



গড়গাঁও মহাবিদ্যালয়

GARGAON COLLEGE

TEACHING PLAN
DEPARTMENT OF CHEMISTRY
JULY 2023- JUNE 2024

GARGAON COLLEGE
TEACHING PLAN

Course: B. Sc.

Session: Odd semester 2023

Subject: CHEMISTRY

Name of the Teacher: DR. ANNA GOGOI

Methods to be applied: Lecture, analytical and activity method, interaction and discussion.

Teaching Materials: Green Board, Chalk Pencil, Duster, Book, Journal, Laptop, Projector.

PaperCode/Title	Allotted Unit/ Topic	No. of Class required	Detail of the topics to be taught & class required	No. of tutorials
CHEMISTRY CHMC1	Unit II: Liquid State	6	<ul style="list-style-type: none"> • Qualitative treatment of the structure of the liquid state [1] • Radial distribution function [1] • physical properties of liquids: vapour pressure, Surface tension, viscosity [3] • Explanation of cleansing action of detergents [1] • Newtonian and non-Newtonian liquid, liquid crystals.[1] 	3
	UNIT:IV EXPERIMENTAL WORK (A)	10	(i) Determine the surface tension of various liquids by drop number method. (ii) Determination of viscosity of aqueous solutions at room temperature.	3
CHEMISTRY MINCHM1	Unit: II Liquid state:	8	<ul style="list-style-type: none"> • Qualitative treatment of the structure of liquids, Physical properties of liquids, vapour pressure. [2] • Surface tension and its determination using stalagmometer.[1] • Viscosity of a liquid and determination of coefficient of viscosity using Ostwald Viscometer. [1] • Effect of temperature on surface tension and coefficient of viscosity of 	3

			<p>a liquid (qualitative treatment) [2]</p> <ul style="list-style-type: none"> • Parachor - determination and application.[2] 	
CHEMISTRY -C-303	UNIT: II Chemical Kinetics	18	<ul style="list-style-type: none"> • Order and molecularity of a reaction, rate laws [2] • Zero, First and Second order reaction [4] • steady-state approximation [1] • complex reactions, Opposing reactions, parallel reactions, consecutive reactions, chain reactions [8] • Arrhenius equation, activation energy, Collision theory of reaction rates [3] • Lindemann mechanism, absolute reaction rates [3] 	5
CHEMISTRY -C-303-LAB	Physical Chemistry Practical	28	<ul style="list-style-type: none"> • Acid hydrolysis of methyl acetate with hydrochloric acid [4] • Saponification of ethyl acetate [4] • Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal [6] 	3
CHEMISTRY GE-301	UNIT: 3 Conductance	6	<ul style="list-style-type: none"> • Conductivity, equivalent and molar conductivity [2] • Kohlrausch's law, Transference number, Hittorf method, Moving boundary methods [4] • Ionic mobility, solubility and solubility products of sparingly soluble salts, hydrolysis constant of a salt. Conductometric titrations [6] 	2
CHEMISTRY GE-301 Lab	Section A: Physical Chemistry	10	<ul style="list-style-type: none"> • Cell constant [2] • conductometric titration [8] 	2
CHEMISTRY -C-502	UNIT: II Molecular Spectroscopy	24	<ul style="list-style-type: none"> • Electromagnetic radiation, Born Oppenheimer approximation [3] • Rotation spectroscopy [5] • Vibrational spectroscopy [6] • Vibration-rotation spectroscopy [5] • Electronic spectroscopy [5] • NMR spectroscopy [4] 	4
CHEMISTRY - C-502 Lab	Physical Chemistry Practical	28	<ul style="list-style-type: none"> • Study the 200-500 nm absorbance spectra of KMnO₄ and K₂Cr₂O₇ (in 0.1 M 	5

