



MUGBERIA GANGADHAR MAHAVIDYALAYA

P.O.—BHUPATINAGAR, Dist.—PURBA MEDINIPUR, PIN.—721425, WEST BENGAL, INDIA

NAAC Re-Accredited B⁺Level Govt. aided College

CPE (Under UGC XII Plan) & NCTE Approved Institutions

DBT Star College Scheme Award Recipient

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DEPARTMENT OF CHEMISTRY, MUGBERIA GANGADHAR MAHAVIDYALAYA,
BHUPATINAGAR, PURBA MEDINIPUR-721425

PROGRAMME OUTCOME (PO), COURSE OUTCOME (CO) AND PROGRAMME
SPECIFIC OUTCOME (PSO) FOR END SEMESTER STUDENTS UNDER GRADUATE
COURSE: 2022-2023

Programme Name: B.SC. HONS. (CHEMISTRY)

Course Outcomes

CLASS	COURSE	SYLLABUS OF COURSE	COURSE OUTCOMES
SEM I	CC1	C1T: Organic Chemistry -1	<ol style="list-style-type: none">To learn the basics concepts of organic chemistry specially on chemical bonding and physical properties, MO theory, aromaticity, hybridization of organic compounds etc.To learn stereochemistry of chiral compounds; Relative and absolute configuration, optical activity, Symmetry elements etc. arises due to presence of stereo-axis; concept of pro-stereoisomerism and concept of conformations of stereo isomers.
		C1P: Organic Chemistry - 1 Lab	<ol style="list-style-type: none">To learn experimentally about the separation of compounds from a solid binary mixture by using common laboratory reagentsTo understand experimentally how to determine the boiling points of organic liquid compounds.
	CC2	C2T: Physical Chemistry - 1	<ol style="list-style-type: none">To understand the basic concept of kinetic theory of gases and know how to solve numerical problems related to that topic.To learn the transport processes of liquids and gases.Understand basic principal of thermodynamics, thermochemistry, equilibrium, and statistical thermodynamicsTo understand rate laws, rate equations of different types of reactions, determine rate constant values, order of reactions, effect of temperature and other factors on reaction rate, homogenous catalysis, catalytic effect on reaction rate, equations related to chemical catalysis
		C2P: Physical Chemistry - 1 Lab	<ol style="list-style-type: none">To study the kinetics of decomposition of H₂O₂, acid-catalyzed hydrolysis of methyl acetate, viscosity measurement of unknown liquids, measurement of solubility of sparingly soluble salts.Determine pH of unknown solution, K_a of weak acid and heat of neutralization of a strong acid by a strong base.

SEM II	CC3	C3T: Inorganic Chemistry - 1	<ol style="list-style-type: none"> 1. To know extra nuclear structure of atom 2. To study in detail about modern periodic table, physical and chemical properties of the elements along a group or period, factors influences those properties, relativistic effects and inert pair effect. 3. To understand acid base reactions 4. To know the basic concepts of redox reactions
		C3P: Inorganic Chemistry – 2 Lab	To study the estimation of ions or salts by acid-base titration method and oxidation-reduction titration method of Permanganometry and Dichrometometry.
	CC4	C4T: Organic Chemistry -2	<ol style="list-style-type: none"> 1. To learn stereochemistry of chiral compounds; Chirality arising due to presence of stereo-axis 2. Concept of prostereoisomerism and concept of conformations of stereo isomers. 3. To understand reaction kinetics, reaction thermodynamics and tautomerism of organic compounds. 4. To understand about the formation and stability of reaction intermediates and their electrophilic and nucleophilic behavior. 5. To know the concept, types, reaction mechanism and examples of elimination, free-radical and nucleohilic substitution reactions.
		C4P: Organic Chemistry - 2 Lab	To learn experimentally how to synthesize, calculate the yield and determine the melting point of pure organic compounds in the laboratory through performing different types of organic reactions.
SEM III	CC5	C5T: Physical Chemistry - 2	<ol style="list-style-type: none"> 1. Understand properties of liquid; viscosity and surface tension, conductance of electrolytes. 2. Predictive understanding of physical phenomena associated to chemical thermodynamics and kinetics. Importance of chemical potential and properties of ideal solution. Understand limitations and uses of models for the solution of applied problems involving chemical thermodynamic and kinetics 3. Understand principle of quantum mechanics such as wave functions, concept of operators, properties of particle in a box, concept of simple harmonic oscillator and analyze related phenomenon, study quantum mechanical model. 4. To write the expressions for equilibrium constants. To study the laws of equilibrium.
		C5P: Physical Chemistry – 2 Lab	Study viscosity of unknown liquids. Kinetic study of inversion of cane sugar, determination of partition co-efficient value, saponification, Conductometric titration of acid/base, and pH metric titration of an acid against strong base
	CC6	C6T: Inorganic Chemistry -2	<ol style="list-style-type: none"> 1. To learn about the basic concepts and types of chemical bonding, laws, rules and equations for formation of chemical bonds, solubility, hybridization and dipole moment of molecules. 2. To study the modern approaches of chemical bonding (Molecular Orbital Theory, Metallic Bonding concept, Role of weak intermolecular forces) 3. Basic knowledge of nuclear structure, stable and unstable atomic nuclei, nuclear reactions and different modes of radioactive decay and also methods for measurements of radioactivity. The fundamentals of radiochemistry, isotopic chemistry, radiation chemistry and the applications of these in measuring technology, kinetics, radical chemistry, biotechnology and materials and

