene expression, coding and non-coding region, Nuclear and Mitocondrial DNA, Expression of protein, transcriptions, transcription (protein synthesis), Outline concept of epigenetics in human genetics, Cytogenetics; concept of karyotype, Banging (G banding) and high resolution FISH. Concept of point mutation; Family study; pedigree analysis, concept of dominant, recessive and co-dominant inheritance, Penetrance and expressivity; Sex linkage (Dominant and recessive) and sex influenced traits. Electrophoresis, PCR technology and sequencing (Concept and outline.	C. Sherpa & Dr. P. Sarkar

	ANT-G-6-DSE-2B-P(Practical) Project/ Report on any chosen topic from ANT-G-6-DSE-2B-TH	
ANT-G-6-DSE-3B Heritage Management		
	ANT-G-6-DSE-3B-TH Theory **Introduction to Heritage**: Understanding the meaning of heritage; types of heritage (tangible, intangible and living); defining 'heritage' and its 'value' and 'significance'; Classification of cultural assets. **History, Theory and Concepts of Conservation**: History and development of conservation, Conservation principles and practices. **Cultural Heritage Management**: Conservation plan, Management plan, Project management, Heritage economics, Risk preparedness, Disaster management, Sustainable conservation, Popularizing archaeology, Community participation. **Sustainability and Conservation**: Ideology behind the use of local material and techniques for conservation, eco-friendly approaches, understanding global issues related to heritage conservation, sustainable conservation. **Museum Studies**: Introduction the notion of a 'museum', types of museums, curation, material culture, material conservation, documentation and cataloguing, visitor experience, museum as an educational space.	A. Mazumdar & Dr. P. Sarkar
	ANT-G-6-DSE-3B-P (Practical) Project/ Report on any chosen topic from ANT-G-DSE-3B-TH	

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

	Topic	Name of the Teacher
ANT-G-3-SEC-A (1)		
	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.	C. Sherpa & Dr. P. Sarkar
Or		
ANT-G-3-SEC-A (1)- 2:Anthropology and Development		
	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	C. Sherpa & Dr. P. Sarkar

Part II: Semester IV
AEE Course: ANT-G-4-SEC-B(1)
Fourth Semester: January to June

	Topic	Name of the Teacher
	ANT-G-4-SEC-B (1)	
	ANT-G-4-SEC-B (1)-3. ANTHROPOLOGY AND TOURISM **I. Introducing the Core: Anthropology, Tourism and Tourists** **II. Brief Introduction to Related Concepts and Methods** 1. Authenticity 2. Community-based tourism 3. Culinary tourism 4. Cultural tourism 5. Culture broker 6. Ecotourism 7. Ethnic tourism 8. Policy and policymaking 9. Safari 10. Sex tourism **III. Development and Tourism in Developing Countries**	C. Sherpa & Dr. P. Sarkar
	Or	
	ANT-G-4-SEC-B (1) - 4.: MEDIA AND ANTHROPOLOGY **I. Media Anthropology** 1. Media, Mass and Anthropology 2. The Paradox: Definitions, Actors, Fields, Methods, Strategies and taboo, Case of Illustration 3. Media Effects Tradition 4. Themes and problems 5. Controversies 6. The Possible Contribution of Anthropology 7. Examples of use of anthropology in communication	

Part III: Semester V
AEE 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	

Part III: Semester VI
AEE Course: ANT-G-6-SEC-B (2)
Sixth Semester: January to June

	Topic	Name of the teacher
	ANT-G-6-SEC-B-(2)	
	ANT-G-6-SEC-B (2)-7: Earliest Evidences of Urbanisation in India 1. Harappan Cultural Tradition: general Framework and chronology: a. Pre/Early Harappan cultures of the Indian subcontinent 2. Mature Harappan a. Geographical Distribution and Settlement Pattern b. Subsistence of the Harappans- plant and animal diet, agriculture and agriculture system, water management, exploitation of natural resources. c. Social, Political, Religious and Economic organization Decline and the Late Harappan a. Various factors and theories about the Harappan Decline and consequences	A. Mazundar
	Or	
	ANT-G-6-SEC-B (2)-8. Anthropological Demography Basic concepts of demography, Historical background. Aims and objectives of demography, Importance of Anthropological demography, Sources of demographical data, Various terms in demography: census, cohort, fertility, mortality, fecundity, life expectancy, life table, migration, parity, morbidity, population control, Vital statistics- measures of fertility and mortality	C. Sherpa

ACADEMIC CALENDAR FOR ODD SEMESTERS

(1st, 3rd & 5th SEMESTERS)

SEMESTER - 1

PHYSICS HONOURS (PHSA)

(To be Effective from September, 2021)

Name of the Teacher	Topic
Dr. Mukul Kumar Mitra	**Vector Algebra and Vector Calculus** :: a) Recapitulation of Vector Algebra: b) Vector Differentiation: c) Vector Integration: d) Orthogonal Curvilinear Coordinates:
Dr. Anindya Sarkar	**Mechanics** 1. Fundamental of Dynamics 2. Work and Energy 3. Gravitation & Central Force Motion
Prof. Souvik Prasad	**1.** Introduction to plotting with Gnuplot 2. Introduction to programming in python
Dr. Nilormi Biswas	**Calculus:** a) Recapitulation -> Limits, continuity, etc. b) Convergence of infinite series c) First order and second order Differential equations d) Calculus of functions of more than one variable
Prof. Chinmay Sikdar	**Mechanics** 1. Non-Inertial Systems 2. Rotational Dynamics
Md. Lucky Dildar	**Matrices** :: a) Addition and Multiplication of Matrices: b) Eigen-values and Eigen Vectors (Degenerate & Non-degenerate): **Mechanics**:: Fluid Motion

N.B.: For details please see the syllabus.

SEMESTER – 3

PHYSICS HONOURS (PHSA)

(To be Effective from September, 2021)

Name of the Teacher	Topic
Dr. Mukul Kumar Mitra	**Mathematical Physics -II** 1. Fourier Series 2. Frobenius Method & Spherical Functions 3. Some Special Integrals
Dr. Anindya Sarkar	**Mathematical Physics -II** 1. Integral Transformations 2. Introduction to Probability 3. Partial Differential Equations
Prof. Souvik Prasad	**Modern Physics** 1. Nuclear Physics 2. Interaction with & within nucleus 3. Lasers
Dr. Nilormi Biswas	**Renewable Energy** 1. Fossil Fuels and Alternate Sources of Energy 2. Solar Energy 3. Wind Energy Harvesting 4. Ocean Energy 5. Geothermal Energy 6. Hydro Energy 7. Piezoelectric Energy Harvesting 8. Electromagnetic Energy Harvesting 9. Fuel Cell
Prof. Chinmay Sikdar	**Modern Physics** 1. Radiation and its Nature 2. Basics of Quantum Mechanics
Md. Lucky Dildar	**Thermal Physics** 1. Kinetic Theory of Gases 2. Conduction of Heat 3. Introduction to Thermodynamics 4. Thermodynamic Potentials

N.B.: For details please see the syllabus.