			<p>H₂SO₄) and λ determine the max values</p> <ul style="list-style-type: none">• Verify Lambert-Beer's law and determine the concentration of KMnO₄• Viva Voce [2]	
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Paper Code/Title	Allotted Unit/ Topic	No. of Class required	Detail of the topics to be taught & class required	No. of tutorials
CHEMISTRY CHMC2	UNIT: II Chemical Thermodynamics I	30	<ul style="list-style-type: none">• Intensive and extensive variables; state and path functions; isolated, closed and open systems [3]• zeroth law of thermodynamics [2]• First law: Concept of heat, q, work, w, internal energy, U [3]• enthalpy, H, heat capacities [3]• enthalpy, H, relation between heat capacities, calculations of q, w, U and H for free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions [6]• Joule Thomson effect, calculation of Joule Thomson co-efficient for ideal and Vander Waal's gas. [3]• Thermo chemistry- Hess's law, Kirchhoff's law relation of reaction enthalpy with internal energy [2]• bond energy, bond dissociation energy and resonance energy [3]	4
CHEMISTRY MINCHM2	Unit II Ionic Equilibria:	12	<ul style="list-style-type: none">• Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization [2]	4

			<ul style="list-style-type: none"> • ionization constant and ionic product of water. [2] • Ionization of weak acids and bases, pH scale, common ion effect. [1] • Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. [3] • Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. [2] 	
	Unit IV Experimental Work	20	<ul style="list-style-type: none"> • pH -metry and (i) pH- metric titration; (a) strong acid vs. strong base (b) weak acid vs. strong base [4] • (ii) Preparation of buffer solutions of different pH (a) sodium acetate-acetic acid (b) ammonium chloride-ammonium hydroxide[2] • Determine the surface tension of various liquids by drop number method. [4] • Determination of viscosity of aqueous solutions at room temperature. [4] 	3
CHEMISTRY - C-403	UNIT: I Conductance	20	<ul style="list-style-type: none"> • Arrhenius theory of electrolytic dissociation, Conductivity, equivalent and molar conductivity [4] • Kohlrausch law of independent migration of ions, Debye-Hückel-Onsager equation [3] • Wien effect, Debye-Falkenhagen effect, Walden's rules [2] • Ionic velocities, mobilities, transference number and its determination, Hittorf method, Moving Boundary method [6] • degree of dissociation of weak electrolytes, ionic product of water, hydrolysis constants of salts and conductometric titrations[6] 	3
CHEMISTRY - C-403 -LAB	Physical Chemistry Practical	16	<ul style="list-style-type: none"> • Determination of cell constant [4] • conductometric titrations [12] • Viva Voce [3] 	4

CHEMISTRY -GE-401	UNIT: V Liquids	6	<ul style="list-style-type: none"> • surface tension and its determination [2] • Viscosity of a liquid and its determination [2] • Effect of temperature on surface tension and coefficient of viscosity of a liquid [2] 	1
	UNIT: VII Chemical Kinetics	8	<ul style="list-style-type: none"> • The concept of reaction rates, Effect of temperature, pressure, catalyst and other factors on reaction rates [2] • Order and molecularity of a reaction, Zero order reaction, First order reaction, Second order reaction [4] • Half-life of a reaction, determination of order of a reaction [2] • activation energy and its calculation from Arrhenius equation [1] • Collision theory and Activated Complex theory [2] 	2
CHEMISTRY -GE-401-LAB	Section B: Physical Chemistry Practical	12	<ul style="list-style-type: none"> • Determination of the surface tension [6] • Determination of viscosity of liquid [6] • Viva Voce [3] 	2
CHEMISTRY- DSE-603	Project Work	48	<ul style="list-style-type: none"> • Project Work [48] 	6



Signature of Faculty

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Name of the Teacher: **Dr. Arandao Narzary**

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CHEMISTRY CHMC1	Stereochemistry:	14	<ul style="list-style-type: none"> • Elements of symmetry[1] • Definition and classification of Stereoisomerism[1] • Representation of organic molecules in three & two dimension[1] • Optical isomerism [4] • Relative and absolute configuration: D/L and R/S designations [3] • Geometrical Isomerism [4] 	2
CHEMISTRY CHMC1-Lab	Organic Chemistry practical	4	<ul style="list-style-type: none"> • Purification of organic compounds by crystallization[2] • Separation of a mixture of o-and p-nitrophenol or o and p-aminophenol by thin layer chromatography (TLC)[2] 	4
Chemistry MINCHM1	Aliphatic Hydrocarbons-1:	8	<ul style="list-style-type: none"> • Alkanes (upto 5 carbons) Preparation:-Catalytic hydrogenation, Wurtz reaction, Kolbe's Synthesis, from Grignard reagent. Corey-House Synthesis. [2] • Reactions: Free radical Substitution: Halogenations[6] 	2
Basic Analytical Chemistry SEC123-Lab	Analytical practical	2	<ul style="list-style-type: none"> • Determination of dissolved oxygen in water[2] • Spectrophotometric determination of Iron in Vitamin / Dietary Tablets [2] • 	2