			process technology. Skills in handling and measurement of radioactive material.
		C6P: Inorganic Chemistry -2 Lab	To know experimentally how to estimate the percentage of chlorine in bleaching powder; vitamin C; arsenic and antimony in a sample by iodimetric titration method. Students can also learn how to estimate Cu in brass, Cr and Mn in steel and Fe in cement
	CC7	C7T: Organic Chemistry -3	<ol style="list-style-type: none"> To learn in detail about the synthesis, properties, chemical reactions and reaction mechanism of alkenes and alkynes To understand about different types of electrophilic and nucleophilic aromatic substitution reactions, reaction intermediates and their mechanisms. To study the properties and reactions of carbonyl compounds and corresponding reaction mechanisms. To learn preparations, reactions and corresponding reaction mechanisms of organometallic compounds.
		C7P: Organic Chemistry -3 Lab	<ol style="list-style-type: none"> Learn experimental and qualitative detection of solid and liquid organic compounds through detection of functional groups, melting point, solubility etc. Learn to prepare crystalline and pure known organic compounds.
	SEC-1	SEC-1T Pharmaceutical Chemistry	<ol style="list-style-type: none"> Helps to understand about the drug discovery, design and development of representative drugs of the following classes: Antipyretic, Analgesics, Anti-inflammatory, Anti-bacterial, Antifungal, Antiviral, Antibiotics, Anti-laprosy, Central Nervous System agents, HIV-AIDS related drugs. To know about aerobic and anaerobic fermentation, importance of Vitamins and Amino acids, synthesis of Penicillin, Cephalosporin, Chloromycetin, Streptomycin and their role as an antibiotic.
		SEC-1P Pharmaceutical Chemistry	<ol style="list-style-type: none"> To learn experimentally how to prepare aspirin in the laboratory and how to analyze it. To learn experimentally how to prepare magnesium bisilicate in the laboratory.
SEM IV	CC-8	C8T: Physical Chemistry -3	<ol style="list-style-type: none"> Helps to understand the fundamental concept, basic terms, derivation and application of Quantum Mechanics, derive Schrödinger's time dependent and independent equations, Realize the terms ionic strength, activity coefficient, DHO equation. Know the Eigen function, Eigen value, operator and postulates of quantum mechanics. Learn the thermodynamic description of exact, inexact differential and state function. Know the qualitative properties of solution, the depression in freezing point, elevation in boiling point and osmotic pressure. Know the qualitative properties of solution, the depression in freezing point, elevation in boiling point and osmotic pressure. Know the statistical thermodynamics and various partition functions. Study the steady state approximation Michael's- menten mechanism, lindemann-hinshelwood mechanism, chain reaction, Rate determining stapes and consecutive elementary reactions.

		C8P: Physical Chemistry – 3 Lab	Learn about Potentiometric titrations, pH metric titrations of acid-base. Study phase diagrams, determine solubility product etc.
	CC-9	C9T: Inorganic Chemistry -3	<ol style="list-style-type: none"> 1. Learn methods of Isolation and purification of metals from their ores. Use of Ellingham's diagram. 2. Learn physical and chemical properties of s and p block elements and their hydrides, oxides, halides, oxyacids, relative stabilities of different oxidation state and their uses, lanthanide contraction, inert pair effect. 3. Chemistry of nobel gases. 4. Properties, synthesis, structural aspects and application of inorganic polymers 5. Learn Werner's theory of coordination compounds, ligands, IUPAC names, and also different types of isomerism.
		C9P: Inorganic Chemistry -3 Lab	<ol style="list-style-type: none"> 1. Study complexometric titration for quantitative estimation of metal ions in mixture. Hardness of water. 2. Learn to prepare different types of inorganic complex.
	CC-10	C10T: Organic Chemistry - 4	<ol style="list-style-type: none"> 1. Study synthetic methods, properties, and reactions of different types of amines, Nitro compounds, nitriles, diazonium salts and their reduced compounds, and different types of rearrangement reactions. 2. Develop an understanding of organic synthesis by learning analytical methods of retrosynthesis, strategy of ring synthesis and asymmetric synthesis. 3. Study the fundamental techniques of UV-Vis, NMR and IR spectroscopy.
		C10P: Organic Chemistry - 4 Lab	<ol style="list-style-type: none"> 1. Learn estimation of organic compounds like glycine, glucose, and sucrose using Fehling's solution, 3. estimation of vitamin-C, 4. aromatic amine and phenol by bromination, 5. saponification of oil, 6. estimation of urea, acetic acid and formaldehyde.
	SEC-2	SEC-2T	<ol style="list-style-type: none"> 1. Helps to understand about the preparation, structures, properties, reactions, benefits and adverse effects of pesticide compounds. 2. Helps to understand how to calculate acidity/ alkalinity in a given sample of pesticide formulations as per BIS specifications. 3. To learn experimentally how to prepare organophosphates, phosphonates and thiophosphates. 4. Study chemistry of cosmetics like hair dye, spray, shampoo, face powder, talcum powder, lipstick, moisturizing cream, nail polish etc. Study importance of essential oils in cosmetics industry.
		SEC-2P	<ol style="list-style-type: none"> 1. Learn synthetic methods of talcum powder, shampoo, face cream, nail polish etc. 2. Learn to calculate acidity/alkalinity in a given sample of pesticide and to prepare organophosphates, phosphates etc.
SEM V	CC11	C11T-Inorganic Chemistry-4	<ol style="list-style-type: none"> 1. Learn about VBT, CFT, MOT for interpretation of structure, colour, magnetism, electronic spectroscopy, Energy term symbols, structural distortion and its effects on coordination compounds, Orgel diagrams.

			<ol style="list-style-type: none"> 2. Study properties of d block elements, their e-configuration, oxidation state, redox properties, coordination chemistry. 3. Study f block elements, their colour, spectral and magnetic properties, separation, oxidation state, lanthanide contraction etc.
		C11P-Inorganic Chemistry Lab-4	<ol style="list-style-type: none"> 1. Learn gravimetric estimation of Ni, Ag, chloride and Cu. 2. Measuring 10Dq value and λ_{\max} spectrophotometrically for some coordination complex and also chromatographic separation of metal ions.
	CC12	C12T-Organic Chemistry-5	<ol style="list-style-type: none"> 1. Know the chemistry of 5 and 6 membered heterocyclic compounds their derivatives and several important name reactions with mechanism. 2. Study stereo chemistry of alicyclic compounds and related name reactions. 3. Study Mechanism, stereochemistry, regeoselectivity of some pericyclic reactions like cycloaddition, electrocyclic etc. 4. Study chemistry of carbohydrates and biomolecules.
		C12P-Organic Chemistry Lab-4	<ol style="list-style-type: none"> 1. Learn chromatographic separation of mixtures of organic compound 2. Learn spectroscopic analysis UV-Vis, IR, NMR of selected organic compounds.
	DSE1	DSE 1T- Advanced Physical Chemistry	<ol style="list-style-type: none"> 1. Study the theoretical aspects of micro system through the analysis of different thermodynamic properties. 2. Gain physical concept about the polymeric material in respect of their different properties 3. To gain conceptual knowledge of zero Kelvin temperature through study of third law of thermodynamics
		DSE 1P	<ol style="list-style-type: none"> 1. Learn numerical analysis of differentiation and integration to find out different physical properties of liquid and gaseous system using C programming software
	DSE 2	DSE 2T- Analytical methods in chemistry	<ol style="list-style-type: none"> 2. To study the fundamental laws of spectroscopy and Selection rules, (UV-visible and Infra-red spectroscopy) and their use for the determination of composition of inorganic complexes, estimation of metal ions in aqueous solution, quantitative analysis of geometrical isomers and keto-enol tautomerism. 3. To learn in detail about the Flame Atomic Absorption and Emission Spectrometry, the basic concepts of thermogravimetry, electroanalytical methods and their applications Solvent extraction technique and Chromatography technique.
		DSE 2P	<ol style="list-style-type: none"> 1. Learn to determine pKa value of indicator, BOD and COD specrophotometrically 2. Determine ion exchange capacity of cation exchange and anion exchange resin. 3. Learn to separate metals ions using solvent extraction technique. 4. Chromatographic separation techniques of separation of different compounds. 5. Soil analysis.
SEM VI	CC-13	C13T – Inorganic Chemistry 5	<ol style="list-style-type: none"> 1. Study different inorganic chemistry of different biological process such as role of different elements biological system, oxygen transport, activity of enzymes, proteins, nitrogen fixation, Photosynthesis etc. 2. Gain knowledge of organometallic compounds, their use in catalysis.

		3. Reaction kinetics and mechanism of reactions of coordination compounds.
	C13P- Inorganic Chemistry 5-LAB	Learn qualitative analysis mixture of inorganic salt mixture and determine their composition.
CC14	C14T- Physical Chemistry 5	1. Study different spectroscopic properties (UV, rotational, vibrational) of molecule to explain different molecular properties. 2. To analyze different physicochemical behaviour of chemical compounds in respect of their interaction with light.
	C14P- Physical Chemistry 5- LAB	Learn to measure physicochemical data (absorbance, molar extinction coefficient, pH of buffer, CMC etc.) of some compounds and also their interaction with biomolecules using UV, IR spectrophotometer.
	DSE 3T – Inorganic materials of industrial importance	1. Study about the synthesis, properties, manufacture, composition and use of different industrially important inorganic compounds like silicates (glass, ceramics, cements), fertilizers, surface coatings, batteries, alloys, nano materials, explosives. 2. Study basics of catalysis.
	DSE 3P – LAB	1. Learn to analyze important characteristics of fertilizer. 2. Learn analysis of cement and alloy. 3. Preparation pigment, coating of ceramics
DSE4	DSE 4T – Polymer Chemistry	To gain knowledge about organic polymers regarding the preparation, reaction kinetics, physical properties, and their application in respect to the interaction with different biomolecules.
	DSE 4P – Polymer Chemistry	Learn different methods for preparation of polymers.

Program Outcomes

PO-1: Disciplinary knowledge and skill: A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding both theoretical and practical knowledge in all disciplines of Chemistry. Students can solve their subjective problems very methodically, independently and finally draw a logical conclusion. Further, the student will be capable of applying modern technologies, handling advanced instruments and Chemistry related soft-wares for chemical analysis, characterization of materials and in separation technology.

PO-2: Skilled communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

PO-3: Critical thinker and problem solver: The course curriculum also includes components that can be helpful to graduate students to develop critical thinking and to design, carry out, record and analyze the results of chemical reactions. Students will be able to think and apply evidence based comparative chemistry approach to explain chemical synthesis and analysis.

PO-4: Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.

PO-5: Team player: The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based situation and industry.

PO-6: Skilled project manager: The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

PO-7: Digitally literate: The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, use of chemical simulation software and related computational work.

PO-8: Ethical awareness: A graduate student requires understanding and developing ethical awareness or reasoning which is adequately provided through the course curriculum. Students

PO-9: Environmental Awareness: As an inhabitant of this green planet a Chemistry graduate student should have many social responsibilities. The course curriculum is designed to teach a Chemistry graduate student to follow the green routes for the synthesis of chemical compounds and also find out new greener routes for sustainable development. The course also helps them to understand the causes of environmental pollution and thereby applying environmental friendly policies instead of environmentally hazard ones in every aspect.

PO-10: Lifelong learner: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available e-techniques, e-books and e-journals for personal academic growth.

PO-11: Analytical skill development and job opportunity: The course curriculum is designed in such a way that Chemistry graduate students can handle many Chemistry based software, decent instruments and advanced technologies to synthesize, characterize and analyze the chemical compounds very skillfully. Such a wonderful practice in the graduate level will bring a good opportunity to the students for getting job in industries besides academic and administrative works.

PROGRAMME SPECIFIC OUTCOME:

PSO1: Thinking every topic in a critical manner.

PSO 2: When there arise situation to provide information about any problem students are able to identify it, locate, evaluate and use the information effectively.

PSO 3: Realize, evaluate, and formulate different quantitative models arising in social science, business and other fields.

PSO 4: Apply knowledge of Chemistry and logical argument to develop and formulate every problem in a unique way.

PSO 5: Acquire clear concept and knowledge to understand every problem.

SO 6: Aware about the responsibility to become a citizen of the society and promise to scatter the scope of acquire knowledge.

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DETAILED SYLLABUS OF END SEMESTER UG COURSES

CC-13: Inorganic Chemistry

C13T: Inorganic Chemistry

Course Contents:

CC13.1

Bioinorganic Chemistry

Elements of life: essential and beneficial elements, major, trace and ultra trace elements. Basic chemical reactions in the biological systems and the role of metal ions (specially Na^+ , K^+ , Mg^{2+} , Ca^{2+} , $\text{Fe}^{3+}/2+$, $\text{Cu}^{2+}/+$, and Zn^{2+}). Metal ion transport across biological membrane Na^+ / K^+ -ion pump. Dioxygen molecule in life. Dioxygen management proteins: Hemoglobin, Myoglobin, Hemocyanine and Hemerythrin. Electron transfer proteins: Cytochromes and Ferredoxins. Hydrlytic enzymes: carbonate bicarbonate buffering system and carbonic anhydrase and carboxyanhydrase A. Biological nitrogen fixation. Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II. Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases (examples only)

. Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II. Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases (examples only)

Organometallic Chemistry

CC13.2

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. 18-electron and 16-electron rules (pictorial MO approach). Applications of 18-electron rule to metal carbonyls, nitrosyls, cyanides. General methods of preparation of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls. Pi-acceptor behavior of CO, synergic effect and use of IR data to explain extent of back bonding. Zeise's salt: Preparation, structure, evidences of synergic effect. Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). Reactions of organometallic complexes: substitution, oxidative addition, reductive elimination and insertion reactions.

CC13.3

Catalysis by Organometallic Compounds

Study of the following industrial processes

1. Alkene hydrogenation (Wilkinson's Catalyst)
2. Hydroformylation
3. Wacker Process
4. Synthetic gasoline (Fischer Tropsch reaction)
5. Ziegler-Natta catalysis for olefin polymerization.

CC13.4

Reaction Kinetics and Mechanism

Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect and its application in complex synthesis, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes.

C13P: LAB

Practical:

Qualitative semimicro analysis of mixtures containing four radicals. Emphasis should be given to the understanding of the chemistry of different reactions and to assign the most probable composition.

Cation Radicals: Na^+ , K^+ , Ca^{2+} , Sr^{2+} , Ba^{2+} , Al^{3+} , Cr^{3+} , $\text{Mn}^{2+}/\text{Mn}^{4+}$, Fe^{3+} , $\text{Co}^{2+}/\text{Co}^{3+}$, Ni^{2+} , Cu^{2+} , Zn^{2+} , Pb^{2+} , Cd^{2+} , Bi^{3+} , $\text{Sn}^{2+}/\text{Sn}^{4+}$, $\text{As}^{3+}/\text{As}^{5+}$, $\text{Sb}^{3+}/\text{Sb}^{5+}$, NH_4^+ , Mg^{2+} .

Anion Radicals: F^- , Cl^- , Br^- , BrO_3^- , I^- , IO_3^- , SCN^- , S^{2-} , SO_4^{2-} , NO_3^- , NO_2^- , PO_4^{3-} , AsO_4^{3-} , BO_3^{3-} , $\text{CrO}_4^{2-} / \text{Cr}_2\text{O}_7^{2-}$, $\text{Fe}(\text{CN})_6^{4-}$, $\text{Fe}(\text{CN})_6^{3-}$.

Insoluble Materials: Al_2O_3 (ig), Fe_2O_3 (ig), Cr_2O_3 (ig), SnO_2 , SrSO_4 , BaSO_4 , CaF_2 , PbSO_4 .

CC-14: Physical Chemistry

Course Contents:

CC14.1

a) Molecular Spectroscopy

Interaction of electromagnetic radiation with molecules and various types of spectra; BornOppenheimer approximation Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, 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

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals

CC14.2

b) 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; Bond dissociation 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;

CC14.3

c) 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 derivation required); Gibbs adsorption isotherm and surface excess; Heterogeneous catalysis (single reactant); Zero order and fractional order reactions;

Colloids: Lyophobic and lyophilic sols, Origin of charge and stability of lyophobic colloids, Coagulation and Schulz-Hardy rule, Zeta potential and Stern double layer (qualitative idea), Tyndall effect; Electrokinetic phenomena (qualitative idea only); Determination of Avogadro number by Perrin's method; Stability of colloids and zeta potential; Micelle formation

C14P: LAB

Practical Experiment 1: Determination of surface tension of a liquid using Stalagmometer
Experiment 2: Determination of CMC from surface tension measurements
Experiment 3: Verification of Beer and Lambert's Law for KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ solution
Experiment 4: Study of kinetics of $\text{K}_2\text{S}_2\text{O}_8 + \text{KI}$ reaction, spectrophotometrically
Experiment 5: Determination of pH of unknown buffer, spectrophotometrically
Experiment 6: Spectrophotometric determination of CMC

Discipline Specific Electives (DSE)

DSE-3: Green Chemistry

Course Contents:

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

Principles of Green Chemistry and Designing a Chemical synthesis:

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 process into 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. $\text{risk} = (\text{function}) \text{hazard} \times \text{exposure}$; waste or pollution prevention hierarchy.

- Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorinated biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents.
- Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD “What you don’t have cannot harm you”, greener alternative to Bhopal Gas Tragedy (safer route to carbonyl) and Flixborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation.

DSE3P: LAB

Practical:

1. Safer starting materials

- Preparation and characterization of nanoparticles of gold using tea leaves.

2. Using renewable resources

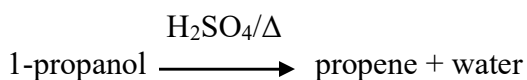
- Preparation of biodiesel from vegetable/ waste cooking oil.

3. Avoiding waste

Principle of atom economy

- Use of molecular model kit to simulate the reaction to investigate how the atom economy can illustrate Green Chemistry.
- Preparation of propene by two methods can be studied

Triethylamine ion + OH⁻ → propene + trimethyl propene + water



- Other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

DSE-4: Polymer Chemistry

Course Contents:

Introduction and history of polymeric materials:

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

Functionality and its importance:

Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems.

Kinetics of Polymerization:

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

Crystallization and crystallinity:

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.



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MAPPING OF CO, PO, PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CC13.1	✓	✓				✓	✓		✓			✓	
CC13.2	✓	✓			✓			✓		✓		✓	
CC13.3	✓	✓		✓			✓		✓			✓	
CC13.4	✓	✓		✓			✓	✓	✓		✓		
CC13.5	✓	✓		✓				✓		✓	✓		
CC13.LAB	✓	✓		✓			✓		✓		✓		
CC14.1	✓	✓			✓			✓	✓				✓
CC14.2	✓	✓				✓	✓	✓				✓	
CC14.3	✓	✓			✓		✓		✓		✓		
CC14.LAB	✓	✓	✓			✓		✓		✓			
DSE3	✓	✓		✓				✓		✓	✓		
DSE4	✓	✓			✓		✓		✓		✓		

JUSTIFICATION MATRIX OF CO WITH PO & PSO (High: 3, Medium: 2, Low: 1)

	Mapping	Correlation	Justification
CO1 3.1	PO1	HIGH	Acquire knowledge on essential and beneficial elements, major, trace and ultra-trace elements. Basic chemical reactions in the biological systems and the role of metal ions (specially Na ⁺ , K ⁺ , Mg ²⁺ , Ca ²⁺ , Fe ³⁺ / 2 ⁺ , Cu ²⁺ / +, and Zn ²⁺).
	PO2	HIGH	Students make questioning and reasoning to Metal ion transport across biological membrane Na ⁺ / K ⁺ -ion pump. Dioxygen molecule in life. Dioxygen management proteins: Hemoglobin, Myoglobin, Hemocyanine and Hemerythrin..

	PO6	MODERATE	Students able to find their scope of job real life problem learning application of this course.
	PO7	HIGH	Students will be able to use research methods for this specified courses.
	PSO2	HIGH	Students will able to Identify critical. Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II. Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases (examples only)
	PSO5	HIGH	Student realize to evaluate the problem of the Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II. Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases
CO1 3.2	PO1	HIGH	Students will able to obtain vast fundamental knowledge of and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. 18-electron and 16-electron rules (pictorial MO approach). Applications of 18-electron rule to metal carbonyls, nitrosyls, cyanides.
	PO2	HIGH	Student learn about the classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. 18-electron and 16-electron rules (pictorial MO approach). Applications of 18-electron rule to metal carbonyls, nitrosyls, cyanides.
	PO5	HIGH	Student apply knowledge on Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II. Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases (examples only)
	PSO1	MODERATE	Students will think the topics of the hapticity of organic ligands. 18-electron and 16-electron rules (pictorial MO approach). Applications of 18-electron rule to metal carbonyls, nitrosyls, cyanides.
	PSO3	LOW	Student realize how hepticity of organic compound in problem solving.
	PSO5	HIGH	Student will able to understand the Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II. Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases (examples only)
CO1 3.3	PO1	HIGH	Students will able to obtain Catalysis by Organometallic Compounds .
	PO2	HIGH	Student learn about Catalysis by Organometallic Compounds and Alkene hydrogenation (Wilkinson's Catalyst) Hydroformylation , Wacker Process
	PO4	HIGH	Students apply the knowledge of fundamental uncertain. Synthetic gasoline (Fischer Tropsch reaction) 5. Ziegler-Natta catalysis for olefin polymerization
	PO7	HIGH	Student able to think in advance topics related this subject and improve research skill
	PSO2	HIGH	Students able to he problems and analyze to find information correctly in this course
	PSO5	HIGH	Students acquired more detailed knowledge about the problem of this course by mathematical& statistical method.
CO1 3.4	PO1	HIGH	Students learn the concept. the basic concepts Reaction Kinetics and Mechanism .
	PO2	HIGH	Acquire knowledge of questioning and reasoning onthe inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect and its application in complex.
	PO3	HIGH	Students will able to build knowledge of Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic

			stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes.
	PSO1	MODERATE	Students will able to think critical problems related to this course.
	PSO2	HIGH	To help the learners for solving complex of various practical problems.
	PSO4	HIGH	Student will able to identify and formulate the basic Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates
CO1 3P.L AB	PO1	HIGH	Students acquired sound and sufficient knowledge Qualitative semi micro analysis of mixtures containing four radicals. Emphasis should be given to the understanding of the chemistry of different reactions and to assign the most probable composition.
	PO2	HIGH	To understand how to make appropriate questions and reasoning in practical.
	PO4	MODERATE	Student learn to communicate with other using concept of different aspect of this course
	PSO1	HIGH	Students will able to think critical problems related to this course
	PSO3	LOW	Student realize how to evaluate the problem by figures and models of this course
	PSO4	HIGH	Student will able to identify and formulate the problems of Skills in analysis and synthesis; the application of knowledge and problem solving, critical thinking and independent learning.
CO1 4.1	PO1	HIGH	Obtain knowledge on basic concepts Molecular Spectroscopy
	PO2	HIGH	Acquire knowledge about critical reasoning and questioning in Study different spectroscopic properties (UV, rotational, vibrational) of molecule to explain different molecular properties. To analyze different physicochemical behaviour of chemical compounds in respect of their interaction with light.
	PO4	MODERATE	Student learn to communicate with other using concept of different aspect of this course
	PO7	HIGH	Student able to think in advance topics related this subject and improve research skill
	PSO2	HIGH	Student learn to identify the problems and analyze to find information correctly in this course
	PSO4	LOW	Student will able to identify and derive the expression NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules
CC1 4.2	PO1	HIGH	Obtain concepts on Study different spectroscopic properties (UV, rotational, vibrational) of molecule to explain different molecular properties. To analyze different physicochemical behaviour of chemical compounds in respect of their interaction with light.
	PO2	HIGH	Students make questioning and reasoning to enrich in specific subject
	PO5	HIGH	Students apply the knowledge for solving of various real-life practical problems in self-directed way.
	PSO1	MODERATE	Students will able to think critical problems related to this course
	PSO2	HIGH	Student learn to identify the problems and analyze to find information correctly in this course.
	PSO6	HIGH	Student will able to create awareness and scope of applying this course
CO1 4.3	PO1	HIGH	Acquire knowledge on <u>Surface tension and energy, Adsorption, Colloids.</u>
	PO2	HIGH	Students make questioning and reasoning to enrich in Freundlich and Langmuir adsorption isotherms, Lyophobic and lyophilic sols, Origin of charge and stability of lyophobic colloids.
	PO6	MODERATE	Students able to find their scope of job real life problem learning application of this course
	PO7	HIGH	Students will be able to use research methods for this specified courses

	PSO1	HIGH	Students will able to think critical problems related to real life application.
	PSO5	HIGH	Student realize to evaluate the problem of this course by mathematical & statistical method
CC14 P.LA B	PO1	HIGH	Obtain clear concept to measure physicochemical data (absorbance, molar extinction coefficient, pH of buffer, CMC etc.) of some compounds and also their interaction with biomolecules using UV, IR spectrophotometer.
	PO2	HIGH	Students make questioning and reasoning to enrich in Understand the technique to solve the problem using IR Spectrometer..
	PO5	MODERATE	Students gather the knowledge of absorbance, molar extinction coefficient, pH of buffer, CMC of some compounds and also their interaction with biomolecules using UV, IR spectrophotometer.
	PO7	LOW	Student able to think in advance topics related this subject and improve research skill
	PSO2	HIGH	Student learn to identify the problems and analyze to find information correctly in this course.
	PSO4	HIGH	Student will able to identify and formulate the problems of Optimal Control in a unique way.
DSE3	PO1	HIGH	Students obtain knowledge of synthesis, properties, manufacture, composition and use of different industrially important inorganic compounds like silicates (glass, ceramics, and cements), fertilizers, surface coatings, batteries, alloys, nano materials, explosives. and Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry
	PO2	HIGH	Acquire knowledge of questioning and reasoning fertilizers, surface coatings, batteries, alloys, nano materials, explosives.
	PO3	MODERATE	Students will able to build their interdisciplinary pathway by choosing Reliability and Information Theory.
	PO6	HIGH	Students will able to identify problems, solve using constructive reasoning on this course.
	PSO1	HIGH	Students will able to think critical problems Shannon-Fano Encoding procedure and necessary and sufficient condition for noiseless encoding
	PSO3	MODERATE	Student realize how to evaluate the problems of this course by figures and models
DSE4	PO1	HIGH	Obtain clear concept to gain knowledge about organic polymers regarding the preparation, reaction kinetics, physical properties, and their application in respect to the interaction with different biomolecules.
	PO2	HIGH	Identify key research questions within the field of polymer on which students will carry out independent research.
	PO4	MODERATE	Student learn to communicate with other using concept of different aspect of this course
	PSO1	HIGH	Students will able to think critical problems related to this course.
	PSO3	HIGH	Student realize how to evaluate the problem by figures and models of this course
	PSO4	MODERATE	Student will able to identify and formulate the problems and learners will handle the real-life application of problems in a unique way.



MUGBERIA GANGADHAR MAHAVIDYALAYA

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DEPARTMENT OF CHEMISTRY, MUGBERIA GANGADHAR MAHAVIDYALAYA, BHUPATINAGAR, PURBA MEDINIPUR-721425

ARTICULATION MATRIX OF CO WITH PO & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CC13.1	3	3				2	3		3			3	
CC13.2	3	3			3			2		3		3	
CC13.3	3	3		3			3		3			3	
CC13.4	3	3		3			3	3	3		3		
CC13.5	3	3		2				3		1	3		
CC13.LAB	3	3		2			3		3		1		
CC14.1	3	3			3			2	3				3
CC14.2	3	3				2	3	3				3	
CC14.3	3	3			2		1		3		3		
CC14.LAB	3	3	2			3		3		2			
DSE3	3	3		2				3		3	2		
DSE4	3	3			3		2		3		3		
Target	3	3	2	2.4	2.7	2.3	2.6	2.7	3	2.3	2.5	3	3

Attainment of Course & Programme Outcomes

http://www.vidyasagar.ac.in/Downloads/ShowPdf.aspx?file=/policies_regulations/UG_CB_CS_Regulations_18082021.pdf

In the Outcome Based Education (OBE), assessment is done through one or more than one processes, carried out by the department, that identify, collect, and prepare data to evaluate the achievement of course outcomes (CO's).

The process for finding the attainment of Course outcomes uses various tools/methods. These methods are classified into two types: **Direct methods and indirect methods.**

Direct methods display the student's knowledge and skills from their performance in the class/assignment test, internal assessment tests, assignments, semester examinations, seminars, laboratory assignments/practical's, mini projects etc. These methods provide a sampling of what students know and/or can do and provide strong evidence of student learning.

Indirect methods such as course exit survey and examiner feedback to reflect on student's learning. They are used to assess opinions or thoughts about the graduate's knowledge or skills.

Following tables show the various methods used in assessment process that periodically documents and demonstrates the degree to which the Course Outcomes are attained. They include information on:

- Listing and description of the assessment processes used to gather the data, and
- The frequency with which these assessment processes are carried out.

Sr. No.	Direct Assessment Method	Assessment frequency	Description
1.	Internal Assessment Test	Twice in a Semester	The Internal Assessment marks in a theory paper shall be based on two tests generally conducted at the end of 6 th and 11 th weeks of each semester. It is a metric used to continuously assess the attainment of course outcomes w.r.t course objectives. Average marks of two tests shall be the Internal Assessment Marks for the relevant course.
2.	Lab Assignments / experiments	Once in a week	Lab Assignment/Experiment is a qualitative performance assessment tool designed to assess students' practical knowledge and problem-solving skills. Minimum ten experiments need to be conducted for every lab course.
3.	End Semester Examination	Once in a Semester	End Semester examination (theory or practical) are the metric to assess whether all the course outcomes are attained or not framed by the course in charge. End Semester Examination is more focused on attainment of all course outcomes and uses a descriptive questions.
4.	Practical Semester Examination		

5.	Home Assignments	Twice in a Semester	Assignment is a metric used to assess student's analytical and problem solving abilities. Every student is assigned with course related tasks & assessment will be done based on their performance. Grades are assigned depending on their innovation in solving/deriving the problems.
6.	Class / Assignment Test	Twice in a Semester	It is a metric used to continuously assess the student's understanding capabilities.
7.	Preliminary Examination	Once in a semester	Preliminary examination is the metric to assess whether all the course outcomes are attained or not by asking descriptive questions.
8.	Presentations	As per the requirement	Presentation is the metric used to assess student's communication and presentation skills along with depth of the subject knowledge. Seminars topics are given to the students that cover topics of current interest or provide in-depth coverage of selected topics from the core courses.
9.	Class Attendance	As Per Vidyasagar University Guideline.	Total 5 Marks allotted for every Course / SEC/ DSE/AECC or others. The marks obtained of every course from Class Attendance by the students is following manner. <ol style="list-style-type: none"> 1. 05 Marks if he/ she attained greater than or equal to 95%. 2. 04 Marks if he/ she attained greater than or equal to 90%. 3. 03 Marks if he/ she attained greater than or equal to 85%. 4. 02 Marks if he/ she attained greater than or equal to 80%. 5. 01 Marks if he/ she attained greater than or equal to 75%.

Table 2: Indirect Assessment tool used for CO attainment

Sr. No.	Indirect Assessment Method	Assessment frequency	Method Description
1	Course Exit Survey / Students Feedback Survey	End of Semester	Collect variety of information about course outcomes from the students after learning entire course.

The weightages given for various assessment tools used for the attainment of Course Outcomes are shown in table 3.

Table 3: List of Course Assessment tools

			Tools	Frequency	Weightage
Assessment Tools	Direct	Internal Tools	Assignment Tests	Twice in a semester	10/75, 05/50
			Internal Assessment	Twice in a semester	
			Home Assignments	Selected Topic	
			MOCK Practical	Once in a semester	
			MCQ		
			Seminar/Presentations		
			Mini Projects		
			Preliminary Examination		
			End Semester Practical		20/75(Practical Paper Only)
			End Semester Field Visit	03/75(Field Visit Paper Only)	
		Projects	20/100(Project Report Only)		
		External Tools	End Semester Examination	Once in a semester	60/75(Theory paper),40/50(Theory paper), 40/75(Practical Paper)
		Class Attendance	Counted after completion the End Semester classes.	Once in a semester	Total 5 Marks allotted for every Course / SEC/ DSE/AECC or others. The marks obtained of every course from Class Attendance by the students is following manner. 1. 05 Marks if he/ she attained greater than or equal to 95%. 2. 04 Marks if he/ she attained greater than

					or equal to 90%. 3. 03 Marks if he/ she attained greater than or equal to 85%. 4. 02 Marks if he/ she attained greater than or equal to 80%. 5. 01 Marks if he/ she attained greater than or equal to 75%.
	Indirect	--	Course Exit Survey/ Examiners feedback	Once in a Semester	On Marks Allotted but As Per NAAC / IQAC Guideline

**DEPARTMENT OF CHEMISTRY, MUGBERIA GANGADHAR MAHAVIDYALAYA,
BHUPATINAGAR, PURBA MEDINIPUR-721425**

CO ATTAINMENT

DIRECT METHOD

Academic Session: 2022-2023

Semester VI

Programme Name: B. SC. (CHEMISTRY)

ATTAINMENT LEVELS FOR

Target Level	Level Description Marks student scoring	50 → indicates % and above in the questions in Internal and External tests
1	Below 40%	
2	Below 40%-49%	
3	50% & about	



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DBT Star College Scheme Award Recipient

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DEPARTMENT OF CHEMISTRY
MUGBERIA GANGADHAR MAHAVIDYALAYA,
BHUPATINAGAR, PURBA MEDINIPUR-721425
PO & PSO ATTAINMENT INDIRECT METHOD

Academic Session: 2022-2023

Semester VI

Programme Name: B. SC. (CHEMISTRY)

EXIT FORM SURVEY IS CONDUCTED THROUGH QUESTIONNAIRE METHODS. OUT OF 10 QUESTIONS, FIRST 7 OF THEM RELATE DIRECTLY TO THE POs & THE LAST 3 QUESTIONS RELATE TO THE PSOs. A SAMPLE FORM IS GIVEN BELOW:

MUGBERIA GANGADHAR MAHAVIDYALAYA
BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: TANMAY JANA

Course-UG Sem: V

Mobile No: 6295605047

Email: Tanmayjana98@gmail.com

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
✓			

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
	✓		

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
		✓	

5. Did the courses help in developing self-directed learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
✓			

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
✓			

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
	✓		

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
✓			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
✓			

MUGBERIA GANGADHAR MAHAVIDYALAYA
BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION :2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: Ripita Jais

Course-UG

Sem: 2

Mobile No: 8450090044

Email:

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>			

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>			

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
	<input checked="" type="checkbox"/>		

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>			

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>			

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
	<input checked="" type="checkbox"/>		

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>			

MUGBERIA GANGADHAR MAHAVIDYALAYA
BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: MOUMITA JANA Course-UG Sem: VI
Mobile No: 8372925580 Email: moumitajana12@gmail.com

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
		✓	

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
✓			

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
✓			

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
		✓	

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
		✓	

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
		✓	

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
✓			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
✓			

MUGBERIA GANGADHAR MAHAVIDYALAYA
BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: Sayan Mondal.

Course-UG Sem: V

Mobile No: 6294983919

Email: Sayanmondal@gmail.com

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
		✓	

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
✓			

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
✓			

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
	✓		

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
	✓		

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
	✓		

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
✓			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
	✓		

MUGHERIA GANGADHAR MAHAVIDYALAYA
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DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: *Shreya Jana* Course-UG Sem: *VI*
 Mobile No: *777636277* Email: *shreyajana2000@gmail.com.*

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
✓			

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
	✓		

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
✓			

5. Did the courses help in developing self-directed learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
✓			

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
✓			

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
	✓		

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
		✓	

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
✓			

MUGBERIA GANGADHAR MAHAVIDYALAYA
BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: Sanjana Bera.

Course-UG Sem: V

Mobile No: 7087993915

Email: SanjanaBera967@gmail.com

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: Rupsa Das Course-UG Sem: VI
Mobile No: 9732650943 Email: mypsada@gmail.com.

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
	✓		

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
✓			

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
		✓	

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
✓			

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
	✓		

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
✓			

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
✓			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
	✓		

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DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: SNEHASISH SAHOO Course-UG Sem: VI

Mobile No: 9883531247 Email:

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
	✓		

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
	✓		

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
	✓		

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
		✓	

5. Did the courses help in developing self-directed learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
✓			

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
	✓		

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
✓			

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
✓			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
		✓	

MUGBERIA GANGADHAR MAHAVIDYALAYA
 BHUPATINAGAR, PURBA MEDINIPUR-721425
 DEPARTMENT OF CHEMISTRY
 INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
 QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: *Siddhartha Majhi* Course-UG Sem: *VI*

Mobile No: *8167244152* Email: -

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
	✓		

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
	✓		

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
✓			

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
	✓		

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
✓			

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
✓			

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
✓			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
	✓		

MUGBERIA GANGADHAR MAHAVIDYALAYA
BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: Subrajit Maity Course-UG Sem: VI
Mobile No: 8001280901 Email: subrajitmaity@gmail.com.

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
	✓		

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
✓			

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
	✓		

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
		✓	

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
✓			

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
✓			

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
✓			

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
✓			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
✓			

MUGBERIA GANGADHAR MAHAVIDYALAYA
BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: Poornabendu Maitly Course-UG Sem: VI
Mobile No: 9883028993 Email: poornabendu19@ymail.com

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
	✓		

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
✓			

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
✓			

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
✓			

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
	✓		

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
✓			

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
✓			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
✓			

MUGBERIA GANGADHAR MAHAVIDYALAYA
BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: JAYA SREE BHAMACHARYA Course-UG Sem: VJ
Mobile No: 9083072112 Email: Jayasree Bhamacharya 19 @ jmu.ac

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
	✓		

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor
✓			

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
	✓		

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
✓			

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
✓			

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
	✓		

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
✓			

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
	✓		

MUGBERIA GANGADHAR MAHAVIDYALAYA
BHUPATINAGAR, PURBA MEDINIPUR-721425
DEPARTMENT OF CHEMISTRY
INDIRECT ASSESSMENT METHOD: ACADEMIC SESSION : 2022-2023
QUESTION FOR GRADUATE EXIT SURVEY (Tick the appropriate option)

Student Name: ANAMIKA BARMAN Course-UG Sem: V1
 Mobile No: 8710001402 Email: ANAMIKA BARMAN3@gmail.com

1. Did you acquire sound & sufficient knowledge of the courses taught?

Excellent	Good	Average	Poor
✓			

2. Rate your skill development in terms of critical thinking & reasoning offered in the course?

Excellent	Good	Average	Poor
	✓		

3. How much are in the courses offered to you suggesting an interdisciplinary approach?

Excellent	Good	Average	Poor

4. Rate the courses as per their communication skill and attitude?

Excellent	Good	Average	Poor
	✓		

5. Did the courses help in developing self-direct learning?

Excellent	Good	Average	Poor
✓			

6. Rate the courses in terms of their updation with recent development.

Excellent	Good	Average	Poor
✓			

7. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?

Excellent	Good	Average	Poor
	✓		

8. Rate the courses in terms their experimental learning and employability option?

Excellent	Good	Average	Poor
	✓		

9. Rate the courses in terms of developing research-oriented skill?

Excellent	Good	Average	Poor
		✓	

10. Rate the courses are relevant in terms of job opportunities and research/further studies?

Excellent	Good	Average	Poor
	✓		



MUGBERIA GANGADHAR MAHAVIDYALAYA

P.O.—BHUPATINAGAR, Dist.—PURBA MEDINIPUR, PIN.—721425, WEST BENGAL, INDIA

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Programme Name: B. Sc (CHEMISTRY)

**DEPARTMENT OF CHEMISTRY, MUGBERIA GANGADHAR MAHAVIDYALAYA,
BHUPATINAGAR, PURBA MEDINIPUR-721425**

RATING AND RELATION OF POs AND PSOs WITH QUESTIONNAIRE

Average Rating (Excellent- 4, Good-3, Average-2, Poor-1) Target level: 3

Questions	Average Rating (Out of 10 Students)
1. Did you acquire sound & sufficient knowledge of the courses taught?	3.7
2. Rate your skill development in terms of critical thinking & reasoning offered in the courses?	3.5
3. How much are the courses offered to you suggesting an interdisciplinary approach?	3.5
4. Rate the courses as per their communication skill and attitude	3.8
5. Did the courses help in developing self-directed learning?	3.4
6. Rate the courses in terms of their updation with recent developments.	3.3
7. Rate the courses in terms of their experimental learning and employability option?	2.7
8. Rate the courses in terms of their environmental awareness and relevance to sustainable measures?	3.7
9. Rate the courses in terms of developing research oriented skill	3.8
10. How far the courses are relevant in terms of job opportunities and research/further studies?	3.9

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
Questionier	Q1, Q3, Q2	Q1,Q 4,Q5	Q1, Q7, Q5	Q1, Q5, Q3	Q2, Q4, Q9	Q1, Q6, Q3	Q1, Q5, Q9	Q1,Q 10,Q 6	Q1,Q 4,Q7	Q2,Q 6,Q9	Q1,Q 6,Q8	Q1, Q3, Q8	Q1, Q7, Q10
Average Rating	3.57	3.63	3.27	3.53	3.7	3.5	3.67	3.63	3.4	3.53	3.57	3.63	3.43

DEPARTMENT OF CHEMISTRY**FINAL ATTAINMENT OF CO, PO&PSO****PROGRAMME NAME: B.Sc. HONOURS IN CHEMISTRY**

BATCH 2022-2023

Direct Method: Average COs of all courses

	CO	CO	CO	CO
	13.1,13.2,13.3,13.4,13.5,13.LAB	14.1,14.2,14.3,14.LAB	DSE3	DSE4
Direct Attainment	3	3	3	3

Indirect Method: Average of PO & PSO with the questionnaire

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	1	2	3	4	5	6	7	8	9	10	11	12	13
Indirect Attainment	3.7	3.6	3.2	3.57	3.7	3.53	3.8	3.73	3.8	3.5	3.67	3.7	3.27

**DEPARTMENT OF CHEMISTRY, MUGBERIA GANGADHAR MAHAVIDYALAYA,
BHUPATINAGAR, PURBA MEDINIPUR-721425**

The following list of students from 2022-2023 Batch have taken admission into HEIs for higher studies:

Name of student enrolling into higher education UG Course (2022-2023)	Program under Graduated from	Name of institution joined	Name of Programme admitted to
Pranabendu Maity	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Midnapore College	M.Sc. in CHEMISTRY
Jayasree Bhattacharya	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Raja Narendralal Khan Women's College	M.Sc. in CHEMISTRY
Siddhartha Majhi	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Prabhat Kumar College	M.Sc. in CHEMISTRY
Snehasish Sahoo	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Prabhat Kumar College	M.Sc. in CHEMISTRY
Sanjana Bera	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Haldia Government College	M.Sc. in CHEMISTRY
Suvajit Maity	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Panskura Banamali College	M.Sc. in CHEMISTRY
Shreya Jana	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Midnapore College	M.Sc. in CHEMISTRY
Rupsa Das	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Purba Medinipur G.K. College of Education	B.Ed.
Tanmay Jana	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Visva-Bharati University	M.Sc. in CHEMISTRY
Arpita Jana	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Haldia Government College	M.Sc. in CHEMISTRY
Anamika Barman	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Prabhat Kumar College	M.Sc. in CHEMISTRY
Moumita Jana	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Try to get admission into M.Sc.	
Sayan Mondal	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Preparing for Combined Defense Service (CDS) Exam	
Subhadip Bhoj	B.Sc. from Mugberia Gangadhar Mahavidyalaya	Indian Association For The Cultivation Of Science	M.Sc. in CHEMISTRY



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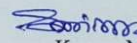
DBT Star College Scheme Award Recipient

E-mail : mugberia_college@rediffmail.com // www.mugberiangangadharmahavidyalaya.ac.in

The above documents of COs and POs of Chemistry Department is original and correct to best of the knowledge.

 9.10.2023

Dr. Bidhan Chandra Samanta
HOD & Associate Professor
Department of Chemistry

 9.10.2023

Dr. Swapan Kumar Misra
Principal
Mugberia Gangadhar Mahavidyalaya

Principal
Mugberia Gangadhar Mahavidyalaya