SEMESTER – 5

PHYSICS HONOURS (PHSA)

(To be Effective from September, 2021)

Name of the Teacher	Topic
Dr. Mukul Kumar Mitra	**Electromagnetic Theory** 1. Maxwell Equations 2. EM Wave Propagation in Unbounded Media 3. EM Wave Propagation in Bounded Media 4. Polarization 5. Polarization in Uniaxial Crystals 6. Rotatory Polarization
Dr. Anindya Sarkar	**Statistical Physics (Theory): Part-I** 1. Classical Statistical Mechanics 2. Systems of Identical Particles
Prof. Souvik Prasad	**Nuclear and Particle Physics (Theory)** 1. Introduction 2. Nuclear Reactions 3. Interaction of Nuclear Radiation with Matter 4. Detector for Nuclear Radiations 5. Particle Accelerators 6. Particle Physics
Dr. Nilormi Biswas	**Fiber Optics (Theory)** 1. Fiber Optics 2. Holography 3. Introductory Nonlinear Optics
Prof. Chinmay Sikdar	**Laser (Theory)** 1. Einstein Co-efficients and Rate Equations 2. Basic Properties of Laser 3. Resonators 4. Transient Effect 5. Basic Laser Systems 6. Practical Properties and uses of Laser
Md. Lucky Dildar	**Statistical Physics (Theory): Part-II** 3 Bose-Einstein Statistics 7. Radiation: classical and quantum aspects **8.** Fermi-Dirac Statistics

N.B.: For details please see the syllabus.

SEMESTERS – 1,3,5

PHYSICS GENERAL (PHSG)

(To be Effective from September, 2021)

Name of Teacher	SEM - 1	SEM - 3	SEM - 5
Dr. Mukul Kumar Mitra	Mathematical Physics	- - - - -	Modern Physics-I: Radiation & its Nature
Dr. Anindya Sarkar	Newtonian Mechanics	- - - - -	Nuclear & Particle Physics
Prof. Souvik Prasad	Practical	Thermal Physics: Statistical Mechanics SEC-A: Renewable Energy	- - - -
Dr. Nilormi Biswas	Oscillation, Elasticity & Surface Tension	Practical	Modern Physics-II: i) Foundation of Quantum Mechanics ii) Special Theory of Relativity
Prof. Chinmay Sikdar	Central Force & Gravitation	Thermal Physics: Laws of Thermodynamics, Thermodynamic Potentials	Modern Physics-III: LASERS
Md. Lucky Dildar	Practical	Thermal Physics: Kinetic Theory of Gases, Theory of Radiation	- - - -

N.B.: For details please see the syllabus.

ACADEMIC CALENDAR FOR EVEN SEMESTERS

(2ND, 4TH & 6TH SEMESTERS)

1. SEMESTER – 2 (HONOURS)

Name of the Teacher	Topics
Dr. Mukul Kr. Mitra	Diffraction of Light: 1. Fraunhofer Diffraction: a) Single slit, b) Circular aperture, c) Resolving power of a telescope, d) Double slit, e) Multiple slits, f) Diffraction grating, g) Resolving power of grating, h) Rayleigh criterion for resolution. 2. Fresnel's Diffraction: a) Half period zone, b) Explanation of rectilinear propagation of light, c) Zone plate, c) Fresnel's integral.
Dr. Anindya Sarkar	Wave Optics: 1. **Electromagnetic nature of light:** a) Definition and properties of wave front. Huygens Principle, (b) Temporal and Spatial Coherence, c) Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. d) Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index, 2. **Interferometers:** (a) Michelson Interferometer (1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes.
Prof. Souvik Prasad	Waves (Theory) 1. **Oscillations**: a) Differential equation of Simple Harmonic Oscillation and its solution. Kinetic energy, potential energy, total energy and their time average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor. 2. **Superposition of Harmonic Oscillations**: (a) Superposition of Two Collinear Harmonic oscillations having equal frequencies and different frequencies (Beats). (b) Superposition of Two Perpendicular Harmonic Oscillation for phase difference = 0, _2 , π : Graphical and Analytical Methods, Lissajous Figures with equal and unequal frequency and their uses. 3. **Wave motion**: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Traveling) Waves. Wave Equation for travelling waves . Particle and Wave Velocities. (Solution of spherical wave equation may be assumed) 4. **Superposition of Harmonic Waves:** (a) Velocity of Transverse Vibrations of Stretched Strings, Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. (form of the solution of wave equation may be assumed). Plucked and Struck Strings. (b) Superposition of N Harmonic Waves. Phase and Group Velocities.
Dr. Nilormi Biswas	**The Magnetostatic Field:** (a) Biot-Savart's law. Application of Biot-Savart's law to determine the magnetic field of a straight conductor, circular coil. Force on a moving point charge due to a magnetic field: Lorentz force law. Force between two straight current carrying wires.