CHEMISTRY C-302	Unit I: Chemistry of Halogenated Hydrocarbons Part:A Alkyl Halide and Aryl halide	15	<ul style="list-style-type: none"> Nucleophilic substitution reaction[2] S_Ni mechanisms with stereochemical aspects and effect of solvent etc.[2] Nucleophilic substitution vs. elimination[2] Methods of preparation including Hunsdiecker Reaction[1] Preparation, including preparation from diazonium salts.[1] Nucleophilic aromatic substitution; S_NAr[1] Benzyne mechanism[2] Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.[3] 	6
	Part:B Organometallic compounds of	2	<ul style="list-style-type: none"> Organometallic compounds of Mg and Li – Use in synthesis of organic compounds.[2] 	2
	Unit II: Periodicity of Elements Part A:	12	<ul style="list-style-type: none"> Structure, reactivity and preparation[1] Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α- substitution reactions, Clemmensen, Wolff-Kishner, MPV[8] LiAlH₄, NaBH₄, PDC , PCC , SeO₂, Pb(OAc)₄ & HIO₄ .(Synthetic applications only)[2] Addition reactions of unsaturated carbonyl compounds: Michael addition. Unsaturated Aldehydes (Acrolein, Crotonaldehyde, Cinnamaldehyde) Unsaturated Ketone (MVK)[1] 	7
	Part B	2	<ul style="list-style-type: none"> Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate[2] 	
CHEMISTRY C-302-LAB	Organic Chemistry practical	17	<ul style="list-style-type: none"> Functional group tests for alcohols, carbonyl, and carboxylic acid group[8] Preparation by Acetylation[1] Preparation by Benzoylation [2] Preparation by Oxidation[1] Preparation by Nitration[1] Preparation by Hydrolysis[1] Preparation by Benzil-Benzilic acid rearrangement[1] Viva Voce [2] 	2
	Unit I: Nucleic Acids	9	<ul style="list-style-type: none"> Components of nucleic acids, Nucleosides and nucleotides[3] 	4

CHEMISTRY-C-501			<ul style="list-style-type: none"> • Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine[2] • Structure of polynucleotides. Structure of DNA (Watson & Model) and RNA, Genetic Code Biological role of DNA and[2] • RNA, Replication, Transcription and Translation [2] 	
	Unit II: Amino Acids, Peptides and Proteins	16	<ul style="list-style-type: none"> • Amino acids, Peptides and their classification. α-Amino Acids [4] • Synthesis, properties and reactions [3] • Study of peptides: determination of their primary structures-end group analysis [4] • Methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups - Solid-phase synthesis [5] 	5
	Unit IV: Lipids	8	<ul style="list-style-type: none"> • Introduction to oils and fats; common fatty acids present in oils and fats[3] • Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity[5] 	2
	Unit V: Disconnection approach in Organic Synthesis	10	<ul style="list-style-type: none"> • Elementary idea about disconnection, Synthons and Synthetic equivalent, Functional group interconversion (FGI), Functional group addition (FGA) [3] • Simple examples of retrosynthesis of C-C bond formation (Corey House, Grignard, aldol condensation)[2] • Retrosynthesis of monofunctionalised [3] • Bi-functionalized (1,1 and 1,2) compounds.[2] 	6
CHEMISTRY-C-501-LAB	Organic Chemistry practical	8	<ul style="list-style-type: none"> • Estimation of glycine by Sorenson's formalin method.[2] • Study of the titration curve of glycine[1] • Study of the action of salivary amylase on starch at optimum conditions[1] • Effect of temperature on the action of salivary amylase[1] • Saponification value of an oil or a fat.[1] • Viva [2] 	2
CHEMISTRY-DSE-502-LAB	Green Chemistry practical	10	<ul style="list-style-type: none"> • Preparation of biodiesel from vegetable oil[2] • Preparation of acetanilide from aniline using acetic acid in presence of zinc dust[1] • Photoreduction of benzophenone to benzopinacol in the presence of sunlight[5] • Viva[2] 	2
	Unit VIII: Amino Acids, Peptides and Proteins	12	<ul style="list-style-type: none"> • <i>Introduction and Preparation of Amino Acids</i>: Strecker synthesis using Gabriel's phthalimide synthesis [4] • Zwitterion, Isoelectric point and Electrophoresis[2] 	3

