SRIPAT SINGH COLLEGE

(Estd. 1949 Govt. Sponsored)

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ACADEMIC CALENDAR
SESSION: July'23-December'23

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

Course Code	Course Title	Name of the Course	Course Content	Assigned Teacher
BOT-MJ-CC-T-01	ORIGIN , LIFEPROCESSES &DIVERSITYOF PLANTGROUPS	MAJOR(THEORY)	**Unit 1:Origin of Life** What is life? Theories of origin of life; role of water in life process; origin of land plants.**(12L)**	DR
			Unit2:Microbes Viruses-Discovery, general structure; economic importance; Bacteria-Discovery, general characteristic sand cell structure; economic importance. **(6L)**	RI
			Unit3:Algae General characteristics; salient features of Cyanophyceae,Chlorophyceae,Charophyceae,Phaeophyceae,RhodophyceaeandBacillariophyceae;ecologyand distributionofalgae;economicimportanceofalgae**(8L)**	DR
			Unit4:Fungi Introduction – General characteristics, salient features of Myxomycota, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina,Deuteromycotina; fungi- nutrition and reproduction; ecology and significance;Mycorrhiza:ectomycorrhizaandendomycorrhiza;Lichens-generalaccount **(7L)**	SM
			Unit5:IntroductiontoArchegoniate Unifying features of archegoniates; transition to land habit; alternation of generations **(7L)**	RI
			Unit6:Bryophytes General characteristics, salient features of Hepaticopsida, Anthocerotopsida and Bryopsida. Adaptation to land habitat, adaptation to land habitat; Ecological andeconomic importance of Bryophytes. **(7L)**	RI
			Unit7:Pteridophytes General characteristics, salient features of Psilophyta, Lycophyta, Sphenophyta and Filicophyta;Ecologicalandeconomicalimportance. **(7L)**	SM
			Unit 8:Gymnosperms General characteristics; salient features of Cycadophyta, Coniferophyta and Gnetophyta.; Ecological and economic importance. **(7L)**	DR

				BC
			Unit9:Angiosperms Floral characteristics, affinity with Gymnosperms; Herbarium; Botanical Garden. **(10L)**	
BOT-MJ--CC-P-01	Origin , LifeProcesses &Diversityof Plantgroups	Major (Practical)	**Bacterialforms**: Coccus, Bacillus, Spirillum, Vibrio **Algae**: *Nostoc, Lyngbya,Spirogyra,Oedogonium* **Fungi**: *Rhizopus* (Vegetative structure with sporangium/ zygospore) ,*Aspergillus* (vegetative structure with conidia), *Ascobolus* (Fruit body, L.S of *Ascobolus* fruit body), *Agaricus* (Fruit body, L.S of gills). **Bryophytes**: *Riccia,*(Entire thallus, T.S of thallus showing sporophyte), *Marchantia* (V.S of archegoniophore & antheridiophore, sporophyte), *Funaria,*(Plant body, L.S of capsule). **Pteridophytes***: Lycopodium* (Plant body, L.S of strobilus), *Pteris,*(T.S of leaflet). **Gymnosperms:** Megasporophyll and microsporophyll of *Cycas*, external morphology of *Pinus* female cone; L.S of male and female cone of*Pinus*. **Angiosperms:***Polyanthestuberosa,Crysopogonacic ulatus,Tridaxprocumbens,Oldenlandia corymbosa, Solanumnigrum* **(60L)**	Three practical groups each conducted by SM, RI, DR
BOT-SEC-T-01	A. BIOFERTILIZERS	Theory	Unit 1: General account about the microbes used as bio fertilizer - *Rhizobium* - isolation. identification, mass multiplication, carrier-based inoculants, Actinorhizal symbiosis **(4L)**	DR
			Unit 2: *Azospirillum*: isolation and mass multiplication - carrier based inoculants, associative effect of different microorganisms. *Azotobacter*: classification, characteristics - crop response to *Azotobacter* inoculum, maintenance and mass multiplication. **(8L)**	RI
			Unit 3: Cyano bacteria (blue green algae), *Azolla* and *Anabaenaazollae* association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. **(4L)**	RI
			Unit 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield - colonization of AM - isolation and inoculums production of AM, and its influence on growth and yield of crop plants. **(8L)**	SM
			Unit 5: Organic farming - Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and industrial wastes - bio compost making methods, types and method of vermicomposting- field application. **(6L)**	SM

BOT-SEC-P-01-A		**Practical**	1. Isolation of *Rhizobium* from leguminous root nodule 2. Isolation of *Azotobacter*, *Azospirillum* 3. Isolation of BGA from water and soil samples 4. Production of *Azolla* in trays 5. Study of different types of mycorrhizal association from permanent slides/photographs 6. Visit to areas where organic farming, bio composting, vermicomposting is practiced **(30L)**	SM, RI, DR
BOT-MI-CC-T-01	**BIODIVERSITY OF MICROBES, ALGAE, FUNGI AND BRYOPHYTES**	**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. **(10L)**	BC
			Unit 2: Algae General characteristics: reproduction; Classification of algae by Fritsch (1935); Economic importance of algae. **(12L)**	BC
			Unit 3: Fungi Introduction: General characteristics, cell wall composition, reproduction and classification (Alexopoulos, Mims and Blackwell 1996); Symbiotic associations-Lichens: General account; Mycorrhiza: ectomycorrhiza and endomycorrhiza. **(12L)**	SY
			Unit 4: Bryophyte General characteristics; adaptations to land habit; classification following Smith G.M. (1955);Economic importance of bryophytes with special mention of *Sphagnum* **(10L)**	SP

		EMs/Models of viruses-T-Phageand TMV.	BC, SY
BOT–MI-CC-P-01	**MINOR (PRACTICAL)**	**Types of Bacteria -**from temporary/permanent slides/photographs. **Gramstaining.** **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). **(30L)**	

DEPARTMENT OF BOTANY
Syllabus Distribution
SEMESTER-III (UNDER CBCS)
SESSION: July 2023-December2023
HONOURS

COURSE CODE	COURSE TITLE	COURSE CONTENT	TEACHER ASSIGNED
	Diversity of Bryophytes and Pteridophytes	Unit 1: General account of Bryophytes **(5L)**	**RI**
		Unit 2: Classification of Bryophytes **(4L)**	**RI**
		Unit 3: Type Studies of Bryophyte **(12L)**	**RI**
		Unit 4: Origin and Evolution of Bryophytes **(7L)**	**RI**
		Unit 5: Importance of Bryophytes**(2L)**	**RI**
		Unit 6: General Account of Pteridophytes**(5L)**	**DR**
		Unit 7: Classification of Pteridophytes**(4L)**	**DR**
		Unit 8: Type Studies of Pteridophytes**(12L)**	**DR**
		Unit 9: Origin and Evolution**(7L)**	**DR**
		Unit 10: Importance of Pteridophytes**(2L)**	**DR**
UG-H-BOT-CC-P-05 (PRACTICAL)		1.Riccia – Morphology of thallus. **(30L)**	**RI**
		2.Marchantia- Morphology of thallus, whole mount of rhizoids and Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).	**RI**
		3.Anthoceros- Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).	**RI**

		4. Pellia - Permanent slides.	**RI**
		5. Sphagnum- Morphology of plant, whole mount of leaf (permanent slide only).	**RI**
		6. Funaria- Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema **(30L)**	**RI**
		7.Psilotum- Study of specimen, transverse section of synangium (permanent slide).	**DR**
		8. Lycopodium- Morphology, transverse section of stem, whole mount of sporophyll (temporary slides), whole mount of strobilus, longitudinal section of strobilus	**DR**
		9. Selaginella- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of microsporophyll and megasporophyll (temporary slides), whole mount of strobilus, longitudinal section of strobilus. **(15L)**	**DR**
		10. Equisetum- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (temporary slide), transverse section of rhizome (permanent slide).	**SM**
		11. Pteris- Morphology, transverse section of rachis, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide).	**SM**
		12. Early land plants- Transverse section of stem of Cooksonia, Rhynia, Lepidodendron, Calamites (permanent fossil slides if available or photographs). **(15L)**	**SM**
UG-H-BOT-CC-T-06 (THEORY)	Diversity of Gymnosperms and Palaeobotany	Unit 1: Progymnosperms and General account of Gymnosperms**(4L)**	**RI**
		Unit 2: Classification of Gymnosperms**(4L)**	**RI**
		Unit 3: Type Studies of Gymnosperms**(12L)**	**RI**
		Unit 4: Origin and Evolution of Gymnosperms**(8L)**	**RI**
		Unit 5: Importance of Gymnosperms**(2L)**	**RI**
		Unit 6: Introduction to Palaeobotany**(4L)**	**SM**
		Unit 7: Plant fossil & their age determination**(12L)**	**SM**
		Unit 8: Study of plant fossil records**(4L)**	**SM**
		Unit 9: Evolutionary theories, mass extinction and the plant fossil record**(5L)**	**SM**
		Unit 10: Gondwana land and plant fossil (Glossopteris) **(5L)**	**SM**
- UG-H-BOT-CC-P-06 (PRACTICAL)		Gymnosperms: *Cycas, Pinus, Gnetum, Ephedra***(30L)**	**RI**
		Palaeobotany**(30L)**	**SM**
UG-H-BOT-CC-T-07	Reproductive Biology of	Unit 1: Introduction**(4L)**	**DR**
		Unit 2: Reproductive development**(6L)**	**RI**
		Unit 3: Anther and pollen biology**(10L)**	**SM**

		Unit 4: Ovule**(10L)**	**SM**
(THEORY)	Plants	Unit 4: Pollination and fertilization**(6L)**	**RI**
		Unit 5: Self incompatibility**(10L)**	**RI**
		Unit 6: Embryo, Endosperm and Seed**(10L)**	**DR**
		Units 7: Polyembryony and Apomixis**(4L)**	**DR**
UG-H-BOT-CC-P-07 (PRACTICAL)		1. Anther**(10L)**	**RI**
		2. Pollen grains**(10L)**	**RI**
		3. Ovule**(10L)**	**SM**
		4. Female gametophyte through permanent slides/ photographs**(30L)**	**DR**
		5. Pollination	**DR**
		6. Endosperm	**DR**
		7. Embryogenesis	**DR**
UG-H-BOT-SEC-T-01	A. Biofertilizers	Unit 1: General account about the microbes used as biofertilizer - *Rhizobium* - isolation. identification, mass multiplication, carrier-based inoculants, Actinorhizal symbiosis**(4L)**	**DR**
		Unit 2: *Azospirillum*: isolation and mass multiplication - carrier based inoculants, associative effect of different microorganisms. *Azotobacter*: classification, characteristics - crop response to *Azotobacter* inoculum, maintenance and mass multiplication. **(8L)**	**RI**
		Unit 3: Cyanobacteria (blue green algae), *Azolla* and *Anabaenaazollae* association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. **(4L)**	**RI**
		Unit 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield - colonization of AM - isolation and inoculum production of AM, and its influence on growth and yield of crop plants. **(8L)**	**SM**
		Unit 5: Organic farming - Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and industrial wastes - bio compost making methods, types and method of vermicomposting- field application. **(6L)**	**SM**
UG-H-BOT-GE-T-01	Biodiversity of Microbes, Algae, Fungi and Archegoniate	Unit 1: Microbes**(10L)**	**SP**
		Unit 2: Algae**(12L)**	
		Unit 3: Fungi**(2L)**	
		Unit 4: Introduction to Archegoniate**(10L)**	
		Unit 5: Bryophytes**(8L)**	
		Unit 6: Pteridophytes**(6L)**	
		Unit 7: Gymnosperms**(6L)**	
UG-H-BOT-GE-P-01		1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle. 2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule. 3. Gram staining. **(60L)**	

		4. Study of vegetative and reproductive structures of Nostoc, Oedogonium, Vaucheria, and Polysiphonia through temporary preparations; Chlamydomonas and Fucus through permanent slides and preserved specimens.	
		5. Rhizopus and Penicillium: Asexual stage from temporary mounts and sexual structures through permanent slides.	
		6. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both hosts.	
		7.Agaricus: Specimens of button stage and full grown mushroom; Sectioning of gills of Agaricus.	
		8. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose). 9. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs).	
		10. Marchantia- morphology of thallus, whole mount (WM) rhizoids and scales, vertical section (VS) thallus through gemma cup, WM gemmae (all temporary slides), VS antheridiophore, archegoniophore, longitudinal section (LS) sporophyte (all permanent slides). 11. Funaria- morphology, WM leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, LS capsule and protonema.	
		12. Lycopodium- morphology, transverse section (TS) stem, w.m. strobilus, w.m. sporophyll, and LS strobilus (permanent slide).	
		13. Selaginella- morphology, WM leaf with ligule, TS stem, WM strobilus, microsporophyll and megasporophyll (temporary slides), LS strobilus (permanent slide).	
		14. Equisetum- morphology, TS internode, LS strobilus, TS strobilus, WM sporangiophore, and spores (temporary slides); TS rhizome (permanent slide).	
		15. Pteris- morphology, TS rachis, VS sporophyll, WM sporangium, WM spores (temporary slides), TS rhizome, WM prothallus with sex organs and young sporophyte (permanent slides)	

Programme Course (PCC)

COURSE CODE	COURSE TITLE	COURSE CONTENT	TEACHER ASSIGNED
UG-BOT-G-CC-T-03 (Theory)	Plant Cell, Anatomy and Embryology	**Plant Cell** Unit 1: Cell as a unit of life**(2L)**	**SP**
		Unit 2: Cell organelles**(8L)**	
		Unit 3: Cell membrane and Cell wall**(4L)**	
		Unit 4: Cell cycle**(2L)**	
		Unit 5: Genetic material and protein synthesis**(4L)**	
		Anatomy Unit 6: Meristematic tissues, permanent tissues and organs**(8L)**	
		Unit 7: Secondary growth, adaptive and protective systems**(8L)**	

		Embryology	
		Unit 8: Structural organization of flower**(8L)**	
		Unit 9: Pollination and fertilization**(6L)**	
		Unit 10: Embryo and endosperm**(6L)**	
		Unit 11: Apomixis and polyembryony**(4L)**	
UG -BOT-G-CC-P-03 (Practical)		**Plant Cell** 1. Study of prokaryotic cells (bacterial), viruses, eukaryotic cells with the help of light and electron micrographs. 2. Study of the photomicrographs of cell organelles. 3. Study of the structure of plant cells through temporary mounts. 4. Study of mitosis and meiosis (temporary mounts and permanent slides). 5. Study of plasmolysis and deplasmolysis on Rhoeo leaf. 6. Measurement of cell size (either length or breadth/diameter) by micrometry. **Anatomy** 7. Study of meristems through permanent slides and photographs. 8. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (permanent slides, photographs). 9. Stem: Monocot (Zea mays); Dicot (Helianthus); Secondary: Helianthus (only permanent slides). 10. Root: Monocot (Zea mays); Dicot (Helianthus); Secondary: Helianthus (only permanent slides). 11. Leaf: Dicot and Monocot leaf (only permanent slides). **Embryology** 12. Structure of young and mature anther (permanent slides). 13. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous, campylotropous (from permanent slides). 14. Female gametophyte: Polygonum (monosporic), type of embryo sac development (permanent slides/photographs). 15. Dissection of embryo/endosperm from developing seeds. 16. Determination of germination percentage of pollen grains. **(25L)**	**BC**
UG-BOT-G-SEC-T-01 (Theory)	Biofertilizers	Unit 1: General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, and carrier-based inoculants, Actinorrhizal symbiosis. Unit 2: Azospirillum: isolation and mass multiplication – carrier-based inoculants, associative effect of different microorganisms. Azotobacter: classification, characteristics – crop response to Azotobacter inoculum, maintenance and mass multiplication. Unit 3: Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. Unit 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of AM – isolation and inoculum production of AM, and its influence on growth and yield of crop plants.	**SP**

		Unit 5: Organic farming – green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and industrial wastes – biocompost making methods, types and method of vermicomposting – field application. **(30L)**	

DEPARTMENT OF BOTANY
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SEMESTER-V (UNDER CBCS)
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COURSE CODE	COURSE TITLE	COURSE CONTENT	TEACHER ASSIGNED
UG-H-BOT-CC-T-11	Plant Physiology	**Unit 1: Plant-water relations** Water in plant life, diffusion, osmosis, imbibitions, water potential and its components; Water absorption by roots, aquaporins, pathways of water movement, symplast, apoplast, transmembrane pathways, root pressure; Ascent of sap-cohesion-tension theory; Transpiration, factors affecting transpiration, antitranspirants, mechanism of stomatal movement, Guttation**(10L)**	RI
		Unit 2: Mineral nutrition Essential and beneficial elements, macro and micronutrients; Techniques used in nutritional studies and use of nutrient solutions; Criteria of essentiality, Roles of essential elements; Mineral deficiency symptoms. **(6L)**	DR
		Unit 3: Nutrient Uptake Soil as a nutrient reservoir; Transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport. **(8L)**	RI
		Unit 4: Translocation in the phloem Pathways of translocation, experimental evidence, Phloem sap, P-protein; Mass flow and Pressure-Flow Model; Phloem loading and unloading; Source-sink relationship. **(8L)**	DR
		Unit 5: Plant growth regulators Auxins - Discovery, chemical nature (natural and synthetic), biosynthesis of IAA, bioassay and physiological roles of auxins; Gibberellin, Cytokinin, Abscisic acid and Ethylene - Discovery, chemical nature (natural and synthetic), bioassay and physiological roles; Brassinosteroids and Jasmonic acid- Discovery, chemical nature (natural and synthetic) and physiological roles**(12L)**	SM
		Unit 6: Physiology of flowering Classification of plants based on photoperiod responses, critical day length, concept of night length monitoring; Perception of flowering stimulus; Florigen concept; role of Flowering Locus T; Vernalization- Role of cold temperature in flowering. **(6L)**	SM
		Unit 7: Phytochrome, crytochromes and phototropins Discovery, chemical nature, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action. **(6L)**	SM

		Unit 8: Seed dormancy Types, factors causing dormancy, breaking down and significance of seed dormancy. **(4L)**	RI
- UG-H-BOT-CC-P-11 **(Practical)**		1. Determination of osmotic potential of plant cell sap by plasmolytic method. **(10L)**	SM
		2. Determination of water potential of given tissue (potato tuber) by weighing method. **(10L)**	SM
		3. Determination of stomatal frequency and loss of water per stoma per hour. **(10L)**	RI
		4. Effect of humidity and light on the rate of transpiration in excised twig/ leaf. **(10L)**	RI
		5. Comparison of imbibitions of water by starchy, proteinaceous and fatty seeds. **(10L)**	DR
		6. Comparison of germination frequency of two crop seeds and effect of light and dark thereon. **(10L)**	DR
UG-H-BOT-CC-T-12 **(Theory)**	Plant Metabolism	**Unit 1: Concept of metabolism** Introduction, anabolic and catabolic pathways; Regulation of metabolism; Role of regulatory enzymes (allosteric, covalent modulation and Isozymes). **(6L)**	DR
		Unit 2: Carbon assimilation Historical background; Photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres; Photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle; CO_2 reduction: Calvin cycle, photorespiration, C4 pathways; Crassulacean acid metabolism; Factors affecting CO_2 reduction. **(14L)**	SM
		Unit 3: Carbohydrate metabolism Synthesis and catabolism of sucrose and starch. **(2L)**	DR
		Unit 4: Carbon Oxidation Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle; Mitochondrial electron transport, oxidative phosphorylation; Cyanide-resistant respiration; Factors affecting respiration. **(10L)**	SM
		Unit 5: ATP-Synthesis Mechanism of ATP synthesis; Substrate level phosphorylation: chemiosmotic mechanism (oxidative and photophosphorylation); ATP synthase, Boyers conformational model, Racker's experiment; Role of uncouplers. **(8L)**	SM
		Unit 6: Lipid metabolism Synthesis and breakdown of triglycerides; β-oxidation of fatty acids; Glyoxylate cycle; Gluconeogenesis. **(8L)**	DR
		Unit 7: Nitrogen metabolism Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination. **(8L)**	RI
		Unit 8: Mechanisms of signal transduction Receptor-ligand interactions; Second messenger concept, Role of Calcium calmodulin. **(4L)**	RI
UG-H-BOT-CC-P-12		**Detection:** 1. Determination of rate of photosynthesis under varying	RI

(PRACTICAL)		HCO3 concentration in an aquatic plant and to find out the optimum and toxic condition. **(20L)**	
		2. Determination of effect of promoter and inhibitor on the rate of aerobic respiration using Ganong's Respiroscope	**RI**
		3. Determination of the rate of respiration of different plant parts using Ganong's Respiroscope.	**RI**
		4. Determination of RQ of germinating seeds. **(10L)**	**DR**
		5. Estimation of nitrogen/ amino acid by formal titration method (for any amino acid).	**DR**
		6. Estimation of glucose by Benedict's quantitative reagent**(20L)**	**SM**
		7. Estimation of catalase activity in plant samples	**SM**
		8. Estimation of urease activity in plant samples.	**SM**
		9. Colorimetric estimation of protein by Folin phenol reagent. **(10L)**	**DR**
		Demonstration Experiment 1. Chemical separation of photosynthetic pigments.	**DR**
UG-H-BOT-DSE-T-01 (THEORY)	A. Analytical Techniques in Plant Science	Unit 1: Imaging and related techniques Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching. **(15L)**	**DR**
		Unit 2: Cell fractionation Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl2 gradient, analytical centrifugation, ultracentrifugation, marker enzymes. **(8L)**	**SY**
		Unit 3: Radioisotopes Use in biological research, auto-radiography, pulse chase experiment**(4L)**	**SY**
		Unit 4: Spectrophotometry Principle and its application in biological research. **(4L)**	**SY**
		Unit 5: Chromatography Principle; Paper chromatography; Column chromatography, Thin Layer Chromatography (TLC), Gas Liquid Chromatography (GLC), High Performance Liquid Chromatography (HPLC), Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography**(8L)**.	**DR**
		Unit 6: Characterization of proteins and nucleic acids Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: Agarose Gel Electrophoresis, Polyacrylamide Gel Electrophoresis (PAGE), Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis (SDSPAGE) **(6L)**	**RI**
		Unit 7: Biostatistics Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit. **(15L)**	**DR**

UG-H-BOT-DSE-P-01 (PRACTICAL)		1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs. **(10L)**	**RI**
		2. Separation of amino acids by paper chromatography. **(10L)**	**RI**
		3. Demonstration of pigment separation by column chromatography**(10L)**	**SM**
		4. Estimation of protein concentration through Lowry's methods. **(10L)**	**DR**
		5. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH) **(10L)**	**DR**
		6. Preparation of permanent slides by double staining method (Helianthus stem, Nerium leaf, Maize root). **(10L)**	**SM, DR**
UG-H-BOT-DSE-T-02 (THEORY)	Plant Breeding and Biometry	Unit 1: Plant breeding Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. **(10L)**	**SY**
		Unit 2: Methods of crop improvement Introduction: Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations. **(10L)**	**SM**
		Unit 3: Quantitative inheritance Concept, mechanism, examples of inheritance of Kernel colour in wheat, Skin colour in human beings. Monogenic vs polygenic inheritance**(10L)**	**DR**
		Unit 4: Inbreeding depression and heterosis History, genetic basis of inbreeding depression and heterosis; Applications**(10L)**	**BC**
		Unit 5: Crop improvement and breeding Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement**(10L)**	**DR**
		Unit 6: Biometry Terms and Definition– sample and population, quantitative and qualitative variables, random sampling, frequency distribution, arithmetic mean, mode and median; Measurement of dispersion –standard deviation, coefficient of variation and standard error; Test of significance – Null Hypothesis, X^2 -test of goodness of fit, probability; Measurement of gene frequency (Hardy Weinberg hypothesis) **(10L)**	**RI**
- UG-H-BOT-DSE-P-02 (PRACTICAL)		1. Hybridization technique (anthesis, emasculation, pollination) (Demonstration).	**RI**
		2. Differential pollen stainability following aceto-carmine technique. **(20L)**	**RI**
		3. Analysis of statistical data: Calculation of mean, mode, median, standard deviation and standard error**(10L)**	**DR**
		4. Determination of goodness of fit in normal and modified mono -and dihybrid ratios by Chi-square analysis and comment on the nature of inheritance. **(20L)**	**SM**
		5. Calculation of correlation coefficient values and finding out the probability**(10L)**	**DR**

Programme Course (PCC)

COURSE CODE	COURSE TITLE	COURSE CONTENT	TEACHER ASSIGNED
UG-BOT-G-DSE-T-01	A. Analytical Techniques in Plant Sciences	Unit 1: Imaging and related techniques Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.	SY
		Unit 2: Cell fractionation Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, $CsCl_2$ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.	
		Unit 3: Radioisotopes Use in biological research, auto-radiography, pulse chase experiment	
		Unit 4: Spectrophotometry Principle and its application in biological research.	
		Unit 5: Chromatography Principle; Paper chromatography; Column chromatography, Thin Layer Chromatography (TLC), Gas Liquid Chromatography (GLC), High Performance Liquid Chromatography (HPLC), Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.	SY
		Unit 6: Characterization of proteins and nucleic acids Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: Agarose Gel Electrophoresis, Polyacrylamide Gel Electrophoresis (PAGE), Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis (SDSPAGE)	
		Unit 7: Biostatistics Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit. **(60L)**	
UG-BOT-G-DSE-P-01		1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.	BC, SY, SM
		2. Separation of amino acids by paper chromatography.	
		3. Demonstration of pigment separation by column chromatography	
		4. Estimation of protein concentration through Lowry's methods.	
		5. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH)	
		6. Preparation of permanent slides by double staining method (Helianthus stem, Nerium leaf, Maize root).	
UG-BOT-	A. Herbal	Unit 1: Herbal medicines	SP

| G-SEC-T-03 (Theory) | Technology | History and scope: definition of medical terms, role of medicinal plants in Siddha systems of medicine; cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants.
Unit 2: Pharmacognosy
Systematic position and medicinal uses of the following herbs in curing various ailments: Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.
Unit 3: Phytochemistry
Active principles and methods of their testing: identification and utilization of the medicinal herbs- Catharanthus roseus (cardiotonic), Withania somnifera (drugs acting on nervous system), Clerodendrum phlomoides (anti-rheumatic) and Centella asiatica (memory booster).
Unit 4: Analytical pharmacognosy Drug adulteration: types, methods of drug evaluation; Biological testing of herbal drug: phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds). Unit 5: Medicinal plant banks
Micro propagation of important species (Withania somnifera, neem and tulsi- herbal foods, future of pharmacognosy). **(25L)** | |

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)

DEPARTMENT OF CHEMISTRY
Syllabus Distribution
SEMESTER-I
SESSION: July 2023-December2023

Major

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEM-MAT-1 [4 credits] [120 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	Inorganic-1A	• **Atomic Structure** Bohr's model and atomic spectrum of hydrogen, Limitations of Bohr's model and Sommerfeld'smodifications, de Broglie's concept, Heisenberg's uncertainty principle and its significance, Time independent Schrödinger's wave equation (without application and solution detail), Significance of ψ and ψ^2, Radial and angular wave functions for hydrogen atom (qualitative idea), radialprobability distribution curves, shapes of s, p, d and f orbitals (qualitative idea), Quantumnumbers and their significance, Pauli's exclusion principle, aufbau principle and limitations, Hund's rules, exchange energy, Electronic configurations of atoms. Elementary idea of microstates.	16L	MH & MM
		• **Periodic Properties** Modern IUPAC periodic table and classification of elements in the table; Effective nuclear chargeand its calculation using Slater's rules; Atomic radii, Ionic radii and Pauling's method fordetermining univalent ionic radii; Electronegativity (Pauling's, Mulliken's and Allred-Rochow'sscale) and its applications, Ionization energy, Electron affinity and factors influencing these properties; Group trends and periodic trends of these properties with reference to s, p and d-block elements, Inert pair effect.	14L	KKS
	Physical -1A	**Kinetic Theory and Gaseous state** *Kinetic Theory of gases: 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). *Maxwell's distribution of speed and energy: Nature of distribution of velocities, Maxwell's distribution of speeds in one, two and three	18 L	AR

dimensions; Kinetic energy distribution in one, two and three dimensions, calculations of average, root mean square and most probable values in each case; Calculation of number of molecules having energy. Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases.

*Real gas and virial equation: 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, other equations of state (Berthelot, Dieterici); Existence of critical state, Critical constants in terms of van-der - Waals constants; Law of corresponding states; virial equation of state; van-der-Waals equation expressed in virial form and significance of second virial coefficient; Intermolecular forces (Debye, Keesom and London interactions; Lennard-Jones potential - elementary idea)..

Chemical Thermodynamics – I

*Zeroth and 1st law of Thermodynamics:
Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics; Concept of heat, work, internal energy and statement of first law; enthalpy, H: relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van-der-Waals) under isothermal and adiabatic conditions, Joule's experiment and its consequence.

* Thermo chemistry:
Standard states; Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications, Laws of thermo chemistry; bond energy, bond dissociation energy and resonance energy from thermo chemical data, Kirchhoff's equations and effect of pressure on enthalpy of reactions

| | | 12L | RG |

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEM-MAP-1 [2 credits = 20] Practical. Major (Practical)	Inorganic-1A &	i) Preparation of primary standard solutions of tartans ii) Estimation of carbonate and hydroxide present together in a mixture iii) Estimation of carbonate and bicarbonate present together in a mixture.	12	MH & AKK
	Physical-1A	i) Determination of pH of unknown solution (buffer), by color matching method. ii) Determination of heat of neutralization of a strong acid by a strong base iii) Determination of heat of solution of oxalic acid from solubility measurement.	12	AR

DEPARTMENT OF CHEMISTRY
Syllabus Distribution
SEMESTER-III
SESSION: July 2023-December2023

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMHT-5 [4 Credit = 40] + Internal Assessment = 15 Full Marks: 55	Physical Chemistry – II	**1. Transport process** *Viscosity: General features of fluid flow (streamline flow and turbulent flow); Newton's equation, viscosity coefficient: Poiseuille's equation; Principle of determination of viscosity coefficient of liquids by falling sphere method; Temperature variation of viscosity of liquids and comparison with that of gases. *Conductance and transport number: Ion conductance: Conductance and measurement of 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: Debye Hückel theory of Ion atmosphere (qualitative)-asymmetric effect, relaxation effect and electrophoretic effect; Ostwald's dilution law; Ionic mobility: Application of conductance measurement (determination of solubility product and ionic product of water): Conductometric titrations. Transport number. Principles of Hittorf's and Moving-boundary method. **2. Application of Thermodynamics-1** *Partial properties and chemical potential Chemical potential and activity, partial molar quantities, relation	20L	RG & AR

between chemical potential and Gibb's free energy and other thermodynamic state functions, variation of chemical potential (μ) with temperature and pressure, Gibbs-Duhem equation, fugacity and fugacity coefficient, Variation of thermodynamic functions for systems with variable composition, Equations of states for these systems, Change in G, SH and V during mixing for binary solutions.

*Chemical Equilibrium:Thermodynamic conditions for equilibrium, degree of advancement, Van't Hoff's reaction isotherm (deduction from chemical potential), Variation of free energy with degree of advancement, Equilibrium constant and standard Gibbs free energy change, Definitions of KP, Kc and Kx, Van't Hoff's reaction isobar and isochore from different standard states; Shifting of equilibrium due to change in external parameters e.g. temperature and pressure, variation of equilibrium constant with addition to inert gas, Le Chatelier's principle.
Nernst's distribution law, Application-(finding out Keq using Nernst distribution law for KI+12=KI, and dimerization of benzene.
*Chemical potential and other properties of ideal substances-pure and mixtures Pure ideal gas:
Its chemical potential and other thermodynamic functions and their changes during a change of thermodynamic parameters of mixing, Chemical potential of an ideal gas in an ideal gas mixture: Concept of standard states and choice of standard states of ideal gases.

*Condensed Phase: Chemical potential of pure solid and pure liquids, Ideal Solution-Definition, Raoult's law, Mixing properties of ideal solutions, chemical potential of a component in an ideal solution; Choice of standard states of solids and liquids

3. Foundation of Quantum Mechanics:
*Beginning of Quantum Mechanics Wave-particle duality, light as particles:photoelectric and Compton effects; electrons as waves and the de Broglie hypothesis; Uncertainty relations (without proof) Wave function: Schrodinger time-independent equation, nature of the equation, acceptability conditions imposed on the wave functions and probabilityinterpretations of wave function

*Concept of Operators: Elementary concepts of operators, eigenfunctionsandeigenvalues, Linear operators, Commutation of operators, commutator anduncertainty relation, Expectation value; Hermitian operator, Postulates ofQuantum Mechanics.

20 L

RG & AR

		*Particle in a box Setting up of Schrodinger equation for one-dimensional box and its solution, Comparison with free particle eigenfunctions and eigenvalues Properties of particle in a box wave functions (normalisation, orthogonality, probability distribution), Expectation values of x, x, p, and p, and their significance in relation to the uncertainty principle; Extension of the problem to two and three dimensions and the concept of degenerate energy levels.	**20 L**	RG & AR
CHEMHP-5 [2 credits = 20] Practical. Full Marks: 20	Inorganic Chemistry – II [Practical]	i) Study of viscosity of unknown liquid (glycerol, sugar) with respect to water. ii) Determination of partition coefficient for the distribution of I_2 between water and CCl_4 iii) Determination of K, for $KI + I_2 = KI$, using partition coefficient between water and CCl_4 iv) Conductometric titration of an acid (strong, weak/ monobasic, dibasic) against strong base v) Study of saponification reaction conductometrically vi) Verification of Ostwald's dilution law and determination of Ka of weak acid	**(20L)**	RG & AR
CHEMHT-6 [4 Credit = 40] + Internal Assessment = 15 + CHEMHP-6 [2 credits = 20] Practical. Full Marks: 75	Inorganic Chemistry – II	**1. Chemical Bonding – I:** Ionic Bond: Lattice energy, Born-Lande equation with derivation andimportance of Kapustinskii expression for lattice energy, Born-Haber cycle anditsapplications, Polarising power and polarisability of ions, Fajan's rules and itsapplications, radius ratio rules – its applications and limitations, salvation energyand solubility energetics of dissolution process; Packing in crystals, voids incrystal lattice, packingefficiency, Structure of ionic solids: rock salt, zinc blende,wurtzite, fluorite, antifluorite, perovskite and layer lattice. Qualitative idea aboutstoichiometric and non-stoichiometric crystal defects.	(22L)	MH
		2.Chemical Bonding – II directional properties of covalent bond, Concept of Equivalent and non equivalent Hybridization and shapes of simple molecules and ions (examples from main groups), Stereochemically non-rigid molecules – Berry'spseudorotation, Resonance and Dipole moments of inorganic molecules and ions,VSEPR theory and Bent's rule and their applications; M.O. Theory (elementarypictorial approach), concept of bond order, MO diagram of homo-nucleardiatomics (1_{st} and 2_{nd} period elements), hetero-nuclear diatomics (HF, CO, NO,NO_+ and CN_-) and triatomics (H_2O and BeH_2). Electron sea model and elementary idea about band theory, classification of inorganic solids andtheirconduction properties according to band theory; Hydrogen bonding: classifications, its effect on the properties of compounds and its importance inbiological systems, vander Waal's forces.	(28L)	KKS
		3.Metal extraction and purification: Basic Metallurgy		

		Idea about ores and minerals, operations involved in metallurgy, Flow chart diagram for the extraction of pure Ti, Ni and U(including reactions) from theirimportant ores and their uses.	(10L)	AKK
	Inorganic Chemistry – II [Practical]	i) Estimation of Fe(II) and Fe(III) in a given mixture using K2Cr2O7 solution ii) Estimation of Fe(III) and Cu(II) in a given mixture using K2Cr2O7 solution iii) Estimation of Cr(VI) and Mn(II) in a given mixture using K2Cr2O7 solution iv) Estimation of Fe(III) and Cr(VI) in a given mixture using K2Cr2O7 solution v) Estimation of Fe(II) and Mn(II) in a given mixture using KMnO4 solution vi) Estimation of Fe(III) and Ca(II) in a given mixture using KMnO4 solution		MH +AKK
CHEMHT-7 [4 Credit = 40] + Internal Assessment = 15 + CHEMHP-7 [2 credits = 20] Practical. Full Marks: 75	Organic Chemistry – III	**1. Chemistry of alkenes and alkynes:** **Addition to C=C:**mechanism (with evidence wherever applicable), reactivity, regioselectivity(Markownikoff and anti Markownikoff additions) and stereoselectivity; reactions: hydrogenation, halogenations, iodolactonisation,hydrohalogenation, hydration, oxymercurationdemercuration, hydroboration-oxidation,epoxidation, syn and antihydroxylation,ozonolysis, addition of singlet and triplet carbenes;electrophilic addition to diene (conjugated dienes and allene); radicaladdition: HBr addition; mechanism of allylic and benzylic brominationincompetition with brominations across C=C; use of NBS; dissolving metalreduction of alkenes; interconversion of E - and Z - alkenes; contrathermodynamic isomerization of internal alkenes. **Addition to C≡C (in comparison to C=C):** mechanism, reactivity,regioselectivity (Markownikoff and anti-Markownikoff addition) and 21Prepared byUGBOS (Chemistry)stereoselectivity; reactions: hydrogenation, halogenations, hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation, dissolving metal reduction of alkynes (Birch); reactions of terminal alkynes by exploring its acidity; interconversion ofterminal and non-terminal alkynes. 1. Aromatic Substitution: Electrophilic aromatic substitution: **Electrophilic aromatic substitution:**Mechanisms and evidences in favourof it; orientation and reactivity; reactions: nitration, nitrosation,sulfonation, halogenation,	(16L)	MM

Friedel-Crafts reaction; one-carbon electrophiles(reactions: chloromethylation, Gatterman-Koch, Gatterman, Houben-Hoesch, Vilsmeier-Haack, Reimer-Tiemann, Kolbe-Schmidt); Ipsosubstitituion

Nucleophilic aromatic substitution:
addition-elimination mechanism and
evidences in favour of it; SNArmechanism; cine substitution (benzynemechanism), structure of benzyne.

2. Carbonyl and Related Compounds:
Addition to C=O: structure, reactivity and preparation of carbonylcompounds; mechanism (with evidence), reactivity, equilibrium andkinetic control; Burgi-Dunitz trajectory in nucleophilic additions;formation of hydrates, cyanohydrins and bisulphite adduct; nucleophilicaddition-elimination reactions with alcohols, thiols and nitrogen-based
nucleophiles; reactions: benzoin condensation, Cannizzaro and Tischenkoreactions, reactions with ylides: Wittig and CoreyChaykovskyreaction;Rupe rearrangement, oxidations and reductions: Clemmensen, Wolff-
Kishner, $LiAlH_4$, $NaBH_4$, MPV, Oppenauer, Bouveault-Blanc, acyloincondensation; oxidation of alcohols with PDC and PCC; periodic acid andleadtetraacetate oxidation of 1,2-diols.

Exploitation of acidity of α-H of C=O:
formation of enols and enolates;
kinetic and thermodynamic enolates; reactions (mechanism with evidence):halogenation of carbonyl compounds under acidic and basic conditions,Hell-Volhard-Zelinsky (H. V. Z.) reaction, nitrosation, SeO_2 (Riley)oxidation; condensations (mechanism with evidence): Aldol, Knoevenagel,Claisen-Schmidt, Claisen ester including Dieckmann, Stobbe; Mannichreaction, Perkin reaction, Favorskii rearrangement; alkylation of active
methylene compounds; preparation and synthetic applications of diethyl
malonate and ethyl acetoacetate; specific enol equivalents (lithium
enolates, enamines, aza-enolates and silyl enol ethers) in connection with
alkylation, acylation and aldol type reaction.

Elementary ideas of Green Chemistry: Twelve (12) principles of greenchemistry; planning of green synthesis; common organic reactions and
their counterparts: reactions: Aldol, Friedel-Crafts, Michael, Knoevenagel,
Cannizzaro, benzoin condensation and Dieckmann condensation.
Nucleophilic addition to α,β-unsaturated carbonylsystem:generalprinciple and mechanism
(with evidence); direct and conjugate addition,addition

| | (8L) | MM |
| | (30L) | MM |

		of enolates (Michael reaction), Stetter reaction, Robinsonannulations. 3. Organometallics: Grignard reagent; Organolithiums; Gilman cuprates: preparation and reactions (mechanism with evidence); addition of Grignard and organolithium to carbonyl compounds; substitution on -COX; directedortho metalation of arenes using organolithiums, conjugate addition byGilmancuprates; Corey-House synthesis; abnormal behavior of Grignardreagents; comparison of reactivity among Grignard, organolithiumsandorganocopper reagents; Reformatsky reaction; Blaise reaction; concept ofumpolung and base-nucleophile dichotomy in case of organometallicreagents.		
	Organic Chemistry – III [Practical]	Qualitative Analysis of Single Solid Organic Compounds: 1. Detection of special elements (N, S, Cl, Br) by Lassaigne's test 2. Solubility and classification (solvents: H_2O, 5% HCl, 5% NaOH and 5%$NaHCO_3$) 3. Detection of the following functional groups by systematic chemical tests: 4. Aromatic amino (Ar-NH_2), aromatic nitro (Ar-NO_2), amido (-$CONH_2$,including imide), phenolic hydroxyl (Ph–OH), carboxylic acid (-COOH),carbonyl (-CHO and >C=O); only one test for each functional group is to be reported. 5. Melting point of the given compound 6. Preparation, purification and melting point determination of a crystallinederivative of the given compound 7. Identification of the compound through literature survey.Each student, during laboratory session, is required to carry out qualitative chemical tests for all the special elements and the functional groups with relevant derivatisation in known and unknown (at least six) organic compounds	MM MM (6L)	

DEPARTMENT OF CHEMISTRY
Syllabus Distribution
SEMESTER-V
SESSION: July 2023-December2023

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	Inorganic Chemistry – IV	**1. Coordination Chemistry – II :** Structure and bonding of coordination compounds on the basis of V.B.Theory and its limitations. Elementary idea about CFT, splitting of d_n configuration in ML_4 to ML_6 and ML_8 systems, factors affecting , measurement of spectrochemical series of ligands, CFSE in weak and strong fields, OSSE, Highspin and low spin complexes, spin isomerism, tetragonal distortion, Jahn Tellertheorem and applications, achievements and limitations of CFT, nephelauxetic effect, stabilisation of unusually high and low oxidation states of 3d serieselements, MOT (elementary idea), σ and π bonding in octahedral complexes (apictorial approach). Colour and electronic spectra of complexes: selection rules for electronic transitions, d-d transition, charge transfer transition (qualitative33Prepared byUGBOS (Chemistry) idea), L-S coupling and R-S ground state term for atomic no. up to 30, qualitative ORGEL diagram for $3d_1$ – $3d_9$ ions with appropriate symbols for theenergy levels.	(28L)	KKS
		2. Magnetochemistry: Classification of magnetic substances, Origin of para magnetic moments, temperature dependence of para magnetism – Curie and Curie-Weiss law, TIP,magnetic susceptibility and its measurement (Gouy method), diamagneticcorrection, effective magnetic moment, spin only moment for 3d metals, Orbitalcontribution to magnetic moment, spin-orbit coupling, quenching of orbitalcontribution, Sub-normal magnetic moments and antiferromagnetic interactions (elementary idea with examples).		
		3. Chemistry of d- and f-block elements: d-block elements:Characteristic properties, Comparison among the elements of3d series with reference to electronic configuration, oxidation states and E_0values; General comparison between 3d, 4d and 5d series	(12L)	

		elements in term ofelectronic configuration, oxidation states, atomization energy, magneticproperties and coordination chemistry.		MH
		f-block elements：Comparison between d and f-block elements; Electronicconfiguration, oxidation states, variation of magnetic properties (Ln_{3+}), atomicand ionic(3+) radii of lanthanoids; consequences of lanthanide contraction,separation of lanthanides by ion exchange and solvent extraction methods;comparison between lanthanoids and actinoids.	(12L)	MH
		4. Reaction Kinetics and Mechanism: Introduction to inorganic reaction mechanisms, substitution reactions in squareplanar complexes; *trans*-effect - theories and applications; lability and inertnessin octahedral complexes towards substitution reactions. Elementary concept of*cis*-effect.	(8L)	MH
	Inorganic Chemistry – IV[Practical]	A. Quantitative: i) Estimation of available chlorine in bleaching powder using iodometry ii) Estimation of available oxygen in pyrolusite using permanganometry iii) Estimation of Cu in brass using iodometry iv) Estimation of Fe in cement using permanganometry v) Estimation of chloride gravimetrically vi) Estimation of Ni(II) using DMG gravimetrically B. Experiment : i) Paper chromatographic separation of Ni(II) and Co(II) ii) Measurement of 10Dq by spectrophotometric method iii) Preparation of $Mn(acac)_3$ and determination of its λ maxcolorimetrically		MH+AKK
CHEMHT-12 [4 Credit = 40] + Internal Assessment = 15 + Full Marks: 55	Physical Chemistry – IV	**Molecular Spectroscopy:** Interaction of electromagnetic radiation with molecules and various types ofspectra; Born-Oppenheimer approximation *Rotation spectroscopy: Selection rules, intensities of spectral lines, determinationof bond lengths of diatomic and linear triatomic molecules, isotopic substitution. *Vibrational spectroscopy: Classical equation of vibration, computation of forceconstant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies; Diatomic vibrating rotator, P, Q, R branches	(24 L)	RG & AR

| | | *Raman spectroscopy:
Qualitative treatment of Rotational Raman effect;Vibrational Raman spectra, Stokes and anti-Stokes lines

*NMR & ESR spectroscopy:
NMRspectroscopy: Principles of NMRspectroscopy, Larmor precession, chemical shift and low resolution spectra.
R spectroscopy: Its principle, ESR of simpleradicals.
Photochemistry:
*Lambert-Beer's law: Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients;Laws of photochemistry, Stark-Einstein law of photochemical equivalence quantum yield, actinometry, examples of low and high quantum yields.
*Photochemical Processes:
Potential energy curves (diatomic molecules), Frank-Condon principle and vibrational structure of electronic spectra; Bonddissociation and principle of determination of dissociation energy (ground state);Decay of excited states by radiative and non-radiative paths;Pre-dissociation;Fluorescence and phosphorescence,Jablonskii diagram.
*Rate of Photochemical processes:
otochemical equilibrium and the differentialrate of photochemical reactions, Photostationary state; HI decomposition, H_2+Br_2reaction, dimerisation of anthracene; photosensitised reactions, quenching; Roleof photochemical reactions in biochemical processes, photostationary states,chemiluminescence.
Surface Phenomenon:
*Surface tension and energy: Surface tension, surface energy, excess pressure, capillary rise and surface tension; Work of cohesion and adhesion, spreading of liquid over other surface; Vapour pressure over curved surface; Temperature dependence of surface tension.
*Adsorption: Physical and chemical adsorption; Freundlich and Langmuir
adsorption isotherms; multilayer adsorption and BET isotherm (no derivationrequired); Gibbs adsorption isotherm and surface excess; Heterogenous catalysis
(single reactant); Zero order and fractional order reactions.
*Colloids: Lyophobic and lyophilic sols, Origin of charge and stability of
phobic colloids, coagulation and Schultz-Hardy rule, Zeta potential and Stern double layer (qualitative idea), Tyndall effect; Electro-kinetic phenomena (qualitative idea only); Determination of Avogadro | **(24 L)** | AR |
| | | | | RG & |

		number by Perrin's method; Stability of colloids and zeta potential; Micelle formation.	**(24 L)**	AR
CHEMHP-6 [2 credits = 20] Practical. Full Marks: 20	Physical Chemistry – IV[Practical]	i. Determination of surface tension of a liquid using Stalagmometer. ii. Determination of CMC from surface tension measurements. iii. Verification of Beer and Lambert's Law for KMnO4and K2Cr2O7solution. iv. Study of kinetics of K2S2O8+ KI reaction, spectrophotometrically. v. Determination of pH of unknown buffer, spectrophotometrically. Spectrophotometric determination of CMC.		RG & AR
CHEMHTDSE-1B [4 Credit = 40] + Internal Assessment = 15 + CHEMHTDSE-1B [2 credits = 20] Practical. Full Marks: 75	Inorganic Materials of Industrial Importance	**1. Silicate Industries** **1. Silicate Industries (9L)** i) Glass: Glassy state and its properties, classification (silicate and non-silicateglasses). Manufacture and processing of glass. Composition and properties of thefollowing types of glasses: Soda lime glass, lead glass, armoured glass, safetyglass, borosilicate glass, fluorosilicate, coloured glass,photosensitive glass. ii) Ceramics: Important clays and feldspar, ceramic, their types and manufacture.High technology ceramics and their applications, superconducting andsemiconducting oxides, fullerenes carbon nanotubes and carbon fibre. iii) Cements: Classification of cement, ingredients and their role, Manufacture ofcement and the setting process, quick setting cements. **2. Fertilizers** Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassiumchloride, potassium sulphate. **3. Surface Coatings** Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Pigments, toners and laker pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint),	(9L) (9L)	AKK

		Water and Oil paints, additives, Metallic coatings(electrolytic and electroless),	
		4. Batteries Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.	
		5. Alloys Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization,demanganization, desulphurization dephosphorisation).. Composition andproperties of different types of steels.	(9L)
		6. Catalysis General principles and properties of catalysts, homogenous catalysis (catalyticsteps and examples) and heterogenous catalysis (catalytic steps and examples)and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.	(9L)
	Inorganic Materials of Industrial Importance Practical	**7. Chemical explosives** Origin of explosive properties in organic compounds, preparation and explosiveproperties of lead azide, PETN, cyclonite (RDX). Introduction to rocketpropellants. **List of Practical** 1. Determination of free acidity in ammonium sulphate fertilizer. 2. Estimation of Calcium in Calcium ammonium nitrate fertilizer. 3. Estimation of phosphoric acid in superphosphate fertilizer. 4. Electroless metallic coatings on ceramic and plastic material. 5. Determination of composition of dolomite (by complexometric titration). 6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples. 7. Analysis of Cement. 8. Preparation of pigment (zinc oxide).	(9L) (6L)

CHEMHTDSE-2C [4 Credit = 40] + Internal Assessment = 15 + CHEMHTDSE-2C [2 credits = 20] Practical. Full Marks: 75	Green Chemistry	**1. Introduction to Green Chemistry:** What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry	(4L)	
		2. Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following: Designing a Green Synthesis using these principles; Prevention of Waste/byproducts; maximum incorporation of the materials used in the processinto the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions. Prevention/ minimization of hazardous/ toxic products reducing toxicity.risk = (function) hazard $\times$ exposure; waste or pollution prevention hierarchy. Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents. Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy. Selection of starting materials; avoidance of unnecessary derivatization –careful use of blocking/protecting groups. Use of catalytic reagents (wherever possible) in preference to43Prepared byUGBOS (Chemistry) stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis. Prevention of chemical accidents designing greener processes, inherentsafer design, principle of ISD "What you don't have cannot harm you",greener alternative to Bhopal Gas Tragedy (safer route to carcarbaryl) and Flixiborough accident (safer route tocyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation. Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.	(26L)	MM

		3. Examples of Green Synthesis/ Reactions and some real-world cases		
		Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis) Microwave assisted reactions in water: Hofmann Elimination, methylbenzoate to benzoic acid, oxidation of toluene and alcohols; microwaveassisted reactions in organic solvents Diels-Alder reaction andDecarboxylationreactionUltrasound assisted reactions: sonochemical Simmons-Smith Reaction(Ultrasonic alternative to Iodine)Surfactants for carbon dioxide – replacing smog producing and ozonedepleting solvents with CO_2 for precision cleaning and dry cleaning of garments.Designing of Environmentally safe marine antifoulant.Right fit pigment: synthetic azopigments to replace toxic organic andinorganic pigments.An efficient, green synthesis of a compostable and widely applicableplastic (poly lactic acid) made from corn. Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterificationfor production of no Trans-Fats and OilsDevelopment of Fully Recyclable Carpet: Cradle to Cradle Carpeting		MM
		4. Future Trends in Green Chemistry: Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co crystal controlled solid state synthesis (C2S3); Green chemistry insustainable development.	(26L)	
		Safer starting materials: Preparation and characterization of nano particles of gold using tea leaves. **Using renewable resources:** Preparation of biodiesel from vegetable/ waste cooking oil. **Avoiding waste:** Principle of atom economy. Use of molecular model kit to stimulate the reaction to investigate how theatom economy can illustrate Green Chemistry. Preparation of propene by two methods can be studied a. Triethylamine ion + OH- $\rightarrow$ propene + trimethylpropene + water 1-propanol b. H_2SO_4 Propene + waterother types of reactions, like addition, elimination,		

		substitution andrearrangement should also be studied for the calculation of atom economy.Principle of atom economy. **Use of enzymes as catalysts:** Benzoin condensation using Thiamine cation (anchored enzyme) as a catalyst instead of cyanide. **Alternative Green solvents:** Extraction of D-limonene from orange peel using liquid CO_2 prepared from dry ice. Mechanochemical solvent free synthesis of azomethines **Alternative sources of energy**:	(4L)	
	Green Chemistry Practical	Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).Photoreduction of benzophenone to benzopinacol in the presence of sunlight.		MM
		Inorganic Materials of Industrial Importance **List of Practicals** 1. Determination of free acidity in ammonium sulphate fertilizer. 2. Estimation of Calcium in Calcium ammonium nitrate fertilizer. 3. Estimation of phosphoric acid in superphosphate fertilizer. 4. Electroless metallic coatings on ceramic and plastic material. 5. Determination of composition of dolomite (by complexometric titration). 6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples. 7. Analysis of Cement. 8. Preparation of pigment (zinc oxide).		MH+A KK

DEPARTMENT OF CHEMISTRY
Syllabus Distribution
SEMESTER-I
SESSION: July 2023-December2023
MINOR

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMGT-1 [3 credits] [47 L] Full Marks: 35 (End Sem. 25+Internal Assessment 10)	**Course Title: Inorganic-1 & Organic-1**	**Inorganic Chemistry –I** 1. **Atomic Structure** Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, Aufbau principle and its limitations.	6L	MM
		2. **Chemical Periodicity** Classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements. Positions of hydrogen and noble gases in the periodic table. Atomic and ionic radii, ionization potential, electron affinity, and electronegativity; periodic and group wise variation of above properties in respect of s- and p- block elements.	6L	RG
		3. **Acids and bases** Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.	8LL	MH
		4. **Redox reactions** Balancing of equations by oxidation number and ion-electron method, Standard electrode potential, formal potential, redox indicator and redox titrations.	4L	AKK
		Organic Chemistry – I 1.**Fundamentals of Organic Chemistry** Electronic displacements: Inductive effect, resonance and hyperconjugation; cleavage of bonds: homolytic and heterolytic; structure of organic molecules on the basis of VBT; nucleophiles and electrophiles; reactive intermediates: carbocations, carbanions and free radicals	4	MM

		2. Stereochemistry Different types of isomerism; geometrical and optical isomerism; concept of chirality and optical activity (up to two carbon atoms); asymmetric carbon atom; elements of symmetry (plane and centre); interconversion of Fischer and Newman representations; enantiomerism and diastereomerism, meso compounds; threo and erythro, D and L, cis and trans nomenclature; CIP Rules: R/S (upto 2 chiral carbon atoms) and E/Z nomenclature.	**8L**	AR
		Nucleophilic Substitution and Elimination Reactions: Nucleophilic substitutions: SN1 and SN2 reactions; eliminations: E1 and E2 reactions (elementary mechanistic aspects); Saytzeff and Hofmann eliminations; elimination vs substitution.	**4L**	AKK
		Aliphatic Hydrocarbons: Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures. Alkanes (up to 5 Carbons). Preparation: catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: mechanism for free radical substitution: halogenation. Alkenes: (up to 5 Carbons). Preparation: elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides; cis alkenes (partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alkaline $KMnO_4$) and trans-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and anti-Markownikoff's addition],	**5L**	AKK
		hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction. Alkynes: (up to 5 Carbons). Preparation: acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alkaline $KMnO_4$.	**5L**	RG
CHEM-MIP-1A (Minor-1) [F.M. = 15]	**Inorganic-1**	Practical: 1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture. 2. Estimation of oxalic acid by titrating it with $KMnO_4$. 3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$. 4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$. 5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.	**4L**	**AKK**
	Organic Chemistry – I	Qualitative Analysis of Single Solid Organic Compound(s) 1. Detection of special elements (N, Cl, and S) in organic compounds. 2. Solubility and Classification (solvents: H_2O, dil. HCl, dil. NaOH, dil. $NaHCO_3$) **3.** 3. Detection of functional groups: Aromatic-NO_2, Aromatic-NH_2, -COOH, carbonyl (no distinction of –CHO and >C=O needed), -OH (phenolic) in solid organic compounds. Experiments 1 to 3 with unknown (at least 6) solid samples containing not more than two of the above type of functional groups should be done.	**4L**	**MM**

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMGT-3 [4 credits] [60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	Physical Chemistry – II	1. **Chemical Energetics** a. Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics; Concept of heat, work, internal energy and statement of first law; enthalpy, H; relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases b. Standard states; Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; Laws of thermochemistry; bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equations and effect of pressure on enthalpy of reactions; Adiabatic flame temperature; explosion temperature c. Statement of the second law of thermodynamics; Concept of heat reservoirs and heat engines; Carnot cycle; Physical concept of Entropy; Carnot engine, refrigerator and efficiency; Entropy change of systems and surroundings for various processes and transformations; Auxiliary state functions (G and A) and Criteria for spontaneity and equilibrium.	12L	AR
		2. Chemical Equilibrium: Thermodynamic conditions for equilibrium, degree of advancement; Variation of free energy with degree of advancement; Equilibrium constant and standard Gibbs free energy change; Definitions of KP, KC and KX and relation among them; van't Hoff's reaction isotherm, isobar and isochore from different standard states; Shifting of equilibrium due to change in external parameters e.g. temperature and pressure; variation of equilibrium constant with addition to inert gas; Le Chatelier's principle		RG
		3. Ionic Equilibria:Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water; Ionization of weak acids and bases, pH scale, common ion effect; Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts; Buffer solutions; Solubility and solubility product of sparingly soluble salts – applications of solubility product principle	9L	AKK

	Organic Chemistry – II	1. Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures. 1. Aromatic Hydrocarbons Benzene: Preparation: from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: electrophilic substitution (general mechanism); nitration (with mechanism), halogenations (chlorination and bromination), sulphonation and Friedel-Craft's reaction (alkylation and acylation) (up to 4 carbons on benzene); side chain oxidation of alkyl benzenes (up to 4 carbons on benzene). 2. Organometallic Compounds Introduction; Grignard reagents: Preparations (from alkyl and aryl halide); concept of umpolung; Reformatsky reaction.	**9L**	AKK
		3. Aryl Halides Preparation: (chloro-, bromo- and iodobenzene): from phenol, Sandmeyer reactions. Reactions (Chlorobenzene): nucleophilic aromatic substitution (replacement by –OH group) and effect of nitro substituent (activated nucleophilic substitution).	**7L**	MM AKK
		4. Alcohols, Phenols and Ethers a.Alcohols: (up to 5 Carbons). Preparation: 1°-, 2°- and 3°- alcohols: using Grignard reagent, reduction of aldehydes, ketones, carboxylic acid and esters; Reactions: With sodium, HX (Lucas test), oxidation (alkaline KMnO4, acidic dichromate, concentrated HNO3); Oppenauer oxidation; b. Diols: Preparation (with OsO4); pinacol-pinacolone rearrangement (with mechanism) (with symmetrical diols only). c. Phenols: Preparation: cumenehydroperoxide method, from diazonium salts; acidic nature of 62 Prepared by UGBOS (Chemistry) phenols; Reactions: electrophilic substitution: nitration and halogenations; Reimer-Tiemann reaction, Houben–Hoesch condensation, Schotten–Baumann reaction, Fries rearrangement and Claisen rearrangement. d. Ethers: Preparation: Williamson's ether synthesis; Reaction: cleavage of ethers with HI.	**4L** **8L**	RG
		5. Carbonyl Compounds Aldehydes and Ketones (aliphatic and aromatic): (Formaldehye, acetaldehyde, acetone and benzaldehyde): Preparation: from acid chlorides, from nitriles and from Grignard reagents; general properties of aldehydes and ketones; Reactions: with HCN, ROH, NaHSO3, NH2-G derivatives and with Tollens' and Fehling's reagents; iodoform test; aldol condensation (with mechanism); Cannizzaro reaction (with mechanism), Wittig		

		reaction, benzoin condensation; Clemmensen reduction, Wolff-Kishner reduction and Meerwein-Pondorff-Verley (MPV) reduction.	**L04**	AKK
CHEMGP-3 [2 credits = 20] Practical. GE (Practical)	Physical Chemistry –II	Thermochemistry 1. Determination of heat capacity of calorimeter for different volumes 2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide 3. Determination of enthalpy of ionization of acetic acid 4. Determination of enthalpy of hydration of copper sulphate Ionic Equilibria 1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH meter and compare it with the indicator method 2. Preparation of buffer solutions and find the pH of an unknown buffer solution by colour matching method (using following buffers) a. Sodium acetate-acetic acid b. Ammonium chloride-ammonium hydroxide 3. Study of the solubility of benzoic acid in water.		AR
	Organic Chemistry – II	Organic Chemistry – II Identification of a pure organic compound 1. Solid compounds: oxalic acid, tartaric acid, succinic acid, resorcinol, urea, glucose, benzoic acid and salicylic acid. 2. Liquid Compounds: methyl alcohol, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene		**MM**

SEMESTER-V
SESSION: July 2023-December2023

Courses	Course Title	Topic	No. of Lectures (Inclusion of Tutorials)	Teachers
CHEMGTDSE-1	**Analytical and Environme**	Chemical Analysis a) Gravimetric analysis: solubility product and common ion effect; requirements of gravimetry; gravimetric estimation of chloride, sulphate, lead, barium, nickel,		

[4 credits] [60 Classes] Full Marks: 55 (End Sem. 40+Internal Assessment 15)	**ntal Chemistry**	copper and zinc. b) Volumetric analysis: primary and secondary standard substances; principles of acid-base,oxidation –reduction and complexometric titrations; indicators: acid-base, redox and metal ion;principles of estimation of mixtures: NaHCO3 and Na2CO3 (by acidimetry); iron, copper,manganese and chromium (by redox titration); zinc, aluminum, calcium and magnesium (bycomplexometric EDTA titration). c) Chromatography: Chromatographic methods of analysis: column chromatography and thinlayer chromatography.	**14L**	MH
		1. Environmental Chemistry a) The Atmosphere: composition and structure of the atmosphere; troposphere, stratosphere,mesosphere and thermosphere; ozone layer and its role; major air pollutants: CO, SO2, NOx andparticulate matters – their origin and harmful effects; problem of ozone layer depletion; greenhouse effect; acid rain and photochemical smog; air pollution episodes: air quality standard; airpollution control measures: cyclone collector, electrostatic precipitator, catalytic converter. b) The Hydrosphere: environmental role of water, natural water sources, water treatment forindustrial, domestic and laboratory uses; water pollutants; action of soaps and detergents,phosphates, industrial effluents, agricultural runoff, domestic wastes; thermal pollution,radioactive pollution and their effects on animal and plant life; water pollution episodes: waterpollution control measures : waste water treatment; chemical treatment and microbial treatment;water quality standards: DO, BOD, COD, TDS and hardness parameters; desalination of seawater : reverse osmosis, electrodialysis. c) The Lithosphere: water and air in soil, waste matters and pollutants in soil, wasteclassification, treatment and disposal; soil pollution and control measures.	16L	AKK
	Analytical Industrial Chemistry	1. Error Analysis and Computer Applications a) Error analysis: accuracy and precision of quantitative analysis, determinate, indeterminate,systematic and random errors; methods of least squares and standard deviations. b) Computer applications: general introduction to computers, different components of acomputer; hardware and software; input and output devices; binary numbers and arithmetic;introduction to computer languages; programming and operating	**12L**	AKK AR

		systems.
		2. Industrial Chemistry
		   a) Fuels: classification of fuel; heating values; origin of coal, carbonization of coal, coal gas, producer gas, water gas, coal based chemicals; origin and composition of petroleum, petroleumrefining, cracking, knocking, octane number, antiknock compounds, kerosene, liquefiedpetroleum gas (LPG), liquefied natural gas (LNG); petrochemicals (C1 to C3 compounds andtheir uses).
		   b) Fertilizers: manufacture of ammonia and ammonium salts, urea, superphosphate, biofertilizers.
		   c) Glass and ceramics: definition and manufacture of glasses, optical glass and coloured glass;clay and feldspar, glazing and vitrification, glazed porcelein, enamel.
		   d) Cement: portland cement: composition and setting of cement, white cement.
			18L	MH

CHEMGPDSE-1 [2 credits = 20] Practical. PCC (Practical)	**Analytical and Environmental Chemistry**	1. To find the total hardness of water by EDTA titration. 2. To find the pH of an unknown solution by comparing color of a series of HCl solutions + 1 drop of methyl orange, and a similar series of NaOH solutions + 1 drop of phenolphthalein. 3. To determine the rate constant for the acid catalysed hydrolysis of an ester. 4. Determination of the strength of the H_2O_2 sample. 5. To determine the solubility of a sparingly soluble salt, e.g. KHTa (one bottle)	**5L**	AR
	Analytical and Industrial Chemistry	1. Titration of Na_2CO_3 and $NaHCO_3$ mixture vs HCl using phenolphthalein and methyl orange indicators. 2. Titration of HCl and CH_3COOH mixture vs NaOH using two different indicators to find the concentration. **3.** Estimation of available oxygen in pyrolusite	**4L**	**AKK**

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

1ST Semester Syllabus distribution for the academic Session July, 2023-December, 2023

MAJOR

Teachers' Name	CS-MJ-T-1	CS-MJ-P-1	CS-SEC-P-1
BIPLAB BISWAS	**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	1. Write a C Program to read radius of a circle and to find area and circumference 2. Write a C Program to read three numbers and find the biggest of three *3. Write a C Program to demonstrate library functions in math.h* 4. Write a C Program to check for prime 5. Write a C Program to generate n primes 6. Write a C Program to read a number, find the sum of the digits, reverse the number and check it for palindrome 7. Write a C Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers 8. Write a C Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder) 9. Write a C Program to find the roots of quadratic equation (demonstration of switch-case statement) 10. Write a C program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array) 11. Write a C Program to remove Duplicate Element in a single dimensional Array	**Computer software and Introduction to Operating System and Installation:-** Computer software: Introduction, Software definition, Software categories, Installing and uninstalling software, Software piracy, Software terminologies. Introduction to Operating System with GUI, CUI and installation of different OS with required software. Office package: Introduction, Office user interface, Different office package software. **Presentation:-** Starting Presentation, Working with Presentation, Creating, Saving and Printing a presentation, Working with Animation, adding a slide to presentation, Navigating through a presentation, Slide-sorter, Slide-show, Editing slides, Working with Graphics and Multimedia (Inserting Photo, Video & Sound) **Spreadsheet:-** Introduction, starting Spreadsheet, Spreadsheet environment, Working with Spreadsheet workbook, **Working with worksheet** – Entering data, formatting tips and Techniques, Generating graphs, Formulas and Functions, Inserting charts, sorting, Pivot Tables, data extraction, adding clip art, add an image from a file, Printing in Spreadsheet. **Formulas and Functions-** Understanding formulas and cell references, basic mathematical operations, using common functions (e.g., SUM, AVERAGE, COUNT), applying absolute and relative cell references, nesting functions **Collaboration and Sharing**

	accessing, passing arguments, Function prototypes, Recursion, Library functions, Static functions **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.		Protecting worksheets and workbooks, sharing spreadsheets with others, tracking changes and commenting, collaborating in real-time, using version history and revision control. **Statistical Functions and Analysis** Descriptive statistics (mean, median, mode, variance, etc.), Calculating measures of central tendency and dispersion, Correlation and regression analysis, Hypothesis testing and confidence intervals, Analysis of variance (ANOVA). **Exploratory Data Analysis** Identifying patterns and outliers in data, creating histograms and box plots, using conditional formatting for data visualization, Data segmentation and drill-down analysis, Applying data validation rules for data integrity.
UTSAB DATTA	**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,	12. Write a C Program to demonstrate string functions. 13. Write a C Program to demonstrate pointers in C 14. Write a C Program to check a number for prime by defining *isprime( )*function 15. Write a C Program to read, display and to find the trace of a square matrix 16. Write a C Program to read, display and add two m x n matrices using functions 17. Write a C Program to read, display and multiply two matrices using functions 18. Write a C Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters. 19. Write a C Program to Reverse a String using Pointer 20. Write a C Program to Swap	**Word Processing :-** Introduction, Starting Word, working with word documents, working with text, working with tables checking spelling and grammar, adding graphs to the document, mail merge, header and footers, page numbers, protect the document, working with formatting tools. **Spreadsheet:-** **Data Analysis and Manipulation** Working with text functions for data cleaning, Splitting and combining data, Datanormalization and standardization, working with ranges and named ranges, conditional formatting, data validation and error checking, using logical functions (e.g., IF, AND, OR), sorting and filtering

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 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	Two Numbers using Pointers 21. Write a C Program to demonstrate student structure to read & display records of n students. 22. Write a C Program to demonstrate the difference between structure & union. 23. File related programs.	data. **Advanced Spreadsheet Features** Creating and managing tables, creating and modifying pivot tables, using lookup functions (e.g., VLOOKUP, HLOOKUP), working with charts and graphs, importing and exporting data. **Pivot Tables and Data Aggregation** Creating pivot tables for data summarization, grouping and aggregating data by categories, applying filters and slicers to pivot tables, calculating calculated fields and items. **Advanced Data Visualization** Creating charts and graphs for data representation, customizing chart elements (titles, axes, legends), Using sparklines and data bars for visual analysis, creating interactive dashboards, incorporating trendlines and forecasting in charts. **Advanced Analysis Techniques** Using goal seek and solver for optimization problems, performing "what-if" analysis with data tables, simulating data using random number functions, Monte Carlo simulation for risk analysis. Creating scenario analysis models **Reporting and Presentation of Results** Designing informative reports and summaries. Creating interactive dashboards for data presentation, Data visualization best practices, Documenting data analysis processes Presenting findings to stakeholders.

DEPARTMENT OF COMPUTER SCIENCE

1ST Semester Syllabus distribution for the academic year 2023-2024

MINOR

Teachers' Name	CS-MI-T-1	CS-MIP-1
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 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	**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. **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	**Functions**: Argument passing, return statement, return values and their types, recursion **Arrays**: String handling with arrays, String handling functions. **Pointers**: Definition and initialization, Pointer

(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
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.

arithmetic, Pointers and arrays, String functions and manipulation, Dynamic storage allocation.

File Access:
Opening, Closing, I/O operations.

DEPARTMENT OF COMPUTER SCIENCE
3RD Semester Syllabus distribution for the academic year 2023-2024
PCC

Teachers' Name	G-CC-L-301C	G-CC-P-301C	G-SEC-P-301
BIPLAB BISWAS	**Introduction to Database Management Systems**: Characteristics of database approach, data models, DBMS architecture and data independence. **Relational Data Model**: Basic concepts, relational constraints, relational algebra, SQL queries.	**DDL Commands:** • Create table, alter table, drop table **DML Commands:** • Set manipulation using (any, in, contains, all, not in, not contains, exists, not exists, union, intersect, minus, etc.) • Categorization using group by……..having • Arranging using order by	**Excel 2007:** Introduction, Workbook, Worksheet, Formatting in excel, Advanced formatting in Excel, Working with formulas, Printing worksheets **MS Access:** Access Basics, Design a Database, Build a Database, Work with Forms, Sort, Retrieve, Analyze Data, Work With Reports, Access with Other Applications, Manage an Access Database
UTSAB DATTA	**Entity Relationship and Enhanced ER Modeling**: Entity types, relationships, SQL: Schema Definition , constraints, and object modeling. **Database design**: ER and EER to relational mapping, functional dependencies, normal forms up to third normal form.	**DML Commands:** • Select , update, delete, insert statements • Condition specification using Boolean and comparison operators (and, or, not,=,<>,>,<,>=,<=) • Arithmetic operators and aggregate functions(Count, sum, avg, Min, Max) • Multiple table queries (join on different and same tables) • Nested select statements	**MS Word:** Introduction, Windows 2007 Interface, Customizing the Word Application, Document Views, Basic Formatting in MS Word 2007, Advanced Formatting, Navigating through a Word Document, Performing a Mail Merge, A Quick Look at Macros, Printing Documents, Print Preview **MS PowerPoint:** Introduction, Creating a Presentation, Basic Formatting in PowerPoint, Advanced Formatting, Using Templates, Inserting charts, Inserting tables, Printing presentations **Security and Networking:** Introduction, Simple Fine Sharing, Internet Information Services, Peer to Peer Networking

DEPARTMENT OF COMPUTER SCIENCE
5th Semester Syllabus distribution for the academic year 2023-2024
PCC

Teachers' Name	DSE-L-501A	DSE-P-501A	SEC-P-503
BIPLAB BISWAS	**Algorithm Design Techniques**: Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms. **Sorting Techniques:** Elementary sorting techniques-Bubble Sort, Insertion Sort,	1. Implement Insertion Sort (The program should report the number of comparisons) 2. Implement Merge Sort(The program should report the number of comparisons)	**GUI Environment:** Introduction to graphical user interface (GUI), programming language (procedural, object oriented, event driven), the GUI environment, compiling, debugging, and running the programs. **Operations:**

	Merge Sort, Advanced Sorting techniques-Heap Sort, Quick Sort, Sorting in Linear Time- Bucket Sort, Radix Sort and Count Sort **Complexity Analysis:** Medians & Order Statistics. **Data Structures:** 3.Queues :-Array and Linked representation of Queue, De-queue, Priority Queues 4. Linked Lists :-Singly, Doubly and Circular Lists, representation of Stack and Queue as Linked Lists. 5. Recursion :-Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion;	3. Implement Heap Sort (The program should report the number of comparisons) 4. Implement Randomized Quick sort (The program should report the number of comparisons) 5. Implement Radix Sort.	Data types, constants, named & intrinsic, declaring variables, scope of variables, val function, arithmetic operations, formatting data. **Forms Handling :** Multiple forms creating, adding, removing forms in project, hide, show method, load, unload statement, me keyword, referring to objects on a different forms. **Software Lab Based on Visual Basic:** 1. Write a VB application to compute the sum of two variables. 2. Write a VB application to compute the factorial of a number n. 3. Write a VB application to compute the Fibonacci series of a number n. 4. Write a VB application to compute the series of prime numbers till number n. 5. Write a VB application to compute the maximum of three numbers. 6. Write a VB application to compute the sum of odd numbers and even numbers in an array of n integers. 7. Write a VB application to compare the strings.
UTSAB DATTA	**Introduction** Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm **Searching Techniques:** Linear and Binary search.. **Data Structures:** 1. Arrays:- Single and Multi-dimensional Arrays, Sparse Matrices 2. Stacks:- Implementing stack using array and linked list, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; 6. Trees :-Introduction to Tree as a data structure; Binary	6. Implement Searching Techniques 7. Implementation of Recursive function. 8. Array and Linked list implementation of Stack and Queue. 9. Implementation of Single, Double and circular Linked List 10. Creation and traversal of Binary Search Tree.	**Controls :** Introduction to controls textboxes, frames, check boxes, option buttons, images, setting borders and styles, the shape control, the line control, working with multiple controls and their properties, designing the user interface, keyboard access, tab controls, default & cancel property, coding for controls. **Decision Making :** If statement, comparing strings, compound conditions (and, or, not), nested if statements, case structure, using if statements with option buttons & check boxes, displaying message in

	Trees, Binary Search Tree, (Creation, and Traversals of Binary Search Trees)		message box, testing whether input is valid or not. **Iteration Handling:** Do/loops, for/next loops, using msgbox function, using string function. **Software Lab Based on Visual Basic:** 8. Write a VB application to make a calculator. 9. Write a VB application to choose your hobbies from a list. 10. Write a VB application to illustrate the use of color radio button. 11. Write a VB application to illustrate the use of color scroll bar form. 12. Write a VB application to illustrate the use of color scroll bar label text. 13. Write a VB application to illustrate the use of color text box. 14. Write a VB application to show a timer.
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Faculty Members

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

DEPARTMENT OF ECONOMICS

DISTRIBUTION OF COURSES IN SEMESTER- 1 JULY2023-DECEMBER 2023 NEP-2020(SESSION 2023-2024)

Course	Course title	Topic	No of Lectures	Teachers
MAJOR (MAC 1)	Introductory Microeconomics	Unit 1: Exploring the subject matter of Economics	12	SKD
		Unit 2: Supply and Demand: How Markets Work	20	SKD
		Unit 3: Consumer Theory	20	SKD
		Unit 4: Production and Costs	20	SKD
MINOR (MIC 11)	Principles of Microeconomics	Unit 1: Introduction	12	SKD
		Unit 2: Consumer Theory	15	SKD
		Unit 3: Production and Cost:	15	AKC
		Unit 4: Perfect Competition	06	AKC

COURSE	COURSE TITLE	TOPIC	NO OF LECTURES	*TEACHERS*
SEC-1 –	Basic Mathematics –	Unit 1: Basic Concepts of Functions	4	AKC
		Unit 2: Limits and Continuity of Functions	6	AKC
		Unit 3: Derivatives	14	AKC
		Unit 4: Integrals of functions of one variable	6	AKC
		Unit 5: Matrix and Determinants	6	AKC

EPARTMENT OF ECONOMICS

DISTRIBUTION OF COURSES IN SEMESTER- III, JULY2023-DECEMBER 2024 (SESSION 2023-2024)

COURSE	COURSE TITLE	TOPIC	NO OF LECTURES	TEACHERS
ECON-H-CC-T-5	Intermediate Microeconomics – I	1.Consumer Theory	6	AKC
		2. Production and Costs	5	AKC
		3. Competitive Equilibrium	5	
		4. Input market in perfect competition	6	AKC
				AKC
ECON-H-CC-T-6	Intermediate Macroeconomics – I	1. Income Determination in the short-run	8	SKD
		2. Aggregate Demand and Aggregate Supply	12	
		3. Inflation, Unemployment and Expectations	10	SKD
				SKD
ECON-H-CC-T-7	Statistical Methods for Economics	1. Elementary Probability Theory	6	AKC
		2. Univariate Probability Distribution	5	AKC
		3. Jointly Distributed Random Variables	5	
		4. Sampling	6	AKC
		5. Estimation	4	AKC
				AKC
ECON-H-SEC-T-1	Statistical Tools for	1. Sources of Data, Population versus sample surveys, Random sampling	4	AKC

COURSE	COURSE TITLE	TOPIC	NO OF LECTURES	TEACHERS
	Data Analysis	2. Presentation of Data; Univariate Frequency Distribution; Measures of central tendency, Measures of Dispersion, Moments, Skewness and Kurtosis; Bivariate Frequency Distribution- correlation and regression.	10	AKC
		3. Time Series (Components, Measures of trend, Moving Average, Curve fitting (linear only)	4	AKC
		4. Index Numbers (Laspayer's, Paasche and Fisher, Cost of Living, Factor Reversal and Time Reversal Test)	4	AKC
		5. Vital Statistics (Life Tables – Concepts Only)	3	AKC
				AKC
ECON-H-GE-T-3A	Introductory Microeconomics	1. Exploring the subject matter of Economics	3	SKD
		2. Supply and Demand: How Markets Work, Markets and Welfare	4	SKD
		3. The Households	4	SKD
		4. The Firm and Perfect Market Structure	5	AKC
ECON—G-CC-T-07	Principles of Microeconomics - II	1. Market Structures a. Theory of a Monopoly Firm b. Imperfect Competition	6	AKC
		2. Consumer and Producer Theory a. Consumer and Producer Theory in Action b. Markets and Market Failure	6	SKD
		3. Income Distribution and Factor pricing	4	
		4. International Trade	3	

DEPARTMENT OF ECONOMICS
DISTRIBUTION OF COURSES IN SEMESTER- V, JULY2023-DECEMBER 2023

COURSE	COURSE TITLE	TOPIC	NO OF LECTURES	TEACHERS
ECON-H-CC-T-11	International Economics	1. Basics of trade theory	4	AKC
		2. Technology and Trade (Ricardian Model)	3	AKC
		3. Factor Endowment & Trade (Heckscher-Ohlin-Samuelson Model)	4	AKC
		4. Trade Policy	4	AKC
		5. Balance of Payments & Exchange Rate	3	AKC
ECON-H-CC-T-12	Public Economics	1. Nature and Scope of Public Economics	4	SKD
		2. Theory of Public Good	4	SKD
		3. Taxation	3	SKD
		4. Public Expenditure and Public Debt	4	SKD
ECON-H-DSE-T-1A	Economic Development and Policy in India - I	1. Issues in Growth, Development and Sustainability	5	SKD SKD SKD
		2. Factors in Development	4	
		3. Population and Economic Development	3	
		4. Employment	3	SKD
		5. Indian Development Experience	5	SKD
ECON-H-DSE-T-2A	Public	Theory	5	

	Finance	1. Overview of Fiscal Functions, Tools of Normative Analysis, Pareto Efficiency, Equity and the Social Welfare		AKC
		2. Market Failure, Public Good and Externalities	4	
		3. Elementary Theories of Product and Factor Taxation (Excess Burden and Incidence)	4	AKC
		Issues from Indian Public Finance		AKC
		1. Current Issues of India's Tax System	4	
		28		SKD
		2. Working of Monetary and Fiscal Policies	3	SKD
		3. Analysis of Budget and Deficits	3	SKD
		4. Fiscal Federalism in India	3	SKD
		5. State and Local Finances	3	
• ECON—G-DSE-T-1A	Economic Development and Policy in India - I	1. Issues in Growth, Development and Sustainability	4	SKD
		2. Factors in Development	4	SKD
		3. Population and Economic Development	5	AKC
		4. Employment	3	AKC
		5. Indian Development Experience	4	AKC
ECON—G-GE-T-1	Introductory Microeconomics	1. Exploring the subject matter of Economics	2	SKD
				SKD
		2. Supply and Demand: How Markets Work, Markets and Welfare	5	
		3. The Households	4	SKD
		4. The Firm and Perfect Market Structure	6	AKC
		5. Imperfect Market Structure	5	AKC
		6. Input Markets	4	AKC
ECON—G-SEC-T-03	Statistical Tools for Data Analysis - II	1. Bivariate frequency distribution. Correlation and regression. Rank correlation.	4	AKC
		2. Basics of index numbers: price and quantity index numbers.	4	AKC

Faculty Members

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

Course	Course title	Topic	No. of Lectures	Teachers
MAJOR (Code- ENVS-M-1) FULL MARKS: 75 Semester End Exam-40 Practical-25 Internal Assessment-5 (test exam)+5(attendance)=10	Fundamentals of environment & Ecology	Unit 1: Life & Environment Unit 2: Environmental Systems & Subsystems Unit 3: Ecology of Individuals Unit 4: Population Ecology Unit 5: Community Ecology Unit 6: Ecosystem Ecology Unit 7: Biogeochemical Cycles & Nutrient Cycling ENVS-M-1-P(PRACTICAL)	08 08 08 08 08 08 08 08	AK AK AK AK RP RP RP AK & RP
MINOR Code- ENVS-MI-(I)-1 FULL MARKS: 75 Semester End Exam-40 Practical-20 Internal Assessment-10 (test exam)+5(attendance)=15	Environmental Pollution	Unit 1: Air Pollution Unit 2: Water Pollution Unit 3: Soil Pollution Unit 4: Solid & Hazardous Waste Unit 5: Noise Pollution Unit 6: Marine Pollution Unit 7: Radioactive Pollution	07 07 07 07 07 07 07 06	AK AK AK RP RP RP AK

VALUE ADDED COURSE (VAC)
NEP -2020 (SESSION 2023-2024)
All Science & Arts Group students

Course	Course title	Topic	No. of Lectures	Teachers
VALUE ADDED COURSE (VAC) (Code: UG-ENVS-VA -01) FULL MARKS: 50, Semester End Exam-40 Internal Assessment-05(Assignment)+05(attendance)=10	ENVIRONMENTAL EDUCATION	Unit 1: Humans & the Environment Unit 2: Natural Resources Unit 3: Ecosystem & Biodiversity Unit 4: Environmental Pollution & Degradation Unit 5: Climate Change Unit 6: Environmental Treaties & Legislation Unit 7: Environmental Ethics & Sustainable Development	04 04 04 04 04 04 04	AK UG UG AK RP RP AK

SEC (Skilled Enhancement Course)
NEP -2020 (SESSION 2023-2024)

Course	Course title	Topic	No. of Lectures	Teachers
SEC (Code: ENVS-SEC-1-P) FULL MARKS: 45 Semester End Exam-35 Internal Assessment-5 (test exam)+5(attendance)=10	WATER & AIR QUALITY ANALYSIS	Unit 1: Water & Air Quality Techniques	07	AK
		Unit 2: Estimation of Physicochemical & biological properties of water	09	RP
		Unit 3: Flamephotometry / Spetrophotometry	09	AK
		Unit 4: Air Quality Parameters	09	RP
		Unit 5: Relative Humidity & Wind Rose Preparation	07	RP
		Unit 6: Field Visit	02	AK & RP

Department of Environmental Science
Distribution of Courses in Semester -III: July-, 2023-December, 2024
Core Course (CC) & SEC (Skilled Enhancement Course)
CBCS

Course	Course title	Topic	No. of Lectures	Teachers
CORE COURSE 5 (Code: UG-ENVS-H-CC-05) FULL MARKS: 75 Semester End Exam-40 Practical-20 Internal Assessment-10 (test exam)+5(attendance)=15	ECOLOGY AND ECOSYSTEMS	Unit 1: Introduction Unit 2: Ecology of individuals	08 09	AK RP
		Unit 3: Ecology of populations		
		Unit 4: Ecology of communities	08	AK
		Unit 5: Ecosystem ecology	09	AK
		Unit 6: Biogeochemical cycles and nutrient cycling	09 08	RP RP
		Unit 7: Biological invasions UG-ENVS-H-CC-P-05 (Practical)	09	AK
			08	AK & RP
CORE COURSE 06 (Code: UG-ENVS-H-CC-06) FULL MARKS: 75 Semester End Exam-40 Practical-20 Internal Assessment-10 (test exam)+5(attendance)=15	BIODIVERSITY AND CONSERVATION	Unit 1: Levels of organization in living world	09	RP
		Unit 2: Biodiversity patterns		
		Unit 3: Biodiversity estimation	09	AK
		Unit 4: Importance of biodiversity		
		Unit 5: Threats to biodiversity	08	RP
		Unit 6: Biodiversity Conservation		
		Unit 7: Biodiversity in India	09	AK
		UG-ENVS-H-CC-P -06 (Practical)	08	RP
			08	AK
			09	AK
			08	AK & RP

Course	Course title	Topic	No. of Lectures	Teachers
CORE COURSE 07 (Code: UG-ENVS-H-CC-07) FULL MARKS: 75 Semester End Exam-40 Practical-20 Internal Assessment-10 (test exam)+5(attendance)=15	ATMOSPHERE AND GLOBAL CLIMATE CHANGE	Unit 1: Fundamentals of atmospheric chemistry Unit 2: Meteorology and atmospheric stability	12 12	AK RP
		Unit 3: Global warming and climate change	12	AK
		Unit 4: Ozone layer depletion Unit 5: Climate change and policy	12 12	AK RP
			12	RP
		UG-ENVS-H-CC-P -07 (Practical)		
			08	AK & RP
SKILL ENHANCEMENT COURSE 01 (Code: UG-ENVS-H- SEC-01a) FULL MARKS: 50 Semester End Exam-40 Internal Assessment-05 (test exam)+05(attendance)= 10	REMOTE SENSING, GEOGRAPHIC INFORMATION SYSTEM & MODELLING	Unit 1: Remote Sensing: definitions and principles; electromagnetic (EME) spectrum; interaction of EMR with Earth's surface; spectral signature; satellites and sensors; aerial photography and image interpretation. Unit 2: Geographical Information Systems: definitions and components; spatial and non-spatial data; raster and vector data; database generation; database management system; land use/ land cover mapping; overview of GIS software packages; GPS survey, data import, processing, and mapping.	06 06	AK RP
		Unit 3: Applications and case studies of remote sensing and GIS in geosciences, water resource management, and land use planning, forest resources, agriculture, marine and atmospheric studies. Unit 4: Basic elements of statistical analyses: sampling; types of distribution – normal, binomial, poisson; measurements of central tendency and dispersion; skewness; kurtosis; hypothesis testing; parametric and non-parametric tests; correlation and regression; curve fitting; analysis of variance. Unit 5: Demonstrative exercise	06	RP
		1.*Visual interpretation of standard False Colour Composite (FCC) data.*	06	AK
		2.*Thematic map generation.*		
		3.*Digitisation of thematic layer.*	06	RP
		4.*Overlay analysis of thematic layer in GIS environment.*		
		5.*GIS laboratory visit.*		

Department of Environmental Science
Distribution of Courses in Semester -V: July, 2023-December, 2024
Core Course (CC)

Course	Course title	Topic	No. of Lectures	Teachers
CORE COURSE 11 (Code: UG-ENVS-H-CC-11)	ENVIRONMENTAL BIOTECHNOLOGY	Unit 1: The structure and function of DNA, RNA and protein	15	AK
		Unit 2: Recombinant DNA technology	15	AK
FULL MARKS: 75		Unit 3: Bioremediation and ecological restoration	15	AK
Semester End Exam-40		Unit 4: Ecologically safe products and processes	15	RP
Practical-20				
Internal Assessment-10 (test exam)+5(attendance)=15		UG-ENVS-H-CC-P -11 (Practical)	10	AK & RP
CORECOURSE 12 (Code: UG-ENVS-H-CC-12)	EVOLUTIONARY BIOLOGY	Unit 1: History of life on Earth	09	RP
		Unit 2: Introduction Unit 3: Evolution of unicellular life	11	AK
			10	AK
		Unit 4: Geography of evolution	10	RP
FULL MARKS: 75		Unit 5: Molecular evolution		
Semester End Exam-40		Unit 6: Fundamentals of population genetics	11	AK
Practical-20				
Internal Assessment-10 (test			09	RP
exam)+5(attendance)=15		UG-ENVS-H-CC-P -12 (Practical)	10	RP

Course	Course title	Topic	No. of Lectures	Teachers
DISCIPLINE SPECIFIC ELECTIVE 01 (Code: UG-ENVS-H-DSE -01a)	ENERGY AND ENVIRONMENT	Unit 1: Introduction Unit 2: Energy resources	09	AK
		Unit 3: Energy demand Unit 4: Energy, environment and society	08	RP
		Unit 5: Energy, ecology and the environment	09	AK
FULL MARKS: 75		Unit 6: Politics of energy policy	08	RP
Semester End Exam-40		Unit 7: Our energy future		
Practical-20				
Internal Assessment-10 (test			09	RP
		UG-ENVS-H-DSE-P -01a (Practical)		
exam)+5(attendance)=15			08	AK
			09	AK
			08	AK

DISCIPLINE SPECIFIC ELECTIVE 01 (Code: UG-ENVS-H-DSE- 01b) FULL MARKS: 75 Semester End Exam-40 Practical-20 Internal Assessment-10 (test exam)+5(attendance)=15	ECOTO XICOL OGY AND ENVIR ONME NTAL HEALT H	Unit 1: Introduction to Environmental toxicology Unit 2: Toxicity of heavy metals: Unit 3: Pesticide toxicity Unit 4: Emerging contaminants Unit 5: Environmental epidemiology Unit 6: Environmental Health UG-ENVS-H-DSE-P-01b (Practical)	10 10 10 10 10 10 08	RP AK RP AK RP RP RP

FACULTY MEMBERS

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

DEPARTMENT OF MATHEMATICS

DISTRIBUTION OF COURSES IN SEMESTER-I: July 2023 - December 2023
Mathematics Major

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course Code: MATH-M-T-01 Major Course; Credit-6; Full Marks-75	**Course Title: Calculus & Analytical Geometry**	**Unit 1.** ● Hyperbolic functions and its derivative, higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b}\sin x, e^{ax+b}\cos x, (ax+b)^n \sin x, (ax+b)^n \cos x$. ● Pedal equations. ● Curvature, radius of curvature, centre of curvature, circle of curvature ● Asymptotes ● Envelopes. ● Singular points, concavity and inflection points. ● Curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves. ● L'Hospital's rule, applications in business, economics and life sciences.	**25L**	PM
		Unit 2. ● Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x\, dx, \int \cos^n x\, dx, \int \tan^n x\, dx, \int \sec^n x\, dx, \int (\log x)^n\, dx, \int \sin^n x \cos^m x\, dx.$ ● Parametric equations, parameterizing a curve, arc length of a curve, arc length of parametric curves, area under a curve, area and volume of surface of revolution, techniques of sketching conics.	**16L**	ARM
		Unit 3. ● Transformation of coordinate axes, pair of straight line, reflection properties of conics, rotation of axes and second-degree equations, classification of conics using the discriminant, polar equations of conics. ● Straight lines in 3D, sphere, cylindrical surfaces. central conicoids, paraboloids, plane sections of conicoids, generating lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid.	**30L**	UA
Course Code: MATH-SEC-T-01 Skill Enhancement Course; Credit-3; Full	**Course Title: Logic & Boolean Algebra**	**Unit 1.** ● Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contrapositive and inverse propositions and precedence of logical operators. ● Propositional equivalence, Logical equivalences. ● Predicates and quantifiers: Introduction, quantifiers, binding variables and negations. **Unit 2.**	**15L**	UA

Marks-45		• • Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle.	**10L**	SKB
		• ● Lattices as ordered sets, lattices as algebraic structures, sublattices, products and homomorphisms. **Unit-3** • • Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials, minimal and maximal forms of Boolean polynomials. • ● Quinn-McCluskey method, Karnaugh diagrams, logic gates, switching circuits and applications of switching circuits.	**20L**	SKB

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 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	**20L** **30L**	**ARM** **UA**

		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.		

DISTRIBUTION OF COURSES IN SEMESTER-III: July 2023 - December 2023
DEPARTMENT OF MATHEMATICS

Mathematics Honours

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course: MATH-H-CC-T-05 Core Course; Credit-6; Full Marks-75	**Course title: Theory of Real & Vector Functions**	**Unit 1:** ● Limits of functions (ε - δ approach). Sequential criterion for limits. Divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. ● Continuous functions, neighbourhood property. Sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, ● Bolzano's Theorem, intermediate value theorem. Location of roots theorem, preservation of intervals theorem. ● Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.	**25L**	**UA**
		Unit 2. ● Differentiability of a function at a point and in an interval. ● Caratheodory's theorem. ● Algebra of differentiable functions. ● Darboux's theorem.	**20L**	**PM**
		Unit 3. ● Rolle's theorem. ● Lagrange's and Cauchy's mean value theorems. ● Taylor's theorem with Lagrange's and Cauchy's forms of remainder. ● pplication of Taylor's theorem to convex functions. ● Applications of mean value theorem to inequalities and approximation of polynomials. ● Relative extrema, interior extremum theorem. ● Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions $\log(1+x), \dfrac{1}{ax+b}, (1+x)^n,$	**20L**	**UA**

		● Application of Taylor's theorem to inequalities. **Unit 4.** ● Vector products. ● Introduction to vector functions, operations with vector-valued functions. ● Limits and continuity of vector functions. ● Differentiation and integration of vector functions of one variable $\left(\int\limits_{a}^{b} \overline{f(t)} dt \right)$. ● Gradient, divergence, curl of vector functions.	10L	**PM**
Course: MATH-H-CC-T-06 Core Course; Credit-6; Full Marks-75	**Course title: Group Theory-I**	**Unit 1.** ● Subgroups, examples and properties of subgroups. ● Product of two subgroups. ● Cyclic group, examples and properties of cyclic group. ● Classification of subgroups of cyclic groups. ● Cosets and their properties. ● Lagrange's theorem and consequences including Fermat's little theorem.	30L	**ARM**
		Unit 2. ● External direct product of a finite number of groups. ● Centre of a group, centralizer, normalizer. ● Normal subgroups. ● Factor groups. ● Cauchy's theorem for finite abelian groups.	25L	**ARM**
		Unit 3. ● Group homomorphisms, basic properties of homomorphisms. ● Cayley's theorem. ● Properties of isomorphisms. ● First, second and third isomorphism theorems.	20L	**ARM**
Course: MATH-H-CC-T-07 Core Course; Credit-6; Full Marks-75	**Course title: Numerical Methods (Theory) & Numerical Methods Lab**	**Unit 1.** ● Algorithms, convergence, errors, relative, absolute, round-off, truncation errors. ● Interpolation, Lagrange and ewton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation. Central difference interpolation formula: Stirling and Bessel interpolation ● Numerical differentiation, methods based on interpolations, methods based on finite differences.	10L	**SKB**
		Unit 2. ● Numerical integration, ewton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule, Boole's rule. Midpoint rule, composite trapezoidal rule, composite Simpson's 1/3rd rule, Gauss quadrature formula.	10L	**SKB**

		Unit 3. ● Transcendental and polynomial equations, bisection method, ewton's method, secant method, Regula-Falsi method, fixed point iteration, Newton-Raphson method, rate of convergence of these methods.	10L	SKB
		● System of linear algebraic equations, Gaussian elimination and Gauss Jordan methods, Gauss Jacobi method, Gauss Seidel method and their convergence analysis, LU decomposition Unit 4. ● The algebraic eigenvalue problem, power method.		
		● Approximation, least square polynomial approximation. 17 Unit 5: ● Ordinary differential equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four.	10L 10L	SKB PM
		LIST OF PRACTICAL PROBLEMS (Using 'C' or Python programming) (i) Calculate the sum of infinite convergent series. (ii) Find the absolute value of an integer. (iii) Enter 100 integers into an array and sort them in an ascending order. (iv) Bisection Method. (v) Newton Raphson Method. (vi) Secant Method. (vii) Regula-Falsi Method. (viii) LU decomposition Method. (ix) Gauss-Jacobi Method. (x) SOR Method or Gauss-Seidel Method. (xi) Lagrange's Interpolation (xii) Trapezoidal Rule. (xiii) Simpson's rule.	25L	UA & ARM
MATH-H-GE-T-03 General Elective Course(except Math Hons); Credit-6; Full Marks-75	Course title: Algebra & Analytical Geometry	Unit 1. ● Complex umbers De Moivre's theorem and its applications. Exponential, Sine, Cosine and Logarithm of a complex number. Definition of . 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 rule of signs and its applications. Relation between roots and coefficients, transformations of equations. Cardan's method of solution of a cubic equation. ● Rank of a matrix: Determination of rank either by considering minors or by sweep-out process. Consistency and solution of a system of linear equations with 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.	40L	SKB

		Concepts of permutation Group, alternating group, finite groups: , . The group 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 2nd degree in and may represent two straight lines. Point of intersection of two intersecting straight lines. Angle between two lines given by 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 polar equation of chord joining two points polar equations of tangents and normals.	**35L**	**PM**
Course: MATH-H-SEC-T-1A Skill Enhancement Course; Credit-2; Full Marks-50	**Course title: Programming in 'C'**	**Unit 1.** ● 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 flow chart: 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. ● Control statements: While statement, do-while statement, for statement. ● 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 of function.	**7L** **18L**	**PM** **PM**

MATHEMATICS GENERAL
SEMESTER-III

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course: MATH-G-CC-T-03 Core Course; Credit-6; Full Marks-75	**Course title: Real Analysis**	**Unit 1.** ● Review of algebraic and order properties of $\mathbb{R}$. ● Idea of countable sets, uncountable sets and uncountability of $\mathbb{R}$. Countability of $\mathbb{Q}$. ● Bounded above sets, bounded below sets, bounded sets, unbounded sets. Suprema and infima. ● Completeness property of $\mathbb{R}$ and its equivalent properties. ● The Archimedean property, density of rational (and Irrational) numbers in $\mathbb{R}$, intervals. ● Intervals, -neighborhood of a point in $\mathbb{R}$, Interior points, Limit points of a set, isolated points, open set, closed set, union and intersection of open and closed sets. derived set, Closure of a set, Interior of a set. ● Bolzano-Weierstrass theorem for sets (statement only).	25L	ARM
		Unit 2. ● Sequences, bounded sequence, convergent sequence, Sandwich theorem. ● Cauchy's convergence criterion for sequences. Cauchy's theorem on limits ● Monotone sequences, monotone convergence theorem (without proof).	20L	UA
		Unit 3. ● Infinite series, Convergence and divergence of infinite series, Cauchy's criterion. ● Series of positive terms, Geometric Series, p-Series. ● Tests for convergence: comparison test, limit comparison test, ratio test: D'Alembert's ratio test, Raabe's test, Cauchy's root test. ● Alternating series, Leibnitz test (without proof), definition and examples of Absolute and conditional convergence. ● Power series and radius of convergence (problems only).	30L	PM
Course: MATH-G-SEC-T-1A Skill	**Course title: Logic & Sets**	**Unit 1.** ● Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contrapositive and inverse proportions and precedence of logical operators.	10L	UA

Courses	Course title	Topic	No. of lectures	Teacher
Enhancement Course; Credit-2; Full Marks-50 C		● Propositional equivalence: Logical equivalences. ● Predicates and quantifiers: Introduction, quantifiers, binding variables and negations. **Unit 2.** ● Sets, subsets, set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. ● Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.	**7L**	UA
		Unit 3. ● Difference and Symmetric difference of two sets. Set identities, generalized union and intersections. ● Relation: Product set. Composition of relations, types of relations, partitions, equivalence Relations with example of congruence modulo relation. Partial ordering relations, -ary relations.	**8L**	UA

DISTRIBUTION OF COURSES IN SEMESTER-V: July 2023 - December 2023
DEPARTMENT OF MATHEMATICS

Mathematics Honours

Courses	Course title	Topic	No. of lectures (inclusive of Tutorials)	Teacher
Course: MATH-H-CC-T-11, Core Course; Credit-6; Full Marks-75	**Course title: Riemann Integration and Series of Functions**	**Unit 1.** ● Riemann integration: inequalities of upper and lower sums, Darbaux theorem, Riemann conditions of integrability, Riemann sum and definition, Riemann integral through Riemann sums. ● Equivalence of two definitions. Riemann integrability of monotone and continuous functions, properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. ● Fundamental theorem of integral calculus. ● 1st and 2nd mean value theorems for integral calculus.	**23L**	ARM
		Unit 2. ● Improper integration: Type1, Type2. Necessary and sufficient condition for convergence of improper integral in both cases. Cauchy's Criterion. Cauchy's principal value. ● Tests of convergence: Comparison and -test. Absolute and non-absolute convergence and. bel's and Dirichlet's test for convergence on the integral of a product. ● Convergence of Beta and Gamma functions. Relation between Beta and Gamma functions and related	**22L**	ARM

		problems.		
		Unit 3. ● Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. ● Series of functions. Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass -Test. ● Power series, radius of convergence, Cauchy Hadamard theorem. Differentiation and integration of power series; bel's theorem; Weierstrass approximation theorem.	**25L**	ARM
		Unit 4. ● Fourier series: Definition of Fourier coefficients and series, examples of Fourier expansions and summation results for series.	**5L**	ARM
Course: MATH-H-CC-T-12, Core Course; Credit-6; Full Marks-75	**Course title: Mechanics-I**	**Unit-1:** ● Motion in a straight line, motion under attractive and repulsive forces, motion under acceleration due to gravity. ● Simple harmonic motion, horizontal oscillation, composition of two S.H.M.'s, damped harmonic motion, forced oscillation, damped forced oscillation. ● Motion in a resisting medium: Vertical and curvilinear motion in a resisting medium. ● Motion of varying mass: Equations of motion.	**15L**	PM
		Unit-2: ● Work, Power and Energy: Definitions. Work done in stretching an elastic string. ● Conservative forces. Conservation of energy. ● Impulse and impulsive forces: Impulse of a force. Impulsive forces. Conservation of linear momentum. ● Collision of elastic bodies: Elasticity. Impact of smooth bodies. Impact on a fixed plane. Direct and oblique impact of two smooth spheres. Loss of kinetic energy. Angle of deflection.	**10L**	PM
		Unit-3: ● Motion in a Plane: Velocity and acceleration of a particle moving on a plane in Cartesian and polar coordinates. Motion of a particle moving on a plane refers to a set of rotating rectangular axes. Angular velocity and acceleration. Circular motion. Tangential and normal accelerations. ● Central orbit: Characteristics of central orbits. Areal velocity. Law of force for elliptic, parabolic and hyperbolic orbits. Velocity under central forces. Orbit under radial and transverse accelerations. Stability of nearly circular orbits.	**20L**	PM

		● Planetary motion ewtonian law. Orbit under inverse square law. Kepler's laws of planetary motion. Time of description of an arc of an elliptic, parabolic and hyperbolic orbit. Effect of disturbing forces on the orbit. Artificial satellites: Orbit round the earth. Parking orbits. Escape velocity.		
		Unit-4: ● Degrees of freedom. Moments and products of inertia: Moment of inertia (M.I) and product of inertia (P.I.) of some simple cases. M.I. about a perpendicular axis. Routh's rule. M.I. about parallel axes. M.I. about any straight line. M.I. of a lamina about a straight line in its plane. Momental ellipsoid. Equi-momental systems. ● General equations of motion D' lembert's principle and its application to deduce general equations of motion of a rigid body. Motion of the centre of inertia (C.I.) of a rigid body. Motion relative to C.I. ● Motion about an axis: Rotation of a rigid body about a fixed body. Equation of motion. K.E. of the body rotating about an axis. Compound pendulum and its minimum time of oscillation. 30 ● Motion in two dimensions under finite forces: Equations of motion. K.E. and angular momentum about the origin of a rigid body moving in two dimensions. Two – dimensional of a solid of revolution down a rough inclined plane. Necessary and sufficient conditions for pure rolling.	**30L**	PM
Course: MATH-H-DSE-T-1B Discipline Specific Elective Course; Credit-6; Full Marks-75	**Course title: Partial Differential Equations & Laplace Transforms**	**Unit 1.** ● Derivation of heat equation, wave equation and Laplace equation. ● Classification of second order linear equations. ● Reduction of second order linear equations to canonical forms.	**20L**	SKB
		Unit 2. [30L] ● The Cauchy problem, Cauchy-Kovalevskaya theorem (Statement only), Cauchy problem of an infinite string. ● Initial boundary value problems. Semi-infinite string with a fixed end, semi-infinite string with a free end. ● Method of separation of variables, solving the vibrating string problem. Solving the heat conduction problem. ● One dimensional diffusion equation and parabolic differential equations. Method of separation of variables. Solving the vibrating string problem and the heat conduction problem. ● Wave equation.	**30L**	SKB
		Unit 3. ◻ Laplace Transform (LT) of Elementary functions. Properties of LTs: change of scale theorem, shifting theorem. LTs of derivatives and integrals of functions, derivatives and integrals of LTs. LT of Dirac Delta	**20L**	SKB

		function, periodic functions.		
		Ⓒ Convolution Theorem. Inverse LT. Application of Laplace transforms to solve ordinary and partial differential equations. 32 **Graphical Demonstration (Teaching aid) [10L]** 1. Solution of Cauchy problem for first order PDE. 2. Finding the characteristics for the first order PDE. 3. Plot the integral surfaces of a given first order PDE with initial data. 4. Solution of wave equation for the following associated conditions: (a) (b) 5. Solution of wave equation for the following associated conditions: (a) (b)	**10L**	SKB
Course: MATH-H-DSE-T-2A Discipline Specific Elective Course; Credit-6; Full Marks-75	**Course title: Number Theory**	**Unit 1.** ● Linear diophantine equation, prime counting function, statement of prime number theorem. ● Goldbach conjecture, linear congruences, complete set of residues. ● Chinese remainder theorem, Fermat's little theorem, Wilson's theorem, Statement of Fermat's Last theorem and their applications. 33	**20L**	UA
		Unit 2. ● Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatest integer function. ● Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.	**25L**	UA
		Unit 3. [30L] ● Order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots. ● Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli. ● Prime number and its properties. ● The arithmetic of , a prime, pseudo prime and Carmichael Numbers, Fermat Numbers, perfect numbers, Mersenne numbers. ● Public key encryption, RSA encryption and decryption, the equation	**30L**	UA

Mathematics General
SEMESTER-V

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course: MATH-G-DSE-T-1A Discipline Specific	**Course title: Group Theory & Linear Algebra**	**Unit 1.** ● Definition and examples of groups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of a group, examples of subgroups including the center of a group. ● Cosets, Index of subgroups, Lagrange's theorem, order of an element.	**30L**	SKB

Elective Course; Credit-6; Full Marks-75		● Normal subgroups, their definition, examples, and characterizations, Quotient groups. **Unit 2:** ● Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces. 13 ● Characteristic Polynomial, Eigenvalues and Eigenvectors. ● Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. ● Dual Space, Dual Basis, Change of basis. ● Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3.	45L	SKB
Course: MATH-G-SEC-T-3A Skill Enhancement Course; Credit-2; Full Marks-50	Course title: Theory of Probability	**Unit 1:** ● Sample space, probability axioms, real random variables (discrete and continuous). ● Cumulative distribution function, probability mass/density functions. ● Mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, continuous distributions: uniform, normal, exponential.	13L	PM
		Unit 2: ● Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions. ● Expectation of function of two random variables, conditional expectations, independent random variables.	12L	PM

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-I: JULY2023-DECEMBER 2023

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course category:MBBT -M-T-1.(The) 4-credit Full marks :55 (Theory 40+Internal Assessment 10+Attendence 05)	BIOCHEMESTRY AND METABOLISM	*UNIT-1:Water, buffer, and acid-base chemistry: Physical and chemical properties of water, Weak interactions in aqueous systems, Basis of acidity and basicity, Ionization of water, weak acids and weak bases, Equilibrium constant, Dissociation constant and the pH scale, Ionic product of water, Buffers – systems that resist pH changes Chromatography: Principles and Applications in protein purification	10	BB
		*UNIT-2:Structure classification and properties of Amino acids, Peptide bond, Conformation of peptide bonds, Backbone torsion angles, Ramachandran plot, Forces stabilizing protein structure, Different Level of structural organization of proteins Strategies of protein purification. Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharidesand Polysaccharides (glycogen, starch, cellulose).	20	BB+MB
		*UNIT-3:Lipids: Structure and functions –Classification, nomenclature, and properties of fatty acids, essential fatty acids. Triglycerides, Membrane lipids: Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Archaebacterial ether lipids, Prostaglandins, Cholesterol. Nucleic acids: Structure and functions: Physical & chemical properties of Nucleic acids, purines &pyrimidines, Nucleosides & Nucleotides,	10	MB
		*UNIT-4:Carbohydrates Metabolism		

		(Reactions and regulations): Glycolysis, Fate of pyruvate under aerobic and anaerobic conditions, TCA cycle, Gluconeogenesis, Glycogenolysis, glycogen synthesis, Pentose phosphate pathway. Fatty acid metabolism (Reactions and regulations): Synthesis and ß-oxidation of fatty acids.	20	MB
Course category:MBBT -M-P-1.(Pract) 2-credit Full marks:20	BIOCHEMESTRY AND METABOLISM (PRACT)	1. Examination of physical properties of biomolecules – colour, odour, texture. 2. Preparation of normal, molar, and gm% solutions. 3. Qualitative tests for Carbohydrates, proteins, and lipids. 4. Operation of pH meter. 5. Preparation of buffers. 6. Separation of Amino acids and plant pigments by Paper chromatography. 7. Separation of Amino acids and plant pigments by Thin Layer chromatography		BB
Course category:MBBT -SEC-T-1.(The) 4-credit Full marks :55 (Theory 40+Internal Assesment 10+Attendence 05)	ENZYMOLOGY	*UNIT-1:Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric &oligomeric enzymes, activation energy and transition state, enzyme activity and enzyme Unit, Enzyme substrate complex: Two substrate reactions (Random, ordered and ping-pong mechanism) Enzyme inhibition: types of inhibition, Lineweaver-Burk plots, suicide inhibitor. Zymogens and their activation (Proteases and Prothrombin)Role of: NAD+, NADP+, FMN/FAD, coenzymes A, Thiamine pyrophosphate, Pyridoxalphosphate, lipoic-acid, Biotin vitamin B12, Tetrahydrofolate and metallic ions	15	MB+SB
		*UNIT-2:Allosteric enzymes with special reference to phosphofructokinase, kinetics of allosteric	15	AB+DM

Course category	Course	Content		BB
		enzymes. Isoenzymes– multiple forms of enzymes. Ribozymes. Multifunctional enzyme. Immobilized enzyme and their comparison with soluble enzymes, Application of Immobilized and soluble enzyme in health and industry. Methods for protein sequencing. Brief overview of the methods for analysis of secondary and tertiary structures of enzymes.		
Course category:MBBT -SEC-P- 1.(Pract) 2-credit Full marks:20	ENZYMOLOGY (PRACTICAL)	1. Demonstration of the digestion of starch by amylase. 2. Investigation of the effect of temperature on enzyme activity. 3. Demonstration of the action of lipase. 4. Demonstration of Enzyme/Cell Immobilization. 5. Demonstration of Isolation and purification of enzymes. 6. Demonstration of Protein sequencing techniques.		BB

DISTRIBUTION OF COURSRS IN **SEMESTER-III**: JULY2023-DECEMBER 2023

DEPARTMENT OF: MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course category:CCR5.(The) 4-credit Full marks :55 (Theory 40+Internal Assesment 10+Attendence 05)	GENETICS	*Unit-1: Introduction: Historical developments in the field of genetics. Cell Cycle: Mitosis and Meiosis: Control points in cell-cycle progression in yeast. Role of meiosis in life cycles of organisms. Mendelian genetics: Mendel's experimental design, monohybrid, di-hybrid and tri hybrid crosses, Law of segregation & Principle of independent assortment.	10	AB
		*UNIT-2: Non allelic interactions: Interaction producing new phenotype complementary genes, epistasis (dominant & recessive), duplicate genes and inhibitory genes. Chromosome and genomic organization: Eukaryotic nuclear genome nucleotide sequence composition – unique & repetitive DNA, satellite DNA Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin	15	MB
		*UNIT-3: Chromosome and gene mutations, Sex determination and sex linkage: Mechanisms of sex determination, Environmental factors and sex determination, Barr bodies, dosage compensation, genic balance theory, Fragile-Xsyndrome and chromosome, sex influenced dominance, sex limited gene expression, sex linked inheritance.	15	DM
		*UNIT-4: Genetic linkage, crossing over and chromosome mapping: Linkage and Recombination of genes in a chromosome crossing over Extra chromosomal inheritance: Rules of extra nuclear inheritance, maternal effects, maternal linheritance, cytoplasmic inheritance, organelle heredity, genomic imprinting. *UNIT-5: Chromosomal aberration- number and structure, deletion, duplication, inversion. Associated diseases and Evolutionary. Significance; Cytogenetics of human disorder, Turner syndrome, Klinefelter syndrome, Down syndrome, copy number variation and human diseases, gene dosage, dosage compensation	10	DM
			10	MB

Course category:CCR5.(Pract) 4-credit Full marks :20	GENETICS (PRACTICAL)	1. Permanent and temporary mount of mitosis. 2. Permanent and temporary mount of meiosis. 3. Mendelian deviations in dihybrid crosses 4. Demonstration of - Barr Body – 5. Translocation study in Rhoeo. 5. Karyotyping with the help of photographs		AB+DM
Course category:CCR6.(The) 4-credit Full marks :55 (Theory 40+Internal Assesment 10+Attendence 05)	GENERAL MICRO BIOLOGY	*UNIT-1: Fundamentals, History and Evolution of Microbiology. Classification of microorganisms:Microbial Diversity: Distribution and characterization Prokaryotic and Eukaryotic cells, Morphology and cell structure of major groups of microorganisms.	10	SB
		*UNIT-2:Cultivation and Maintenance of microorganisms: Nutritional categories of micro-organisms, Methods of isolation, Purification and preservation.	10	SB
		*UNIT-3: Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria Reproduction: Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria.	20	MB
		*UNIT-4:Control of Microorganisms: By physical, chemical and chemotherapeutic Agents. Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal Food Microbiology: Important microorganism in food Microbiology	20	MB
Course category:CCR6.(Pract) 4-credit Full marks :20	GENERAL MICRO BIOLOGY (PRACTICAL)	1. Isolation of bacteria & their biochemical characterization. 2. Staining methods: simple staining, Gram staining, spore staining, negative staining, hanging drop. 3. Preparation of media & sterilization methods, Methods of Isolation of bacteria from different sources. 4. Determination of bacterial cell size by micrometry. 5. Enumeration of microorganism - total & viable count.		SB+MB

Courses	Course title	Topic	No. of lectures (inclusive of Tutorials)	Teacher
Course category:CCR7.(The) 4-credit Full marks :55 (Theory 40+Internal Assesment 10+Attendence 05)	BIO PHYSICS	*UNIT-1:Atomic structure and bonding: Intermolecular attractions, hydrogen bonding, vanderwaalsforce, hydrophobic and hydrophillic bond, polar bond, properties of water.Thermodynamics, reaction kinetics and energy transduction:Isolated, closed and open systemsActivation energy and transition-state theory; Different orders of chemical reactions, free energy and chemical reaction.	10	SB
		*UNIT-2:.Isotopes and radioactivity: Radioactivity, decay law, Radioactive labeling, Detection and measurement of radioactive dose by GM counter,Hydrodynamic properties: Surface tension, diffusion, osmosis, sedimentation at molecular level. Factors affecting themCentrifugation – Basic Principle ofCentrifugation,Instrumentation of Ultracentrifuge (Preparative, Analytical)	20	MB
		*UNIT-3:X-Ray Crystallography – X-ray diffraction, Bragg equation, Reciprocal lattice, Miller indices &Unit cell, Concept of different crystal structure,Absorption Spectroscopy – Properties of light, molecular mechanism of the absorption of light by molecules, Beer-Lambert law, Factors affecting the absorption properties of a Chromophore.	20	AB
		*UNIT-4:Spectroscopy: Raman Spectroscopy – What is Raman Effect, Quantum mechanical reason of Raman effect, NMR Spectroscopy – Basic principle of NMR spectroscopy,Experimental technique & instrumentation, Chemical shift, Hyperfine splitting, Relaxation process.	10	DM

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course category: MBSEC 101.(The) 2-credit Full marks :55 (Theory 40+Internal Assesment	BIOFERTILIZERS	*UNIT-1:General account about the microbes used as biofertilizer – Rhizobium isolation,identification, mass multiplication, carrier based inoculants, Actinorrhizalsymbiosis.Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of,different,microorganisms.Azotobacter: classification, characteristics – crop response to Azotobacterinoculum,maintenance and mass.	15	AB
t		*UNIT-2:Mycorrhizal association- types of mycorrhizal association, taxonomy, occurrence anddistribution, phosphorus nutrition, growth and yield – colonization of	15	AB

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| 10+Attendence 05 | | VAM – isolation andinoculum production of VAM, and its influence on growth and yield of crop plants.Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost | | |

DISTRIBUTION OF COURSES IN **SEMESTER-V**: JULY2023-DECEMBER 2023
DEPARTMENT OF: MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Courses	Course title	Topic	No .of lectures (inclusive of Tutorials)	Teacher
Course category:CCR11.(The) 4-credit Full marks :55 (Theory 40+Internal Assessment 10+Attendence 05)	BIOPROCESS TECHNOLOGY	*UNIT-1: Introduction to bioprocess technology. Range of bioprocess technology and its chronological Development . Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics– Batch, Fed batch and Continuous culture.	10	SB
		*UNIT-2: Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production Vessels - Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing – Media preparation, Inoculums development and sterilization.	20	SB
		*UNIT-3: Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting KLa. Bioprocess measurement and control system with special reference to computer aided process Control	15	MB
		*UNIT-4: Introduction to downstream processing, product recovery and purification. Effluent treatment. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.	15	MB

Course category:CCR11 (Pract) 2-credit Full marks :20	BIOPROCESS TECHNOLOGY(PRACT)	1. Bacterial growth curve. 2. Calculation of thermal death point (TDP) of a microbial sample. 3. Production and analysis of ethanol. 4. Production and analysis of amylase. 5. Production and analysis of lactic acid.		SB+MB
Course category: CCR12.(The) 4-credit Full marks :55 (Theory 40+Internal Assessment 10+Attendence 05)	RECOMBINANT DNA TECHNOLOGY	*UNIT-1: Molecular tools and applications-restriction enzymes, ligases, polymerases, alkaline phosphatase. Gene Recombination and Gene transfer: Transformation, Episomes, Plasmids and other cloning vectors (Bacteriophage-derived vectors, artificial chromosomes), Microinjection, Electroporation, Ultrasonication, Principle and applications of Polymerase chain reaction (PCR), primer-design, and RT- (Reverse transcription) PCR.	15	DM
		*UNIT-2: Restriction and modification system, restriction mapping. Southern and Northern hybridization. Preparation and comparison of Genomic and cDNA library, screening of recombinants,	20	AB
		*UNIT-3: Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis, Gene shuffling, production of chimeric proteins, Protein	10	AB
		*UNIT-4: Genetic engineering in plants: Use of Agrobacterium tumefaciens and A. rhizogenes, Ti plasmids, Strategies for gene transfer to plant cells,	15	DM
Course category:CCR12 (Pract) 2-credit Full marks :20	RECOMBINANT DNA TECHNOLOGY(PRACT)	1. Isolation of chromosomal DNA from plant cells 2. Isolation of chromosomal DNA from E. coli 3. Qualitative and quantitative analysis of DNA using spectrophotometer 4. Plasmid DNA isolation 5. Restriction digestion of DNA		AB+DM
Course category DSE1.(The) 4-credit	ANIMAL BIOTECHNOLOGY	*UNIT-1:Gene transfer methods in Animals – Microinjection, Embryonic Stem cell, gene transfer,	10	DM

Full marks :55 (Theory 40+Internal Assesment 10+Attendence 05)		Retrovirus & Gene transfer.		
		*UNIT-2:Introduction to transgenesis. Transgenic Animals – Mice, Cow, Pig, Sheep, Goat, Bird, Insect. Animal diseases need help of Biotechnology – Foot-and mouth disease, Coccidiosis, Trypanosomiasis, Theileriosis.	10	DM
		*UNIT-3:Animal propagation – Artificial insemination, Animal Clones. Conservation Biology – Embryo transfer techniques. Introduction to Stem Cell Technology and its applications	20	DM
		*UNIT-4:Genetic modification in Medicine - gene therapy, types of gene therapy, vectors in gene therapy, molecular engineering, human genetic engineering, problems & ethics.	20	AB
Course category:DSE1(Pract) 2-credit Full marks :20	ANIMAL BIOTECHNOLOGY(PRACT)	1. Sterilization techniques: Theory and Practical: Glass ware sterilization, Media sterilization, Laboratory sterilization 2. Sources of contamination and decontamination measures. 3. Preparation of Hanks Balanced salt solution 4. Preparation of Minimal Essential Growth medium 5. Isolation of lymphocytes for culturing		AB+DM
Course category DSE2.(The) 4-credit Full marks :55 (Theory 40+Internal Assesment 10+Attendence 05)	PLANT BIOTECHNOLOGY	*UNIT-1:History of plant tissue culture, concept on differentiation, dedifferentiation and redifferentiation. Types of culture: Seed, Embryo, Callus, Organs, Cell and Protoplast culture.	15	SB
		*UNIT-2:In vitro haploid production Androgenic methods: Anther culture, Microspore culture andogenesis Sgnificance and use of haploids, Ploidy level and chromosome doubling, diplodization, Gynogenic haploids, factors effecting gynogenesis, chromosome elimination	20	SB
		*UNIT-3:Protoplast Isolation and fusion Methods of protoplast isolation, Protoplast development, Somatic hybridization, identifiation and selection of hybrid cells, Cybrids, Potential of somatic hybridization limitations.	15	MB
		*UNIT-4:lant Growth Promoting bacteria. Nitrogen fixation, Nitrogenase, Hydrogenase, Nodulation, Biocontrol of pathogens, Growth promotion by free-living bacteria.	10	MB

Course category:DSE2 (Pract) 2-credit Full marks :20	PLANT BIOTECHNOLOGY(PRACT)	1. Preparation of simple growth nutrient (knop's medium), full strength, half strength, solid and liquid. 2. Preparation of complex nutrient medium (Murashige & Skoog's medium) 3. Selection, Prune, sterilize and prepare an explant for culture. 4. Significance of growth hormones in culture medium. 5. To demonstrate various stages of Micropropagation.		BB+MB+SB

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

DISTRIBUTION OF COURSES IN SEMESTER-I: July 2023 - December 2023

Major

courses	Courses Title	Topic	No. of Lectures	Teachers
Theory PHY-M-T-1 Marks (Semester End - 40, Internal Assessment - 10) Theory: (4 Credits) No. of Lectures – 60	MATHEMATICAL PHYSICS-I	**Unit-1**-Calculus: a) Recapitulation:	5 15	AKM DPD
		b) Second Order Differential equations:	6	PB
		Unit-II-Vector Calculus: a) Recapitulation of vectors:	7	AH
		b)Vector Differentiation:		
		Unit -III-Vector Integration:	10	GP
		Unit-IV-Orthogonal Curvilinear Coordinates:	4	GP
		Unit-V-Matrices	6	SB
		Unit-VI-Introduction to probability:	5	SM
		Unit-VII-Dirac Delta function and its properties:	2	DPD
PRACTICAL **PHY-M-P-1:** Marks (Semester End - 20, Internal Assessment – 5) (Lab. Note Book - 05, Viva-Voce-05, Experiment -10) Practical - (2 Credits) No. of Lectures - 60	**PHY-M-P-1: MATHEMATICAL PHYSICS-I**	**Uint-I-** a) Introduction and Overview b)Basics of scientific computing c)Errors and error Analysis	15	AH
		Unit-II a)Introduction to programming in Python/Fortran/Matlab/C/C++: b)Introduction to plotting graphs with Matplotlib/Gnuplot/Origin/Excel	15	DPD
		Unit-III a)Programs: b)Random number generation c) Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods d) Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation e) Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	30	SM
Theory PHY-SEC-T-1: Marks (Semester End – 35, Internal Assessment – 10) Internal Assessment [(Class Test/ Assignment/ quiz etc) - 10] Theory: (3 Credits) No. of Lectures - 45	**ELECTRICAL CIRCUITS & NETWORK SKILLS**	**Unit-I**- Basic Electricity Principles:	6	PB
		Unit-II- Understanding Electrical Circuits:	8	PB
		Unit-III-Generators and Transformers:	4	NH
		Unit-IV-Electric Motors:	3	NH

		Unit-**V**-Solid-State Devices:		
		Unit-**VI**-Electrical Protection:	**4**	**NH**
		Unit-**VII**- Electrical Wiring:	**3**	**SM**
			2	**SM**

Minor

courses	Courses Title	Topic	No. of Lectures	Teachers
Theory PHY-MI-T-1: Marks (Semester End - 30, Internal Assessment – 5) Theory – (3 Credits) No. of Lectures - 45	**MATHEMATICAL PHYSICS -I**	Unit-**I**-Calculus: Unit-**II**-Vector Calculus: Unit-**III**-Vector Integration: Unit-**IV-**Matrices: Unit-**V-**Dirac Delta function and its properties:	**15** **13** **10** **5** **2**	**NH** **AH** **AKM** **SB** **SB**
Practical **PHY-MI-P-1:** Marks (Semester End - 10, Internal Assessment – 5) Practical - (1 Credits) No. of Lectures - 30	**MATHEMATICAL PHYSICS-I**	Unit-**I**-Introduction to programming in Python/Fortran/Matlab/C/C++: Unit-**II**-Introduction to plotting graphs with Matplotlib/Gnuplot/Origin/Excel Unit-**III**-Programs: Unit-**IV**-Random number generation Unit-**V**-Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods	**5** **5** **10** **4** **6**	**SB** **NH** **AH** **AH** **AH**

Semester-III(HONS)

courses	Courses Title	Topic	No. of Lectures	Teachers
Theory PHY-H-CC-T-05 (Credits: Theory-04, Practicals-02) Theory: 60 Lectures F.M. = 75 (Theory - 40, Internal Assessment – 15)	**Mathematical Physics II**	Unit-**I**-Fourier Series Unit-**II**-Frobenius Method and Special Functions Unit-**III**-Some Special Integrals Unit-**IV**-Theory of Errors and Partial Differential Equations	14 24 4 18	AH SM SB AH
Practical PHY-H-CC-P-05: Practical – 20 marks (Lab. Note Book – 05, Viva-Voce-05,Experiment - 10)	**MATHEMATICAL PHYSICS-II**	Unit-I-Introduction to Numerical computation numpy, scipy/Matlab/Octave/ Scilab Unit-II-Curve fitting, Least square fit, Goodness of fit, standard deviation Unit-III-Solution of Linear system of equations by Gauss elimination method and Gauss Seidal method. Diagonalization of matrices, Inverse of a matrix, Eigen vectors, eigen values problems Unit-IV-Generation of Special functions using User defined functions	**30**	**DPD**

		Unit-V-Solution of ODE First order Differential equation Euler, modified Euler and Runge-Kutta second order methods Second order differential equation ,Fixed difference method	**30**	**SM**
PHY-H-CC-T-06: (Credits: Theory-04, Practicals-02) Theory: 60 Lectures F.M. = 75(Theory - 40, Internal Assessment – 15)	**THERMAL PHYSICS**	**Unit-I** a) Introduction to Thermodynamics b) Second Law of Thermodynamics c) Entropy d) Thermodynamic Potentials **Unit-II** Maxwell's Thermodynamic Relations **Unit-III** a) Kinetc Theory of Gases(Distribution of Velocities, Molecular Collsions, Real Gases)	**32** **7** **21**	**DPD** **GP** **AKM**
Practical PHY-H-CC-P-06: Practical – 20 marks (Lab. Note Book – 05, Viva-Voce-05,Experiment - 10)	**THERMAL PHYSICS**	1. To determine Mechanical Equivalent of Heat, J, by Callender and 27 Barne's constant flow method. 2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus. 3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method. 4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method. 5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT). 6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions. 7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature 8. Determination of the boiling point of a liquid by Platinum resistance thermometer 9. Determination of the melting point of a solid with a thermocouple. 10. Measurement of the coefficient of linear expansion of a solid using an optical Lever	**60**	**GP+AH+SB**
PHY-H-CC-T-07: (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 **Unit-III** a) Arithmetic Circuits b) Sequential Circuits **Unit-IV** a) Digital circuits b) Timers c) Shift registers d) Counters e) Computer Organization f) Intel 8085 Microprocessor	**6** **10** **11** **33**	**SM** **NH** **SB** **PB**

		Architecture g) Introduction to Assembly Language		
Practical PHY-H-CC-P-07: 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 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.	**60**	**PB+NH**
PHY—H-SEC-T-01: (Credits: 02) F.M. = 50 (Theory - 40, Internal Assessment – 10) Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]	**ELECTRICAL CIRCUITS & NETWORK SKILLS**	**Unit-I** Basic Electricity Principles **Unit-II** a) Understanding Electrical Circuits b) Electric Motors **Unit-III** Electrical Drawing and Symbols **Unit-IV** Generators and Transformers **Unit-V** Solid -State devices **Unit-VI** a) Electrical Protection b) Electrical Wiring	**3** **8** **4** **3** **3** **9**	**AH** **DPD** **PB** **SB** **SM** **NH**

courses	Courses Title	Topic	No. of Lectures	Teachers
Theory PHY-H-GE-T-03: (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	**DIGITAL, ANALOG CIRCUITS AND INSTRUMENTATION**	**UNIT-1:** a) Digital Circuits b) Semiconductor Devices and Amplifiers: **Unit-II** a) Operational Amplifiers (Black Box approach): b) Instrumentations	**SB** **AKM**	**30** **30**
Practical PHY-H-GE-P-03: Practical – 20 marks (Lab. Note Book – 05, Viva-Voce-05,Experiment - 10) 60 Lectures	**DIGITAL, ANALOG CIRCUITS AND INSTRUMENTS**	1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using CRO 2. To verify and design AND, OR, NOT and XOR gates using NAND gates. 3. To minimize a given logic circuit. 4. Half adder, Full adder and 4-bit Binary Adder. 5. Adder-Sub tractor using Full Adder I.C. 6. To design an astable multivibrator of given specifications using 555 Timer. 7. To design a monostable multivibrator of given specifications using 555 Timer. 8. To study IV characteristics of PN diode, Zener and Light emitting diode 9. To study the characteristics of a Transistor in CE configuration. 10. To design a CE amplifier of given gain (mid-gain) using voltage divider bias. 11. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response. 12. To design a non-inverting amplifier of given gain using Op-amp 741 and study its Frequency Response. 13. To study Differential Amplifier of given I/O specification using Op-amp. 14. To investigate a differentiator made using op-amp. 15. To design a Wien Bridge Oscillator using an op-amp.	**60**	**AKM+AH+PB**

courses	Courses Title	Topic	No. of Lectures	Teachers
PHY-G-CC-T-03 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]	**Elements of Modern Physics**	**Unit-I** a) Quantum Mechanics **Unit-II** Radioactivity	**45** **15**	**GP** **AH**
PHY-G-CC-P-03: 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 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.	**60**	**DPD+GP+SB**
PHY-H-SEC-T-02	Renewable Energy and Energy Harvesting	<u>**Unit-I**</u> a) Fossil fuels and Alternate Sources of energy b) Solar energy c) Wind energy harvesting d) Ocean Energy e) Geothermal Energy f) Hydro Energy g) Piezoelectric Energy Harvesting h) Electromagnetic Energy Harvesting	**30**	**NH**

courses	Courses Title	Topic	No. of Lectures	Teachers
PHY-H-CC-T-11: (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]	**QUANTUM MECHANICS AND APPLICATIONS**	**Unit-I** a) Time dependent Schrodinger equation: b) Time independent Schrodinger equation-Hamiltonian **Unit-II** a) General discussion of bound states in an arbitrary potential b) Quantum theory of hydrogen-like atoms: **Unit-III** a) Atoms in Electric & Magnetic Fields: b) Atoms in External Magnetic Fields **Unit-IV** a) Many electrons atom	16 22 12 10	GP DPD SB SM
PHY-H-CC-P-11: QUANTUM MECHANICS AND APPLICATIONS Practical – 20 marks (Lab. Note Book – 05, Viva-Voce-05,Experiment -10)	**QUANTUM MECHANICS AND APPLICATIONS**	1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom: 2. Solve the s-wave radial Schrodinger equation for an atom: Laboratory based experiments: 3. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency 4. Study of Zeeman effect: with external magnetic field; Hyperfine splitting 5. To show the tunneling effect in tunnel diode using I-V characteristics. 6. Quantum efficiency of C CD s	60	SM
Theory PHY-H-CC-T-12 (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]	**Solid State Physics**	**Unit-I** a) Crystal Structure b) Superconductivity **Unit-II** a) Elementary Lattice Dynamics b) Ferroelectric Properties of Materials **Unit-III** a) Magnetic Properties of Matter b) Elementary band theory **Unit-IV** a) Dielectric Properties of Materials	18 16 18 8	SM NH SB DPD

PHY-H-CC-P-12: 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 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.	**60**	**DPD+GP+PB**
PHY-H-DSE-T-01: (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]	**CLASSICAL DYNAMICS**	<u>**Unit-I**</u> a) Classical Mechanics of Point Particles b) Electromagnetic radiation <u>**Unit-II**</u> Special Theory of Relativity	**37** **38**	**PB** **SB+DPD**
PHY-H-DSE-T-02: (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]	**NUCLEAR AND PARTICLE PHYSICS**	<u>**Unit-I**</u> a) General Properties of Nuclei b) Nuclear Models c) Detector for Nuclear Radiations d) Particle Accelerators <u>**Unit-II**</u> a) Radioactivity b) Nuclear Reactions c) Nuclear Astrophysics d) Interaction of Nuclear Radiation with matter <u>**Unit-III**</u> Particle Physics	**33** **28** **14**	**AH** **AKM** **PB**

courses	Courses Title	Topic	No. of Lectures	Teachers
PHY-G-DSE-T-01: (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	**ELECTRICITY AND MAGNETISM**	**Unit-I** a) Vector Analysis **Unit-II** a) Electrostatics b) Magnetism **Unit-III** a) Electromagnetic Induction b) Maxwell's equation and Electromagnetic wave propagation	**12** **32** **16**	PB NH AKM
PHY-G-SEC-T-4 (Credits: 02) F.M. = 50 (Theory - 40, Internal Assessment – 10) Internal Assessment [Class Attendance	**Basic Instrumentation Skills**	**Unit-I** a) Basic of Measurement: b) Electronic Voltmeter: c) Cathode Ray Oscilloscope: **Unit-II** a) Signal Generators and Analysis Instruments: b) Impedance Bridges & Q-Meters: c) Digital Instruments: d) Digital Multimeter:	**17** **13**	**PB** **NH**

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-I: July 2023 - December 2023

MAJOR

Courses	Course Title	Topic	No. of Lectures (inclusive of Tutorials)	Teachers
ZOO-MJ-T-101 **[4 credits] [4 Classes PW] Full Marks: 55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	Taxonomy and Introduction to Non-chordates	**Module 1: Basics of Animal Classification**	**5**	HGT
		Module 2: Protista	**5**	AB
		Module 3: Porifera	**5**	AB
		Module 4: Cnidaria	**5**	SD
		Module 5: Ctenophora	**5**	SB
		Module 6: Platyhelminthes	**5**	AB
		Module 7: Aschelminthes	**5**	SB
		Module 8: Annelida	**5**	SB
		Module 9: Arthropoda	**5**	SH
		Module 10: Onychophora	**5**	DM
		Module 11: Mollusca	**5**	HGT
		Module 12: Echinodermata	**5**	SD
		Module 13: Hemichordata	**5**	HGT
ZOO-MJ-P-101 **[2 credits] [4 Classes PW] Full Marks: 20 (End Sem. 20)**	Taxonomy and Introduction to Non-chordates Lab	**Identification (upto subclass)**	**60**	HGT AB UG SD SB

MINOR

Courses	Subject/ Course Title	Topic	No. of Lectures (inclusive of Tutorials)	Teachers
ZOO-MI-T-101 **[3 credits] [3 Classes PW] Full Marks: 35 (End Sem. 25+Internal Assessment 10)**	Basic idea of animal diversity and taxonomy	Module 1: Basics of Animal Classification	3	DM
		Module 2: Protista	3	SB
		Module 3: Porifera	3	DM
		Module 4: Cnidaria	3	DM
		Module 5: Platyhelminthes	3	SH
		Module 6: Nematoda	3	AB
		Module 7: Annelida	3	SB
		Module 8: Arthropoda	3	SH
		Module 9: Mollusca	3	AB
		Module 10: Echinodermata	3	SB
		Module 11: Protochordata	3	SH
		Module 12: Pisces	3	DM
		Module 13: Amphibia	3	SH
		Module 14: Reptilia	3	AB
		Module 15: Aves	3	SB
		Module 16: Mammalia	3	AB
ZOO-MI-P-101 **[1 credits] [2 Classes PW] Full Marks: 15 (End Sem. 15)**	Basic idea of animal diversity and taxonomy Lab	**1**. Identification	30	UG & DM
		2. Pecten from Fowl head	2	
		3. Dissection of brain and pituitary of Rohu/Catla/Mrigal	2	
		4. Identification and significance	2	

DISTRIBUTION OF COURSES IN SEMESTER-III: July 2023 – December 2023
DEPARTMENT OF: ZOOLOGY

HONOURS

Courses	Course Title	Topic	No. of Lectures	Teachers
ZOOL-H-CC-T-05 **[4 credits]** **Full Marks: 55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	Diversity of Chordates	**Unit 1: Introduction to Chordates**	6	HGT
		Unit 2: Protochordata	6	SD
		Unit 3: Origin of Chordata	6	SB
		Unit 4: Agnatha	6	SH
		Unit 5: Pisces	6	AB
		Unit 6: Amphibia	6	DM
		Unit 7: Reptilia	6	AB
		Unit 8: Aves	6	HGT
		Unit 9: Mammals	6	SH
		Unit 10: Zoogeography	6	SD
ZOOL-H-CC-P-05 **[2 credits]** **Full Marks: 20 (End Sem. 20)**	Diversity of Chordates Lab	1. Identification, upto Order 2. Pecten from Fowl head 3. Dissection of brain and pituitary of Rohu/Catla	24 3 3	SH SD UG HGT AB SB DM
ZOOL-H-CC-T-06 **[4 credits]** **Full Marks: 55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	Animal Physiology: Controlling and Coordinating Systems	**Unit 1: Tissues** **Unit 2: Bone and Cartilage** **Unit 3: Nervous System** **Unit 4: Muscular system** **Unit 5: Reproductive System** **Unit 6: Endocrine System**	10 10 10 10 10 10	SB SH SD AB DM HGT
ZOOL-H-CC-P-06 **[2 credits]** **Full Marks: 20 (End Sem. 20)**	Animal Physiology: Controlling and Coordinating Systems Lab	1.Preparation of temporary mounts 2.Identification 3. Microtomy	5 10 15	SH HGT AB SD SB DM UG
ZOOL-H-CC-T-07 **[4 credits]** **Full Marks: 55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	Fundamentals of Biochemistry	**Unit 1: Carbohydrates** **Unit 2: Lipids** **Unit 3: Proteins** **Unit 4: Nucleic Acids** **Unit 5: Enzymes** **Unit 6: Oxidative Phosphorylation**	10 10 10 10 10 10	DM SB HGT SH SD AB
ZOOL-H-CC-P-07 **[2 credits]** **Full Marks: 20 (End Sem. 20)**	Fundamentals of Biochemistry Lab	LAB BASED BIOCHEMICAL TEST	30	SD SH HGT AB UG DM SB

Courses	Subject/ Course Title	Topic	No. of Lectures	Teachers
ZOOL-H-SEC- 01 [2 Credits] Full Marks:20(End Sem.20)	Aquarium Fish Keeping	**Unit 1: Introduction to Aquarium Fish Keeping**	8	HGT
		Unit 2: Biology of Aquarium Fishes	8	SD
		Unit 3: Food and feeding of Aquarium fishes	8	AB
		Unit 4: Fish Transportation	8	SH

GENERIC ELECTIVE (GE)

Courses	Subject/ Course Title	Topic	No. of Lectures	Teachers
ZOOL-HGE-T-03 [4 credits] Full Marks: 55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)	Animal Diversity and Taxonomy	**Unit 1: Basics of Animal Classification**	2	HGT
		Unit 2: Protista	4	HGT
		Unit 3: Porifera	4	SB
		Unit 4:Cnidaria	4	SD
		Unit 5: Platyhelminthes	4	AB
		Unit 6: Nematoda	4	AB
		Unit 7:Annelida	2	DM
		Unit 8: Arthropoda	4	SH
		Unit 9: Mollusca	4	AB
		Unit 10: Echinodermata	4	SD
		Unit 11: Protochordata	4	SD
		Unit 12: Pisces	4	HGT
		Unit 13: Amphibia	4	DM
		Unit 14: Reptilia	4	SH
		Unit 15: Aves	4	SH
		Unit 16: Mammalia	4	SB
ZOOL-HGE-P-03 [2 credits] Full Marks: 20 (End Sem. 20)	Animal Diversity, Taxonomy Lab	1. Identification	15	UG
		2. Pecten from Fowl head	5	AB
		3. Dissection of brain and pituitary of Rohu/Catla	5	UG
		4. Identification and significance	5	AB

PROGRAMME COURSES (PCC)

Courses	Subject/ Course Title	Topic	No. of Lectures	Teachers
ZOOL-G-CC-T-03 **[4 credits]** **Full Marks: 55** **(End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	Cell Biology, Genetics and Evolutionary Biology	**Unit 1: Overview of Cells**	4	SD
		Unit 2: Plasma Membrane	4	SB
		Unit 3: Cytoplasmic organelles-I	4	SH
		Unit 4: Cytoplasmic organelles-II	4	AB
		Unit 5: Nucleus	4	SB
		Unit 6: Cell Division	4	SD
		Unit 7: Cell Signaling	4	SH
		Unit 8: Mendelian Genetics and its Extension	4	HGT
		Unit 9: Linkage, Crossing Over and Chromosomal Mapping	4	SD
		Unit 10: Mutations	4	SH
		Unit 11: Sex Determination	4	HGT
		Unit 12: Evolution – 1: Idea	4	DM
		Unit 13: Evolution - 2: Mechanism	4	AB
		Unit 14: Evolution - 3: Effect	4	HGT
		Unit 15: Evolution - 4: Humans	4	DM
ZOOL-G-CC-P-03 **[2 credits]** **Full Marks: 20 (End Sem. 20)**	Cell Biology, Genetics and Evolutionary Biology Lab	1. Study of various stages of meiosis.	10	SH
		2. Study of fossils from models/ pictures.	10	UG
		3. Chi-square analyses.	10	SD
ZOOL-G-SEC- 01 **[2 Credits]** **Full Marks:20(End Sem.20)**	Aquarium Fish Keeping	**Unit 1: Introduction to Aquarium Fish Keeping**	8	HGT
		Unit 2: Biology of Aquarium Fishes	8	SD
		Unit 3: Food and feeding of Aquarium fishes	8	AB
		Unit 4: Fish Transportation	8	SH

DISTRIBUTION OF COURSES IN **SEMESTER-V**: July 2023 -
December 2023
DEPARTMENT OF: ZOOLOGY

HONOURS

Courses	Course Title	Topic	No. of Lectures	Teachers
ZOOL-H-CC-T-11 **[4 credits] Full Marks:55 (End Sem. 40+Internal Assessment 10+Attendance in Classes 05)**	Molecular Biology	**Unit 1: Nucleic Acids**	6	SB
		Unit 2: DNA Replication	6	DM
		Unit 3: Transcription	8	SH
		Unit 4: Translation	8	SB
		Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA	8	DM
		Unit 6: Gene Regulation	8	AB SD
		Unit 7: DNA Repair Mechanisms	8	
		Unit 8: Molecular Techniques	8	HGT
ZOOL-H-CC-P-11 **[2 credits] Full Marks: 20 (End Sem 20)**	Molecular Biology Lab	1. Demonstration of polytene and lampbrush chromosome	10	UG HGT
		2. Isolation and quantification of genomic DNA	10	SD
		3. Agarose gel electrophoresis for DNA	10	SB DM
ZOOL-H-CC-T-12 **[4 Credits] Full Marks:55 (End Sem 40+Internal assesment10+ Attendance in classes 05)**	Principles of Genetics	**Unit 1: Mendelian Genetics and its Extension**	8	HGT
		Unit 2: Linkage, Crossing Over and Chromosomal Mapping	10	SD
		Unit 3: Mutations	8	SH
		Unit 4: Sex Determination	8	SD
		Unit 5: Extra-chromosomal Inheritance	10	DM
		Unit 6: Recombination in Bacteria and Viruses	8	SH
		Unit 7: Transposable Genetic Elements	8	AB
ZOOL-H-CC-P-12 **[2 Credits] (End Sem 20)**	Principles of Genetics Lab	1. Chi-square analyses.	7	UG HGT
		2. Preparation of linkage maps.	9	
		3. Identification of chromosomal aberration	7	SD
		4. Pedigree analysis	7	SB DM

ZOOL-H-DSE-T-01 [4 Credits] Full Marks:55 (End Sem 40+Internal Assessment 10+ Attendance in classes 05)	Fish and Fisheries	Unit 1: Introduction and Classification	12	SH
		Unit 2: Morphology and Physiology	12	AB
		Unit 3: Fisheries	12	HGT
		Unit 4: Aquaculture	12	SD
		Unit 5: Fish in research	12	DM
ZOOL-H-DSE-P-01 [2 Credits] Full Marks:20(End Sem 20)	Fish and Fisheries Lab	1. Morphometric and meristic characters of fishes.	4	UG
		2.Identification	6	HGT
		3. Study of different types of scales	4	SD
			4	SH
		4.Study of crafts and gears used in Fisheries	4	AB
		5. Study of air breathing organs.	4	DM
		6. Project Report on a visit to any fish farm	4	SB
ZOOL-H-DSE-T-03 [4 Credits] Full Marks:55 (End Sem 40+Internal Assesment 10+Attendance in classes 05)	Wildlife conservation and Management	Unit 1: Introduction to Wild Life Unit 2: Evaluation and management of wild life	7	AB
		Unit 3: Management of habitats	8	DM
		Unit 4: Population estimation	8	SH
		Unit 5: Aims and objectives of wildlife conservation	8	SD
		Unit 6: Management planning of wild life in protected areas	8	AB
			7	HGT
		Unit 7: Man and Wildlife	7	SH
		Unit 8: Protected areas	7	SB
ZOOL-H-DSE-P-03 [2 Credits] Full Marks:20 (End Sem 20)	Wildlife conservation and Management Lab	1.Identification	7	DM
		2. Demontration of basic equipment needed in wildlife study.	7	UG
				SB
		3.Familiarization and study of animal evidences in the field	7	HGT
		4. Monitoring for estimation of faunal abundance and diversity in locality	10	SD

PROGRAMME COURSE (PCC)

Courses	Subject/ Course Title	Topic	No. of Lectures (inclusive of Tutorials)	Teachers
ZOOL-G-DSE-T-01 **[4 Credits] Full Marks:55 (End Sem 40+Internal Assesment 10+ Attendance in classes 05)**	Fish and Fisheries	**Unit 1: Introduction and Classification**	12	SH
		Unit 2: Morphology and Physiology	12	AB
		Unit 3: Fisheries	12	HGT
		Unit 4: Aquaculture	12	SD
		Unit 5: Fish in research	12	DM
ZOOL-G-DSE-P-01 **[2 Credits] Full Marks:20(End Sem 20)**	Fish and Fisheries Lab	1. Morphometric and meristic characters of fishes.	4	UG
		2.Identification	6	SH
		3. Study of different types of scales	4	
		4.Study of crafts and gears used in Fisheries	4	
		5. Study of air breathing organs.	4	SD
		6. Project Report on a visit to any fish farm	4	
ZOOL-G-SEC-03 **[2 Credits] Full Marks:50 (End Sem 40 + Internal assessment 10)**	Sericulture	**Unit 1: Introduction**	6	HGT
		Unit 2: Biology of Silkworm	6	SD
		Unit 3: Rearing of Silkworms	6	SH
		Unit 4: Pests and Diseases	6	SH
		Unit 5: Entrepreneurship in Sericulture	6	SH

Faculty Members

Uttam Ghosh (UG)
Dr. Himadri Guhathakurta (HGT)
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Abhishek Bagdi (AB)
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Scheduled of Internal Examination
Stream: Science
Session: July 2023-December 2023

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

Sl. No.	Semester	Topic	Date
01.	Semester-I	Major & Minor course	18th December-23th December, 2023
02.	Semester-III	Honours & Program course	18th December-23th December, 2023
03.	Semester-V	Honours & Program course	20th November-25th November, 2023

THE END