	(b) Divergence of the magnetic field and its solenoidal nature. Magnetic vector potential, calculation for simple cases. (c) Curl of the magnetic field. Ampere's circuital law. Its application to (1) Infinite straight wire, (2) Infinite planar surface current, and (3) Infinite Solenoid. **Magnetic properties of matter :** (a) Potential and field due to a magnetic dipole. Magnetic dipole moment. Force and torque on a magnetic dipole in a uniform magnetic field. (b) Magnetization, Bound currents. The magnetic intensity $\tilde{H}$. Relation between $\tilde{B}$, $\tilde{H}$ and $\tilde{M}$. Linear media. Magnetic Susceptibility and Permeability. Boundary conditions for $\tilde{B}$ and $\tilde{H}$. Brief introduction of dia-, para- and ferro-magnetic materials. B-H curve and hysteresis. **Electro-magnetic induction** : Ohms law and definition of E.M.F. Faraday's laws of electromagnetic induction, Lenz's law. Self-Inductance and Mutual Inductance. Reciprocity Theorem. Introduction to Maxwell's Equations. Charge conservation. Displacement current and resurrection of Equation of Continuity.
Prof. Chinmay Sikdar	**Method of Images** : a) Laplace's and Poisson equations. Uniqueness Theorems. Method of Images and its application to: Plane Infinite metal sheet, Semi-infinite dielectric medium and metal Sphere. b)Electrostatic Energy : Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Energy per unit volume in electrostatic field. **Electrical circuits** : a) AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor,and (4) Band Width. Parallel LCR Circuit.
Prof. Lucky Dildar	2.1.1 Electricity and Magnetism (Theory) 1. **Dirac delta function and it's properties** : a) Dirac delta function: definition of Dirac delta function. Delta function as limit of different representations. b) Properties of delta function. c) Three dimensional delta function. Proof of the relation $\nabla . (\hat{rr}_2) = 4\pi\ \delta_3(\tilde{r})$. 2. **Electrostatics** : (a) Coulombs law, principle of superposition, electrostatic field. Electric field and charge density, surface and volume charge density, charge density on the surface of a conductor. Force per unit area on the surface. (b) Divergence of the Electrostatic field, flux, Gauss's theorem of electrostatics, applications of Gauss theorem to find Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. (c) Curl of the Electrostatic Field. Conservative nature of electrostatic field, Introduction to electrostatic potential, Calculation of potential for linear, surface and volume charge distributions, potential for a uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. 3. **Dielectric properties of matter** : a) Electric dipole moment, electric potential and field due to an electric dipole, force and Torque on a dipole. b) Electric Fields inside matter, Electric Polarisation, bound charges, displacement density vector, relation between $\tilde{E}$, $\tilde{P}$ and $\tilde{D}$. c) Gauss's theorem in dielectrics, linear Dielectric medium, electric susceptibility and permittivity. d) Electrostatic boundary conditions for $\tilde{E}$ and $\tilde{D}$.

***** For further details please see the syllabus*****.

2. SEMESTER – 4 (HONOURS)

Name of the Teacher	Topics
Dr. Mukul Kr. Mitra	Mathematical Physics III (Theory) 1. **Complex Analysis** : (a) Brief Revision of Complex Numbers and their Graphical Representation. b) Euler's formula, Roots of Complex Numbers. c) Functions of Complex Variables. d) Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. e) Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. f) Cauchy's Inequality. g) Cauchy's Integral formula. Simply and multiply connected region. h) Laurent and Taylor's expansion. I) Residues and Residue Theorem. Application in solving Definite Integrals. Only single valued integrals; simple poles on and off the real axis. 2. **Variational calculus in Physics** : a) Functionals. Basic ideas of functionals. b) Extremization of action as a basic principle in mechanics. c) Lagrangian formulation. d) Euler's equations of motion for simple systems: harmonic oscillators, simple pendulum, spherical pendulum, coupled oscillators. e) Cyclic coordinates. f) Symmetries and conservation laws. g) Legendre transformations and the Hamiltonian formulation of mechanics. h) Canonical equations of motion. i) Applications to simple systems.
Dr. Anindya Sarkar	Analog Electronics **Amplifiers** : a) Transistor amplifier; CB, CE and emitter follower circuit and their uses. Load Line analysis of Transistor amplifier. b) Classification of Class A, B & C Amplifiers with respect to placement to Q point. c) Frequency response of a CE amplifier. d) The role of series and parallel capacitors for cut off frequencies. e) The idea about the value of coupling and bypass capacitor with respect to lower cut-off frequencies. f) Miller capacitance and its role in higher cut-off frequency. **Feedback amplifiers and OPAMP** : (a) Effects of Positive and Negative Feedback. b) Voltage series, current series, voltage shunt and current shunt feedback and uses for specific amplifiers. c) Estimation of Input Impedance, Output Impedance, Gain, Stability, Distortion and Noise for voltage series feedback (d) Operational Amplifiers (Black Box approach): Characteristics of an Ideal and Practical Op-Amp. (IC 741) e) Open-loop and Closed-loop voltage Gain. f) Frequency Response. CMRR. g) Slew Rate and concept of Virtual ground. **Application of OPAMP**: a) D.C. Application: • Inverting and non-inverting amplifiers • Inverting and non inverting Adder *HONOURS: SEMESTER 4. CC 8, CC 9, CC 10, SEC B* 38 • Differentiator as Subtractor • Logarithmic & anti logarithmic amplifiers • Error amplifier – Comparator – Schmidt Trigger A.C. Application: • Differentiator • Integrator **Multivibrator** :

	a) Transistor as a switch, Explanation using CE output characteristics. Calculation of component values for a practical transistor switch. b) Transistor switching times, use of speed up capacitor (Physical explanation only) Construction and operation, using wave shapes of collector coupled Bistable, Monostable andAstable Multivibrator circuits, Expression for time period. **Oscillators** : a) Sinusoidal Oscillators: Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, b) Wein Bridge oscillator, determination of feedback factor and frequency of oscillation. c) Reactive network feedback oscillators: Hartley's & Colpitt's oscillators. Relaxation oscillator using OPAMP.
Prof. Souvik Prasad	**Special theory of Relativity** : (a) Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. b) Lorentz Transformations. c) Simultaneity and order of events. Lorentz contraction. Time dilation. d) Relativistic transformation of velocity. Relativistic Dynamics. e) Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. **Transformation of Energy and Momentum** : (a) A short introduction to tensors Covariant and contravariant vectors. Contraction. Covariant, contravariant, and mixed tensors of rank-2, transformation properties. The metric tensor (flat space-time only). Raising and lowering of indices with metric tensors. (Consistent use of convention → diag(1,-1,-1,-1).) (b) Relativity in Four Vector Notation: Four-vectors, Lorentz Transformation and Invariant interval, Space-time diagrams. Proper time and Proper velocity. Relativistic energy and momentum - Four momentum. Conservation of four momentum and applications to collisions. Minkowski Force. Mathematical Physics III (Practical) 1. Exploring Gaussian Integrals and the delta function 3 Lectures + 8 Classes • Numerically handling improper integrals over infinite intervals • Numerically verifying the Gaussian integral result ˆ ∞ −∞ exp □−ax2 + bx + c_ = r π a exp_b2 4a + c_ • Verifying that the convolution of two Gaussian function is a Gaussian • Verifying that ´ a+x2 a−x1 δ (x − a) f (x) dx = f (a) using different limiting representation of δ (x). 2. Solution of Differential Equation 3 Lectures + 6 Classes First order and 2nd order ODE by scipy.integrate.odeint(). 3. Special functions 3 Lectures + 6 Classes Use of special functions taken from scipy.special. Plotting and verification of the properties of special functions. Orthogonality relations and recursion relations. Examples, (a) zJ′ _(z) + ν J_(z) = zJ_−1(z) (b) □1 − x2_P′ n(x) + (n + 1) xPn(x) − (n + 1)Pn+1(x) (c) ´∞ −∞ Pn(x) Pm(x) dx = 2 2n+1 δ mn *HONOURS: SEMESTER 4. CC 8, CC 9, CC 10, SEC B* 36