			<ul style="list-style-type: none"> • <i>Reactions of Amino acids</i>: ester of –COOH group, acetylation of –NH₂ group, complexation with Cu₂₊ ions, ninhydrin test[2] • Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins[4] 	
CHEMISTRY-GE-301-LAB	Chemistry Practical	10	<ul style="list-style-type: none"> • Systematic Qualitative Organic Analysis of Organic Compounds[10] 	2

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CHEMISTRY-CHMC2	Carbon-carbon pi-bond	16	<ul style="list-style-type: none"> Formation of alkenes and alkynes [4] Elimination reaction [2] Reaction of alkenes: Electrophilic and free radical additions, their mechanisms. Oxymercuration–demercuration, Hydroboration- Oxidation, Ozonolysis, reduction (catalytic and chemical). Syn and Anti hydroxylation(oxidation)[8] 	4
CHEMISTRY-CHMC2 -Lab	Organic Chemistry Practical	15	<ul style="list-style-type: none"> Detection of elements (N, S and Halogens) and detection of functional groups [15] 	5
Chemistry MINCHM2	Fundamentals of Chemistry	7	Alkenes Preparation and Reactions[4] Alkynes: Preparation and Reactions[3]	3
CHEMISTRY SEC223	Basic Analytical Chemistry	4	<ul style="list-style-type: none"> To determine the Aniline point of a given lubricating oil[2] To determine the acid value of a given oil[2] 	2
CHEMISTRY-C-402	UnitII: Polynuclear Aromatic Hydrocarbons	14	<ul style="list-style-type: none"> Preparation and structure elucidation & Reactions of Polynuclear hydrocarbons : naphthalene [4] Preparation and structure elucidation & Reactions of Polynuclear hydrocarbons : Phenanthrene [4] Preparation and structure elucidation & Reactions of Polynuclear hydrocarbons : anthracene [4] Important derivatives of naphthalene and anthracene [2] 	2
	Unit III: Heterocyclic Compound-I	12	<ul style="list-style-type: none"> Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom[2] Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole 	4

	Heterocyclic Compound-II	12	<p>(Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene [8]</p> <ul style="list-style-type: none"> • Derivatives of furan: Furfural and furoic acid [2] • • Synthesis and reaction of Pyridine, Pyrimidine, indole, Fischer indole quinoline and isoquinoline [12] 	
	Unit V: Terpenes	7	<ul style="list-style-type: none"> • Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, Neral and α-terpineol[7] 	1
CHEMISTRY-C-402-LAB	Organic Chemistry Practical	14	<ul style="list-style-type: none"> • Qualitative analysis of unknown organic compounds [14] 	2
CHEMISTRY-C-602	Unit I: Organic Spectroscopy <i>NMR Spectroscopy:</i>	15	<ul style="list-style-type: none"> • Basic principles of Proton Magnetic Resonance[[2] • Chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics[3] • Interpretation of NMR spectra of simple compounds[2] • Applications of IR, UV, NMR and Mass for identification of simple organic molecules[8] 	2
	Unit II: Carbohydrates	16	<ul style="list-style-type: none"> • Occurrence, classification and their biological importance [2] • Monosaccharides: Constitution and absolute configuration of glucose and fructose [4] • Epimers and anomers, mutarotation [2] • Determination of ring size of glucose and fructose[4] • Haworth projections and conformational structures; Ascending and descending in monosaccharide[1] • Interconversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation [3] 	2
	Unit III: Dyes	8	<ul style="list-style-type: none"> • Classification, Colour and constitution; Mordant and Vat Dyes [2] • Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red [1] • Triphenyl Methane Dyes -Malachite Green, Rosaniline and Crystal Violet[1] • Phthalein Dyes – Phenolphthalein and Fluorescein[1] • Natural dyes –structure[1] • Elucidation and synthesis of Alizarin and Indigotin; Edible Dyes with examples [2] 	1

CHEMISTRY-C-602-LAB	Organic Chemistry Practical	19	<ul style="list-style-type: none"> Qualitative analysis of unknown organic compounds containing monofunctional groups [14] Extraction of caffeine from tea leaves [1] Identification of simple organic compounds by IR spectroscopy and NMR Spectroscopy (Spectra to be provided) [2] Viva [2] 	3
CHEMISTRY-DSE-603	Dissertation (<i>Project Work</i>)	30	<ul style="list-style-type: none"> Project Work [30] 	2
CHEMISTRY-GE-201	Section B: <i>Organic Chemistry</i> Unit IV: Aromatic Hydrocarbons	8	<ul style="list-style-type: none"> Preparation of aromatic hydrocarbon [2] Reactions: Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's Side chain oxidation of alkyl benzenes [6] 	2
	Unit V: Alkyl and Aryl Halides	8	<ul style="list-style-type: none"> Nucleophilic Substitution (S_N1, S_N2 and S_Ni) reactions [2] Preparation of alkylhalide from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.[2] <i>Aryl Halides: Preparation:</i> (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.[2] Aromatic nucleophilic substitution and effect of nitro substituent. Benzyne Mechanism[1] Reactivity Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides[1] 	2
CHEMISTRY-GE-201-LAB	Chemistry Practical	5	<ul style="list-style-type: none"> <i>Purification</i> of organic compounds by crystallization [2] Determination of melting and boiling points[1] Preparation by Benzoylation of amines/phenols[1] Preparation of Oxime and 2, 4-dinitrophenylhydrazone of aldehyde/ketone[1] Viva [2] 	2

Abandao Nangany

(Signature)

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Subject: **CHEMISTRY**

Name of the Teacher: **Mr. Rituraj Tahu**

Methods to be applied: Lecture, practical demonstration, interaction and discussion.

Teaching Materials: White Board, Marker Pen, Duster, Book, Journal, Laptop, Projector, Pointer, etc

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CHEMISTRY CHMC1	UNIT III: Basics of Organic Chemistry	13	<p>Basics of Organic Chemistry</p> <ul style="list-style-type: none"> Organic Compounds: classification and Nomenclature. Hybridization: Shape of molecules, Influence of hybridization on bond properties. Electronic displacements: Inductive, Electromeric, Resonance, Mesomeric effects and Hyper conjugation and their applications. Dipole moment. Organic acids and bases: Their relative strength, Homolytic and Heterolytic fission, Electrophiles and Nucleophiles: Nucleophilicity and basicity. Reactive intermediates: Carbocations, carbanions, free radicals, carbenes, nitrenes, Types, Shape and their relative Stability. Energy profile diagrams of one step, two steps and three steps reactions, Rate limiting steps. Activation Energy. Kinetically and thermodynamically controlled reactions. 	3
UNIT IV	EXPERIMENTAL WORK (B)	18	<p>EXPERIMENTAL WORK (B)</p> <ul style="list-style-type: none"> Purification of organic compounds by crystallization using the following solvents: a. Water b. Alcohol c. Alcohol-water and determination of the melting points of above compounds (Kjeldahl method and electrically heated melting point apparatus) OR 	

			(ii) Separation of a mixture of o- and p-nitrophenol or o- and p-aminophenol by thin layer chromatography	
CHEMISTRY C-302	Unit II: Alcohols, Phenols, Ethers and Epoxides	14	<p>Alcohols</p> <ul style="list-style-type: none"> preparation, properties and relative reactivity of 1°, 2°, 3° alcohols Bouveault-Blanc Reduction Preparation and properties of glycols Oxidation by OsO₄, alkaline KMnO₄, periodic acid and lead Tetraacetate Pinacol Pinacolone Rearrangement <i>Trihydric alcohols</i>: Glycerol /Preparation & Properties [8] <p>Phenols</p> <ul style="list-style-type: none"> Preparation and properties; Acidity and factors effecting it Ring substitution reactions, Reimer–Tiemann and Kolbe’s–Schmidt Reactions Fries and Claisen rearrangements with mechanism [3] <p>Ether and Epoxides</p> <ul style="list-style-type: none"> Preparation and reactions with acids Reaction of epoxide with alcohols ammonia derivatives and LiAlH₄ [3] 	4
	Unit IV: Carboxylic Acids and their Derivatives:	12	<ul style="list-style-type: none"> Preparation, physical properties and reactions of monocarboxylic acids (Acidity and factors affecting it) Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids [4] succinic, phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids Preparation and reactions of acid chlorides, anhydrides, esters and amides [4] Comparative study of nucleophilic substitution at acyl group - Mechanism of acidic and hydrolysis of esters Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement [4] 	7

CHEMISTRY C-302-LAB	Organic Chemistry practical	17	<ul style="list-style-type: none"> • Functional group tests for alcohols, carbonyl, and carboxylic acid group [8] • Preparation by Acetylation [1] • Preparation by Benzoylation [2] • Preparation by Oxidation [1] • Preparation by Nitration [1] • Preparation by Hydrolysis [1] • Preparation by Benzil-Benzilic acid rearrangement [1] • Viva Voce [2] 	2
CHEMISTRY- C-501	Unit III: Enzymes	8	<ul style="list-style-type: none"> • Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes [2] • Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity) [3] • enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive inhibition including allosteric inhibition) [3] 	4
	Unit VI: Pharmaceutical Compounds: Structure and Importance	16	<ul style="list-style-type: none"> • Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials • Antacids: Ranitidine; Antibacterial: Povidone—Iodine Solution, Synthesis and mode of action of Sulphanilamide and other Sulpha drugs (sulphapyridine sulphathiazole) • Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C. 	8

CHEMISTRY-C-501-LAB	Organic Chemistry practical	8	<ul style="list-style-type: none"> • Estimation of glycine by Sorenson's formalin method.[2] • Study of the titration curve of glycine [1] • Study of the action of salivary amylase on starch at optimum conditions [1] • Effect of temperature on the action of salivary amylase [1] • Saponification value of an oil or a fat.[1] • Viva [2] 	2
CHEMISTRY-MINCHM1	Introduction to Organic Chemistry	12	<p>Introduction to Organic Chemistry:</p> <ul style="list-style-type: none"> • Importance of Organic Chemistry & organicsystems to human beings & society. Electronicdisplacements: Inductive effect, Electrometriceffect, Resonance and hyperconjugation.b) Mechanism of organic reactions: Cleavage ofBonds- Homolysis and Heterolysis. Structure, shapeand reactivity of organic molecules- Nucleophilesand electrophiles. Reactive Intermediates- Carbocations, carbanions, free radicals, carbenes &nitrenes. Strength of organic acids and bases. 	5
CHEMISTRY-GE-301	<p><i>Section B: Organic Chemistry</i></p> <p>Unit V: Carboxylic acids and their derivatives</p>	6	<ul style="list-style-type: none"> • <i>Carboxylic acids (aliphatic and aromatic):</i> Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelinsky Reaction [2] • <i>Carboxylic acid derivatives (aliphatic): (upto 5 carbons)</i> Preparation: Acid chlorides, anhydrides, Esters and Amides from acids and their interconversion [2] • Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin Condensation [2] 	3

	Unit VI: Amines and Diazonium Salts	6	<ul style="list-style-type: none"> • <i>Amines (Aliphatic and Aromatic)</i>: (Up to 5 carbons): Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO₂, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation [4] • <i>Diazonium salts</i>: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes [2] 	3
CHEMISTRY-GE-301-LAB	Chemistry Practical	10	<ul style="list-style-type: none"> • Systematic Qualitative Organic Analysis of Organic Compounds [10] 	2

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CHEMISTRY CHMC2	UNIT III	15	<ul style="list-style-type: none"> • Carbon- Carbon sigma bonds: Chemistry of Alkanes: Formation of alkanes with special emphasis on Corey House Synthesis, Wurtz reaction, Wurtz-Fittig reaction. Reactions of alkanes: Free Radical substitution: Halogenations-relative reactivities and selectivity. • Syn and Anti hydroxylation(oxidation), simple effect of stereo selectivity and stereo specificity. • Reactions of Alkynes: Acidity, Electrophilic and Nucleophilic additions, Hydration to form carbonyl compounds. Alkylation of terminal alkynes. 	4
	UNIT IV	15	<p>EXPERIMENTAL WORK (B):</p> <ul style="list-style-type: none"> • Detection of elements (N, S and Halogens) • (ii) Detection of functional groups. 	5
CHEMISTRY- C-402	Unit I: Nitrogen Containing Functional Groups	16	<ul style="list-style-type: none"> • Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's 	2

			<p>exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid [10]</p> <ul style="list-style-type: none"> • Diazonium Salts: Preparation and their synthetic applications. Diazomethane & Diazoacetic Ester with synthetic application [6] 	
	Unit IV: Alkaloids	6	<ul style="list-style-type: none"> • Natural occurrence, General structural features, Isolation and their physiological action [2] • Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine [4] 	
CHEMISTRY-C-402-LAB	Organic Chemistry Practical	14	<ul style="list-style-type: none"> • Qualitative analysis of unknown organic compounds 	2
CHEMISTRY-C-602	Unit I: Organic Spectroscopy	15	<ul style="list-style-type: none"> • UV Spectroscopy: Types of electronic transitions, λ_{max}, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λ_{max} for the following systems: α, β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers. • IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis. 	2
	Unit IV: Polymers	16	<ul style="list-style-type: none"> • Introduction and classification of polymers [6] 	2

			<ul style="list-style-type: none"> • Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene) [10] 	
CHEMISTRY-C-602-LAB	Organic Chemistry Practical	19	<ul style="list-style-type: none"> • Qualitative analysis of unknown organic compounds containing monofunctional groups [14] • Extraction of caffeine from tea leaves [1] • Identification of simple organic compounds by IR spectroscopy and NMR Spectroscopy (Spectra to be provided) [2] • Viva [2] 	3
CHEMISTRY-DSE-603	Dissertation (<i>Project Work</i>)	30	<ul style="list-style-type: none"> • Project Work [30] 	2
CHEMISTRY-GE-201	Section B: <i>Organic Chemistry</i> Unit VI: Alcohols, Phenols and Ethers (Up to 5 Carbons)	8	<ul style="list-style-type: none"> • <i>Alcohols</i>: Preparation: Preparation of 1o, 2o and 3o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Luca's test), esterification, oxidation (with PCC, <i>alk.</i> KMnO₄, acidic dichromate, conc. HNO₃). Diols: (Up to 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement [2] • <i>Phenols</i>: (Phenol case): Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer- Tiemann Reaction, Schotten – Baumann Reaction [2] • <i>Ethers (aliphatic and aromatic)</i> Cleavage of ethers with HI [2] • <i>Aldehydes and ketones (aliphatic and aromatic)</i>: (Formaldehyde, acetaldehyde, acetone and benzaldehyde): Preparation: from acid chlorides and from nitriles. Reactions – Reaction with HCN, ROH, NaHSO₃, NH₂-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's Reaction, Wittig Reaction, Benzoin Condensation. Clemensen Reduction and 	2

			Wolff Kishner Reduction. Meerwein-Ponndorf Verley Reduction [2]	
CHEMISTRY-GE-201-LAB	Chemistry Practical	5	<ul style="list-style-type: none"> • Purification of organic compounds by crystallization [2] • Determination of melting and boiling points [1] • Preparation by Benzoylation of amines/phenols [1] • Preparation of Oxime and 2, 4-dinitrophenylhydrazone of aldehyde/ketone [1] • Viva [2] 	2

Rituraj Taneer

Signature of the Teacher

GARGAON COLLEGE

TEACHING PLAN

Course: B. Sc.

Session: Odd semester 2023

Subject: CHEMISTRY

Name of the Teacher: DR. PAKIZA BEGUM

Methods to be applied: Lecture, analytical and activity method, Group Work, Flipped Classroom, Problem-Based Learning, Peer Teaching, Experiential Learning, Assessment for Learning, Assignments and Exercises, Group Activities and Discussions, Feedback and Assessments.

Teaching Materials: White Board, Marker, Duster, Laptop, Projector, text books, multimedia, applications, software, digital learning resources including video, audio, text, websites, animations and images, lectures, Online Resources etc.

Paper Code/Title	Allotted Unit/ Topic	No. of Classes required	Detail of the topics to be taught & class required	No. of tutorials
Core Course -1 CHMC1	Unit I: Bonding and structure	7	<ul style="list-style-type: none"> • Hydrogen Bonding. Covalent Bonding: VB Approach-Concept of hybridization (sp, sp², sp³, sp³d, sp³d² and dsp²) [2] • VSEPR Theory. Resonance and Resonance energy: Study of some inorganic and organic compounds (O₃, NO₃⁻, CO₃²⁻, SO₄²⁻, RCOO⁻, C₆H₆) [1] • Co-ordinate or Dative Bond. Bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combination of atomic orbitals non-bonding combination of orbitals [2] • MO treatment of homonuclear diatomic molecules and heteronuclear diatomic molecules such as CO, NO and NO⁺ [2] 	7
Fundamentals of Chemistry – 1 MINCHM 1	Unit I: Atomic Structure	7	<ul style="list-style-type: none"> • (Recapitulation of Bohr's Theory, de Broglie, Theory, Heisenberg Uncertainty Principle) [2] • Quantum numbers [1] • Electronic configuration of elements based upon electronic configuration in the periodic table [1] • Periodic properties-effective nuclear charge, ionization energy, electron affinity [1] • Electronegativity (Pauling, Mulliken's and Allred-Rochow scales) [1] • Redox potential [1] 	4
Basic Analytical Chemistry SEC123	Unit II: Analysis of water	5	<ul style="list-style-type: none"> • Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods [1] • Determination of pH, acidity and alkalinity of a water sample [2] • Determination of dissolved oxygen (DO) of a water sample [2] 	2

Inorganic Chemistry C-301	Unit I: General Principles of Metallurgy	6	<ul style="list-style-type: none"> Chief modes of occurrence of metals based on standard electrode potentials [1] Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent [2] Electrolytic Reduction, Hydrometallurgy [1] Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond's process, Zone refining [2] 	7
	Unit II: Acids and Bases	8	<ul style="list-style-type: none"> Brönsted-Lowry concept of acid-base reactions, solvated proton [2] Relative strength of acids, types of acid-base reactions, levelling solvents [2] Lewis acid-base concept, Classification of Lewis acids [2] Hard and Soft Acids and Bases (HSAB) Application of HSAB principle [2] 	7
	Unit IV: Noble gases	8	<ul style="list-style-type: none"> Occurrence and uses, rationalization of inertness of noble gases, Clathrates [2] Preparation and properties of XeF₂, XeF₄ and XeF₆ [2] Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF₂) [2] Molecular shapes of noble gas compounds (VSEPR theory) [2] 	4
CHEMISTRY-C-301-LAB	Inorganic Chemistry Practical	28	<ul style="list-style-type: none"> Iodo / Iodimetric Titrations [12] Inorganic preparations [14] Viva Voce [2] 	3
Analytical Methods in Chemistry DSE-501	Unit II: UV-Visible and IR Spectrometry	25	<ul style="list-style-type: none"> Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law [3] <i>UV-Visible Spectrometry</i>: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method [8] <i>Infrared Spectrometry</i>: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, effect and importance of isotope substitution [7] <i>Flame Atomic Absorption and Emission Spectrometry</i>: Basic principles of instrumentation (choice of source, 	7

			monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples [7]	
CHEMISTRY-DSE-501-PRACT	Analytical Methods in Chemistry Practical	28	<ul style="list-style-type: none"> • Paper chromatographic separation of Fe^{3+}, Al^{3+}, Cr^{3+}, Ag^+, Hg_2^{2+}, and Pb^{2+} [6] • Determine the pH of the given aerated drinks fruit juices, shampoos and soaps [6] • Determination of dissolved oxygen in water [8] • Analysis of soil: determination of pH of soil [6] • Viva Voce [2] 	1
Green Chemistry DSE-502	Unit I: Introduction to Green Chemistry	4	<ul style="list-style-type: none"> • What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry [2] • Limitations? Obstacles in the pursuit of the goals of Green Chemistry [2] 	1
	Unit II: Principles of Green Chemistry and Designing a Chemical synthesis	5	<ul style="list-style-type: none"> • Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following [1] • i) 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 [3] • ii) Prevention/ minimization of hazardous/ toxic products reducing toxicity [1] 	1

GARGAON COLLEGE

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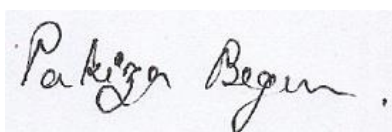
Teaching Materials: White Board, Marker, Duster, