SRIPAT SINGH COLLEGE

(Estd. 1949 Govt. Sponsored)
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ACADEMIC CALENDAR
SESSION: January'24-June'24

Stream: Science

DISTRIBUTION OF COURSES

Content list

Introduction

The Academic Calendar for the Science Stream for all the students of the nine Science departments of Sripat Singh College including Botany, Chemistry, Computer Science, Economics, Environmental Science, Mathematics, Molecular Biology and Biotechnology, Physics and Zoology. This Calendar is prepared by the Academic Calendar and Prospectus Committee (List: 1) with the full support and help of all HODs (List:2) of the above mentioned departments.

List 1:Academic Calendar and Prospectus Committee

01	**Dr. Kamal Krishna Sarkar, (Chairperson, Principal)**
02	**Dr. Amal Modak (ex-offici, TCS)**
03	**Dr. Sudhanshu Kumar Biswas, (Convenor)**
04	**Sri Dibakar Das, Member**
05	**Sri Ashok Raj Mahali, Member**
06	**Dr. Amit Kumar Kundu, Member**
07	**Dr. Md. Habib, Member**
08	**Dr. Ajoy Debnath, Member**
09	**Sri Monirul Mondal, Member**

List 2: List of Head Of the Department(HOD) (Science Stream)

Sl. No.	Department of	HOD
01	**Botany**	**Dr. Suchetana Mukherjee**
02	**Chemistry**	**Dr. Amit Kumar Kundu**
03	**Computer Science**	**Sri Biplab Biswas**
04	**Economics**	**Sri Arunava Kumar Choudhury**
05	**Environmental Science**	**Sri Amitava Kar**
06	**Mathematics**	**Dr. Sudhanshu Kumar Biswas**
07	**Molecular Biology & Biotechnology**	**Dr. Abhishek Basu**
08	**Physics**	**Sri Paban Bittar**
09	**Zoology**	**Dr. Sajal Dey**

DEPARTMENT OF BOTANY

EVEN SEMESTER SYLLABUS DISTRIBUTON FOR THE SESSION July-December, 2024

2ND SEMESTER UNDER NEP 2020

Course Code	Course Title	Name of the Course	Course Content	Assigned Teacher	No. of Lectures (inclusive of Tutorials)
BOT-MJ-CC-T-02	Biomolecules and Cell Biology	MAJOR (THEORY)	**Unit 1: Biomolecules** 1. Types and significance of chemical bonds; Structure and properties of water; pH and buffers. 2. Carbohydrates: Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and Polysaccharides. 3. Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerol structure, functions and properties; Phosphoglycerides. 4. Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Protein denaturation and biological roles of proteins. 5. Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of t RNA.	**SM, DR**	(20)
			Unit 2: Bioenergetics	**RI**	(4)
			Unit 3: Enzymes Menten equation, enzyme inhibition and factor affecting enzyme activity.	**SM**	(6)
			Unit 4: The cell Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic Theory).	**DR**	(4)
			Unit 5: Cell wall and plasma membrane Chemistry, structure and function of plant cell wall. Overview of membrane function; fluid mosaic model;Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.	**DR**	(4)
			Unit 6: Cell organelles 1. Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecularorganization of chromatin; nucleolus. 2. Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament. 3. Chloroplast, Mitochondrion, and Peroxisome: Structural organization; Function;Semiautonomous nature of mitochondrion and chloroplast.	**RI (1,2), DR (3,4,5)**	(20)

			4. Endomembrane system: Endoplasmic Reticulum (ER) – Structure, targeting and insertion of protiens in the ER, protien folding, processing; Smooth ER and lipid synthesis, export of protiensand lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export fromGolgi Apparatus; Lysosome 5. Organelle without membranes: Ribosomes – structure and function		
			Unit 7: Cell division Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle-checkpoints, role of proteinkinases.	**RI**	7
BOT-MJ--CC-P-02	**Biomolecules and Cell Biology**	**Major (Practical)**	1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins. 2. Study of plant cell structure with the help of epidermal peel mount of *Allium cepa/ Rhoeo/Crinum*. 3. Demonstration of the phenomenon of protoplasmic streaming in Hydrilla leaf. 4. Measurement of cell size by the technique of micrometry. 5. Counting the cells per unit volume using haemocytometer (Yeast/pollen grains). 6. Study of cell and its organelles with the help of electron micrographs. 7. Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion usingPeriodic Schiff's (PAS) staining technique (demonstration only). 8. Study the phenomenon of plasmolysis and deplasmolysis. 9. Study different stages of mitosis and meiosis.	**SM (1,5,8) RI (2,3,9) DR (4,6,7)**	60
BOT-SEC-T-02					
			SEC PAPER NOT UPLOADED BY UNIVERSITY. WILL BE DONE LATER		
BOT-SEC-P-02-A		**Practical**			
BOT-MI-CC-T-01 (EITHER IN SEMESTER 1 OR 2)	**BIODIVERSITY OF MICROBES, ALGAE, FUNGI AND**	**MINOR (THEORY)**	**Unit 1: Microbes** Virus- General structure, replication (general account), DNA virus (T-phage); Lytic and Lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria- General characteristics and cell structure; Reproduction- conjugation, transformation and transduction; Economic importance.	**BC**	10
			Unit 2: Algae General characteristics: reproduction; Classification of algae by Fritsch (1935); Economic importance of algae.	**BC**	12
			Unit 3: Fungi Introduction: General characteristics, cell wall composition,	**SY**	12

			reproduction and classification (Alexopoulos, Mims and Blackwell 1996); Symbiotic associations- Lichens: General account; Mycorrhiza: ectomycorrhiza and endomycorrhiza.		
			Unit 4: Bryophyte General characteristics; adaptations to land habit; classification following Smith G.M. (1955); Economic importance of bryophytes with special mention of *Sphagnum*	**SP**	10
BOT–MI-CC-P-01 (EITHER IN SEMESTER 1 OR 2)		**MINOR (PRACTICAL)**	**EMs/Models of viruses** -T-Phage and TMV. **Types of Bacteria -**from temporary/permanent slides/photographs. **Gram staining.** **Algae- (Study from permanent slides/ permanent slide/preserved specimen)** -*Nostoc*, *Oedogonium*, *Chlamydomonas* and *Fucus* **Fungi- (Study from permanent slides/ permanent slide/preserved specimen)**- *Rhizopus* and *Penicillium*, *Agaricus* (Section of gills). **Lichens:** Study of growth forms of Lichens (crustose, foliose and fruticose). **Mycorrhiza**: ectomycorrhiza and endomycorrhiza (Photographs). **Bryophyte-(Study from permanent slides/ permanent slide/preserved specimen)**- *Marchantia* (morphology of thallus, VS of antheridiophore, archegoniophore), *Funaria (*morphology, LS of capsule).	**BC**	

4th semester

COURSE CODE	COURSE TITLE	COURSE CONTENT	TEACHER ASSIGNED	No. of Lectures (inclusive of Tutorials)
UG-H-BOT-CC-T-08 &	**Taxonomy of Angiosperms and Plant Systematics**	**Unit 1: Significance of plant systematics** Introduction to systematics; Plant identification, Classification (Artificial, Natural, Phylogenetic and Modern systems), Nomenclature. Taxonomy and its phases (Pioneer, Consolidation, Biosystematic and Encylopaedic; alpha- and omega-taxonomy. Evidences from palynology, cytology, phytochemistry and molecular data. Field inventory (Data sources in Taxonomy); Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access. Application of plant taxonomy in ecological and natural hybridization studies.	**RI**	**(10)**
		Unit 2: Taxonomic hierarchy Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).	**SM**	**(4)**
		Unit 3: Botanical nomenclature Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication,	**SM**	**(8)**

		rejection of names, principle of priority and its limitations.		
		Unit 4: Systems of classification Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Outline of classification systems of Bentham and Hooker (1862-1883) (up to series) and Cronquist (1988); Brief reference of Angiosperm Phylogeny Group (APG III) classification.	**DR**	**(10)**
		Unit 5: Biometrics, numerical taxonomy and cladistics Characters; Variations; OTUs; Cluster analysis; Phenograms, cladograms (definitions and differences).	**DR**	**(4)**
		Unit 6: Phylogeny of Angiosperms Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly and clades). Origin and evolution of angiosperms.	**DR**	**(6)**
		Unit 7: Diagnostic features, Systematic position (Bentham and Hooker, and Cronquist), Economically important plants (parts used and uses) of the following families Monocotyledons: Alismataceae, Poaceae, Arecaceae, Zingiberaceae, Orchidaceae. Dicotyledons: Nymphaeceae, Ranunculaceae, Magnoliaceae, Leguminosae (subfamilies), Euphorbiaceae, Malvaceae, Lamiaceae, Solanaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Asteraceae.	**RI (**Nymphaeceae, Ranunculaceae, Magnoliaceae, Leguminosae, Euphorbiaceae, Malvaceae, Solanaceae**)** **DR (**Lamiaceae, Acanthaceae, Rubiaceae, Asteraceae, Cucurbitaceae Monocotyledons: Poaceae, Alismataceae**)** **SM (**Arecaceae, Zingiberaceae, Orchidaceae.**)**	**(18)**
UG-BOT-CC-P-08 (PRACTICAL)		1. Study of vegetative and floral characters of the following families according to Bentham & Hooker's system of classification: Dicotyledons: Leguminosae (subfamilies- Papilionoidae and Caesalpinioidae), Euphorbiaceae, Malvaceae, Solanaceae, Lamiaceae, Acanthaceae, Rubiaceae, Asteraceae Monocotyledons: Poaceae Construction of dichotomous keys (indented/bracketed) for the genera.	**RI (**Leguminosae, Euphorbiaceae, Malvaceae, Solanaceae**)** **DR (**Lamiaceae, Acanthaceae, Rubiaceae, Asteraceae	

			Monocotyledons: Poaceae)	
		Spot identification (Binomial, Family) of common wild plants from families included in Theoretical syllabus.	**RI, DR**	
		Field visit (2 local and 1 to different phytogeographic zone). Among the two local field visits one should be at Acharya Jagadish Chandra Bose Indian Botanic Garden, Shibpur, Howrah and Central National Herbarium (CNH).		
		Submission of properly preserved herbarium specimens of at least 25 common wild plants with herbarium label, proper field record and notes. The herbarium specimens should be submitted during End Term Examination and to be arranged following Bentham & Hooker's system of classification.		
Course: UG-H-BOT-CC-T-09	**Plant Ecology and Phytogeography**	**Unit 1: Introduction** Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.	**RI**	**(4)**
		Unit 2: Soil Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development.	**RI**	**(8)**
		Unit 3: Water Importance: States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table.	**RI**	**(4)**
		Unit 4: Light, temperature, wind and fire Variations; adaptations of plants to their variation.	**RI**	**(6)**
		Unit 5: Biotic interactions Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop.	**RI**	**(2)**
		Unit 6: Population ecology Characteristics and Dynamics; Ecological Speciation.	**DR**	**(4)**
		Unit 7: Plant communities Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts.	**SM**	**(8)**
		Unit 8: Ecosystems Structure; Processes; Trophic organisation; Food	**SM**	**(4)**

		chains and Food webs; Ecological pyramids.		
		Unit 9: Functional aspects of ecosystem Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.	**SM**	**(8)**
		Unit 10: Phytogeography Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local vegetation.	**DR**	**(12)**
UG-BOT-CC-P-09 (PRACTICAL)		1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/ hygrometer, rain gauge and lux meter.	**SM**	
		2. Determination of pH of various soil and water samples (using pH meter and pH paper).	**SM**	
		3. Comparison of physical characteristics (temperature, colour and texture) and water holding capacity of two soil samples.	**SM**	
		4. Comparison of chemical characteristics of two soil samples (carbonate content, nitrate content and base deficiency) by rapid field tests.	**DR**	
		5. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.	**DR**	
		6. Study of morphological adaptations of hydrophytes and xerophytes (two each).	**DR**	
		7. Determination of minimum quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).	**RI**	
		8. Determination of minimum quadrat number for the study of herbaceous vegetation in the college campus.	**RI**	
		9. Field visit to familiarise students with ecology of different sites.	**RI**	
UG-H-BOT-CC-T-10 (THEORY)	**Economic Botany and Pharmacognosy**	**Unit 1: Origin of Cultivated Plants** Concept of centres of origin, their importance with reference to Vavilov's work. Examples of major plant introductions; Crop domestication and loss of genetic diversity.	**DR**	**(4)**

		Unit 2: Cereals Rice and Wheat (origin, morphology, processing and uses); Brief account of millets.	**DR**	**(4)**
		Unit 3: Legumes Origin, morphology and uses of Chick pea, Pigeon pea and fodder legumes. Importance to man, and ecosystem.	**DR**	**(4)**
		Unit 4: Sources of sugars and starches Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation and uses.	**RI**	**(4)**
		Unit 5: Spices and Condiments General description of important spices, their families, part used and economic importance with special reference to coriander, cumin, fennel, saffron, cardamom, clove and black pepper.	**RI**	**(6)**
		Unit 6: Beverages Tea, Coffee and Cacao (morphology, processing & uses)	**RI**	**(2)**
		Unit 7: Sources of oils and fats General description, classification, extraction, their uses and health implications safflower, linseed, soybean, mustard and coconut (botanical name, family and uses). Essential Oils: General account, extraction methods, comparison with fatty oils and their uses.	**RI**	**(8)**
		Unit 8: Natural Rubber Para-rubber: tapping, processing and uses.	**RI**	**(2)**
UG-H-BOT-CC-P-10 (PRACTICAL)		**Unit 10: Timber plants** General account with special reference to teak/ sissoo and pine.	**DR**	**(2)**
		Unit 11: Fibers Classification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses).	**SM**	**(3)**
		Unit 12: Pharmacognosy Introduction (Definition; Drug – Crude and commercial); Preparation of drugs; Organoleptic study of drugs; Physical and chemical evaluation of drugs; Classification of drug plants; Individual drugs; drug adulteration; constituents.	**SM**	**(6)**
		Unit 13: Study of following drug plants (Botanical name with family, source, short description, histology, constituents, uses, adulterants) *Swertia chirata*, *Andrographis paniculata*, *Justicia adhatoda*, *Aloe barbedensis, Centella asiatica, Ephedra gerardiana, Zingiber officinale, Rauvolfia serpentina, Alstonia scholaris,*	**SM**	**(15)**

		Mentha piperita, Dioscorea alata, Aconitum heterophyllum, Atropa belladonna, Hemidesmus indicus, Withania somnifera.		
UG-H-BOT-CC-P-10:		1. **Cereals**: Rice/Wheat (habit sketch, L.S./T.S. grain, starch grains, micro-chemical tests).	**RI**	**4**
		2. **Legumes**: Soybean, Gram (habit, fruit, seed structure, micro-chemical tests).	**RI**	**8**
		3. **Sources of sugars and starches**: Sugarcane (habit sketch; cane juice- micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, whole mount of starch grains, micro-chemical tests).	**RI**	**4**
		4. **Spices:** Black pepper, Fennel and Clove (habit and sections).	**DR**	8
		5. **Beverages**: Tea (plant specimen/tea leaves), Coffee (plant specimen/beans).	**DR**	6
		6. **Sources of oils and fats**: Coconut- T.S. nut, Mustard–plant specimen, seeds; tests for fats in crushed seeds.	**DR**	
		7. **Essential oil-yielding plants**: Habit sketch of *Rosa*, *Vetiveria/ Cymbopogon* and *Eucalyptus* (specimens/ photographs).	**DR**	
		8. **Rubber**: specimen, photograph/model of tapping, samples of rubber products.	**DR**	
		11. **Woods:** *Tectona/ Dalbergia, Pinus*: Herbarium and wood specimen, section of young stem.	**RI**	
		12. **Fiber-yielding plants**: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber).	**RI**	
		Pharmacognosy: Specimens of *Rauvolfia, Zingiber, Alstonia* for following examinations- 1. Study of drug plants - Microscopical preparation, Stomatal Index, Vein-islet number, Palisade ratio, Fibres, Vessels. 2. Study of powdered drugs – Morphological observations and identification of tissue elements.	**SM**	
UG- H-BOT-SEC-T-02	**B. Mushroom Culture**	**Unit 1:** Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea,*	**SM (2)** **RI (3,4)** **DR (1)**	**30**

		Pleurotus citrinopileatus, Agaricus bisporus. **(5)** **Unit 2:** Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, 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. **(12)** **Unit 3:** Storage and nutrition: Short-term storage (Refrigeration – up to 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins. **(8)** **Unit 4:** Food Preparation: Types of foods prepared from mushroom. Research Centres - National level and regional level. Cost benefit ratio - Marketing in India and abroad, Export Value. **(5)**		
UG-H-BOT-GE-T-02	Plant Ecology, Morphology and Taxonomy	Unit 1: Introduction Concept of ecology	**THEORY-PRACTICAL - SY**	**(2)**
		Unit 2: Ecological factors Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature. Adaptation of hydrophytes, halophytes and xerophytes		**(5)**
		Unit 3: Plant communities Characters; Ecotone and edge effect; Succession; Processes and types.		**(6)**
		Unit 4: Ecosystem Structure; energy flow, trophic organisation; Food chains and food webs, Ecological pyramids, production and productivity; Tritrophic interactions (plant defense against herbivore) with reference to Volatile Organic Compounds (VOC) and other secondary compounds, Biogeochemical cycling; Cycling of carbon, nitrogen and phosphorous.		**(6)**
		Unit 5: Phytogeography Botanical zones in India (D. Chatterjee, 1962), Present status; Endemism		**(4)**
		Unit 6: Conservation of Biodiversity Level of Biodiversity: genetic, species and ecosystem diversity, Biodiversity hot spotscriteria, Indian hotspots, In- situ and ex-situ conservation, Ecological restoration, Geographic Information System and Remote Sensing (brief idea).		**(3)**

		Unit 7: Plant Morphology Variations in leaf morphology; phyllotaxy; types of inflorescence; morphology of flowers – types of flowers; modification of calyx; aestivation; floral formula and floral diagram; adhesion and cohesion of floral parts; placentation types; types of fruits and seeds		**(10)**
		Unit 8: Introduction to plant taxonomy Identification, Classification, Nomenclature.		**(2)**
		Unit 9: Identification Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access.		**(4)**
		Unit 10: Taxonomic hierarchy Ranks, categories and taxonomic groups.		**(2)**
		Unit 11: Botanical nomenclature Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations (with examples).		**(4)**
		Unit 12: Classification Types of classification - artificial, natural and phylogenetic. Outline of Bentham and Hooker (up to series) classification with merits and demerits.		**(2)**
		Unit 13: Numerical taxonomy and cladistics (brief idea)		**(2)**
		Unit 14: Salient features, Systematic position (Bentham and Hooker), economically important plants of the following families Monocotyledons: Liliaceae; Arecaceae; Poaceae; Orchidaceae Dicotyledons: Brassicaceae; Leguminosae (s.l.); Malvaceae; Solanaceae; Lamiaceae; Cucurbitaceae; Euphorbiaceae; Asteraceae		**(8)**

UG-H-BOT-GE-P-02		1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter. 2. Comparison of bulk density, porosity and rate of infiltration of water in soil of two habitats. 3. Study of morphological adaptations of hydrophytes, halophytes and xerophytes (four each). 4. Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orobanche)- illustration only, Epiphytes, Predation (Insectivorous plants)- illustration only. 5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method (species to be listed). 6. Quantitative analysis of herbaceous vegetation in any suitable habitat for frequency distribution and comparison with Raunkiaer's frequency distribution law. 7. Study of vegetative and floral characters of following families of the available genera distributed locally according to Bentham & Hooker's system of classification: Dicotyledons: Brassicaceae; Leguminosae (Papilionoidae and Caesalpinioidae); Euphorbiaceae, Malvaceae; Lamiaceae; Solanaceae; Asteraceae Monocotyledons: Poaceae 8. Spot identification (Binomial, Family) of common wild plants from families included in Theoretical syllabus. 9. Submission of properly preserved herbarium specimens of at least 15 common wild plants with herbarium label, proper field record and notes. The herbarium specimens should be submitted during End Term Examination and to be arranged following Bentham and Hooker's system of classification.		**60**

Semester-IV, PCC

COURSE CODE	COURSE TITLE	COURSE CONTENT	TEACHER ASSIGNED	
UG-BOT-G-CC-T-04 (Theory)	Plant Physiology and Metabolism	**Unit 1: Plant-water relations** Properties of water and its role in cells, osmosis, absorption of water by roots, Transpiration (mechanisms) and its significance.	**SP/SY/BC**	**(8)**
		Unit 2: Mineral nutrition Concept of Essential elements, macro and micronutrients; Physiological Role of essential elements; Movement of solutes through conducting tissues active and passive transport, carriers, channels and pumps.		**(8)**
		Unit 3: Translocation in phloem. Concept of phloem, composition; Pressure flow model; Phloem loading and unloading, source – sink concept.		**(6)**

		Unit 4: Photosynthesis Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C_3, C_4 and CAM pathways of carbon fixation; Photorespiration.		**(12)**
		Unit 5: Respiration Aerobic and anaerobic respiration, Glycolysis, and TCA cycle; Oxidative phosphorylation, ATP synthesis and its balance sheet. Oxidative Pentose Phosphate Pathway, significance.		**(6)**
		Unit 6: Enzymes Structure and properties; Mechanism of enzyme catalysis, coenzymes, co-factors, effects of temperature and pH.		**(4)**
		Unit 7: Nitrogen metabolism Biological nitrogen fixation; nitrate and ammonia assimilation.		**(4)**
		Unit 8: Plant growth regulators Properties of plant growth regulators and function: auxins, gibberellins, cytokinins, ABA, ethylene.		**(6)**
		Unit 9: Plant response to light and temperature Definition of Photoperiodism, types, (SDP, LDP, Day neutral plants); Phytochrome: structure and function red and far-red light responses on photomorphogenesis; Vernalization.		**(6)**
UG -BOT-G-CC-P-04 (Practical)		1. Determination of osmotic potential of plant cell sap by plasmolytic method. 2. Effect of two environmental factors (light and humidity) on transpiration by excised twig. 3. Determination of stomatal index and stomatal frequency. 4. Effect of bicarbonate concentration on O_2 evolution in photosynthesis. 7. Comparison of the rate of respiration in different plant parts. 8. Separation of amino acids by paper chromatography. **Demonstration experiments** 1. Effect of IAA on rooting. 2. Demonstration of suction due to transpiration. 3. Demonstration of R.Q. in germinating seeds.	**BC**	**60**

UG-BOT-G-SEC-T-02	**B. Mushroom Culture**	**Unit 1:** Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus*. **(5)** **Unit 2:** Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, 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. **(12)** **Unit 3:** Storage and nutrition: Short-term storage (Refrigeration – up to 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins. **(8)** **Unit 4:** Food Preparation: Types of foods prepared from mushroom. Research Centres - National level and regional level. Cost benefit ratio - Marketing in India and abroad, Export Value. **(5)**	**SP/SY/BC**	**30**

6TH SEMESTER HONOURS UNDER CBCS

COURSE CODE	COURSE TITLE	COURSE CONTENT	TEACHER ASSIGNED	No. of Lectures (inclusive of Tutorials)
UG-H-BOT-CC-T-13	Genetics	Unit 1: Mendelian genetics and its extension Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and dominant traits; Polygenic inheritance	**DR**	**10**
		Unit 2: Extrachromosomal inheritance Chloroplast mutation: Variegation in Four o'clock plant (Mirabilis jalapa); Maternal effectsshell coiling in snail; Infective heredity- Kappa particles in Paramecium.	**DR**	**5**
		Unit 3: Linkage, crossing over and chromosome mapping Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Three-point mapping; Interference and coincidence.	**DR**	**5**
		Unit 4: Chromosome and nucleic acids Physical and Chemical structure of chromosome; DNA	**SM**	**6**

		packaging (Kornberg's Nucleosome Model); Structure of Nucleic acids - DNA, RNA; Types of DNA (A, B and Z); DNA replication: Evidence for semi-conservative replication (Messelson and Stahl); Mechanism of bidirectional replication in bacteria.		
		Unit 5: Variation in chromosome number and structure Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy	**SM**	**6**
		Unit 6: Fine structure of gene Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus.	**SM**	**4**
		Unit 7: Gene mutations Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: ClB method. Role of Transposons in mutation. DNA repair mechanisms.	**SM (upto intercatalating agents) Rest RI**	**6**
		Unit 8: Central dogma and genetic code Central Dogma, Genetic code (deciphering and salient features)	**RI**	**2**
		Unit 9: Transcription Transcription in prokaryotes; Principles of transcriptional regulation: Concept of operon; Structure and mode of control of inducible (lactose operon of E. coli) and repressible (tryptophan operon of E. coli) operons. Brief idea about eukaryotic transcription.	**RI**	**9**
		Unit 10: Translation Various steps of protein synthesis in prokaryotes.	**RI**	**4**
		Unit 11. Population genetics Allele frequencies, Genotype frequencies; Hardy-Weinberg Law.	**RI**	**3**
- UG-H-BOT-CC-P-13 **(Practical)**		1. Meiosis through temporary smear preparation	**RI**	**10**
		2. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.	**RI**	**10**
		3. Chromosome mapping using three-point test cross data	**DR**	**10**
		4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).	**SM**	**10**
		5. Blood Typing: ABO groups and Rh factor	**SM**	**10**
		6. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.	**DR**	**10**
		7. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.	**RI**	
UG-H-BOT-CC-T-14 **(Theory)**	Plant Molecular Biology and Biotechnology	Unit 1: Plant tissue culture Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).	**DR**	**16**
		Unit 2: Recombinant DNA technology Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pBR322, Ti plasmid, BAC);	**DR**	**12**

		Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).		
		Unit 3: Gene cloning Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; PCR.	**SM**	**10**
		Unit 4: Methods of gene transfer Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GFP).	**SM**	**8**
		Unit 5: Applications of biotechnology Pest resistant (Bt-cotton); herbicide resistant plants (Roundup Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines.	**RI**	**14**
UG-H-BOT-CC-P-14 (PRACTICAL)		1. Demonstration of preparation of MS medium; in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc	**DR**	**20**
		2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis and artificial seeds through photographs.	**RI**	
		3. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.	**SM**	
		4. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.	**RI**	**10**
		5. Visit to a tissue culture laboratory/ biotechnological park.		
UG-H-BOT-DSE-T-03 (THEORY)	A. Biodiversity and Conservation	Unit 1: Natural resources Definition, types and distribution.	**DR**	**2**
		Unit 2: Sustainable utilization Concept, approaches (economic, ecological and socio-cultural).	**DR**	**8**
		Unit 3: Land Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation, restoration, conservation and management	**SM**	**8**
		Unit 4: Water Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.	**SM**	**8**
		Unit 5: Biological Resources Biodiversity- definition and types; Significance; Threats; Management strategies; Bioprospecting; Intellectual Property Regime (IPR); Convention on Biological Diversity (CBD); National Biodiversity Action Plan.	**SM**	**10**
		Unit 6: Forests Definition, Cover and its significance (with special reference to India); Major and minor forest products; Depletion; Management.	**DR**	**6**
		Unit 7: Energy	**RI**	**6**

		Renewable and non-renewable sources of energy		
		Unit 8: Contemporary practices in resource management Environmental Impact Assessment (EIA), Geographical Information System (GIS), Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint; Resource Accounting; Waste management.	**RI**	**8**
		Unit 9: National and international efforts in resource management and conservation National legislations: The Biological Diversity Act, 2002; Forest Conservation Act, 1980; Case studies relevant to resource management and conservation (eg. World Heritage Sites (Natural)/ Sacred Groves/ Biodiversity Heritage Sites/ Protection of Plant Varieties.	**RI**	**4**
UG-H-BOT-DSE-P-03 (PRACTICAL)		1. Collection of data (qualitative and quantitative) on a local forest/ sacred grove cover (field visit). 2. Collection of data (qualitative and quantitative) on a designated area under Protected Area Network (field visit). 3. Collection of data (qualitative and quantitative) on a specific area exhibiting urban diversity (field visit). 4. Measurement of dominance of woody species by DBH (diameter at breast height) method. 5. Calculation and analysis of ecological footprint.	**RI DR SM**	**60**
UG-H-BOT-DSE-P-04 (PRACTICAL)		Dissertation/ Project	**(SM/RI/DR)**	

6TH SEMESTER PCC UNDER CBCS

COURSE CODE	COURSE TITLE	COURSE CONTENT	TEACHER ASSIGNED	
UG-BOT-G-DSE-T-02	A. Biodiversity and Conservation	Unit 1: Natural resources Definition, types and distribution.	**SY/SP/BC**	**2**
		Unit 2: Sustainable utilization Concept, approaches (economic, ecological and socio-cultural).		**8**
		Unit 3: Land Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation, restoration, conservation and management		**8**
		Unit 4: Water Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.		**8**
		Unit 5: Biological Resources Biodiversity- definition and types; Significance; Threats; Management strategies; Bioprospecting; Intellectual Property Regime (IPR); Convention on Biological Diversity (CBD); National Biodiversity Action Plan.		**12**
		Unit 6: Forests Definition, Cover and its significance (with special reference to India); Major and minor forest products; Depletion; Management.		**6**
		Unit 7: Energy Renewable and non-renewable sources of energy		**6**

		Unit 8: Contemporary practices in resource management Environmental Impact Assessment (EIA), Geographical Information System (GIS), Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint; Resource Accounting; Waste management.		**8**
		Unit 9: National and international efforts in resource management and conservation National legislations: The Biological Diversity Act, 2002; Forest Conservation Act, 1980; Case studies relevant to resource management and conservation (eg. World Heritage Sites (Natural)/ Sacred Groves/ Biodiversity Heritage Sites/ Protection of Plant Varieties.		**4**
UG-BOT-G-DSE-P-02		1. Collection of data (qualitative and quantitative) on a local forest/ sacred grove cover (field visit). 2. Collection of data (qualitative and quantitative) on a designated area under Protected Area Network (field visit). 3. Collection of data (qualitative and quantitative) on a specific area exhibiting urban diversity (field visit). 4. Measurement of dominance of woody species by DBH (diameter at breast height) method. 5. Calculation and analysis of ecological footprint.	**SY**	**60**
UG-BOT-G-SEC-T-04 (Theory)	A. Ethnobotany	Unit 1: Ethnobotany Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or tribals of India, and their life styles. Plants used by the tribals: a) food plants b) intoxicants and beverages c) Resins and oils and d) miscellaneous uses. Unit 2: Methodology of Ethnobotanical studies a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places. Unit 3: Role of ethnobotany in modern medicine Medico-ethnobotanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) Azadirachta indica b) Ocimum sanctum c) Vitex negundo d) Gloriosa superba e) Tribulus terrestris f) Pongamia pinnata g) Cassia auriculata h) Indigofera tinctoria. Role of ethnobotany in modern medicine with special reference to Rauvolfia sepentina, Trichopus zeylanicus, Artemisia spp., Withania somnifera. Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management). Unit 4: Ethnobotany and legal aspects Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge.	**SP/SY/BC**	**30**

DEPARTMENT OF BOTANY, Faculty Members
DR SUCHETANA MUKHERJEE (SM)
DR ROUSHAN ISLAM (RI)
DEBRAJ ROY (DR)
BHASWATI CHATTOPADHYAY (BC)
SHRABANI PAUL (SP)
SABINA YEASMIN (SY**)**

DISTRIBUTION OF COURSES IN SEMESTER-II, IV & VI: January, 2024 – July 2024

Department of Chemistry

B. Sc. (Hons.)

DISTRIBUTION OF COURSES IN SEMESTER-II

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMHT-3 [**4 Credit]** [60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	**Inorganic Chemistry – IB**	1. **Redox Reactions and precipitation reactions :** Qualitative idea about complimentary, noncomplimentary, disproportionation and comproportionation reactions, standard redox potentials with sign conventions, Electrochemical series and its application to explore the feasibility of reactions and equilibrium constants, Nernst equation; effect of pH, complexation and precipitation on redox potentials, formal potential; Basis of redox titration and redox indicators, Redox potential diagrams (Latimer and Frost) of common elements and their applications. Solubility product principle, common ion effect and their applications to the precipitation and separation of common metallic ions as hydroxides, sulphides, carbonates, sulphates and halides. 1. **Acid-Base Concepts and Solvents :** Recapitulation of Arrhenius concept, Bronsted-Lowry concept, Solvent system concept (in H_2O, liq. NH_3, liq. SO_2 and liq. HF), Lux-Flood concept, Lewis concept, Drago-Wayland equation, Solvent levelling and differentiating effects, Relative strength of different acids and bases, Pauling's rules, Hammett acidity function and super acids, HSAB principle and its applications, Acid-base equilibria in aqueous solution, pH, Buffer, Acid-base neutralization curves and choice of indicators. Gas phase acidity.	**(15L)** **(15L)**	KKS MH
	Physical Chemistry – IB	**Chemical Thermodynamics - II** 2. Second Law: Need for a Second law; statement of the second law of thermodynamics; Concept of heat		

		reservoirs and heat engines; Carnot cycle; Physical concept of Entropy; Carnot engine and refrigerator; Kelvin –Planck and Clausius statements and equivalence of the two statements with entropic formulation; Carnot's theorem; Values of §dQ/T and Clausius inequality; Entropy change of systems and surroundings for various processes and transformations; Entropy and unavailable work; Auxiliary state functions (G and A) and their variation with T, P and V. Criteria for spontaneity and equilibrium. Thermodynamic relations: Maxwell's relations; Gibbs-Helmholtz equation, Joule-Thomson experiment and its consequences; inversion temperature; JouleThomson coefficient for a van der Waals gas; General heat capacity relations. 3. **Chemical kinetics:** Rate law, order and molecularity: Introduction of rate law, Extent of reaction; rate constants, order; Forms of rates of First, second and nth order reactions; Pseudo first order reactions (example using acid catalyzed hydrolysis of methyl acetate); Determination of order of a reaction by half -life and differential method; Opposing reactions, consecutive reactions and parallel reactions (with explanation of kinetic and thermodynamic control of products; all steps first order). Role of Temperature and theories of reaction rate: Temperature dependence of rate constant; Arrhenius equation, energy of activation; Rate-determining step and steady-state approximation – explanation with suitable examples; Collision theory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment). Homogeneous catalysis: Homogeneous catalysis with reference to acid-base catalysis; Primary kinetic salt effect; Enzyme catalysis; Michaelis-Menten equation, Lineweaver-Burk plot,	12 L 18 L	AR RG

		turn-over number.		
CHEMHP-3 [2 credits = 20] Practical. Full Marks: 20	**Inorganic Chemistry – IB** & **Physical Chemistry – IB**	I. Estimation of Fe(II) using $K_2Cr_2O_7$ solution II. Estimation of Fe(III) using $K_2Cr_2O_7$ and $KMnO_4$ solution III. Estimation of Ca^{2+} using $KMnO_4$ solution IV. Estimation of Cu^{2+} iodometrically V. v. Estimation of Cr^{3+} using $K_2Cr_2O_7$ solution **&** VI. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate. VII. Study of kinetics of decomposition of H_2O_2.	(10L)	MH+ AKK AR+RG
CHEMHT-4 [**4 Credit]** [60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	**Organic Chemistry – II**	A. **Stereochemistry-II:** 1. **Chirality arising out of stereoaxis:** Stereoisomerism of substituted cumulenes with even and odd number of double bonds; chiral axis in allenes, spiro compounds, alkylidenecycloalkanes and biphenyls; related configurational descriptors (R_a/S_a and P/M); atropisomerism; racemisation of chiral biphenyls; buttressing effect. 2. **Concept of prostereoisomerism:** Prostereogenic centre; concept of pro_n-chirality: topicity of ligands and faces (elementary idea); pro-R/pro-S, pro-E/pro-Z and Re/Si descriptors; pro-r and pros descriptors of ligands on propseudoasymmetric centre. 3. **Conformation:** Conformational nomenclature: eclipsed, staggered, gauche, syn and anti; dihedral angle, torsion angle; Klyne-Prelog terminology; P/M descriptors; energy barrier of rotation, concept of torsional and steric strains; relative stability of conformers on the basis of steric effect, dipole-dipole interaction and H-bonding; butane gauche interaction; conformational analysis of ethane, propane, n-butane, 2- methylbutane and 2,3-dimethylbutane; haloalkane, 1,2-dihaloalkanes and 1,2- diols (up to four carbons); 1,2-halohydrin; conformation of conjugated systems (s-cis and s-trans).	**(14L)** (18L)	RG MM

		B. **General Treatment of Reaction Mechanism II :** 4. **Reaction thermodynamics:** Free energy and equilibrium, enthalpy and entropy factor, calculation of enthalpy change via BDE, intermolecular & intramolecular reactions. 5. **Concept of organic acids and bases:** Effect of structure, substituent and solvent on acidity and basicity; proton sponge; gas-phase acidity and basicity; comparison between nucleophlicity and basicity; HSAB principle; application of thermodynamic principles in acid-base equilibria. 6. **Tautomerism:** Prototropy (keto-enol, nitro - aci-nitro, nitroso-oximino, diazo-amino and enamine-imine systems); valence tautomerism and ring-chain tautomerism; composition of the equilibrium in different systems (simple carbonyl; 1,2- and 1,3-dicarbonyl systems, phenols and related systems), factors affecting keto-enol tautomerism; application of thermodynamic principles in tautomeric equilibria. 7. **Reaction kinetics:** Rate constant and free energy of activation; concept of order and molecularity; free energy profiles for one-step, two-step and three-step reactions; catalyzed reactions: electrophilic and nucleophilic catalysis; kinetic control and thermodynamic control of reactions; isotope effect: primary and secondary kinetic isotopic effect (k_H/k_D); principle of microscopic reversibility; Hammond's postulate. C. **Substitution and Elimination Reactions:** 8. **Free-radical substitution reaction:** Halogentaion of alkanes, mechanism (with evidence) and stereochemical features; reactivity-selectivity principle in the light of Hammond's postulate. 9. **Nucleophilic substitution reactions:**	(28L)	MM

		Substitution at sp^3 centre: mechanisms (with evidence), relative rates & stereochemical features: S_N1, S_N2, S_N2', S_N1' (allylic rearrangement) and S_Ni; effects of solvent, substrate structure, leaving group and nucleophiles (including ambident nucleophiles, cyanide & nitrite); substitutions involving NGP; role of crown ethers and phase transfer catalysts; [systems: alkyl halides, allyl halides, benzyl halides, alcohols, ethers, epoxides]. Concept of aliphatic electrophilic substitution reactions (S_E1, S_E2, S_Ei). 10. **Elimination reactions:** E1, E2, E1cb and E_i (pyrolytic syn eliminations); formation of alkenes and alkynes; mechanisms (with evidence), reactivity, regioselectivity (Saytzeff/ Hofmann) and stereoselectivity; comparison between substitution and elimination; importance of Bredt's rule relating to the formation of C=C.		
CHEMHP-4 [2 credits = 20] Practical. Full Marks: 20	**Organic Chemistry – II**	A. **Organic Preparations:** The following reactions are to be performed, noting the yield of the crude product: 1. Nitration of aromatic compounds 2. Condensation reactions 3. Hydrolysis of amides/imides/esters 4. Acetylation of phenols/aromatic amines 5. Benzoylation of phenols/aromatic amines 6. Side chain oxidation of aromatic compounds 7. Diazo coupling reactions of aromatic amines 8. Bromination of anilides using green approach (Bromate-Bromide method) 9. Redox reaction including solid-phase method 10. Green 'multi-component-coupling' reaction 11. Selective reduction of m-dinitrobenzene to m-nitroaniline 12. Students must also calculate percentage yield, based upon isolated yield (crude) and 13. theoretical yield.	(10L)	**MM+AKK**

		B. Purification of the crude product is to be made by crystallisation from water/alcohol, C. crystallization after charcoal treatment, or sublimation, whichever is applicable. **D.** Melting point of the purified product is to be noted.		

DISTRIBUTION OF COURSES IN SEMESTER-IV

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMHT-8 [**4 Credit]** [60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	**Physical Chemistry – III**	1. **Application of Thermodynamics – II** Colligative properties: Vapour pressure of solution; Ideal solutions, ideally dilute solutions and colligative properties; Raoult's law; Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) Osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution; Abnormal colligative properties. Phase rule: Definitions of phase, component and degrees of freedom; Phase rule and its derivations; Definition of phase diagram; Phase diagram for water, CO_2, Sulphur. First order phase transition and Clapeyron equation; Clausius-Clapeyron equation -26 derivation and use; Liquid vapour equilibrium for two component systems; Phenolwater system. Three component systems, water-chloroform-acetic acid system, triangular plots. Binary solutions: Ideal solution at fixed temperature and pressure; Principle of fractional distillation; Duhem-Margules equation; Henry's law; Konowaloff's rule; Positive and negative deviations from ideal behavior; Azeotropic solution; Liquidliquid phase diagram using phenol-water system; Solid-liquid phase diagram; Eutectic	**20 L** **20 L**	**RG**

		mixture. 2. **Electrical Properties of molecules** Ionic equilibria: Chemical potential of an ion in solution; Activity and activity coefficients of ions in solution; Debye-Huckel limiting law-brief qualitative description of the postulates involved, qualitative idea of the model, the equation (without derivation) for ion-ion atmosphere interaction potential. Estimation of activity coefficient for electrolytes using Debye-Huckel limiting law; Derivation of mean ionic activity coefficient from the expression of ion-atmosphere interaction potential; Applications of the equation and its limitations. Electromotive Force: Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry; Chemical cells, reversible and irreversible cells with examples; Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of halfcells. Application of EMFmeasurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass electrodes. Concentration cells with and without transference, liquid junction potential; Determination of activity coefficients and transference numbers; Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation). Dipole moment and polarizability: Polarizability of atoms and molecules, dielectric constant and polarisation, molar polarisation for polar and non-polar molecules; Clausius-Mosotti equation and Debye equation (both without derivation) and their application; Determination of dipole moments. 3. **Quantum Chemistry**	**20 L**	**AR** **AR**

		4. Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component; Rigid rotator model of rotation of diatomic molecule; Schrödinger equation, transformation to spherical polar coordinates; Separation of variables. Qualitative treatment of hydrogen atom and hydrogen-like ions: Setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression); Average and most probable distances of electron from nucleus; Setting up of Schrödinger equation for many-electron atoms (He, Li). LCAO and HF-SCF: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+; Bonding and antibonding orbitals; Qualitative extension to H_2; Comparison of LCAO-MO and VB treatments of H_2 and their limitations; Hartree-Fock method development, SCF and configuration interaction (**only basics**).		
CHEMHP-8 [2 credits = 20] Practical. Full Marks: 20	**Physical Chemistry – III**	I. Determination of solubility of sparingly soluble salt in water, in electrolyte II. with common ions and in neutral electrolyte (using common indicator). III. Potentiometric titration of Mohr's salt solution against standard K_2Cr_2O-solution. IV. Determination of K_{sp} for AgCl by potentiometric titration of $AgNO_3$solution V. against standard KCl solution. VI. Effect of ionic strength on the rate of Persulphate –Iodide reaction. VII. Study of phenol-water phase diagram. **VIII.** pH-metric titration of acid (mono- and di-basic) against strong base.		**AR**
CHEMHT-9 [**4 Credit]** [60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	**Inorganic Chemistry – III**	1. **Radioactivity and nuclear chemistry :** Atomic nucleus – nuclear stability, n/p ratio and different modes of decay, mass defect, packing fraction and nuclear binding energy. Nuclear forces: Meson exchange theory, elementary idea of nuclear shell model and magic numbers. Fission, fusion	(15L)	

		and spallation reactions, artificial radioactivity, super heavy elements and their IUPAC nomenclature. Moderators, slow and fast neutrons, Applications of radio-isotopes in: determination of structures, establishment of reaction mechanisms and radio-carbon dating, hazards of radiation and safety measures. 2. **Chemistry of s and p-block elements :** Diagonal relationship (Li-Mg; B-Si) and anomalous behaviour of first member of each group, Allotropy and catenation (examples of C, P and S compounds). Study of the following compounds with emphasis on preparation, properties, structure and bonding: Berylium hydrides and halides; diborane; borazine; boron nitride, boric acid, borax, fluorocarbons (with environmental effect); oxides and oxyacids of nitrogen, phosphorous, sulphur and chlorine; Peroxo acids of sulphur; tetrasulphur trtranitride; interhalogens, pseudohalogens, polyhalides, fluorides and oxides of xenon. Noble gas clathrates; basic properties of iodine. Synthesis, structural aspects and applications of silicones and phosphazines; Structural properties of various silicates. 3. **Coordination Chemistry - I :** Idea about double salts and complex salts, Werner's theory, EAN rule, classification of ligands and their binding modes, IUPAC nomenclature of coordination compounds (up to two metal centres), overall and stepwise stability constants, chelates, innermetallic complexes, Stereochemistry and isomerism (constitutional and stereo) of complexes with coordination no. 4 and 6.	(30L) (15L)	MH KKS
CHEMHP-9 [2 credits = 20] Practical. Full Marks: 20	**Inorganic Chemistry – III**	**A. Complexometric Titration :** i. Estimation of Hardness of water ii. Estimation of Ca(II) and Mg(II) in a mixture iii. Estimation of Zn(II) and Mg(II) in a mixture **B. Inorganic Preparation :** i. Mohr's salt ii. Potassium tris(oxalato)chromate(III) trihydrate iii. Tetraamminecarbonatocobalt(III) nitrate	12L	MH

		iv. Potassiumbis(oxalato)cuprate(II) dihydrate v. Tris(ethylenediamine)nickel(II) chlorid		
CHEMHT-10 [**4 Credit]** [60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	**Organic Chemistry – IV**	A. **Nitrogen compounds:** **Amines:** 1. Aliphatic & Aromatic: preparation, separation (Hinsberg's method) and identification of primary, secondary and tertiary amines; reaction (with mechanism): Eschweiler–Clarke methylation, diazo coupling reaction, Mannich reaction; formation and reactions of phenylenediamines, diazomethane and diazoacetic ester. 2. **Nitro compounds (aliphatic and aromatic):** preparation and reaction (with mechanism): reduction under different conditions; Nef carbonyl synthesis, Henry reaction and conjugate addition of nitroalkane anion. 3. **Alkylnitrile and isonitrile:** preparation and reaction (with mechanism): Thorpe nitrile condensation, von Richter reaction. 4. **Diazonium salts and their related compounds:** reactions (with mechanism) involving replacement of diazo group; reactions: Gomberg, Meerwein, Japp-Klingermann. B. **Rearrangements:Mechanism with evidence and stereochemical features for the following:** 1. **Rearrangement to electron-deficient carbon:** Wagner-Meerwein rearrangement, pinacol rearrangement, dienone-phenol; Wolff rearrangement in Arndt-Eistert synthesis, benzil-benzilic acid rearrangement, Demjanov rearrangement, Tiffeneau–Demjanov rearrangement. 2. **Rearrangement to electron-**	(8L) (10L)	MM

		deficient nitrogen: rearrangements: Hofmann, Curtius, Lossen, Schmidt and Beckmann. 3. **Rearrangement to electron-deficient oxygen:** Baeyer-Villiger oxidation, cumene hydroperoxide-phenol rearrangement and Dakin reaction. 4. **Aromatic rearrangements:** Migration from oxygen to ring carbon: Fries rearrangement and Claisen rearrangement. 5. **Migration from nitrogen to ring carbon:** Hofmann-Martius rearrangement, Fischer-Hepp rearrangement, N-azo to C-azo rearrangement, Bamberger rearrangement, Orton rearrangement and benzidine rearrangement. 6. **Rearrangement reactions by green approach:** Fries rearrangement, Claisen rearrangement, Beckmann rearrangement, Baeyer-Villiger oxidation. C. **The Logic of Organic Synthesis:** 1. **Retrosynthetic analysis:** disconnections; synthons, donor and acceptor synthons; natural reactivity and umpolung; latent polarity in bifunctional compounds: consonant and dissonant polarity; illogical electrophiles and nucleophiles; synthetic equivalents; functional group interconversion and addition (FGI and FGA); C-C disconnections and synthesis: one-group and two-group (1,2- to 1,5-dioxygenated compounds), reconnection (1,6- dicarbonyl); protection-deprotection strategy (alcohol, amine, carbonyl, acid). 2. **Strategy of ring synthesis:** thermodynamic and kinetic factors;	(20L)	MM

		synthesis of large rings, application of high dilution technique. 3. **Asymmetric synthesis:** stereoselective and stereospecific reactions; diastereoselectivity and enantioselectivity (only definition); enantioselectivity: kinetically controlled MPV reduction; diastereoselectivity: addition of nucleophiles to C=O adjacent to a stereogenic centre: Felkin-Anh and Zimmermann-Traxler models. D. **Organic Spectroscopy:** 1. **UV Spectroscopy:** introduction; types of electronic transitions, end absorption; transition dipole moment and allowed/forbidden transitions; chromophores and auxochromes; Bathochromic and Hypsochromic shifts; intensity of absorptions (Hyper-/Hypochromic effects); application of Woodward's Rules for calculation of λmax for the following systems: conjugated diene, α,β-unsaturated aldehydes and ketones (alicyclic, homoannular and heteroannular); extended conjugated systems (dienes, aldehydes and ketones); relative positions of λmax considering conjugative effect, steric effect, solvent effect, effect of pH; effective chromophore concentration: keto-enol systems; benzenoid transitions. 2. **IR Spectroscopy:** introduction; modes of molecular vibrations (fundamental and non-fundamental); IR active molecules; application of Hooke's law, force constant; fingerprint region and its significance; effect of deuteration; overtone bands; vibrational coupling in IR; characteristic and diagnostic stretching frequencies of C-H, N-H, O-H, C-O, C-N, C-X, C=C (including skeletal vibrations	(22L)	**AKK**

		of aromatic compounds), C=O, C=N, N=O, C≡C, C≡N; characteristic/diagnostic bending vibrations are included; factors affecting stretching frequencies: effect of conjugation, electronic effects, mass effect, bond multiplicity, ring-size, solvent effect, H-bonding on IR absorptions; application in functional group analysis. 3. **NMR Spectroscopy:** introduction; nuclear spin; NMR active molecules; basic principles of Proton Magnetic Resonance; equivalent and nonequivalent protons; chemical shift and factors influencing it; ring current effect; significance of the terms: up-/downfield, shielded and deshielded protons; spin coupling and coupling constant (1st order spectra); relative intensities of first-order multiplets: Pascal's triangle; chemical and magnetic equivalence in NMR ; elementary idea about non-first-order splitting; anisotropic effects in alkene, alkyne, aldehydes and aromatics; NMR peak area, integration; relative peak positions with coupling patterns of common organic compounds (both aliphatic and benzenoid-aromatic); rapid proton exchange; interpretation of NMR spectra of simple compounds. Applications of IR, UV and NMR spectroscopy for identification of simple organic molecules.		
CHEMHP-10 [2 credits = 20] Practical. Full Marks: 20	**Organic Chemistry – IV**	i. Estimation of glycine by Sörensen's formol method ii. Estimation of glucose by titration using Fehling's solution iii. Estimation of sucrose by titration using Fehling's solution iv. Estimation of vitamin-C (reduced) 31 Prepared by		**MM +AKK**

		UGBOS (Chemistry) v. Estimation of aromatic amine (aniline) by bromination (Bromate Bromide) method vi. Estimation of phenol by bromination (Bromate-Bromide) method vii. Estimation of formaldehyde (Formalin) viii. Estimation of acetic acid in commercial vinegar ix. Estimation of urea (hypobromite method) x. Estimation of saponification value of oil/fat/ester		
CHEMHS – 2A **[2 Credit]**	**Pharmaceutical Chemistry**	1. **Drugs & Pharmaceuticals:** Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam),Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine). 2. **Fermentation:** Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C. 3. **Hands On Practical:** Preparation of Aspirin and its analysis. Preparation of magnesium bisilicate (Antacid).	(16L) (6L) (8L)	**AKK**

DISTRIBUTION OF COURSES IN SEMESTER-VI

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMHT-13 [4 Credit] [60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	**Inorganic Chemistry – V**	**1. Molecular symmetry and Point group :** Symmetry as a universal theme, concept of symmetry elements and operations (with examples); symmetry properties of atomic orbitals (s, p and d); concept of point groups, identification of molecular point groups in some simple molecules and ions; applications of symmetry for polarity and chirality. **2. Bio-inorganic Chemistry :** Essential elements of life, Role of metal ions in living systems- a brief review, Elementary idea about proteins, enzymes and ionophores; Structure of ATP, Na^+ ion pump and transport of Na^+ and K^+ across cell membrane; active site structures and bio-functions of haemoglobin, myoglobin, carboxy peptidase A, carbonic anhydrase B, cytochrome c, ferredoxins and chlorophyll; biological nitrogen fixation; toxic metals (Pb, Cd and Hg) and their effects, Wilson disease, chelation therapy; platinum and gold complexes as drugs (examples only). **3. Organometallic Chemistry and Catalysis :** Definition, Classification of organometallic compounds, hapticity of ligands, nomenclature, 16- electron & 18-electron rule and its applications; preparation and structure of mono- and bi-nuclear carbonyls of 3d series, synergic effect of CO and use of IR data to explain extent of back bonding; General methods of preparation of metal-carbon σ-bonded complexes, Zeise's salt, Metal-carbon multiple bonding; Preparation, structures, properties and reactions of ferrocene; elementary idea about oxidative addition, reductive elimination, insertion reactions; Study of the following catalytic processes: alkene hydrogenation (Wilkinson's catalyst), hydroformylation, Wacker process,	**(10)** **(25)** **(25) L**	**AKK** **MM**

		Synthetic gasoline (Fischer Tropsch reaction) and Olefin polymerization reaction (Ziegler-Natta catalyst)		
Inorganic Chemistry – V [2 credits = 20] Practical. Full Marks: 20	**Inorganic Chemistry – V**	**Qualitative semimicro analysis** Qualitative semimicro analysis of mixtures containing four radicals (excluding oxide and carbonate). Emphasis should be given to the understanding of the chemistry of different reactions and to assign the most probable composition. Basic Radicals: $K+$, NH_4^+, Mg^{2+}, Ca^{2+}, Ba^{2+}, Sr^{2+}, Al^{3+}, Cr^{3+}, Mn2+, Fe3+/ Fe2+, Co2+, Ni^{2+}, Cu^{2+}, Zn^{2+}, Pb^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+} / Sn^{4+}, As3+/As5+, Sb3+/ Sb5+ Acid Radicals: Cl^- , Br^- , I^- , S^{2-} , SO_4^{2-} , $S_2O_3^{2-}$, SCN^- , NO_3^- , NO_2^- , BO_3^{3-} , PO_4^{3-} , AsO_4^{3-} and H_3BO_3 Insoluble Materials: Cr_2O_3(ig), Fe_2O_3(ig), Al_2O_3, SnO_2, $PbSO_4$, $BaSO_4$, $SrSO_4$	12L	MH + AKK
CHEMHT-14 **[4 Credit]** **[60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)**	**Organic Chemistry – V**	1. **Carbocycles and Heterocycles: Polynuclear hydrocarbons and their derivatives:** synthetic methods include Haworth, Bardhan-Sengupta, Bogert-Cook and other useful syntheses (with mechanistic details); fixation of double bonds and Fries rule; reactions (with mechanism) of naphthalene, anthracene, phenanthrene and their derivatives. **Heterocyclic compounds:** 5- and 6-membered rings with one heteroatom; reactivity, orientation and important reactions (with mechanism) of furan, pyrrole, thiophene and pyridine; synthesis (including retrosynthetic approach and mechanistic details): pyrrole: Knorr synthesis, Paal-Knorr synthesis, Hantzsch; furan: Paal-Knorr synthesis, Feist-Benary synthesis and its variation; thiophenes: Paal-Knorr synthesis, Hinsberg synthesis; pyridine: Hantzsch synthesis; benzo-fused 5- and 6-membered rings with one heteroatom: reactivity, orientation and important reactions (with mechanistic details) of indole, quinoline and isoquinoline; synthesis	**(16L)**	MM

		(including retrosynthetic approach and mechanistic details): indole: Fischer, Madelung and Reissert; quinoline: Skraup, Doebner- Miller, Friedlander; isoquinoline: Bischler-Napieralski synthesis. 2. **Cyclic Stereochemistry:** **Alicyclic compounds:** concept of I-strain; conformational analysis: cyclohexane, mono and disubstituted cyclohexane; symmetry properties and optical activity; topomerisation; ring-size and ease of cyclisation; conformation & reactivity in cyclohexane system: consideration of steric and stereoelectronic requirements; elimination (E2, E1), nucleophilic substitution (S_N1, S_N2, S_Ni, NGP), merged substitution-elimination; rearrangements; oxidation of cyclohexanol, esterification, saponification, lactonisation, epoxidation, pyrolytic syn elimination and fragmentation reactions. 3. **Pericyclic reactions:** **Mechanism, stereochemistry, regioselectivity in case of Electrocyclic reactions:** FMO approach involving 4π- and 6π-electrons (thermal and photochemical) and corresponding cycloreversion reactions. **Cycloaddition reactions:** FMO approach, Diels-Alder reaction, photochemical [2+2] cycloadditions. **Sigmatropic reactions:** FMO approach, sigmatropic shifts and their order; [1,3]- and [1,5]-H shifts and [3,3]-shifts with reference to Claisen and Cope rearrangements. 4. **Carbohydrates:** **Monosaccharides:** Aldoses up to 6 carbons; structure of D-glucose & D fructose (configuration & conformation); ring structure of monosaccharides (furanose and pyranose forms): Haworth representations and non-planar conformations;	**(10L)** **(8L)** **(12L)**	**MM**

		anomeric effect (including stereoelectronic explanation); mutarotation; epimerization; reactions (mechanisms in relevant cases): Fischer glycosidation, osazone formation, bromine-water oxidation, HNO_3 oxidation, selective oxidation of terminal $–CH_2OH$ of aldoses, reduction to alditols, Lobry de Bruyn-van Ekenstein rearrangement; stepping–up (Kiliani-Fischer method) and stepping–down (Ruff's & Wohl's methods) of aldoses; end-group-interchange of aldoses; acetonide (isopropylidene) and benzylidene protections; ring-size determination; Fischer's proof of configuration of (+)-glucose. **Disaccharides:** Glycosidic linkages, concept of glycosidic bond formation by glycosyl donor-acceptor; structure of sucrose, inversion of cane sugar. **Polysaccharides:** starch (structure and its use as an indicator in titrimetric analysis). 5. **Biomolecules:** **Amino acids:** synthesis with mechanistic details: Strecker, Gabriel, acetamido malonic ester, azlactone, Bücherer hydantoin synthesis, synthesis involving diketopiperazine; isoelectric point, zwitterions; electrophoresis, reaction (with mechanism): ninhydrin reaction, Dakin West reaction; resolution of racemic amino acids. **Peptides:** peptide linkage and its geometry; syntheses (with mechanistic details) of peptides using N-protection & C-protection, solid-phase (Merrifield) synthesis; peptide sequence: C-terminal and N-terminal unit determination (Edman, Sanger & 'dansyl' methods); partial hydrolysis;	**(14L)**	**MM**

		specific cleavage (enzymatic) of peptides: use of CNBr. **Nucleic acids:** pyrimidine and purine bases (only structure & nomenclature); nucleosides and nucleotides corresponding to DNA and RNA; mechanism for acid catalysed hydrolysis of nucleosides (both pyrimidine and purine types); comparison of alkaline hydrolysis of DNA and RNA; elementary idea of double helical structure of DNA (Watson Crick model); complimentary base–pairing in DNA.		MM
CHEMHP-14 [2 credits = 20] Practical. Full Marks: 20	**Organic Chemistry – V**	1. TLC separation of a mixture containing 2/3 amino acids 2. TLC separation of a mixture of dyes (fluorescein and methylene blue) 3. Column chromatographic separation of leaf pigments from spinach leaves 4. Column chromatographic separation of mixture of dyes 5. Paper chromatographic separation of a mixture containing 2/3 amino acids6. Paper chromatographic separation of a mixture containing 2/3 sugars **Spectroscopic Analysis of Organic Compounds:** 1. Assignment of labelled peaks in the 1H NMR spectra of the known organic compounds explaining the relative δ-values and splitting pattern. 2. Assignment of labelled peaks in the IR spectrum of the same compound explaining the relative frequencies of the absorptions (C-H, O-H, N-H, C-O, C-N, C-X, C=C, C=O, N=O, C≡C, C≡N stretching frequencies; characteristic bending vibrations are included). 3. The students must record full spectral analysis of at least 15 (fifteen) compounds from the following list: a. 4-Bromoacetanilide b. 2-Bromo-4'-methylacetophenone	20L	MM

		c. Vanillin d. 2-Methoxyacetophenone e. 4-Aminobenzoic acid f. Salicylamide g. 2-Hydroxyacetophenone h. 1,3-Dinitrobenzene i. Benzylacetate j. trans-4-Nitrocinnamaldehyde k. Diethyl fumarate l. 4-Nitrobenzaldehyde m. 4-Methylacetanilide n. Mesityl oxide o. 2-Hydroxybenzaldehyde p. 4-Nitroaniline q. 2-Hydroxy-3-nitrobenzaldehyde r. 2,3-Dimethylbenzonitrile s. Pent-1-yn-3-ol t. 3-Nitrobenzaldehyde u. 3-Ethoxy-4-hydroxybenzaldehyde v. 2-Methoxybenzaldehyde w. Methyl 4-hydroxybenzoate x. Methyl 3-hydroxybenzoate y. 3-Aminobenzoic acid z. Ethyl 3-aminobenzoate aa. Ethyl 4-aminobenzoate bb. 3-nitroanisole cc. 5-Methyl-2-nitroanisole d. 3-Methylacetanilide		
CHEMHTDSE-3 **[4 Credit]** **[60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)**	**Advanced Physical Chemistry**	1. **Crystal Structure** Bravais Lattice and Laws of Crystallography: Types of solid, Bragg's law of diffraction; Laws of crystallography (Haüy's law and Steno's law); Permissible symmetry axes in crystals; Lattice, space lattice, unit cell, crystal planes, Bravais lattice. Packing of uniform hard sphere, close packed arrangements (fcc and hcp). Crystal planes: Distance between consecutive planes [cubic, tetragonal and orthorhombic lattices]; Indexing of planes, Miller indices; calculation of dhkl; Relation between molar mass and unit cell dimension for cubic system; Bragg's law (derivation). Determination of crystal structure: Powder method; Structure of NaCl and KCl crystals. **2. Statistical Thermodynamics** Configuration: Macrostates, microstates and configuration; variation of W with E; equilibrium configuration. Boltzmann distribution: Thermodynamic	20 L 18 L	**AR**

		probability, entropy and probability, Boltzmann distribution formula (with derivation); Applications to barometric distribution; Partition function, concept of ensemble -canonical ensemble and grand canonical ensembles. Partition function: molecular partition function and thermodynamic properties. **3. Special selected topics** Specific heat of solid: Coefficient of thermal expansion, thermal compressibility of solids; Dulong –Petit's law; Perfect Crystal model, Einstein's theory – derivation from partition function, limitations. 3rd law: Absolute entropy, Plank's law, Calculation of entropy, Nernst heat theorem. Polymers: Classification of polymers, nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers; Criteria for synthetic polymer formation; Relationships between functionality, extent of reaction and degree of polymerization.	22 L	AR
CHEMHPDSE-3 [2 credits = 20] Practical. Full Marks: 20	**Advanced Physical Chemistry**	**Computer Programming based on numerical methods for:** i. Roots of equations: (e.g. volume of van der Waals gas and comparison with ideal gas, pH of a weak acid). ii. Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations). iii. Numerical integration (e.g. entropy/ enthalpy change from heat capacity data), probability distributions (gas kinetic theory) and mean values. iv. Simple exercises using molecular visualization software.		AR
CHEMHTDSE-4 [4 credits] **Full Marks: 55 (End Sem. 40+Internal Assessment 15)**	**Project Work**	A dissertation has to be prepared on consultation with teachers/mentors on a topic from any area of Chemistry. During examination a thorough viva-voce will be conducted by the examiners/adjudicators. The dissertation will be evaluated on the basis of written documents submitted by the candidate, originality and importance.		
CHEMHPDSE-4 [2 credits] **Full Marks: 20**	**Project Work**	A power point presentation has to be prepared and a short oral presentation will be considered for continuous evaluation. A PDF file/print copy of the power point will be required to be submitted.		

SRIPAT SINGH COLLEGE

ACADEMIC CALENDAR SESSION- August'24 – July'25

Stream: Science

DISTRIBUTION OF COURSES IN SEMESTER-II, IV & VI: August '2024 – July '2025

Department of Chemistry

Semester II

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMGT-2 [4 credits] [120 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	PHYSICAL CHEMISTRY- I	• **Kinetic Theory of Gases and Real gases** a. Concept of pressure and temperature; Collision of gas molecules; Collision diameter; Collision number and mean free path; Frequency of binary collisions (similar and different molecules); Rate of effusion. b. Nature of distribution of velocities, Maxwell's distribution of speed and kinetic energy; Average velocity, root mean square velocity and most probable velocity; Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases. c. Deviation of gases from ideal behavior; compressibility factor; Boyle temperature; Andrew's and Amagat's plots; van der Waals equation and its features; its derivation and application in explaining real gas behaviour; Existence of critical state, Critical constants in terms of van der Waals constants; Law of corresponding states d. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only)	12L	AR
		• **Liquids** Definition of Surface tension, its dimension and principle of its determination using stalagmometer; Viscosity of a liquid and principle of determination of coefficient of viscosity using Ostwald viscometer; Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only)	05L	RG
		• **Solids** Forms of solids, crystal systems, unit cells,		

		Bravais lattice types, Symmetry elements; Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices; Miller indices of different planes and interplanar distance, Bragg's law; Structures of NaCl, KCl and CsCl treatment only); Defects in crystals; Glasses and liquid crystals. • **Chemical Kinetics** a. Introduction of qualitative rate law, order and molecularity; Extent of reaction; rate constants; Rates of First, second and nth order reactions and their Differential and integrated forms (with derivation); Pseudo first order reactions; Determination of order of a reaction by half-life and differential method; Opposing reactions, consecutive reactions and parallel reactions b. Temperature dependence of rate constant; Arrhenius equation, energy of activation; Collision theory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment).	05 L 08 L	RG AR
	Inorganic Chemistry - II	• **Chemical Bonding and Molecular Structure** a. Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and salvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. b. Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples from s and p block elements of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. c. Concept of resonance and resonating structures in various inorganic and organic compounds. d. MO Approach: Rules for the LCAO method,	20 L	MH KKS AKK

		bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (Including idea of s- p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+ Comparison of VB and MO approaches. • **Comparative study of p-block elements** a. Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements: i. B-Al-Ga-In-Tl ii. C-Si-Ge-Sn-Pb iii. N-P-As-Sb-Bi iv. O-S-Se-Te v. F-Cl-Br-I	10L 12L	
CHEM-MAP-1 [2 credits = 20] Practical. Major (Practical)	Physical Chemistry – I	1. Surface tension measurement (use of organic solvents excluded) a. Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer b. Study of the variation of surface tension of a detergent solution with concentration 2. Viscosity measurement (use of organic solvents excluded) a. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer b. Study of the variation of viscosity of an aqueous solution with concentration of solute 3. Study the kinetics of the following reactions a. Initial rate method: Iodide-persulphate reaction b. Integrated rate method: i. Acid hydrolysis of methyl acetate with hydrochloric acid ii. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate		RG+ AR
	Inorganic Chemistry – II	Qualitative semi-micro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions. Acid Radicals: Cl^-, Br^-, I^-, NO_2^-, NO_3^-, S_2^-,		

		SO_4^{2-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+		MH+AKK

Semester IV

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMHGT-4 [4 Credit = 40] + Internal Assessment = 15 Full Marks: 55	Physical Chemistry – III	**1. Solutions** a. Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions; Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions; Distillation of solutions; Lever rule; Azeotropes b. Critical solution temperature; effect of impurity on partial miscibility of liquids; Immiscibility of liquids- Principle of steam distillation; Nernst distribution law and its applications, solvent extraction **2. Phase Equilibria** a. Phases, components and degrees of freedom of a system, criteria of phase equilibrium; Gibbs-Phase Rule and its thermodynamic derivation; Derivation of Clausius – Clapeyron equation and its importance in phase equilibria; Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $FeCl_3$-H_2O and Na-K only) **3. Conductance** a. Conductance, cell constant, specific conductance and molar conductance; Variation of specific and equivalent conductance with dilution for strong and weak electrolytes; Kohlrausch's law of independent migration of ions; Equivalent and molar conductance at infinite dilution and their determination for strong and weak electrolytes; Ostwald's dilution law; Application of conductance measurement	**7L** **7L** **8 L**	RG AR

	Inorganic Chemistry - III	(determination of solubility product and ionic product of water); Conductometric titrations (acid-base) b. Transport Number and principles of Hittorf's and Moving-boundary method **4. Electromotive force** a. Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry; Chemical cells, reversible and irreversible cells with examples; Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential; Electrochemical series; Thermodynamics of a reversible cell, calculation of thermodynamic properties: G, H and S from EMF data b. Concentration cells with and without transference, liquid junction potential; pH determination using hydrogen electrode and quinhydrone; Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation) **1. Transition Elements (3d series)** a. General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu. b. Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only). **2. Coordination Chemistry** a. Werner's coordination theory, Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. b. Drawbacks of VBT. IUPAC system of nomenclature.	**8L** **10L** **10L**	AKK RG MM

		3. Crystal Field Theory (CFT) (10L) a. Postulates of CFT, splitting of d-orbitals in octahedral and tetrahedral fields, Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Factors affecting the magnitude of Δ. Spectrochemical series. Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry. b. Jahn-Teller distortion		MH
CHEGP-4 [2 Credit = 20] (Practical)	Physical Chemistry – III Inorganic Chemistry – III	(Minimum six experiments to complete) 1. Distribution Law (Any one) a. Study of the equilibrium of one of the following reactions by the distribution method: $I_2(aq) + I^-(aq) = I_3^-(aq)$ 2. Conductance a. Determination of dissociation constant of a weak acid (cell constant, equivalent conductance are also determined) b. Perform the following conductometric titrations: (Any one) i. Strong acid vs. strong base ii. Weak acid vs. strong base 3. Potentiometry a. Perform the following potentiometric titrations: i. Weak acid vs. strong base ii. Potassium dichromate vs. Mohr's salt 1. Complexometric estimation of (i) Mg^{2+} or (ii) Zn^{2+} using EDTA. 2. Preparation of any two of the following complexes: a. tetraamminecarbonatocobalt (III) nitrate b. tetraamminecopper(II) sulphate c. potassium trioxalatochromate(III) trihydrate d. potassium bisoxalatocuprate(II) trihydrate		AR+RG MH+MM

Semester VI

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMHT-11 [4 Credit = 40] + Internal Assessment = 15 + CHEMHP-6 [2 credits = 20] Practical. Full Marks: 75	Advanced Organic Chemistry	Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures. **1. Carboxylic Acids and Their Derivatives** Carboxylic acids (aliphatic and aromatic): strength of organic acids: comparative study with emphasis on factors affecting pK values; Preparation: acidic and alkaline hydrolysis of esters (BAC^2 and AAC^2 mechanisms only) and from Grignard reagents; Reactions: Hell - Vohlard - Zelinsky reaction and Claisen condensation; Perkin reaction. b. Carboxylic acid derivatives (aliphatic): (up to 5 carbons). Preparation: acid chlorides, anhydrides, asters and amides from acids; Reactions: Comparative study of nucleophilicity of acyl derivatives; interconversion among acid derivatives. **2. Amines and Diazonium Salts** a. Amines (aliphatic and aromatic): strength of organic bases; Preparation: from alkyl halides, Gabriel's phthalimide synthesis, Hofmann degradation, by reduction of nitro compounds; Reactions: with HNO_2 (distinction of 1°-, 2°- and 3°-amines), Schotten – Baumann reaction , Diazo coupling reaction (with mechanism). b. Diazonium salts: Preparation: from aromatic amines; Reactions: conversion to benzene, phenol, benzoic acid and nitrobenzene. c. Nitro compounds (aromatic): reduction under different conditions (acidic, neutral and alkaline). **3.Amino Acids and Carbohydrates** a. Amino Acids: Preparations (glycine and alanine only): Strecker synthesis, Gabriel's phthalimide	10L 10 L	MM MM

		synthesis; general properties; zwitterion, isoelectric point; ninhydrin reaction. b. Carbohydrates: classification and general properties; glucose and fructose: constitution; osazone formation; oxidation-reduction reactions; epimers of glucose (definition and example) only); cyclic structures of glucose (determination of ring-size excluded); ascending (Kiliani – Fischer method) and descending (Ruff's and Wohl's methods) in monosaccharides (aldoses only); mutarotation.		AKK
	Industrial Chemistry	1. Polymers: (4L) Basic concept, structure and types of plastics, polythene, polystyrene, phenolformaldehydes, PVC; manufacture, physical properties and uses of natural rubber, synthetic rubber, silicone rubber; synthetic fibres, nylon-66, polyester, terylene, rayon; foaming agents, plasticizers and stabilizers. 2. Paints: (3L) Primary constituents; formulation of paints; binders and solvents for paints; oil based paints, latex paints, alkyd resin paint. 3. Varnishes: (2L) Constituents of varnishes; formulation of varnishes. 4. Synthetic dyes: (2L) Synthesis of methyl orange, congo red, malachite green, crystal violet. 5. Drugs and pharmaceuticals: (3L) Concept and necessity of drugs and pharmaceuticals; preparation and uses: aspirin, paracetamol, sulphadiazine, quinine, chloroquine, phenobarbital, metronidazole. 6. Fermentation chemicals: (3L) Production and purification of ethyl alcohol, citric acid, lactic acid, vitamin B12, penicillin. Industrial Chemistry. 7. Fats and oils: (3L) Natural fat, edible and inedible oil of vegetable origin; common fatty acids; glycerides; hydrogenation of		MM AKK

		unsaturated oil, production of vanaspati and margarine. 8. Soaps and detergents: (3L) Production of toilet and washing soaps; enzyme-based detergents, detergent powder; liquid soaps. 9. Pesticides: (3L) Common pesticides: production, applications and residual toxicity of gammaxane, aldrin, parathion, malathion, DDT, paraquat, decamethrin. 10. Food additives: (4L) Food flavour, food colour, food preservatives, artificial sweeteners, acidulants, alkalies, edible emulsifiers and edible foaming agents, sequesterants – uses and abuses of these substances in food beverages		

Faculty members

Dr. Kamal Krishna Sarkar: KKS **(Principal)**
Dr. Amit Kumar Kundu: AKK
Dr. Md. Habib: MH
Dr. Raja Ghosh: RG
Mr. Manirul Mandal: MM
Mr. Abu Raihan: AR

DEPARTMENT OF COMPUTER SCIENCE

6th Semester Syllabus distribution for the academic year 2023-2024

PCC

Teachers' Name	UG-G-DSE-PRO-601B		SEC-P-604
BIPLAB BISWAS	***Project Work/Dissertation***		**SQL Vs. SQL * Plus:** SQL Commands and Data types, Operators and Expressions, Introduction to SQL * Plus. **Other Database Objects** □ View □ Synonyms, Index **Transaction Control Statements** □ Commit, Rollback, Savepoint **[SQL COMMANDS]** 1) SQL* formatting commands 2) To create a table, alter and drop table. 3) To perform select, update, insert and delete operation in a table. 4) To make use of different clauses viz where, group by, having, order by, union and intersection, 5) To study different constraints. **[SQL FUNCTION]** 6) To use oracle function viz aggregate, numeric, conversion, string function. 7) To understand use and working with joins. 8) To make use of transaction control statement viz rollback, commit and save point. 9) To make views of a table. 10) To make indexes of a table.
UTSAB DATTA	***Project Work/Dissertation***		**Managing Tables and Data:** 1. Creating and Altering Tables (Including constraints) 2. Data Manipulation Command like Insert, update, delete 3. SELECT statement with WHERE, GROUP BY and HAVING, ORDER BY, DISTINCT, Special operator like IN, ANY, ALL BETWEEN, EXISTS, LIKE

			4. Join, Built in functions **Introduction to PL/SQL** □ SQL v/s PL/SQL □ PL/SQL Block Structure □ Language construct of PL/SQL (Variables, Basic and Composite Data type, Conditions looping etc.) □ % TYPE and % ROWTYPE □ Using Cursor (Implicit, Explicit) **[PL/SQL]** 11) To understand working with PL/SQL 12) To implement Cursor on a table. 13) To implement trigger on a table

DEPARTMENT OF COMPUTER SCIENCE

4TH Semester Syllabus distribution for the academic year 2023-2024

PCC

Teachers' Name	G-CC-L-401D	G-CC-T-401D	G-SEC-P-402
BIPLAB BISWAS	**Introduction:** System Software, Resource Abstraction, OS strategies. 2L **Types of operating systems -** Multiprogramming, Batch, Time Sharing, Single user and Multiuser, Process Control & Real Time Systems. 2L **Operating System Organization:** Factors in operating system design, basic OS functions, implementation consideration; process modes, methods of requesting system services – system calls and system programs. **Shell introduction and Shell Scripting:** What is shell and various type of shell, Various editors present in linux, Different modes of operation in vi editor, What is shell script, Writing and executing the shell script, Shell variable (user defined and system variables), System calls, Using system	Tutorials will be given based on **UG-G-CC-L-401D.**	**HTML Programming** **1. Unit-I: Introduction (1L)** **2. Unit-II: The Basics (2L)** o The Head, the Body o Colors, Attributes o Lists, ordered and unordered **3. Unit-III: Links (3L)** o Introduction o Relative Links, Absolute Links o Link Attributes o Using the ID Attribute to Link Within a Document **Software Lab Based on HTML:** Q.1 Create an HTML document with the following formatting options: I. Bold II. Italics III. Underline IV. Headings (Using H1 to H6 heading styles)

	calls.		V. Font (Type, Size and Color) VI. Background (Colored background/Image in background) VII. Paragraph VIII. Line Break IX. Horizontal Rule X. Pre tag Q.3 Create an HTML document which implements Internal linking as well as External linking. Q.4 Create a table using HTML which consists of columns for Roll No., Student's name and grade.
UTSAB DATTA	**Process Management** : System view of the process and resources, initiating the OS, process address space, process abstraction, resource abstraction, process hierarchy, Thread model 15L **Scheduling:** Scheduling Mechanisms, Strategy selection, non-pre-emptive and pre-emptive strategies. 12L **Memory Management:** Mapping address space to memory space, memory allocation strategies, fixed partition, variable partition, paging, virtual memory **Shell introduction and Shell Scripting:** Pipes and Filters, Decision making in Shell Scripts (If else, switch), Loops in shell, Functions, Utility programs (cut, paste, join, tr , uniq utilities), Pattern matching utility (grep)	Tutorials will be given based on **UG-G-CC-L-401D.**	**HTML Programming** **4.Unit-IV: Images (2L)** o Putting an Image on a Page o Using Images as Links o Putting an Image in the Background **5. Unit V: – Tables (4L)** o Creating a Table o Table Headers o Captions o Spanning Multiple Columns o Styling Table **6. Unit VI – Forms (3L)** o Basic Input and Attributes o Other Kinds of Inputs o Styling forms with CSS o Where To Go From Here **Software Lab Based on HTML:** Q.2 Create an HTML document which consists of: I. Ordered List II. Unordered List III. Nested List IV. Image Q.5 Create a Table Q.6 Create a form using HTML which has the following types of controls: I. Text Box II. Option/radio buttons

			III. Check boxes IV. Reset and Submit buttons

DEPARTMENT OF COMPUTER SCIENCE

2ND Semester Syllabus distribution for the academic year 2023-2024

MAJOR

Teachers' Name	**CS-MJ-T-2**	**CS-MJ-P-2**	**CS-SEC-P-2**
BIPLAB BISWAS	**Combinational Circuits** Realization of AND and OR Gates using diodes and NOT Gate using transistors, Standard Gate Assemblies, IC chips packaging nomenclature, Half and Full Adder(3 bits), Multi-bit adders – Ripple carry and Carry Look Ahead Adder, Adder/subtractor, BCD-Adder, Data selectors/multiplexers – expansions, reductions, function realization, universal function realization, multi-function realization, Decoders/Demultiplexers : function realization, De-multiplexer and function realization, Encoder, Priority Encoder, Parity bit Generator/checker, Gray Code Generator, Code Converters, I/O features of BCD to 7- segment LED decoder/driver(7447/7448), Seven segment display unit, Comparators. **Data Converter** NAND gate circuits and its operations, Fan in & Fan out, Noise margin, SSI, MSI, LSI, and VLSI classifications.	**Combinational Circuits** 1. Implement Half Adder/Half Subtractor / Full Adder / Full Subtractor using Logic Gates. Realize a logic function using basic/universal gates in SOP and POS form. Study the functionalities of 7483 and design a BCD adder using 7483 or equivalent. 2. Design a 4 bit 2's complement adder – subtractor unit using 7483 or equivalent and XOR gates. 3. Design a circuit to convert BCD numbers to corresponding gray codes. 4. Design a 4:1 MUX using NAND gates. Study of 74153 and 74151. Design Full Adder / Subtractor using MUX. 5. Design a 2:4 decoder using NAND gates. Study of 74155 and 74138. Design Full Adder / Subtractor using decoders. 6. Design a parity generator/checker using basic gates. 7. Design magnitude comparator using basic/universal gates. Study of 7485. 8. Design a seven-segment display unit.	**Hypertext Markup Language (HTML)** The Basics: The Head, the Body, Colors, Attributes, Lists (ordered and unordered). • Links: Introduction, Relative Links, Absolute Links, Link Attributes, Using the ID Attribute to Link Within a document • Images: Putting an Image on a Page, Using Images as Links, Putting an Image in the Background. • Table: Creating a Table, Table Headers, Captions, Spanning Multiple columns, Styling Table • Form: Basic Input and Attributes, Other Kinds of Inputs, **Document Object Model (DOM)** • DOM Tree • Accessing DOM elements by ID , Class and Tag
UTSAB DATTA	***Sequential Circuits*** *Model of Sequential computing, Difference between Combinational and Sequential circuit, RS-Latch: using NAND and NOR Gates, RS*	**Sequential Circuits** 1) Realize S-R, D, J-K and T flip-flop using basic gates. (Study the undefined state in S-R flip-flop). 2) Study the functional characteristic of IC 74194 with	**Cascading Style Sheets (CSS):** • Introduction • CSS Basics • Anatomy of a CSS ruleset • Different types of selectors • Fonts and text **JavaScript Fundamentals**

	Latch as a Static RAM Cell, Problems of Basic Latch circuits, Digital Clock – Duty Cycle, Rising time, Falling time, Clocked Flip Flops - SR, JK, D, T, Level Trigger and Edge Trigger, Excitation Functions of each flip-flops, Flip-flops with Preset and Clear, Application of Flip-flops: Asynchronous Counter (UP/DOWN) up to 4 bit counter, Mod – n Counter, Synchronous Counters – different mod counters, Ring counter, Registers: Registers with serial and parallel load, Shift Registers. **Data Converter** D/A Conversion principle using basic circuit, R-2R Ladder circuit, Counter based A/D converter, Successive approximation method for A/D conversion. DTL and TTL	emphasis on timing diagram. 3) Design Asynchronous and Synchronous counters. (Mod-8, Mod-10 up counter). 4) Study the functional characteristics of RAM IC chip. Study of open collector and tri-state output. Horizontal expansion of RAM chips by cascading. (Use 74189, 7489, or any available chip).	• Data types and variables, • Functions, methods and events, • Controlling program flow, • JavaScript object model, built-in objects • Operators

DEPARTMENT OF COMPUTER SCIENCE

2ND Semester Syllabus distribution for the academic year 2023-2024

MINOR

Teachers' Name	**CS-MI-T-2**	**CS-MI-P-2**
BIPLAB BISWAS	**Number Systems:-** Super, Mainframe, Mini and Personal Computer. Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language. Problem Solving: Flow Charts, Decision. Tables and Pseudo codes. **Boolean Algebra:-** Fundamentals of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR. Switching function and Boolean function. De Morgan's theorem, Minterm and Maxterm, Truth table and minimization of switching function up to four variables, Algebraic and K-map method of logic circuit synthesis: Two level and Multi level.	***C Programming elements:*** *Character sets, Keywords, Constants, Variables, Data Types, Operators- Arithmetic, Relational, Logical and Assignment; Increment and Decrement and Conditional, Operator Precedence and Associations; Expressions, type casting. Comments, Functions, Storage Classes, Bit manipulation, Input and output.* ***C Preprocessor:*** *File inclusion, Macro substitution.*

	C Language preliminaries:- C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants. ***Operators and expressions:*** *Arithmetic, unary, logical, bit-wise, assignment and conditional operators* ***Storage types:*** Automatic, external, register and static variables. ***Arrays:*** *Defining and processing, Passing arrays to a function, Multi dimensional arrays.* ***Strings:*** Defining and operations on strings. ***Structures:*** Defining and processing, Passing to a function, Unions, typedef, array of structure, and pointer to structure	**Statements**: Assignment, Control statements- if, ifelse, switch, break, continue, goto, Loops-while, do-while, for. **User defined Data types**: Enumerated data types, Structures. Structure arrays, Pointers to Functions and Structures, Unions.
UTSAB DATTA	**Introduction to Computer and Problem Solving** Information and Data. Hardware: CPU, Primary and Secondary storage, I/O devices Software: Systems and Application. **Number Systems and Codes:-** **Number representation**: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notions. Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Parity Bits. Single Error-Detecting and Correcting Codes, Hamming Codes, Fixed and Floating Point Arithmetic: Addition, Subtraction, Multiplication and Division. **C Language preliminaries:-** ***Input-Output:*** *getchar, putchar, scanf, printf, gets, puts, functions.* **Pre-processor commands**: #include, #define, #ifdef ***Functions:*** Defining and accessing, passing arguments, Function prototypes, Recursion, Library functions, Static functions	***Functions:*** *Argument passing, return statement, return values and their types, recursion* ***Arrays:*** *String handling with arrays, String handling functions.* **Pointers**: Definition and initialization, Pointer arithmetic, Pointers and arrays, String functions and manipulation, Dynamic storage allocation. **File Access**: Opening, Closing, I/O operations.

	Pointers: Declarations, Passing pointers to a function, Operations on pointers, Pointer Arithmetic, Pointers and arrays, Arrays of pointers function pointers. ***File structures:*** *Definitions, concept of record, file operations: Storing, creating, retrieving, updating Sequential, relative, indexed and random access mode, Files with binary mode(Low level), performance of Sequential Files, Direct mapping techniques: Absolute, relative and indexed sequential files (ISAM) concept of index, levels of index, overflow of handling.* **File Handling**: File operation: creation, copy, delete, update, text file, binary file.	

Faculty Members

1. **Sri Biplab Biswas**
2. **Sri Utsab Datta**

DEPARTMENT OF ECONOMICS

DISTRIBUTION OF COURSES IN SEMESTER- II, January 2024-June 2024 (SESSION 2023-2024)

CBCS

CORE COURSE, SEC AND GE AND PCC

COURSE	COURSE TITLE	TOPIC	NO OF LECTURES	TEACHERS
ECON-H-CC-T-03	**Introductory Macroeconomics**	1. **National Income Accounting, unemployment and open economy issues** 2. ***Income Determination in the short-run*** 3 **Money and Inflation**	02 02 03	AKC AKC AKC
ECON-H-CC-T-4	**Mathematical Methods for Economics – II**	1. **Matrix Algebra** 2. **Functions of Several Variables** 3. **Multi-variable optimization** ***Differential Equations***	02 02 05 04	SKD SKD SKD
G-CC-T-01	Principles of Microeconomics - I	**1. Introduction** **2. Consumer Theory** **3. Production and Costs** **4. Perfect Competition**	02 03 04 03	AKC AKC AKC AKC
ECON—G-CC-T-04	Principles of Macroeconomics - 1	1. Introduction 2. National Income Accounting 3. Determination of GDP 4. National Income Determination in an Open Economy with Government 5. Money in a Modern Economy	02 02 02 05 03	SKD SKD SKD AKC AKC

DEPARTMENT OF ECONOMICS

DISTRIBUTION OF COURSES IN **SEMESTER- IV**, January 2024-June 2024

CBCS

CORE COURSE, DSE AND PCC

COURSE	COURSE TITLE	TOPIC	NO OF LECTURES	TEACHERS
ECON-H-CC-T-8	**Intermediate Microeconomics – II**	***1.General Equilibrium, Efficiency, and Welfare*** ***2. Market Structure Input Market under Imperfect Competition***	04 04	AKC AKC
ECON-H-CC-T-9	***Intermediate Macroeconomics – II***	1.Schools of Macroeconomic Thoughts 2. Macroeconomic Foundations 3. Monetary Policy 4. Economic Growth	02 02 02 03	SKD SKD SKD SKD
ECON-H-CC-T-10	***Introductory Econometrics***	1. Nature and Scope of Econometrics 2. Statistical Concepts 3 Classical Linear Regression Model: Two Variable Case	02 02 10	AKC AKC AKC
ECON-H-GE-T-4A	***Intermediate Microeconomics – II***	1. General Equilibrium, Efficiency, and Welfare 2. Market Structure 3. Input Market under Imperfect Competition	02 02 03	AKC SKD AKC

ECON-H-GE-T-9	Intermediate Macroeconomics – II	1. Schools of Macroeconomic Thoughts 2 Macroeconomic Foundations 4 Monetary Policy 5. Economic Growth	02 02 02 02	SKD SKD AKC AKC
ECON-H-SEC-T-2	Computer Application for Data Analysis	MS Excel programme	04	SKD, AKC

DISTRIBUTION OF COURSES IN **SEMESTER- VI**, January 2024-June 2024

CBCS

CORE COURSE, SEC AND GE AND PCC

COURSE	COURSE TITLE	TOPIC	NO OF LECTURES	TEACHERS
ECON-H-CC-T-13	Indian Economy	1. Economic Development since Independence 2. Population and Human Development 3. Growth and Distribution 4. Economic Reforms in India	02 02 02 02	AKC AKC AKC
ECON-H-CC-T-14	Development Economics	*1.* Meaning of Economic Development *2.* Stages of Development and Structural Change *3.* Population and Economic Development *4.* Development Strategies *5.* Role of capital and Labour in Economic Development *6.* Poverty and Inequality	02 02 02 01 01 01	SKD SKD SKD AKC AKC AKC

ECON-H-DSE-T-3A	Economic Development and Policy in India - II	1. Agriculture: Policies and Performance 2. Industry: Policies and Performance 3. Foreign Trade: Trends and Policies	02 02 02	AKC AKC AKC
ECON-H-DSE-T-4A	Dissertation	Issues pertaining to Indian economy and/or Global Economy in the present context or in the historical context.	04	SKD AKC
ECON—G-DSE-T-3A	Economic Development and Policy in India - II	1. Agriculture: Policies and Performance 2. Industry: Policies and Performance 3. Foreign Trade: Trends and Policies	02 02 02	AKC SKD AKC
ECON—G-GE-T-2	Introductory Macroeconomics	1. National Income Accounting, unemployment and open economy issues 2. Money and Inflation	02 02	AKC SKD
ECON—G-SEC-T-04	1. Introduction to Indian Public Finance	1. Concepts: 2. Understanding Union Budget	01 02	SKD AKC

Faculty Members

1. Sri Sujan Kumar Das (SKD)
2. Sri Arunava Kumar Chudhury (AKC)

Department of Environmental Science

Distribution of Courses in Semester -II: January, 2024-July, 2024

Core Course (CC)

Course	Course title	Topic	No. of Lectures	Teachers
CORE COURSE 03 (Code: UG-ENVS-H-CC-03) **FULL MARKS: 75** **Semester End Exam-40** **Practical-20** **Internal Assessment-10 (test exam)+5(attendance)=15**	**Water & Water Resources**	**Unit 1: Introduction** **Unit 2: Properties of water** **Unit 3: Surface & Sub surface water** **Unit 4: Wetlands & their management** **Unit 5: Marine Resource management** **Unit 6 : Water resource in India** **Unit7: Water resource conflicts** **Unit 8 : Major laws & treaties** **UG-ENVS-H-CC-P -03(PRACTICAL)**	10 10 10 10 10 10 08 08 06	AK RP AK AK RP AK RP RP AK & RP
CORE COURSE 04: (Code: UG-ENVS-H-CC-04) **FULL MARKS: 75** **Semester End Exam-40** **Practical-20** **Internal Assessment-10 (test exam)+5(attendance)=15**	**Land & Soil Conservation & Management**	**Unit 1: Introduction** **Unit 2: Fundamentals of soil science** **Unit 3: Soil degradation- causes** **Unit 4: Landuse changes & Land degradation** **Unit 5: Costs of land degradation** **Unit 6: Controlling land degaradation** **UG-ENVS-H-CC-P -04(Practical)**	10 10 10 10 10 10 10	AK AK RP AK RP AK AK & RP

Department of Environmental Science

Distribution of Courses in Semester -II: January, 2024-July, 2024

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC-2)

All Science & Arts Group Core Course (CC) students

Course	Course title	Topic	No. of Lectures	Teachers
ABILITY ENHANCEMENT COMPULSORY COURSE (Code: UG-ENVS-H-AECC-02) **FULL MARKS: 50,**	**ENVIRONMENTAL STUDIES**	**Unit 1: Introduction to environmental studies** **Unit 2: Ecosystems** **Unit 3: Natural Resources: Renewable and**	04 04 04	AK UG RP

Semester End Exam-40 **Internal Assessment-05(Assignment)+05(attendance)=10**		**Non-renewable Resources** **Unit 4: Biodiversity and Conservation** **Unit 5: Environmental Pollution** **Unit 6: Environmental Policies & Practices** **Unit 7: Human Communities and the Environment** **Unit 8 Field work (Assignment)**	04 04 04 04 02	AK RP RP AK AK&RP&UG

Department of Environmental Science

Distribution of Courses in Semester -IV: January, 2024-July, 2024

Core Course (CC) & SEC (Skilled Enhancement Course)

Course	Course title	Topic	No. of Lectures	Teachers
CORE COURSE 08(Code: UG-ENVS-H-CC-08) **FULL MARKS: 75** **Semester End Exam-40** **Practical-20** **Internal Assessment-10 (test exam)+5(attendance)=15**	**Bio Systemics & Biogeography**	**Unit 1: Biosystemics-Concept & approaches** **Unit 2: Taxonomic Hierarchy** **Unit 3: Nomenclature & systems of classification** **Unit 4: Numerical & molecular systemics** **Unit 5: Biogeography-An Overview** **Unit 6: Conservation Biogeography** **UG-ENVS-H-CC-P-08 (Practical)**	08 09 08 09 09 08 08	AK RP AK AK RP RP AK & RP
CORE COURSE 09 (Code: UG-ENVS-H-CC-09) **FULL MARKS: 75** **Semester End Exam-40** **Practical-20** **Internal Assessment-10 (test exam)+5(attendance)=15**	**Natural Resource management & Sustainability**	**Unit 1: Introduction** **Unit 2: Natural resources & conservation** **Unit 3: Energy resources – Non renewable & Renewable** **Unit 4: Resource management** **UG-ENVS-H-CC-P -09 (Practical)**	09 08 08 09 08	RP AK RP AK AK & RP

Course	Course title	Topic	No. of Lectures	Teachers
CORE COURSE 10 (Code: UG-ENVS-H-CC-10) **FULL MARKS: 75** **Semester End Exam-40** **Practical-20** **Internal Assessment-10 (test exam)+5(attendance)=15**	**Environmental Pollution & human health**	**Unit 1: Introduction** **Unit 2: Air Pollution** **Unit 3: Water Pollution** **Unit 4: Soil Pollution** **Unit 5: Noise Pollution** **Unit 6: Radioactive & Thermal pollution** **Unit 7: Marine pollution** **Unit 8: Chemistry of environmental pollutants** **Unit 9:Pollution Control** **UG-ENVS-H-CC-P -10 (Practical)**	10 10 10 10 10 10 10 10 10 07	AK RP AK AK RP AK RP RP RP AK & RP
SKILL ENHANCEMENT COURSE 01 (Code: UG-ENVS-H- SEC-02a) **FULL MARKS: 50** **Semester End Exam-40** **Internal Assessment-05 (test exam)+05(attendance)=10**	**Environmental Impact & Risk Assessment**	**Unit 1:** Environmental Impact assessment (Introduction & concept) **Unit 2:** Rapid EIA **Unit 3:** EIA regulation in India ***Unit 4:*** *Life Cycle Assessment(LCA)* ***Unit 5: Risk Assessment*** ***Unit-6: Demonstrative Exercise***	06 06 06 06 06 04	AK RP AK RP AK RP

Department of Environmental Science

Distribution of Courses in Semester -VI: January, 2024-July, 2024

Core Course (CC)

Course	Course title	Topic	No. of Lectures	Teachers
CORE COURSE 13 (Code: UG-ENVS-H-CC-13) **FULL MARKS: 75** **Semester End Exam-40** **Practical-20** **Internal Assessment-10 (test exam)+5(attendance)=15**	**Environmental legislation & Policy**	**Unit 1: Introduction** **Unit 2: History of environmental legislation & policy** **Unit 3: Environmental legislation** **Unit 4: Legislative instruments** **Unit-5: Government institutions** **Unit 6: Case studies** **Unit 7: International laws & policy** **UG-ENVS-H-CC-P - 13 (Practical)**	12 12 12 12 12 12 12 08	AK RP AK AK RP RP AK AK
CORECOURSE 14 (Code: UG-ENVS-H-CC-14) **FULL MARKS: 75** **Semester End Exam-40** **Practical-20** **Internal Assessment-10 (test exam)+5(attendance)=15**	**Urban Ecosystem**	**Unit 1: Introduction** **Unit 2: Environment in an urban setting** **Unit 3: Urban dwelling** **Unit 4: Urban interface with the environment** **Unit 5: Natural spaces in a city** **Unit 6: planning & environmental management** **UG-ENVS-H-CC-P - 14 (Practical)**	09 11 10 10 11 09 06	AK AK RP RP AK RP RP

Department of Environmental Science

Distribution of Courses in Semester -VI: January, 2024-July, 2024

DSE (Discipline Specific Elective)

Course	Course title	Topic	No. of Lectures	Teachers

DISCIPLINE SPECIFIC ELECTIVE 03a (Code: UG-ENVS-H-DSE -03a) **FULL MARKS: 75** **Semester End Exam-40** **Practical-20** **Internal Assessment-10 (test exam)+5(attendance)=15**	**Natural Hazards & Disaster management**	**Unit 1: Introduction** **Unit 2: Natural Hazards** **Unit 3: Anthropogenic Hazards** **Unit 4: Risk & vulnerability assessment** **Unit 5: Mitigation & Prepardness** **Unit 6: disaater management in India** **UG-ENVS-H-DSE-P -03a (Practical)**	08 08 08 09 09 09 08	RP RP AK AK AK RP AK
DISCIPLINE SPECIFIC ELECTIVE 04 (Code: UG-ENVS-H-DSE- 04) **FULL MARKS: 75** **Semester End Exam-40** **Practical-20** **Internal Assessment-10 (test exam)+5(attendance)=15**	**DISSERTATION**	**A dissertation has to be prepared on consultation with teachers/mentors on a topic from any area of Environmental Science. During examination a thorough viva-voce will be conducted by the examiners / adjudicators. The dissertation will be evaluated on the basis of written documents submitted by the candidate, originality and importance.** *A power point presentation has to be prepared and a short oral presentation will be considered for continuous evaluation. A PDF file/print copy of the power point will be required to be submitted.*	**Two months to Three months** **15 DAYS TO 20 DAYS**	**AK** **RP**

FACULTY MEMBERS

1. Sri Amitava Kar (HOD)
2. Sri Rakesh Pal
3. Sri Uttam Ghosh

DEPARTMENT OF MATHEMATICS

DISTRIBUTION OF COURSES IN SEMESTER-II: January 2024 - July 2024

Mathematics Major

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course Code: MATH-M-T-02 **Major Course; Credit-6; Full Marks-75**	**Course Title: Algebra-I**	***Unit 1.*** ● *Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications. Direct and inverse circular form of trigonometric and hyperbolic functions. Exponential & Logarithm of a complex number. Definition of az* ● *Relation between roots and coefficients, transformation of equation, Descartes rule of signs, solution of cubic equation (Cardan's method), solution of biquadratic equation (Ferrari's method).* ● *Well-ordering property of positive integers, division algorithm, divisibility and Euclidean algorithm. Congruence relation between integers. Principles of mathematical induction, statement of fundamental theorem of Arithmetic* ***Unit 2.*** ● *Equivalence relations and partitions. Functions, composition of functions, Invertible functions, one to one correspondence and cardinality of a set.* ● *Permutations, cycle notation for permutations, even and odd permutations.* ● *Definition and elementary properties of groups. Symmetries of a square, dihedral groups. Quaternion groups (through matrices). Permutation group, alternating group, finite groups: $S3$, $V4$. The group Zn of integers under addition modulo n and the group Un of units under multiplication modulo n.* ● *Order of an element, order of a group, simple properties.* ● *Subgroups and examples of subgroups. Product of two subgroups.* ● *Classification of subgroups of cyclic groups.* ***Unit 3.*** ● *Rank of a matrix, inverse of a matrix,*	**30L** **25L** **20L**	PM UA SKB

		characterizations of invertible matrices. Row reduced and echelon forms, Normal form and congruence operations. ● *Solutions of systems of linear equations of the form $Ax = b$ and their applications.*		
Course Code: MATH-SEC-T-02 **Skill Enhancement Course; Credit-3; Full Marks-45**	***Course Title:*** *Fuzzy Set Theory*	***Unit 1.*** ● *Fuzzy Sets: Basic concepts, α-cuts and its properties* ● *Representations of fuzzy sets, decomposition theorems.* ● *Support, convexity, normality, cardinality of fuzzy sets.* ● *Standard set-theoretic operations on fuzzy sets.* ● *Zadeh's extension principle.* ***Unit 2.*** ● *Interval numbers, arithmetic operations on interval numbers,* ● *Fuzzy numbers.* ● *Arithmetic operations on fuzzy numbers (multiplication and division on $\mathbb{R}$+ only).* ● *Fuzzy equations.* ***Unit-3*** ● *Crisp versus fuzzy relations.* ● *Fuzzy matrices and fuzzy graphs.* ● *Composition of fuzzy relations, relational joins.* ● *Binary fuzzy relations.*	**20L** **15L** **10L**	ARM ARM ARM

Semester-II

Mathematics Minor

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
MATH-MI-T-01 **Minor Course; Credit-4; Full Marks-50**	***Algebra & Analytical Geometry***	***Unit 1.*** ● *Complex Numbers: De Moivre's theorem and its applications. Exponential, Sine, Cosine and Logarithm of a complex number. Definition of a^z. Inverse circular and hyperbolic functions.* ● *Polynomials: Fundamental theorem of algebra (Statement only). Polynomials with real coefficients, nature of roots of an equation (surd or complex roots occur in pairs). Statement of Descartes's rule of signs and its applications. Relation between roots and coefficients, transformations of equations. Cardan's method of*	**20L**	**SKB** **ARM**

		solution of a cubic equation. ● *Rank of a matrix: Determination of rank either by considering minors or by the sweep-out process. Consistency and solution of a system of linear equations (not more than 3 variables) by matrix method.* ● *Equivalence relations and partitions. Functions, composition of functions, invertible functions, one-to-one correspondence and cardinality of a set* ● *Definition and elementary properties of groups. Concepts of permutation Group, alternating group, finite groups: S_3, V_4. The group Z_n of integers under addition modulo n.* ● *Order of an element, order of a group, subgroups and examples of subgroups.* ***Unit 2.*** ● *Transformations of rectangular axes: Translation, rotation and their combinations. Invariants.* ● *General equation of second degree in x and y: Reduction to canonical forms. Classification of conics.* ● *Pair of straight lines: Condition that the general equation of 2_{nd} degree in x and y may represent two straight lines. Point of intersection of two intersecting straight lines. Angle between two lines given by $ax^2+2hxy+by^2=0$. Equation of bisectors. Equation of two lines joining the origin to the points in which a line meets a conic.* ● *Polar equation of straight lines and circles. Polar equation of a conic refers to a focus as a pole. Equation of chord joining two points. Equations of tangents and normals.* ● *Sphere and its tangent planes. Right circular cone.*	**30L**	**PM**

DEPARTMENT OF MATHEMATICS

DISTRIBUTION OF COURSES IN SEMESTER-IV: January 2024 - June 2024

Mathematics Honours

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course: MATH-H-CC-T-08 Core	**Course title: Ring Theory & Linear**	**Unit 1:** • Definition and examples of rings. Properties of rings. • Subrings. • Integral domains and fields. Characteristics of a	**20L**	**ARM**

Course; Credit-6; Full Marks-75	**Algebra**	ring. • Ideal, ideal generated by a subset of a ring. • Factor rings. • Operations on ideals. • Prime and maximal ideals. **Unit-2:** • Ring homomorphisms, properties of ring homomorphisms. • Isomorphism theorems I, II and III. • Field of quotients. **Unit-3:** • Concept of Vector space over a field: Examples, concepts of Linear combinations, linear dependence andindependence of a finite number of vectors. • Sub- space, concepts of generators and basis of a finite dimensional vector space. • Replacement theorem. Extension theorem. Deletion theorem and their applications. • Row space, column space. • Euclidean Spaces. Orthogonal and orthonormal vectors. Gram-Schmidt process of orthogonalization. **Unit 4.** • Linear transformations. Null space. Range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. • Eigenvalues, eigen vectors and characteristic equation of a matrix. Matric polynomials, Cayley-Hamiltontheorem and its use in finding the inverse of a matrix. • Diagonalization, Canonical forms.	**20L** **20L** **15L**	**ARM** **ARM** **SKB**
Course: MATH-H-CC-T-09 Core Course; Credit-6; Full Marks-75	**Course title: Multivariate Calculus & Tensor Analysis**	**Unit-I** • Functions of several variables, limit and continuity of functions of two or more variables. • Differentiability and total differentiability. Partial differentiation. • Sufficient condition for differentiability. Schwarz Theorems, Young's Theorems. • Chain rule for one and two independent parameters. • Homogeneous function and Euler's theorem on homogeneous functions and its converse. • Jacobians and functional dependence. • Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems.	**20L**	**SKB**

		Unit 2 • Double integration over a rectangular region. Double integration over non-rectangular regions. Doubleintegrals in polar coordinates. • Triple integrals. Triple integral over parallelepiped and solid regions. Volume by triple integrals, cylindricaland spherical • Change of variables in double integrals and triple integrals. **Unit 3.** • Directional derivatives. The gradient, maximal and normal property of the gradient. • Line integrals, applications of line integrals: Mass and work. Fundamental theorem for line integrals,conservative vector fields, independence of path. • Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The divergence theorem. Applications of Green's, Stoke's and divergence theorems. **Unit-4** • A tensor as a generalized concept of a vector in E^2 and its generalization in E^n. Space of n–dimension.Transformation of coordinates. Summation convention. • Definition of scalar or invariant. Contravariant, covariant vectors and tensors, mixed tensors of arbitraryorder. Kronecker delta. • Equality of tensors, addition, subtraction of two tensors. • Outer product of tensors, contraction and inner product of tensors. • Symmetric and skew symmetric tensors. • Quotient law, reciprocal tensor of a tensor. • Metric tensor, Christoffel symbol, covariant derivative.	**15L** **15L** **25L**	**PM** **PM** **PM**
Course: MATH-H-CC-T-	**Course title: Linear**	**Unit 1** • Introduction to linear programming problems. Mathematical formulation of LPP. Graphical solution.	**10L**	**UA**

10 Core Course; Credit-6; Full Marks-75	**Programming Problems & Game Theory**	• Convex sets. Basic solutions (B.S.) and non-basic solutions. Reduction of B.F.S from B.S. **Unit 2** • Theory of simplex method. Optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison. • Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual. **Unit 3.** • Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of initial basic solution. Algorithms for solving transportationproblems. • Assignment problem and its mathematical formulation, Hungarian method for solving assignment problems. • Travelling Salesman Problems. **Unit 4.** • Game theory: Formulation of two-person zero sum games. • Solving two persons zero sum games. Games with mixed strategies. Graphical solution procedure. • Solving game using simplex algorithm.	**20L** **25L** **20L**	**UA** **UA** **SKB**
Course: MATH-H-SEC-T-1A Skill Enhancement Course; Credit-2; Full Marks-50	**Course title: Graph Theory**	**Unit 1.** • Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bi-partite graphs isomorphism of graphs. **Unit 2** • Eulerian circuits, Eulerian graphs, semi-Eulerian graphs, Hamiltonian cycles. • Representation of a graph by matrix, the adjacency matrix, incidence matrix, weighted graph. **Unit 3.** • Travelling salesman's problem, shortest path, tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm.	**08L** **10L** **07L**	**ARM** **ARM** **ARM**
MATH-H-GE-T-04	**Course title: Calculus**	**Unit 1.** • Real-valued functions defined on an	**35L**	**UA**

General Elective Course(except Math Hons); Credit-6; Full Marks-75	**& Differential Equations**	interval, limit and Continuity of a function (using $s-\delta$). Algebra of limits. Differentiability of a function. • Successive derivative: Leibnitz's theorem and its application to problems of type . $e^{ax+b}sinx, e^{ax+b}cosx, (ax+b)^n sinx, (ax+b)^n cosx.$ • Partial derivatives. Euler's theorem on homogeneous function of two and three variables. • Indeterminate Forms: L'Hospital's Rule (Statement and Problems only). • Statement of Rolle's Theorem and its geometrical interpretation. Mean value theorems of Lagrange and Cauchy. Statements of Taylor's and Maclaurin's theorems with Lagrange's and Cauchy's forms of remainders. Taylor's and Maclaurin's infinite series of functions like e^x, $sinx$, $cosx$, $(1+x)^n$, $log(1+x)$ with restrictions wherever necessary. • Application of the principle of maxima and minima for a function of a single variable. **Unit 2.** • Reduction formulae, derivations . $\int sin^n x\,dx, \int cos^n x\,dx, \int tan^n x\,dx, \int sec^n x\,dx, \int (\log x)^n dx, \int sin^n x cos^m x dx.$ **Unit 3.** • First order equations: (i) Exact equations and those reducible to such equations. (ii) Euler's and Bernoulli's equations (Linear). (iii) Clairaut's Equations: General and Singular solutions. • Second order differential equation: (i) Method of variation of parameters, (ii) Method of undeterminedcoefficients.	**15L** **25L**	**PM** **PM**

MATHEMATICS GENERAL
SEMESTER-IV

Courses	Course title	Topic	No .of lectures (inclusive of	Teacher

			Tutorials)	
Course: MATH-G-CC-T-04 Core Course; Credit-6; Full Marks-75	**Course title: Linear Programming Problems & GameTheory**	**Unit1.** • Introduction to linear programming problems, Graphical solution of LPP. • Convex sets. Basic solutions and non-basic solutions. Reduction of B.F.S from B.S. **Unit-2** • Simplex method, two-phase method, Big-*M* method and their comparison. • Duality, formulation of the dual problem, primal dual relation ships, economic interpretation of the dual. **Unit-3** • Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel's approximation method for determination of initial basic solution. Algorithms for solving transportation problems. • Assignmentproblemanditsmathematicalformulation,Hungarianmethodforsolvingassignmentproblem. **Unit-4** • Game theory: formulation of two-person zero sum games. • Solving two-person zero sum games. Games with mixed strategies. Graphical solution procedure. • Solving game Using Simplex Algorithm.	**10L** **20L** **25L** **20L**	SKB SKB SKB ARM
Course: MATH-G-SEC-T-2A Skill Enhancement Course; Credit-2; Full Marks-50 C	**Course title: Graph Theory**	**Unit1.** • Definition,examplesandbasicpropertiesofgraphs,pseudographs,completegraphs,bi-partitegraphs isomorphism of graphs. **Unit2** • Euleriancircuits,Euleriangraphs,semi-Euleriangraphs,Hamiltoniancycles. • Representationofagraphbymatrix,theadjacencymatrix,incidencematrix,weightedgraph. **Unit3.** • Travelling salesman's problem, shortest path, Tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm.	**8L** **10L** **7L**	ARM ARM ARM

DEPARTMENT OF MATHEMATICS

DISTRIBUTION OF COURSES IN SEMESTER-VI: January 2024 - June2024

Mathematics Honours

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course: MATH-H-CC-T-13, Core Course; Credit-6; Full Marks-75	**Course title: Metric Spaces and Complex Analysis**	**Unit 1.** • Metric spaces: Definition and examples. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set. • Sequences in metric spaces, Cauchy sequences. Complete metric spaces, Cantor's intersection theorem. Subspaces, dense sets, separable spaces. **Unit 2.** • Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Connectedness in metric space and its basic properties, connected subsets of . • Compactness, sequential compactness, Heine-Borel property, countable compactness, totally boundedspaces, finite intersection property, continuous functions on compact sets. **Unit 3.** • Regions in the complex plane, stereographic projection, functions of complex variables, Limits, limits involving the point at infinity, continuity. • Derivatives of functions, analytic functions, examples of analytic functions, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability. **Unit 4.** • Complex integration: Curves in the	**20L** **15L** **20L** **20L**	ARM ARM ARM ARM

		complex plane, properties of complex line integrals, definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. • Cauchy- Goursat theorem (statement only), Cauchy integral formula, problems relating to Cauchy's integral formula and its applications. • Absolute and uniform convergence of power series, Taylor series and its examples. Laurent series and its examples.		
Course: MATH-H-CC-T-14, Core Course; Credit-6; Full Marks-75	**Course title: Probability & Statistics**	**Unit 1.** • Sample space, probability axioms, real random variables (discrete and continuous). • Probability distribution function, probability mass/density functions. Discrete distributions: uniform, binomial, Poisson, geometric, negative binomial. Continuous distributions: uniform, normal, exponential,Beta, Gamma. • Mathematical expectation, moments, moment generating function, characteristic function. **Unit 2.** • Joint cumulative distribution function and its properties, joint probability density functions, marginal andconditional distributions. • Expectation of function of two random variables, conditional expectations, independent random variables,bivariate normal distribution, correlation coefficient. Linear regression for two variables. **Unit 3.** • Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers.	**20L** **20L** **15L**	SKB SKB SKB

		• Central limit theorem for independent and identically distributed random variables with finite variance. **Unit 4.** • Random samples, sampling distributions. • Estimation of parameters and estimate – consistent and biased. Maximum likelihood estimation. Applications to binomial, Poisson and normal populations. • Confidence interval. Interval estimation for parameters of normal population. Confidence intervals for meanand standard deviation of a normal population. Approximate confidence limits for the parameter of a binomial population. • Testing of hypotheses.	**20L**	SKB
Course: MATH-H-DSE-T-03A Discipline Specific Elective Course; Credit-6; Full Marks-75	**Course title: Fuzzy Set Theory**	**Unit 1.** • Interval numbers, arithmetic operations on interval numbers, distance between intervals, two level intervalnumbers. **Unit 2.** • Fuzzy versus crisp sets, different types of fuzzy sets, α-cuts and its properties. • Representations of fuzzy sets, decomposition theorems. • Support, convexity, normality, cardinality of fuzzy sets. • Standard set-theoretic operations on fuzzy sets. • Zadeh's extension principle. **Unit 3.** • Types of fuzzy operations. • Fuzzy complements, fuzzy intersections, fuzzy unions and their properties. • Combinations of fuzzy operations. **Unit 4.** • Crisp versus fuzzy relations. • Fuzzy matrices and fuzzy graphs. • Composition of fuzzy relations, relational joins. • Fuzzy binary relations. **Unit 5.** • Fuzzy numbers. • Arithmetic operations on fuzzy numbers (multiplication and division on $^+$ only). • Fuzzy equations.	**05L** **20L** **30L** **10L** **10L**	UA UA UA UA UA
Course: MATH-H-DSE-T-04B Disciplin	**Course title: Mechanics-II**	**Unit 1.** • Coplanar forces: Reduction of a system of coplanar forces. Moment about any point as base. Equation of the line of resultant. Necessary and sufficient	**15L**	PM

e Specific Elective Course; Credit-6; Full Marks-75		conditions of equilibrium. Astatic equilibrium. Case of three forces. Action at joint in a framework. • Principle of virtual work and its converse. • Forces in three dimensions: Moment of a force about a line. Reduction of a system of forces in space. Poinsot's central axis. Invariants of a system of forces. Equations of the central axis. Wrench and screw. Condition for a single resultant force. **Unit-2:** • Centre of gravity: Centre of gravity of areas, surfaces and volumes (variation of gravity included). Pappus theorem (statement only). • Stable and unstable equilibrium. Stability of equilibrium of two bodies other than spherical bodies. Energy test of stability. Condition of stability of equilibrium of a perfectly rough heavy body lying on a fixed body. **Unit-3:** • Real and ideal fluids. Pressure of fluid. Transmission of fluid pressure. Elasticity. Specific gravity. (* No broad question is to be set from this section) • Pressure of heavy fluids: Magnitude of pressure at a point in a liquid. Pressure at all points at the same horizontal level in a liquid at rest under gravity. For a liquid in equilibrium under gravity, the difference of pressure between any two points is proportional to their depths. Free surface of a homogeneous in equilibrium under gravity is horizontal. Horizontal planes in a liquid in equilibrium under gravity are surfaces of equal density. Pressure at any point in the lower of two immiscible liquids in	**15L** **15L**	PM PM

		equilibrium under gravity; Surface of separation is a horizontal plane. Thrust of homogeneous liquids on the plane surface. • Condition of equilibrium of fluids: Pressure derivative in terms of force. Pressure equation and the conditions of equilibrium. Surfaces of equal pressure. Fluid of equilibrium under gravity. Fluid in relative equilibrium. Rotating fluid. **Unit-4:** • Centre of pressure: Definition, position of the centre of pressure (C.P.) of a plane area. C.P. of a plane area immersed in a heavy liquid under gravity. Positions of centres of pressure of some simple areas, e.g., triangular area, parallelogram, circular area, composite plane area. C.P. of a plane area immersed in a number of liquids with different densities. Locus of the C.P. C.P. of a plane area referred to the axes through its centroid. • Thrusts on curved surfaces: Resultant thrust on a curved surface of a heavy homogeneous fluid at rest. Resultant thrust on a solid body wholly or partially immersed in a heavy fluid at rest. Resultant vertical thrust on a surface exposed to the pressure of a heavy fluid at rest. Resultant horizontal thrust in a given direction on a given surface. Resultant thrust on any surface of a liquid at rest under given forces. Resultant thrust on the curved surface of a solid bounded by a plane curve **Unit-5:** • Equilibrium of floating bodies: Conditions of equilibrium. Bodies floating under constraint. Potential energy of a liquid.	15L 15L	PM PM

		• Stability of floating bodies: Plane and surface of floatation. Buoyancy. Metacentre and metacentric height. Conditions of stability of equilibrium. Properties of surface of buoyancy. Equilibrium of a vessel containing liquid. Some elementary curves of buoyancy, e.g., triangle, rectangle. Oscillation of floating bodies.		

Mathematics General

SEMESTER-VI

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course: MATH-G-DSE-T-2B Discipline Specific Elective Course; Credit-6; Full Marks-75	**Course title: Numerical Methods**	**Unit-1** • Errors, relative, absolute, round-off, truncation errors. • Interpolation, Lagrange and Newton's methods. Finite difference operators. Gregory forward and backward difference interpolation. • Numericaldifferentiation,Methodsbasedoninterpolations,methodsbasedonfinitedifferences. **Unit-2** • Numerical Integration, Newton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, composite trapezoidal rule, composite Simpson's 1/3rd rule. **Unit-3** • Transcendentalandpolynomialequations,Bisectionmethod,Regula-Falsimethod,Fixedpointiteration, Newton-Raphson method, Rate of convergence of these methods. • System of linear algebraic equations, Gaussian elimination and Gauss Jordan methods, Gauss Jacobi method, Gauss Seidel method. **Unit-4** • The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta method of order two.	**20L** **20L** **20L** **15**	UA PM SKB PM
Course: MATH-	**Course title:**	**Unit 1:**	**07L**	ARM

G-SEC-T-4A Skill Enhancement Course; Credit-2; Full Marks-50	**Programminging 'C'**	• Brief historical development. Computer generation. Basic structure and elementary ideas of computer systems, operating systems, hardware and software. • Positional number systems: binary, octal, decimal, hexadecimal systems. Binary arithmetic. • BIT, BYTE, WORD. Coding of data-ASCII, EBCDIC, etc. • Algorithms and Flowchart: Important features, Ideas about complexities of algorithms. Application in simple problems. **Unit 2:** • Programming language and importance of C programming. • Constants, Variables and Data type of C-Program: Character set .Constants and variables data types, expression, assignment statements, declaration. • Operation and Expressions: Arithmetic operators, relational operators, logical operators. ● Decision Making and Branching: decision making with if statement, if-else statement, Nesting if statement, switch statement, break and continue statement. ● ControlStatements:Whilestatement,do-whilestatement,forstatement. ● Arrays: One-dimension, two-dimensional and multidimensional arrays, declaration of arrays, initialization of one and multi-dimensional arrays. ● User-defined Functions: Definition of functions, Scope of variables, return values and their types, function declaration, function call by value, Nesting of functions, passing of arrays to functions, Recurrence offunction.	**18L**	ARM

Faculty Members

1. **Dr. B.M. Uzzal Afsan (UA)**
2. **Sri Prosanta Mondal (PM)**
3. **Dr. Sudhanshu Kumar Biswas (SKB)**
4. **Sri Ashok Raj Mahali (ARM)**

DEPARTMENT OF MOLECULAR BIOLOGY AND BIOTECHNOLOGY

DISTRIBUTION OF COURSES IN SEMESTER-II: JANUARY 2024 - JUNE 2024

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course category:MBBT – M-T-2.(The) 4-credit Full marks :55 (Theory 40+Internal Assesment 10+Attendence 05)	CELL BIOLOGY	*UNIT-1:Cell: Introduction and classificationof organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation, visualisation of cells Cell Membrane and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport. *UNIT-2:Membrane Vacuolar system, cytoskeleton, and cell motility: Structure and function of microtubules, Microfilaments, Intermediate filaments Endoplasmic reticulum: Structure, function including role in protein segregation. Golgi complex: Structure, biogenesis and functions including role in protein secretion. Lysosomes: Vacuoles and micro bodies: Structure and functions. *UNIT-3 Ribosomes: Structures and function including role in protein synthesis. Mitochondria: Structure and function, Genomes, biogenesis Chloroplasts: Structure and function, genomes, biogenesis Nucleus: Structure and function, chromosomes, and their structure Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. *UNIT-4: Cell Signaling: Principles of cell signaling, Signaling through G protein coupled receptor and enzyme coupled receptors, Signaling routes in regulation of gene expression Cell	10 15	AB+DM

		Cycle: Overview of the cell cycle, Cell cycle control system, Control of cell division and cell growth Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics, and molecular basis of cancer.	20 15	
Course category:MBBT – M-P-2.(Pract) 2-credit Full marks:20	CELL BIOLOGY(PRACT)	1. Study the effect of temperature and organic solvents on semi permeable membrane. 2. Demonstration of dialysis. 3. Study of plasmolysis and de-plasmolysis. 4. Cell fractionation and determination of enzyme activity in organelles using sprouted seed or Yeast cell. 5. Study of structure of any Prokaryotic and Eukaryotic cell. 6. Microtomy: Fixation, block making, section cutting, double staining of animal tissues like liver, oesophagus, stomach, pancreas, intestine, kidney, ovary, testes. 7. Cell division in onion root tip/ insect gonads. 8. Preparation of Nuclear, Mitochondrial & cytoplasmic fractions.		BB
Course category:MBBT – SEC- T-2.(The) 4-credit Full marks :55 (Theory 40+Internal Assesment 10+Attendence 05)	MICROBIAL DIAGNOSIS IN HEALTH CLINICS	*UNIT-1: Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis. How to collect clinical samples (oral cavity, throat, skin, Blood, CSF, urine, and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage. Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria; Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens. *UNIT-2:Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes; Kits for Rapid Detection of Pathogens- typhoid, Dengue and HIV,	15	SB+MB

		Swine flu. Testing for Antibiotic Sensitivity in Bacteria- Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method. *UNIT-3: Application based capacity building through educational tours or virtual/ hands-on demonstration of principles and concepts with respect to the following: 1. Preparation and use of culture media for culturing various pathogenic microorganisms 2. Determination of minimal inhibitory concentration (MIC) of an antibiotic. 3. Serological Methods - Agglutination, ELISA	15 15	AB+DM

Faculty Members

Dr. Bibhas Bhattacharyya- BB
Dr. Abhishek Basu- AB
Ms. Debjani Mandal- DM
Mrs. Sayantani Basu - SB
Mrs. Manali Biswas- MB

DEPARTMENT OF: Physics

ACADEMIC CALENDAR: SESSION- January'24-June24

Stream: Science

DISTRIBUTION OF COURSES IN SEMESTER-II

Major

courses	Courses Title	Topic	No. of Lectures	Teachers
Theory **PHY-M-T-2:** **Marks (Semester End - 40, Internal Assessment – 10)** **Theory: (4 Credits) No. of Lectures - 60**	**MECHANICS**	**Unit-1-** **Fundamentals of Dynamics:** **Unit-II** A) Work and Energy B) Collisions C) Elasticity **Unit-III** A) Rotational Dynamics **Unit-IV** A) Fluid Motion B) Gravitation and Central Force Motion **Unit-V** Motion of a particle under a central force field **Unit-VI** A) Oscillations:SHM B) Non-Inertial Systems **Unit-VII** Special Theory of Relativity	**6** **10** **12** **5** **6** **11** **10**	**NH** **AH** **SM** **AKM** **PB** **DPD** **SB**
PRACTICAL **PHY-M-P-2:** Marks (Semester End - 20, Internal Assessment – 5) (Lab. Note Book - 05, Viva-Voce-05, Experiment -10) Practical - (2 Credits) No. of Lectures - 60	**MECHANICS**	1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope. 2. To study the random error in observations. 3. To determine the height of a building using a Sextant. 4. To study the Motion of Spring and calculate (a) Spring constant, (b) g 5. To determine the Moment of Inertia of a	**60**	**AH+SM+DPD**

		Flywheel/ a rigid body. 6. To determine g and velocity for a freely falling body using Digital Timing Technique. 7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method). 8. To determine the Young's Modulus of the material of a bar by flexure method 9. To determine the Modulus of Rigidity of a Wire by - Dynamic Method. 10. To determine the elastic Constants of a wire by Searle's method. 11. To determine the value of g using Bar Pendulum. 12. To determine the value of g using Kater's Pendulum. 13. To draw the frequency - resonance length curve of a sonometer wire and to determine an unknown frequency of a tuning fork 14. Measurement of coefficient of viscosity by Stoke's method.		
Theory PHY-SEC-T-2: Marks (Semester End – 35, Internal Assessment – 10) Internal Assessment [(Class Test/ Assignment/ quiz etc) - 10] Theory: (3 Credits) No. of Lectures - 45	**BASIC INSTRUMENTATION SKILLS**	**Unit-I-:** **A)** Basic of Measurement **B)** Electronic Voltmeter **Unit-II-** A) Cathode Ray Oscilloscope B) Signal Generators and Analysis Instruments **Unit-III** A) : Impedance Bridges & Q-Meters B) Digital Instruments	**12** **19**	**NH** **PB** **SM**

		C) Digital Multi meter	**14**	

Minor

courses	Courses Title	Topic	No. of Lectures	Teachers
Theory PHY-MI-T-2: Marks (Semester End - 30, Internal Assessment – 5) Theory – (3 Credits) No. of Lectures - 45	**MECHANICS**	**Unit-I** A) Laws of Motion B) Momentum and Energy C) Rotational Motion **Unit-II**- A) Non-Inertial Systems B) Gravitation C) Collisions D) Oscillations **Unit-III-** A) Elasticity B) Fluid Motion C) Special Theory of Relativity	**13** **16** **16**	**NH** **AH** **SB**
Practical **PHY-MI-P-2:** Marks (Semester End - 10, Internal Assessment – 5) Practical - (1 Credits) No. of Lectures - 30	**MECHANICS**	1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope. 2. To study the random error in observations. 3. To determine the height of a building using a Sextant. 4. To study the Motion of Spring and calculate (a) Spring constant, (b) g 5. To determine the Moment of Inertia of a Flywheel/ a rigid body. 6. To determine g and velocity for a freely falling body using Digital Timing Technique 7.To determine Coefficient of Viscosity of water	**30**	**AKM+PB+NH+SB**

		by Capillary Flow Method (Poiseuille's method). 8.To determine the Young's Modulus of the material of a bar by flexure method 9.To determine the Modulus of Rigidity of a Wire by - Dynamic Method. 10.To determine the elastic Constants of a wire by Searle's method. 11.To determine the value of g using Bar Pendulum. 12.To determine the value of g using Kater's Pendulum. 13.To draw the frequency - resonance length curve of a sonometer wire and to determine an unknown frequency of a tuning fork 14. Measurement of coefficient of viscosity by Stoke's method.		

Sem-IV(HONS)

courses	Courses Title	Topic	No. of Lectures	Teachers
Theory (Credits: Theory-04, Practicals-02) Theory: 60 Lectures F.M. = 75(Theory - 40, Internal Assessment - 15) Internal Assessment : Class Attendance (Theory) - 05, Theory (Class Test/ Assignment/ Tutorial) - 05, Practical (Sessional Viva-voce) - 05]	**Mathematical Physics III**	**Unit-I**-Complex Analysis **Unit-II**- Integrals Transforms **Unit-III**-Laplace Transforms	30 15 15	SB AH SM
Practical PHY-H-CC-P-08: **Practical - 20**	**MATHEMATICAL PHYSICS-III**	Numerical computation using Python/MATLAB/Octave/Fortran/C/C++:		

marks (Lab. Note Book - 05, Viva-Voce-05,Experiment - 10)		1. Dirac delta function: Calculate the integration $\int e^{\frac{-(2-x)^2}{2\sigma^2}}(x+3)dx$ for σ=1, .1, .01 and show it tends to 5. 2. Write a program to calculate the sum $\sum_{n=1}^{\infty} 0.2^n$ 3. Evaluate the Fourier coefficients of a given periodic function (square wave). 4. Frobenius method and special functions: Verify the relation $\int_{-1}^{1} P_n(\mu)P_m(\mu) = \delta_{n,m}$. Plot $P_n(x), J_n(x)$. 5. Calculation of error for each data point of observations recorded in experiments done in previous semesters (choose any two). 6. Calculation of least square fitting manually without giving weightage to error. Confirmation of least square fitting of data through computer program. 7. Evaluation of trigonometric functions e.g. *sin 6.* 8. Given Bessel's function at N points find its value at an intermediate point. 9. Complex analysis: Integrate $1/(x^2+2)$ numerically and check with computer integration. 10. Compute the nth roots of unity for n = 2, 3, and 4. 11. Find the two square roots of -5+12j. 12. Integral transform: FFT of *exp(-x).*	**30** **30**	**SM** **DPD**

PHY-H-CC-T-09**:** **ELEMENTS OF MODERN PHYSICS** (Credits: Theory-04, Practicals-02) Theory: 60 Lectures **F.M. = 75 (Theory - 40, Internal Assessment - 15)**	**ELEMENTS OF MODERN PHYSICS**	**Unit-I** a) Evolution of quantum theory b) Position momentum uncertainty and wave packets c)Quantum interference and superposition principle d)Eigenvalue and eigenfunctions **Unit-II** a) Nuclear structures b) Radioactivity c) Fission and Fusion **Unit-III** a) Lasers	**29** **21** **4**	**DPD** **AKM** **AH**
Practical PHY-H-CC-P-09: Practical – 20 marks (Lab. Note Book – 05, Viva-Voce-05,Experiment -10)	**ELEMENTS OF MODERN PHYSICS**	1. Measurement of Planck's constant using black body radiation and photo-detector 2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo electrons versus frequency of light 3. To determine work function of material of filament of directly heated vacuum diode. 4. To determine the Planck's constant using LEDs of at least 4 different colours. 5. To determine the wavelength of H-alpha emission line of Hydrogen atom. 6. To determine the ionization potential of mercury. 7. To determine the absorption lines in the rotational spectrum of Iodine vapour. 8. To determine the value of e/m by (a) Magnetic focusing	**60**	**GP+AH +SB**

		or (b) Bar magnet. 9. To setup the Millikan oil drop apparatus and determine the charge of an electron. 10. To show the tunnelling effect in tunnel diode using I-V characteristics. 11. To determine the slit width (a) using diffraction of single slit. 12. To determine the slit width (a,b) using diffraction of double slits. 13. To determine (1) wavelength and of He-Ne light /laser using plane diffraction grating 14. To draw the I-V characteristics of a valve diode and to verify the laws of thermionic emission		
PHY-H-CC-T-10: (Credits: Theory-04, Practicals-02) Theory: 60 Lectures F.M. = 75(Theory - 40, Internal Assessment – 15) Internal Assessment: Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]	**DIGITAL SYSTEMS AND APPLICATIONS**	**Unit-I** a) Introduction to CRO b) Integrated Circuits **Unit-II** A)Boolean algebra B) Data Processing circuits C)Arithmetic Circuits D) Sequential Circuits **Unit-III** a) Digital circuits b) Timers c) Shift registers d) Counters e) Computer Organization f) Intel 8085 Microprocessor Architecture g) Introduction to Assembly Language	**6** **21** **33**	**SM** **NH** **PB**
Practical PHY-H-CC-P-10: Practical – 20 marks (Lab. Note Book – 05, Viva-Voce-05,Experiment -10)	**DIGITAL SYSTEMS AND APPLICATIONS**	1. To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO. 2. To test a Diode and Transistor using a Multimeter. 3. To design a switch (NOT gate) using a transistor. 4. To verify and design AND, OR, NOT , XOR and using NAND gates. 5. To design a combinational logic system for a specified Truth Table. 6. To convert a Boolean expression into logic circuit and design it using logic	**60**	**PB+NH**

		gate ICs. 7. To minimize a given logic circuit. 8. Half Adder, Full Adder and 4-bit binary Adder. 9. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C. 10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates. 11. To build JK Master-slave flip-flop using Flip-Flop ICs 12. To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram. 13. To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs. 14. To design an astable multivibrator of given specifications using 555 Timer. 15. To design a monostable multivibrator of given specifications using 555 Timer. 16. Write the following programs using 8085 Microprocessor a) Addition and subtraction of numbers using direct addressing mode 30 b) Addition and subtraction of numbers using indirect addressing mode c) Multiplication by repeated addition. d) Division by repeated subtraction. e) Handling of 16-bit Numbers.		
PHY—H-SEC-T-02: (Credits: 02) F.M. = 50 (Theory - 40, Internal Assessment – 10) Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]	**RENEWABLE ENERGY AND ENERGY HARVESTING**	**Unit-I** Fossil fuels and Alternate Sources of energy **Unit-II** a) Solar Energy b) Wind Energy Harvesting **Unit-III** Ocean Energy **Unit-IV** A) Geothermal Energy B) Hydro Energy C) Piezoelectric Energy Harvesting **Unit-V** Electromagnetic Energy Harvesting	**3** **8** **5** **8** **5**	**DPD** **AH** **PB** **NH** **SM**

SEM-IV(GE)

courses	Courses Title	Topic	No. of Lectures	Teachers

Theory PHY-H-GE-T-02: (Credits: Theory-04, Practicals-02) F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15) Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05] Theory: 60 Lectures	**WAVE AND OPTICS**	**UNIT-1:** A) Superposition of Collinear Harmonic Oscillations B) Superposition of two perpendicular Harmonic Oscillations C) Wave motion D) Velocity of Wave E) Superposition of two Harmonic Wave **Unit-II** A) Wave Optics B) Interference C) Interferometer D) Diffration	**30** **30**	**DPD** **AH**
Practical PHY-H-GE-P-02: Practical – 20 marks (Lab. Note Book – 05, Viva-Voce-05,Experiment - 10) 60 Lectures	**WAVE AND OPTICS**	1. To investigate the motion of coupled oscillators. 2. To draw the frequency – resonance length curve of a sonometer wire and to determine an unknown frequency of a tuning fork. 3. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify X^2 – T Law. 4. To study Lissajous Figures 5. Familiarization with Schuster's focussing; determination of angle of prism. 6. To determine the Coefficient of Viscosity of water by any method. 7. To determine the Refractive Index of the Material of a Prism using Sodium Light. 8. To determine Dispersive Power of the Material of a Prism using Mercury Light 9. To determine the value of Cauchy	**60**	**AH+NH+SB**

		Constants. 10. To determine the Resolving Power of a Prism. 11. To determine wavelength of sodium light using Fresnel Biprism. 12. To determine wavelength of sodium light using Newton's Rings. 13. To determine the wavelength of monochromatic/Laser light using Diffraction of Single Slit. 14. To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating 15. To determine the Resolving Power of a Plane Diffraction Grating. 16. To measure the intensity using photo sensor and laser in diffraction patterns of single and double slits. 17. To draw the deviation – wavelength of the material of a prism and to find the wavelength of an unknown line from its deviation. .		

SEM-IV(PCC)

courses	Courses Title	Topic	No. of Lectures	Teachers
PHY-G-CC-T-04 Credits: Theory-04, Practicals-02) Theory: 60 Lectures F.M. = 75(Theory - 40, Internal Assessment – 15) Internal Assessment : Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05,	**Solid State Physics**	**Unit-I** a) Crystal Structure b) Elementary Lattice Dynamics c) Elementary band theory **Unit-II**	**32**	**SM**

Practical (Sessional Viva-voce) - 05]		A) Magnetic Properties of Matter B) Dielectric Properties of Materials C) Ferroelectric Properties of Materials D) Superconductivity	**28**	**SB**
PHY-G-CC-P-04: Practical – 20 marks (Lab. Note Book – 05, Viva-Voce-05,Experiment -10)	**Solid State Physics**	1. Measurement of susceptibility of paramagnetic solution (Quinckf s Tube Method) 2. To measure the Magnetic susceptibility of Solids. 3. To determine the Coupling Coefficient of a Piezoelectric crystal. 4. To measure the Dielectric Constant of a dielectric Materials with frequency 5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR) 6. To determine the refractive index of a dielectric layer using SPR 7. To study the PE Hysteresis loop of a Ferroelectric Crystal.8. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis. 9. To measure the resistivity of a semiconductor (Ge) with temperature by four- probe method (room temperature to 150 °C) and to determine its band gap. 10. To determine the Hall coefficient of a semiconductor sample. 11. To measure the mutual inductance of two coaxial coils at various relative orientations using a ballistic	**60**	**SM+DPD+PB**

		galvanometer. 12. Verification of the inverse cube law for magnetic dipoles (study of the dependence of the field of a magnetic dipole on distance) and determination of the horizontal component of the earth's magnetic field by deflection and oscillation magnetometers.		
PHY-G-SEC-T-02	**Electrical Circuits & Network Skills**	**Unit-I** a) Basic Electricity principles b) Understanding Electrical Circuits c) Electric Motors d) Generators and Transformers **Unit-II** A) Electrical Drawing and Symbols B) Solid state devices C) Electrical Protection D) Electrical Wiring	**14** **16**	**SB** **SM**

SEM-VI(HONS)

courses	Courses Title	Topic	No. of Lectures	Teachers
PHY-H-CC-T-13: (Credits: Theory-04, Practicals-02) Theory: 60 Lectures F.M. = 75(Theory - 40, Internal Assessment – 15) Internal Assessment: Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]	**Electromagnetic Theory**	**Unit-I** a) Maxwell Equation b) Rotatory Polarization **Unit-II** a) EM Wave in Bounded Media b) Polarization of Electromagnetic Waves **Unit-III** a) EM Wave Propagation in Unbounded Media **Unit-IV** a) Wave Guides b) Optical Fibres	**17** **22** **10** **11**	**DPD** **SM** **NH** **SB**
PHY-H-CC-P-13: QUANTUM MECHANICS AND APPLICATIONS Practical – 20 marks (Lab. Note Book – 05, Viva-Voce- 05,Experiment -10)	**Electromagnetic Theory**	1. To verify the law of Malus for plane polarized light. 2. To determine the specific rotation of sugar solution using	**60**	**SM+AH+DPD**

		Polarimeter. 3. To analyze elliptically polarized Light by using a Babinet's compensator. 4. To study dependence of radiation on angle for a simple Dipole antenna. 5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating. 6. To study the reflection, refraction of microwaves 7. To study Polarization and double slit interference in microwaves. 8. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film. 9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.45 10. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface. 11. To verify the Stefan's law of radiation and to determine Stefan's constant. 12. To determine the Boltzmann constant using V-I characteristics of PN junction diode. 13. To verify Brewster's law and Fresnel formulae for reflection of electromagnetic waves with the help of a spectrometer, a prism and		

		two polaroids		
Theory PHY-H-CC-T-14 (Credits: Theory-04, Practicals-02) Theory: 60 Lectures F.M. = 75(Theory - 40, Internal Assessment – 15) Internal Assessment : Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05	**STATISTICAL MECHANICS**	**Unit-I** **Classical Statistics** **Unit-II** A) Classical Theory of radiation B) Quantum theory of Radiation **Unit-III** A) Bose-Einstein Statistics B) Fermi-Dirac Statistics	**18** **14** **28**	**SB** **AKM** **AH**
PHY-H-CC-P-14: Practical – 20 marks (Lab. Note Book – 05, Viva-Voce- 05,Experiment - 10)	**STATISTICAL MECHANICS**	1. Plot Planck's law for Black Body radiation and compare it with Wein's Law and Raleigh-Jeans Law at high temperature (room temperature) and low temperature. 2. Plot Specific Heat of Solids by comparing (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature (room temperature) and low temperature and compare them for these two cases 3. Plot Maxwell-Boltzmann distribution function versus temperature. 4. Plot Fermi-Dirac distribution function versus temperature. 5. Plot Bose-Einstein distribution function versus temperature.	**60**	**SM+AKM+PB**
PHY-H-DSE-T-03: (Credits: Theory-05, Tutorials-01) Theory: 75 Lectures F.M. = 75 (Theory - 60, Internal Assessment – 15) Internal Assessment [Class Attendance – 05,	**NANO MATERIALS AND APPLICATIO-NS**	**Unit-I** a) Nanoscale Systems b) Characterization **Unit-II** A) Synthesis of nanostructure	**18** **14**	**DPD** **SM**

Class Test/ Assignment/ Tutorial – 10]		Materials B) Electron Transport **Unit-III** A) Optical Propertes B) Applications	**28**	**PB**
PHY-H-DSE-T-04: (Credits: Theory-05, Tutorials-01) Theory: 75 Lectures F.M. = 75 (Theory - 60, Internal Assessment – 15) Internal Assessment [Class Attendance – 05, Class Test/ Assignment/ Tutorial – 10]	**EXPERIMENT-AL TECHNIQUES**	**Unit-I** a) Measurements b) Shielding and Grounding c) Digital Multimeter **Unit-II** **A)** Signals and Systems **B)** Impedance Bridges And Q-meter **Unit-III** Transducers & industrial instrumentation **Unit-IV** Vacuum Systems	**16** **11** **21** **12**	**SB** **PB** **DPD** **SM**

SEM-VI(PCC)

courses	Courses Title	Topic	No. of Lectures	Teachers
PHY-G-DSE-T-02: (Credits: Theory-04, Practicals -02) **F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15) Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment / Tutorial) – 05, Practical (Sessional Viva-voce)**	**DIGITAL, ANALOG CIRCUITS AND INSTRUMENTATION**	**Unit-I** a) Digital Circuits b) Semiconductor Devices and Amplifiers **Unit-II** a) Operational Amplifiers b) Sinusoidal Oscillators c) Instrumentations	**30** **30**	NH PB

- 05]				
PHY-G-SEC-T-4 (Credits: 02) F.M. = 50 (Theory - 40, Internal Assessment – 10) Internal Assessment [Class Attendance	**Radiation Safety**	**Unit-I** a) Basics of atomic and nuclear physics b) Interaction of Radiation with matter **Unit-II** a) Radiation detection b) Radiation safety management c) Application of nuclear techniques	**13** **17**	**AH** **SM**

Faculty Members
1. Dr. Asit Kumar Mondal (AKM)
2. Dr. Amritendu Haldar (AH)
3. Mr. Shahnewaz Mondal (SM)
4. Dr. Debi Prasad Dutta (DPD)
5. Mr. Paban Bittar (PB)
6. Mrs. Nandini Haldar (NH)
7. Mr. Sudip Bhattacharjee(SB)

DEPARTMENT OF: ZOOLOGY

DISTRIBUTION OF COURSES IN SEMESTER-II: JANUARY 2024 – JUNE 2024

MAJOR

Courses	Course Title	Topic	No. of Lectures (inclusive of Tutorials)	Teachers
ZOO-MJ-T-201 **[4 credits]** **[4 classes PW]** **Full marks: 55** **(End Sem .40+ Internal assessment 15)**	*Introduction to Chordate Diversity and its zoogeographical distribution*	**Module 1: Introduction to Chordates** **Module 2: Origin of Chordata** **Module 3: Origin of Chordata** **Module 4: Agnatha** **Module 5: Pisces** **Module 6: Amphibia** **Module 7: Reptilia** **Module 8: Aves** **Module 9: Mammals** **Module 10: Zoogeography**	**8** **8** **8** **8** **8** **8** **8** **8** **8** **8**	HGT AB SH SD DM SH AB HGT SB SD
ZOO-MJ-P-201 **[2credits]** **[4 Classes PW]** **Full Marks: 20** **(End Sem. 20)**	*Introduction to Chordate Diversity and its zoogeographical distribution Lab*	**Identification** *1. Protochordata* *2. Agnatha* *3. Fishes* *4. Amphibia* *5. Reptilia* *6. Mammalia* *7.Dissection* *8. Power point presentation*	**70**	HGT AB UG SD SB SH

MINOR

Courses	Subject/ Course Title	Topic	No. of Lectures (inclusive of Tutorials)	Teachers
ZOO-MI-T-201 **[3 credits]** **[3 Classes PW]** **Full Marks: 35 (End Sem. 25+Internal Assessment 10)**	*Comparative anatomy and Developmental Biology*	**Module 1: Integumentary System** **Module 2: Skeletal System** **Module 3: Digestive System** **Module 4: Circulatory System** **Module 5: Respiratory System** **Module 6: Urinogenital System** **Module 7: Nervous System** **Module 8: Sense Organs** **Module 9: Developmental Biology**	7 7 7 7 7 7 7 7 7	HGT SD SB SH DM HGT AB SD SH
ZOO-MI-P-201 **[1 credits]** **[2 Classes PW]** **Full Marks: 15 (End Sem. 15)**	*Comparative anatomy and Developmental Biology Lab*	*1. Study of placoid, cycloid and ctenoid scales.* *2. Study of disarticulated skeleton* *3. Demonstration of Carapace and plastron OR Identification of mammalian skulls.*	4 12 5 12 6	UG & DM

MDC

Courses	Course Title	Topic	No of Lectures allotted	Teachers
ZOO-MDC-2 [3 credits] [3 Classes PW] Full Marks : 45 (End Sem 35,Field work 10)	*Economic Zoology and Entrepreneurship*	**Module 1: Agricultural Entomology** **Module 2: Sericulture** **Module 3: Apiculture** **Module 4: Vermiculture** **Module5:Aquaculture** **Module 6: Live Stock Management** **Module7:Entrepreneurship in Economic Zoology**	8 12 8 8 14 8 8	SH SH HGT SD AB DM SB

SEC-02

Courses	Course Title	Topic	No. of Lectures Allotted	Teachers
ZOO-SEC-2 **[3credits] [3ClassesPW]** Full Marks : 45(End Sem 35,Field work 10)	*Basic concept of Aquaculture, Induced breeding and Integrated fish farming*	**Module1:Aquaculture methods** **Module 2: Different systems of aquaculture** **Module 3: Non-conventional aquaculture technology** **Module 4: Induced breeding** **Module 5: Fish pathology** **Module 6: Entrepreneurship in Aquaculture**	10 10 14 10 12 10	SH HGT SD AB SB DM

DISTRIBUTION OF COURSES IN SEMESTER-IV: January 2024 – June 2024
DEPARTMENT OF: ZOOLOGY

HONOURS

Courses	Course Title	Topic	No. of Lectures	Teachers
ZOOL-H-CC- T-08 **[4 credits]** **Full Marks: 55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	*Comparative Anatomy of Vertebrates*	**Unit 1: Integumentary System** **Unit 2: Skeletal System** **Unit 3: Digestive System** **Unit 4: Circulatory System** **Unit 5: Respiratory System** **Unit 6: Urinogenital System** **Unit 7: Nervous System** **Unit 8: Sense Organs**	6 6 6 6 6 6 6 6	AB SD SB SH SD DM HGT HGT
ZOOL-H-CC- P-08 **[2 credits]** **Full Marks: 20 (End Sem. 20)**	*Comparative Anatomy of Vertebrates Lab*	*1. Study of placoid, cycloid and ctenoid scales* *2. Study of disarticulated skeleton* *3. Demonstration of Carapace and plastron of turtle.*	3 10 5 5	SH SD UG HGT AB SB DM
ZOOL-H-CC- *T-09* **[4 credits]** ***Full Marks: 55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)***	*Animal Physiology: Life Sustaining Systems*	**Unit 1: Physiology of Digestion** **Unit 2: Physiology of Respiration** **Unit 3: Physiology of Circulation** **Unit 4: Physiology of Heart** **Unit 5: Thermoregulation & Osmoregulation** **Unit 6: Renal Physiology**	10 10 10 10 10 10	SB SD SH AB HGT DM
ZOOL-H-CC- P-09 **[2 credits]** **Full Marks: 20 (End Sem. 20)**	*Animal Physiology: Life Sustaining Systems Lab*	1. Enumeration of red blood cells and white blood cells. 2. Estimation of haemoglobin. 3. Preparation of haemin crystals 4. Recording of blood pressure.	15 5 5 5	SH HGT AB SD SB DM UG

ZOOL-H-CC-T-10 **[4 credits]** ***Full Marks: 55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)***	*Immunology*	**Unit 1: Overview of Immune System** **Unit 2: Innate and Adaptive Immunity** **Unit 3: Antigens** **Unit 4: Immunoglobulins** **Unit 5: Major Histocompatibility Complex** **Unit 6: Cytokines** **Unit 7: Complement System** **Unit 8: Hypersensitivity** **Unit 9: Immunology of diseases** **Unit 10: Vaccines**	6 6 6 6 6 6 6 6 6 6	SD SH SB HGT DM SB SD AB AB DM
ZOOL-H-CC-P-10 **[2 credits]** **Full Marks: 20 (End Sem. 20)**	*Immunology Lab*	1. Demonstration of lymphoid organs. 2. Determination of ABO Blood group. 3. Histological study of spleen, thymus and lymph nodes. 4. Preparation of stained blood film. 5. Demonstration/virtual lab/dry lab of ELISA.	6 6 6 6 6	SD SH HGT AB UG DM SB
ZOOL-H-SEC- 03 ***[2 Credits]*** ***Full***	*Sericulture*	**Unit 1: Introduction** **Unit 2: Biology of Silkworm** **Unit 3: Rearing of Silkworms** **Unit 4: Pests and Diseases** **Unit 5: Entrepreneurship in Sericulture**	6 6 6 6 6	AB HGT SH SH

GENERIC ELECTIVE (GE)

Courses	Subject/ Course Title	Topic	No. of Lectures	Teachers
ZOOL-G-CC- T-02 **[4 credits]** **Full Marks: 55** **(End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	*Comparative Anatomy, Developmental Biology of Vertebrates and Ecology*	**Unit 1: Integumentary System** **Unit 2: Skeletal System** **Unit 3: Digestive System** **Unit 4: Circulatory System** **Unit 5: Urinogenital System** **Unit 6: Nervous System** **Unit 7: Early Embryonic Development** **Unit 8: Late Embryonic Development** **Unit 9: Post Embryonic Development** **Unit 10: Introduction to Ecology** **Unit 11: Population and Community** **Unit 12: Ecosystem** **Unit 13: Applied Ecology**	4 4 4 4 6 6 4 4 4 4 4 6 4	HGT AB SB SH DM SD SH SB SD SH HGT DM AB
ZOOL-HGE-P-02 **[2 credits]** **Full Marks: 20** **(End Sem. 20)**	*Comparative Anatomy and Developmental Biology of Vertebrates Lab*	*1. Study of placoid, cycloid and ctenoid scales* *2. Study of disarticulated skeleton* *3. Demonstration of Carapace and plastron* *4. Identification of mammalian skulls* *5. Study of an aquatic ecosystem:* *6. Permanent mounting of mosquito*	5 10 5 5 5	HGT AB SD SH SB DM UG

PROGRAMME COURSES (PCC)

Courses	Subject/ Course Title	Topic	No. of Lectures	Teachers
ZOOL-G-CC-T-04 **[4 credits]** **Full Marks: 55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	*Physiology and Biochemistry*	**Unit 1: Digestion and Absorption of Food** **Unit 2: Functioning of Excitable Tissue (Nerve and Muscle)** **Unit 3: Respiratory Physiology** **Unit 4: Renal Physiology** **Unit 5: Cardiovascular Physiology** **Unit 6: Endocrine and Reproductive Physiology** **Unit 7: Carbohydrates** **Unit 8: Lipids** **Unit 9: Proteins** **Unit 10: Nucleic Acids** **Unit 11: Enzymes**	5 6 5 5 6 6 5 5 5 6 6	SB SD SD DM SH HGT SB AB SH AB
ZOOL-G-CC-P-04 **[2 credits]** **Full Marks: 20 (End Sem. 20)**	*Physiology and Biochemistry Lab*	*1. Preparation of temporary mounts: Blood film. 2. Estimation of haemoglobin 3.Examination of permanent histological sections. 4. Qualitative tests of functional groups in carbohydrates, proteins*	7 7 7 9	SH SB HGT DM AB UG
ZOOL-G- *SEC- 02* ***[2 Credits]*** ***Full Marks:50(End***	*Apiculture*	**Unit 1: Biology of Bees** **Unit 2: Rearing of Bees** **Unit 3: Diseases and Enemies** **Unit 4: Bee Economy** **Unit 5: Entrepreneurship in Apiculture**	7 8 7 8 6	HGT SD AB SH DM

DISTRIBUTION OF COURSES IN SEMESTER-VI: January 2024 – June 2024

DEPARTMENT OF: ZOOLOGY

HONOURS

Courses	Course Title	Topic	No. of Lectures	Teachers
ZOOL-H-CC- T-13 **[4 credits]** **Full Marks:55** **(End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	*Developmental Biology*	**Unit 1: Early Embryonic Development** **Unit 2: Late Embryonic Development** **Unit 3: Post Embryonic Development** **Unit 4: Implications of Developmental Biology**	15 15 15 15	SB DM AB SD
ZOOL-H-CC- P-13 **[2 credits]** **Full Marks: 20 (End Sem 20)**	*Developmental Biology Lab*	*1. Study of whole mounts of developmental stages of chick* *2. Study of the developmental stages and life cycle of* Drosophila *from stock culture*	7 7 7 9	UG HGT SD SH DM AB SB
ZOOL-H-CC- *T-14* ***[4 Credits]*** ***Full Marks:55*** ***(End Sem***	*Evolutionary Biology*	*1.Geological time scale* *2. Population genetics* *3.Species concept* *4. Origin and Evolution of Man*	12 12 12 12 12	SB SD AB DM HGT
ZOOL-H-CC- *P-14* ***[2 Credits]*** ***(End Sem 20)***	*Evolutionary Biology Lab*	*1. Study of fossils.* *2. Study of homology and analogy.* *3. Study and verification of Hardy-Weinberg Law with chi square analysis.* *4. Graphical representation and interpretation of data*	7 9 7 7	UG HGT SD AB DM SH AB
ZOOL-H-DSE-T-04 ***[4 Credits]*** ***Full Marks:55*** ***(End Sem 40+Internal***	*Parasitology* *Dissertation on following topic*	***Unit 1: Introduction to Parasitology*** ***Unit 2: Parasitic Protists*** ***Unit 3: Parasitic Platyhelminthes*** ***Unit 4: Parasitic***	10 10 10 10 10 10	SH AB SB UG HGT SD DM

ZOOL-H-DSE-T-06 ***[4Credits]*** ***Full Marks:55(End Sem 40 Internal***	*Biology of Insecta*	***Unit 1: Introduction to Biology of Insecta*** ***Unit 2: Insect Taxonomy*** ***Unit 3: General Morphology of Insects*** ***Unit 4: Physiology of Insects Unit 5: Insect***	4 6 4 4 4 4 4	SD SH HGT SH HGT SH SD
ZOOL-H-DSE-P-06 ***[Credits]*** ***[2 Credits]*** ***Full Marks:20*** ***(End Sem 20)***	*Biology of Insecta Lab*	*1. Study of life cycle of Mosquito.* *2. Methodology of collection and preservation.* *3. Key to common insect orders.* *4. Mounting of wings, different kinds of antennae,*	6 6 6 6 6	AB DM SH SD SB UG HGT

PROGRAMME COURSE (PCC)

Courses	Subject/ Course Title	Topic	No. of Lectures (inclusive of	Teachers
ZOOL-G-DSE-T-04 ***[4 Credits] Full Marks:55 (End Sem 40+Internal Assesment 10+*** **Attendance in classes 05)**	*Biology of Insecta*	***Unit 1: Introduction to Biology of Insecta*** ***Unit 2: Insect Taxonomy*** ***Unit 3: General Morphology of Insects*** ***Unit 4: Physiology of Insects Unit 5: Insect Society*** ***Unit 6: Insect Plant Interaction Unit 7:***	8 10 10 8 8 8 8	SD SH HGT SH HGT SH SD
ZOOL-G-DSE-P-04 ***[2 Credits] Full Marks:20(End Sem 20)***	*Biology of Insecta Lab*	*1. Study of life cycle of Mosquito.* *2. Methodology of collection and preservation.* *3. Key to common insect orders.* *4. Mounting of wings, different kinds of antennae, legs and mouth parts of insect.*	4 6 4 4 4 4	UG HGT DM SH SB AB SD
ZOOL-G-SEC-03 ***[2 Credits] Full Marks:50 (End Sem 40 + Internal assessment 10)***	*Sericulture*	***Unit 1: Introduction*** ***Unit 2: Biology of Silkworm*** ***Unit 3: Rearing of Silkworms*** ***Unit 4: Pests and Diseases***	6 6 6 6 6	HGT SD SB SH DM AB UG

Faculty Members

Uttam Ghosh (UG)

Dr. Himadri Guhathakurta (HGT)

Dr. Sajal Kr. Dey (SD)

Sunita Hansda (SH)

Abhishek Bagdi (AB)

Debabrata Mondal (DM)

Sangita Bhatta (SB)

Scheduled of Internal Examination
Stream: Science
Session: January 2024-June 2024

Tentative schedule of the internal examination are given in the following table

Sl. No.	Semester	Topic	Date
01.	Semester-II	Major & Minor course	19th June-25th June, 2024
02.	Semester-IV	Honours & Program course	19th June-25th June, 2024
03.	Semester-V	Honours & Program course	24th May-31th May,2024

THE END