	Solution of some basic PDEs : (a) Boundary value problems. Finite discrete method with fixed step sizes. Idea of stability. Application to simple physical problems. (b) Laplace equation $\frac{@^2}{@x^2} + \frac{@^2}{@y^2} = 0$, on a square grid with specified potential at the boundaries. (c) Wave equation in 1+1 dimension: $\frac{@^2}{@t^2} = \lambda \frac{@^2}{@x^2}$. Vibration of a string with ends fixed with given initial configurations: ϕ (x, 0) and $\frac{@}{@t}$(x, 0). (d) Heat equation in 1+1 dimension, $\frac{@u}{@t} = \alpha \frac{@^2u}{@x^2}$ with specified value of temperature at the boundaries with given initial temperature at the boundaries with given initial temperature profile. **Fourier Series** : a)Evaluate the Fourier coefficients of a given periodic function using scipy.integrate.quad(). Examples: square wave, triangular wave, saw-tooth wave. Plot to see a wave form from scipy. signal and the constructed series along with.
Dr. Nilormi Biswas	Quantum Mechanics (Theory) **Wavepacket description** : a)Description of a particle using wave packets. b) Spread of the Gaussian wave-packet for a free particle in one dimension. c) Fourier transforms and momentum space wavefunction. d) Position-Momentum uncertainty. **General discussion of bound states in an arbitrary potential** : a)Continuity of wave function, b) boundary condition and emergence of discrete energy levels. c) Application to one dimensional square well potential of finite depth. **Quantum mechanics of simple harmonic oscillator** : a)Setting up the eigenvalue equation for the Hamiltonian. Energy levels and energy eigenfunctions in terms of Hermite polynomials (Solution to Hermite differential equation may be assumed). Ground state, zero point energy & uncertainty principle. **Quantum theory of hydrogen-like atoms** : a)Reduction of a two body problem to a one body problem. b) The time independent Schrodinger equation fora particle moving under a central force, c) the Schrodinger equation in spherical polar coordinates. Separation of variables. d) Angular equation and orbital angular momentum. e) Spherical Harmonics (Solution to Legendre differential equation may be assumed). Radial equation for attractive coulomb interaction - Hydrogen atom. f) Solution for the radial wavefunctions (Solution to Laguerre differential equation may be assumed). g) Shapes of the probability densities for ground & first excited states. h) Orbital angular momentum quantum numbers l and m; s, p, d shells.
Prof. Chinmay Sikdar	Analog Electronics **Circuits and Network** : a)Discrete components, Active & Passive components, Ideal Constant voltage and Constant current Sources. b) Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits. **Semiconductor Diodes and application** :

	(a) P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. b) PN Junction Fabrication (Simple Idea). c) Barrier Formation in PN Junction Diode. d) Static and Dynamic Resistance. e) Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. f) Derivation for Barrier Potential, g) Barrier Width and Current for Step Junction. (h) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, i) Calculation of Ripple Factor and Rectification Efficiency, j) L and C filter. Circuit and operation of clipping and clamping circuit. (k) Principle and structure of - • LEDs • Photodiode • Solar Cell • Varactor diode **Bipolar Junction transistors and biasing** : (a) n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. b) Physical Mechanism of Current Flow. Current gains α and β, Relations between them. c) Active, Cut-off and saturation Regions. DC Load line and Q-point. (d) Transistor Biasing and Stabilization Circuits; Fixed Bias, collector to base bias, emitter or self bias, e) voltage Divider Bias. f) Transistor as 2 port Network. g) h-parameter Equivalent Circuit. h) Analysis of a single-stage CE amplifier using Hybrid Model. i) Input and Output Impedance. **Field Effect transistors** : a)JFET and MOSFET (both depletion and enhancement type) as a part of MISFET. b) Basic structure & principle of operations and their characteristics. c) Pinch off, threshold voltage and short channel effect. **Regulated power supply** : a)Load regulation and line regulation. b) Zener diode as a voltage regulator. c) The problem with the zener regulator circuit. d) Requirement of feedback and error amplifier. e) Study of series regulated power supply using pass and error transistor assisted by zener diode as a reference voltage supplier.
Prof. Lucky Dildar	Quantum Mechanics (Theory) **Generalized Angular Momenta and Spin** : (a) Generalized angular momentum. Electron's magnetic Moment and Spin Angular Momentum. J = L + S. b) Gyromagnetic Ratio and Bohr Magneton and the g factor. c) Energy associated with a magnetic dipole placed in magnetic field. d) Larmor's Theorem. e) Stern-Gerlach Experiment. (f) Addition of angular momenta - statement only. Allowed values of angular momentum. **Spectra of Hydrogen atom and its fine structure** : (a) Formula for first order nondegenerate perturbative correction to the eigenvalue statement only. (b) Spin-orbit interaction and relativistic correction to the kinetic energy and Darwin term. (c) Fine structure of the hydrogen atom spectrum (No rigorous derivation is required). **Atoms in Electric & Magnetic Fields** : (a) Zeeman Effect: Normal and Anomalous Zeeman Effect (Formula for first order perturbative correction to the eigenvalue to be assumed). (b) Paschen Back effect & Stark effects (Qualitative Discussion only). **Many electron atoms** : (a) Identical particles. b) Symmetric & Antisymmetric Wave Functions. c) Pauli's Exclusion Principle. d) Hund's Rule. e) Periodic table. (f) Fine structure splitting. L-S and J-J coupling scheme. g) Spectral Notations for Atomic States and Term symbols. h) Spectra of Alkali Atoms (Na etc.).

***** For further details please see the syllabus. *****

3. SEMESTER – 6 (HONOURS)

Name of the Teacher	Topics
Dr. Mukul Kr. Mitra	Electromagnetic Theory (Theory) **Maxwell Equations :** (a) Review of Maxwell's equations. b) Vector and Scalar Potentials. c) Gauge Transformations: Lorentz and Coulomb Gauge. d) Boundary Conditions at Interface between Di_erent Media. e) Wave Equations. Plane Waves in Dielectric Media. f) Poynting Theorem and Poynting Vector. g) Electromagnetic (EM) Energy Density. h) Physical Concept of Electromagnetic Field Energy Density, i) Momentum Density and Angular Momentum Density. **EM Wave Propagation in Unbounded Media :** (a) Plane EM waves through vacuum and isotropic dielectric medium, b) transverse nature of plane EM waves, c) refractive index and dielectric constant, wave impedance. d) Propagation through conducting media, relaxation time, skin depth. e) Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, f) refractive index, skin depth, application to propagation through ionosphere. **EM Wave in Bounded Media :** (a) Boundary conditions at a plane interface between two media. Re-_ection & Refraction of plane waves at plane interface between two dielectric media-Laws of Re_ection & Refraction. b) Fresnel's formulae for perpendicular & parallel polarization cases, Brewster's law. Re- ection & Transmission coe_cients. c) Total internal re_ection, evanescent waves. Metallic re_ection (normal Incidence). **Electromagnetic origin of Wave Optics** (a) Kirchho_'s Integral Theorem, Fresnel-Kirchho_'s Integral formula. (Qualitative discussion only) (b) Description of Linear, Circular and Elliptical Polarization. Origin of Double-Refraction: Propagation of E.M. Waves in Anisotropic Media. c) Symmetric Nature of Dielectric Tensor. d) Fresnel's Formula. **Polarization in uniaxial crystals :** (a) Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. b) Double Refraction. c) Polarization by Double Refraction. d) Nicol Prism. e) Ordinary & extraordinary refractive indices. f) Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. g) Production & analysis of polarized light. h) Babinet Compensator and its Uses. i) Rotatory polarization. (j) Optical Rotation. Biot's Laws for Rotatory Polarization. k) Fresnel's Theory of optical rotation. l) Calculation of angle of rotation. m) Experimental verification of Fresnel's theory. n) Specific rotation. o) Laurent's half-shade and biquartz polarimeters.
Dr. Anindya Sarkar	Statistical Mechanics (Theory) **Bose-Einstein Statistics**: (a) B-E distribution law. b) Thermodynamic functions of a strongly Degenerate Bose Gas, c) Bose Einstein condensation, properties of liquid He (qualitative description), d) Radiation as a photon gas and Thermodynamic functions of photon gas. e) Bose derivation of Planck's law. **Fermi-Dirac Statistics**:

	(a) Fermi-Dirac Distribution Law. b) Thermodynamic functions of a Completely and strongly Degenerate Fermi Gas, c) Fermi Energy, Electron gas in a Metal, d) Specific Heat of Metals.
Prof. Souvik Prasad	## Statistical Mechanics (Practical) **List of Practicals** : 1. Computational analysis of the behavior of a collection of particles in a box that satisfy Newtonian mechanics and interact via the Lennard-Jones potential, varying the total number of particles N and the initial conditions: (a) Study of local number density in the equilibrium state (i) average; (ii) fluctuations (b) Study of transient behavior of the system (approach to equilibrium) (c) Relationship of large N and the arrow of time (d) Computation of the velocity distribution of particles for the system and comparison with the Maxwell velocity distribution (e) Computation and study of mean molecular speed and its dependence on particle mass (f) Computation of fraction of molecules in an ideal gas having speed near the most probable speed 2. Computation of the partition function Z (_) for examples of systems with a finite number of single particle levels (e.g., 2 level, 3 level, etc.) and a finiite number of non-interacting particles N under Maxwell-Boltzmann, Fermi-Dirac and Bose- Einstein statistics: (a) Study of how Z (_), average energy hE i, energy _uctuation _E, specific heat at constant volume C_v, depend upon the temperature, total number of particles N and the spectrum of single particle states. (b) Ratios of occupation numbers of various states for the systems considered above (c) Computation of physical quantities at large and small temperature T and comparison of various statistics at large and small temperature T. 3. Plot Planck's law for Black Body radiation and compare it with Raleigh-Jeans Law at high temperature and low temperature. 4. Plot Specific Heat of Solids (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature and low temperature and compare them for these two cases. 5. Plot the following functions with energy at different temperatures (a) Maxwell-Boltzmann distribution (b) Fermi-Dirac distribution (c) Bose-Einstein distribution
Prof. Lucky Dildar	## Statistical Mechanics (Theory) **Classical Statistical Mechanics :** (a) Macrostate & Microstate, Elementary Concept of Ensemble and Ergodic Hypothesis. Phase Space. (b) Microcanonical ensemble, Postulate of Equal a-priori probabilities. c) Boltzmann hypothesis: Entropy and Thermodynamic Probability. (d) Canonical ensemble, Partition Function, e) Thermodynamic Functions of an Ideal Gas, f) Classical Entropy Expression, g) Gibbs Paradox. (h) Sackur Tetrode equation, i) Law of Equipartition of Energy (with proof) - Applications to Specific Heat and its Limitations. j) Thermodynamic Functions of a Two-Energy Level System. k) Negative Temperature. (l) Grand canonical ensemble and chemical potential. **Classical Theory of Radiation :** (a) Properties of Thermal Radiation. Blackbody Radiation. Pure temperature dependence. b) Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. c) Wien's Displacement law. Wien's Distribution Law. Rayleigh-Jean's Law. d) Ultraviolet Catastrophe. **Quantum Theory of Radiation :** (a) Spectral Distribution of Black Body Radiation. b) Planck's Quantum Postulates. c) Planck's Law of Blackbody Radiation: Experimental Verification. d) Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law

	from Planck's law.

***** For further details please see the syllabus*****.

SEMESTER – 2 (GENERAL)

Name of the Teacher	Topics
Dr. Mukul Kr. Mitra	Electricity and Magnetism (Theory) **Essential Vector Analysis** : (a) Vector Algebra: Addition of vectors and multiplication by a scalar. Scalar and vector products of two vectors. (b) Vector Analysis: Gradient, divergence and Curl. c) Vector integration, line, surface and volume integrals of vector fields. d) Gauss'divergence theorem and Stoke's theorem of vectors (Statement only) and their significances. **Electrostatics** : (a) Coulombs law, principle of superposition, electrostatic field. Electric field and charge density, surface and volume charge v density, charge density on the surface of a conductor. Force per unit area on the surface. (b) Electric dipole moment, electric potential and field due to an electric dipole, force and Torque on a dipole. c) Electric Fields inside matter, Electric Polarisation, bound charges, displacement density vector, linear Dielectric medium, electric Succeptibility and Permittivity. (d) Divergence of the Electrostatic field, flux, Gauss's theorem of electrostatics, applications of Gauss theorem to find Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Gauss's theorem in dielectrics. (e) Curl of the Electrostatic Field. Conservative nature of electrostatic field, Introduction to electriostatic potential, Calculation of potential for linear, surface and volume charge distributions, potential for a uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Energy per unit volume in electrostatic field.
Dr. Nilormi Biswas	**Magnetism** : (a) Introduction of magnetostatics through Biot-Savart's law. Application of Biot Savart's law to determine the magnetic field of a straight conductor, circular coil, solenoid carrying current. Force between two straight current carrying wires. Lorentz force law. (b) Divergence of the magnetic field, Magnetic vector potential. (c) Curl of the magnetic field. Ampere's circuital law. Determination of the magnetic field of a straight current carrying wire. Potential and field due to a magnetic dipole. Magnetic dipole moment. Force and torque on a magnetic dipole. (d) Magnetic fields inside matter, magnetization, Bound currents. The magnetic intensity H. Linear media. Magnetic susceptibility and Permeability. Brief introduction of dia, para and ferro-magnetic materials. **Electromagnetic Induction** : Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. **Electrodynamics** : Maxwell's Equations, Equation of continuity of current, Displacement current, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, Poynting vector, decay of charge in conducting medium.

SEMESTER – 4 (GENERAL)

Name of the Teacher	Topics
Dr. Anindya Sarkar	**Introduction to wave Optics** : Definition and Properties of wave front. Huygens Principle, Electromagnetic nature of light. **Interference** : Superposition of two waves with phase difference, distribution of energy, formation of fringes, visibility of fringes. Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stoke's treatment. Interference in Thin Films: parallel and wedgeshaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer (a) Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength dierence, Refractive index. **Diffraction** : (a) Fraunhofer diffraction Single slit; Double Slit. Multiple slits and Diffraction grating. (b) Fresnel Diffraction: Half-period zones. Zone plate. **Polarization** : Transverse nature of light waves. Plane polarized light, production and analysis. Circular and elliptical polarization. **Optical activity**.
Prof. Souvik Prasad	SEC B -1 (Technical Skill) Arduino (Project type) **Introduction to Arduino** : Brief history of the Arduino; open-source electronics prototyping. **Basic ideas** : Basic ideas of Arduino, Familiarize the Arduino board, Setting up the arduino board. Installation of IDE in PC/ laptop for Arduino programming(Sketch) **Arduino Programming** : (a) Program structure: data types, variables and constants, operators, control statements, loops, functions, string. (b) Interfacing: serial communication, digital and analog input/output, getting input from sensors(e.g. temperature sensor, ultrasonic sensor etc)
Prof. Chinmay Sikdar	Waves and Optics (Theory) **Accoustics** : (a) Review of SHM, damped & forced vibrations: amplitude and velocity resonance. Fourier's Theorem and its application for some waveforms e.g., Saw tooth wave, triangular wave, square wave. Intensity and loudness of sound. Intensity levels, Decibels. **Superposition of vibrations** : (a) Superposition of Two Collinear Harmonic oscillations having equal frequencies and different frequencies (Beats).

	(b) Superposition of Two Perpendicular Harmonic Oscillation for phase difference δ = 0, $\__2$, π : Graphical and Analytical Methods, Lissajous Figures with equal and unequal frequency and their uses. **Vibrations in String** : (a) Wave equation in streched string and its solutions. Boundary conditions for plucked and struck strings. Expression of amplitude for both the cases (no derivation), Young's law, Ideal of harmonics. Musical scales and notes.

SEMESTER – 6 (GENERAL)

Name of the Teacher	Topics
Dr. Anindya Sarkar	DSE B (2) Nuclear & Particle Physics (Theory) **General Properties of Nuclei** : (a) Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot. **Nuclear Models** : (a) Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies. (b) Evidence for nuclear shell structure - nuclear magic numbers. Basic assumptions of shell model, concept of nuclear force. 3. Radioactivity 12 Lectures (a) α decay: basics of α decay processes. Theory of α emission, Geiger Nuttall law, α decay spectroscopy. (b) β decay: energy and kinematics of β decay, positron emission, electron capture, neutrino hypothesis. (c) γ decay: Gamma ray emission & kinematics, internal conversion.
Prof. Souvik Prasad	**Nuclear Reactions** : Types of Reactions, Conservation Laws, kinematics of reactions, Q value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction. **Detector for Nuclear Radiations** : Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector. **Particle Accelerators** : Accelerator facility available in India, Different type of accelerators • Van-de Graaf generator (Tandem accelerator) • Linear accelerator • Cyclotron • Betatron • Synchrotrons **Particle Physics** : Fundamental particles and their families. Fundamental particle interactions and their basic features. Symmetries and Conservation Laws, Baryon number, Lepton number, Isospin, Strangeness and Charm. Quark model, Quark structure of hadrons. **Tutorial** : In tutorial section, problems in the theory classes should be discussed. Problems and solutions regarding the theory course may be discussed.

Prof. Chinmay Sikdar	DSE B (1) Digital Electronics (Theory) **Integrated Circuits** : Principle of Design of monolithic Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only w.r.t. micron/submicron feature length). **Number System** : Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. Signed and unsigned number representation of binary system. Binary addition, Representation of negative number. 1's Complement and 2's Complement method of subtraction. **Digital Circuits** : (a) Difference between Analog and Digital Circuits. (b) AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates. De Morgan's Theorems. (c) Switching algebra, Simplification of logical expression using switching Algebra. Fundamental Products and sum term (p term and s term). Minterms and Maxterms. Conversion of a Truth Table into an algebraic expression *GENERAL: SEMESTER 6. DSE B, SEC B (SAME AS SEMESTER 4)* in (1) Sum of Products form and (2) Product of sum term form. Implementation of a truth table by NAND or NOR gate. Simplification of algebraic expression from truth table using Karnaugh Map. **Data processing circuits** : Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders. **Sequential Circuits** : Introduction to Next state present state table, excitation table and truth table for Sequential circuits. SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race condition in SR and Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop, T type FF. **Registers and Counters** : (a) Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits). (b) Counters (4 bits): Asynchronous counters: ripple counter, Decade Counter. Synchronous Counter, Ring counter.

N.B.: ***Minor modification of the Academic Calendar may be made considering the SEC subject***.

Chemistry odd SEM Academic Calendar 2021-22

Chemistry Hons

SEMESTER-1

CEMA-CC-1-1-TH :

INORGANIC CHEMISTRY-1

Theory: 40 Lectures

Extra nuclear Structure of atom (14 Lectures) **Dr. Amit Kumar Dutta**
Acid-Base reactions (12 Lectures)
Redox Reactions (14 Lectures)

ORGANIC CHEMISTRY-1A

Theory: 20 Lectures

Basics of Organic Chemistry **Soumyajit Sett**
Bonding and Physical Properties (18 Lectures)
General Treatment of Reaction Mechanism I (02 Lectures)

CEMA-CC-1-1-P(45 Lectures)

1) **INORGANIC CHEMISTRY: LAB (30 Lectures)** **Dr. Amit Kumar Dutta**
Acid and Base Titrations: (DEMO ONLY)
Oxidation-Reduction Titrations:

2) **ORGANIC CHEMISTRY: LAB (15 Lectures)** **Soumyajit Sett**
Separation based upon solubility, by using common laboratory reagents

CEMA-CC-1-2-TH :

PHYSICAL CHEMISTRY-1 Theory(40 Lectures)

Kinetic Theory and Gaseous state (20 Lectures) **Utpal Pradhan**
Transport processes (08 Lectures)
Chemical kinetics (12 Lectures) **Dr. Satadal Paul**

ORGANIC CHEMISTRY-IBTheory (20 Lectures)

Stereochemistry I (17 Lectures) **Soumyajit Sett**
General Treatment of Reaction Mechanism II (03 Lectures)

CEMA-CC-1-2-P: **(45 Lectures)**

1) **PHYSICAL CHEMISTRY: LAB (30 Lectures)** **Utpal Pradhan**
Experiment 1: Study of kinetics of decomposition of H_2O_2
Experiment 2: Study of kinetics of acid-catalyzed hydrolysis of methyl acetate
Experiment 3: Study of viscosity of unknown liquid (glycerol, sugar) with respect to water.
Experiment 4: Study of the variation of viscosity with the concentration of the solution
Experiment 5: Determination of solubility of sparingly soluble salt in water, in electrolyte with common ions and in neutral electrolyte (using common indicator)

2) **ORGANIC CHEMISTRY: O (1B) LAB (15 Lectures)** **Soumyajit Sett**

Determination of boiling point of common organic liquid compounds

Chemistry Hons

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

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.

Chemistry General

SEMESTER-1

CC1/ GE 1:

Theory: 60 Lectures

Kinetic Theory of Gases and Real gases — **Utpal Pradhan**

Liquids

Chemical Kinetics — **Dr. Satadal Paul**

Atomic Structure — **Dr. Amit Kumar Dutta**

Chemical Periodicity

Acids and bases

Fundamentalsof Organic Chemistry — **Dr. Atreyee Basu**

Stereochemistry

Nucleophilic Substitution and Elimination Reactions

CC1/GE 1 Practical: 45 Lectures — Dr. Atreyee Basu

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with $KMnO_4$.

Dr. Amit Kumar Dutta

3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.
4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.
6. Estimation of Fe(II) and Fe(III) in a given mixture using $K_2Cr_2O_7$ solution.

Chemistry General

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

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 2021-22

Chemistry Hons

SEMESTER-2

CEMA-CC-2-3-TH :

Organic Chemistry-2 **Soumyajit Sett**

StereochemistryII (20 Lectures)

General Treatment of Reaction Mechanism III (20 lectures)

Substitution and Elimination Reactions (20 Lectures)

CEMA-CC-2-3-P: **Soumyajit Sett**

(45 Lectures)

Organic Preparations

CEMA-CC-2-4-TH :

Inorganic Chemistry-2 Theory: 60 Lectures **Dr. Satadal Paul**

Chemical Bonding-I (20 Lectures)

Chemical Bonding-II (30 Lectures)

Radioactivity (10 Lectures) **Dr. Amit Kumar Dutta**

CEMA-CC-2-4-P:(45 Lectures)

Iodo-/ Iodimetric Titrations **Dr. Satadal Paul /Dr. Amit Kumar Dutta**

Estimation of metal content in some selective samples

SEMESTER-4

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. Amitava Dutta/ 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

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. Amitava Dutta/ 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**

GENERAL ELECTIVE COURSE IN CHEMISTRY

SEMESTER- 2 (Gen)

CC2/GE 2: Theory: 60 Lectures

Chemical Thermodynamics: **Dr. Satadal Paul**

Chemical Equilibrium:

Solutions **Utpal Pradhan**

Phase Equilibria

Solids

Aliphatic Hydrocarbons **Dr. Atreyee Basu**

Error Analysis and Computer Applications **Dr. Amit Kumar Dutta**

Redox reactions

CC2/GE 2 Practical: 45 Lectures **Utpal Pradhan**

SEMESTER- 4 (Gen)

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)

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 for the session 2021-22
Bangabasi Morning College
Department of Mathematics

Under CBCS system

Course	Commencement of classes	Tentative date of University Examination		
		Internal Assessment(20)	Tutorial(15)	Theoretical(65)
Semester-I	July	3rd week of November	4th week of November	2nd week of December
Semester-II	Within 7 days from the completion of previous semester	2nd week of May	4th week of May	2nd week of June
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	3rd week of May	1st week of June

Syllabus Distribution(under CBCS system):

ODD SEMESTER		
Course	**Course Details**	**Teacher**
SEMESTER- 1		
MTMA (CC1) Co-Ordinator: Partha Bhattacharya	Unit-1: Calculus	PH
	Unit-2: Geometry	PB
	Unit-3: Vector Analysis	
MTMA (CC-2) Co-ordinator: Bikash Ch. Mandal	Unit-1: Complex Number, Theory of Equation, Inequality, Linear difference equation	BCM
	Unit-2: Relation, Mapping, Integers	MM
	Unit-3: Rank and inverse of Matrix, System of Linear equations	
MTMG (GE-1/CC1)	U1: Algebra(15), U3: Differential Equation(15)	BCM

Co-ordinator: Prithwiraj Halder	U2: Differential Calculus(25)	PH
	U4: Geometry(25)	MM
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 Mahhatab 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	MM
	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		
Course	**Course Details**	**Teacher**
SEMESTER- 2		
MTMA (CC-3) Co-Ordinator: Partha Bhattacharya	Real Analysis: Unit-1	PH
	Real Analysis: Unit-2	PB

	Real Analysis: Unit-3	
MTMA (CC-4) Co-ordinator: Md Mahatab Uddin Molla	Group Theory-I: Unit- 1	PH
	Group Theory-I: Unit- 2	MM
	Group Theory-I: Unit- 3	
MTMG (GE-2/CC-2) Co-ordinator: Bikash Ch. Mandal	U1: Differential Calculus-II	PH
	U2: Differential Equation-II	BCM
	U3: Vector Algebra	BCM
	U4: Discrete Mathematics	PB
SEMESTER- 4		
MTMA(CC-8) Co-ordinator: Prithwiraj Halder	Riemann Integration	PH
	Series of Functions	PB
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, MM
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 2021-22

Computer Science Honours

Course Structure

Semester-I and II

Sem	Courses	Title	Credits
I	CMS-A-CC-1-1-TH (Core Course-1) Theory	Digital Logic(MKB)	4
	CMS-A-CC-1-1-P (Core Course-1) Practical	Digital Circuits(MKB)	2
	CMS-A-CC-1-2-TH (Core Course-2) Theory	Programming Fundamentals using C(BPR)	4
	CMS-A-CC-1-2-P (Core Course-2) Practical	Programming in C(BPR)	2
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
	CMS-A-CC-3-5-TH (Core Course-5) Theory	Computer Architecture and Organization(MKB)	4

III	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)	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+BPR)	2

Semester-V and VI

Sem	Courses	Title	Credits
	CMS-A-CC-5-11-TH (Core Course-11) Theory	Database Management system (BPR)	4

V	CMS-A-CC-5-11-P (Core Course-11) Practical	RDBMS lab using My SQL & PHP (PR)	2
	CMS-A-CC-5-12-TH (Core Course-12) Theory	Object Oriented Programming (SK)	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+PR)	4
	CMS-A-DSE-A-2-P (DSE-A-2 Practical)	Data Mining Lab (SG+PR)	2
	CMS-A-DSE-B-2-TH (DSE-B-2 Theory)	Programming using Python (SG+BPR)	4
	CMS-A-DSE-B-2-P (DES-B-2-Practical)	Programming in Python Lab(SG+BPR)	2
VI	CMS-A-CC-6-13-TH (Core Course – 13) Theory	Software Engineering(SK)	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)	Advance Java(PR)	4
	CMS-A-DSE-B-4-P (DES-B-4-Practical)	Advance Java Lab(PR)	2

Semester-I

CMS-A-CC-1-1-TH: Digital Logic Core Course-1: Theory: 04 Credits: 60 hours

- **Introduction to Computer Fundamentals: (02 hours)**
- **Number Systems: (05 hours)**
- **Boolean Algebra: (08 hours)**
- **Combinational Circuits: (20 hours)**
- **Sequential Circuits: (21 hours)**
- **Integrated Circuits (Concept only): (04 hours)**

CMS-A-CC-1-1-P: Digital Circuits
Core Course-1: Practical: 02 Credits: 40 hours

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

CMS-A-CC-1-2-TH: Programming Fundamentals using C
Core Course-2: Theory: 04 Credits: 60 hours

- **Introduction: (04 hours)**
- **C Programming elements: (08 hours)**
- **C Preprocessor: (06 hours)**
- **Statements: (06hours)**
- **Functions: (06 hours)**
- **Arrays: (07hours)**
- **Pointers: (10 hours)**
- **User defined Data types: (07 hours)**
- **File Access: (06hours)**

CMS-A-CC-1-2-P: Programming with C
Core Course-2: Practical: 02 Credits: 40 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--4-TH: Advanced Java
DSE-B: Choice-4, Theory, Credit:04, Contact hours: 60.

- **Basics of Servlet (10 hours)**
- **Session Management (04 hours)**
- **Basics of JSP (10 hours)**
- **Design Pattern (10 hours)**
- **Javascript (10 hours)**
- **JQuery (06 hours)**
- **Spring Framework (10 hours)**

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

Computer Science General

Semester	Courses	Title	Credits
SEM- I	CMS-G-CC-1-1-TH Sem-1-Core Course-1 Theory	Computer Fundamentals and Digital Logic Design (MKB)	04
	CMS-G-CC-1-P Sem-1-Core Course-1 Practical	Word Processing, Spreadsheet, Presentation and Web design by HTML/ PHP (SK)	02
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 (BPR)	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) (SG+SK)	04
	CMS-G-DSE-A-5-1-P	DBMS Lab using SQL(SG)	02
	CMS-G-SEC-A-5-1-TH	Communication, Computer Network and Internet (SK+BPR)	02
SEM - VI	CMS-G-DSE-B-6-2-TH	Object Oriented Programming (PR)	04
	CMS-G-DSE-B-6-2-P	Object Oriented Programming by Java (PR)	02

Semester-I

CMS-G-CC-1-1-TH: Computer Fundamentals and Digital Logic Design
Core Course- 1: Theory: 60 Hours

Group A: Computer Fundamentals (20 hours)

- **General Concepts**
  - Introduction to Computer and Problem Solving
  - Software
  - Introduction to Programming Languages

- Problem Solving
- System Software
- Virus
- Multimedia
- Object Oriented Paradigm

Group B: Digital Logic Design(40 hours)

- **Number Systems and Codes**
- **Boolean Algebra**
- **Digital Electronics**

CMS-G-CC-1-1-P: Word Processing,Spreadsheet, Presentation and Web design by HTML/ PHP
Core Course- 1: Practical: 40 Hours

- **Word Processing: (05 hours)**
- **Spreadsheet: (05 hours)**
- **Presentation: (05 hours)**
- **Web Design: (25 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-5-1-TH: Communication, Computer Network and Internet
Skill Enhancement Course – A (SEC-A-1): Choice-1: Theory: 40 hours

- **Communication and Computer Network** (30 hours)
  - **Introduction**
  - **Network Hierarchy**
  - **Data and Signals (Analog and Digital)**
  - **Transmission Media**
  - **Digital Transmission**
  - **Analog Transmission**
  - **Multiplexing**
- **Internet** (10 hours)

Semester-VI

CMS-G-DSE-B-6-2-TH: Object Oriented Programming
Discipline Specific Elective Course – B (DSE-B-2): Choice-2: Theory: 60 hours

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

CMS-G-DSE-B-6-2-P: Object Oriented Programming by Java
Discipline Specific Elective Course – B (DSE-B-2): Choice-2: Practical: 40 hours

- Object Oriented Programming Lab. by using Java

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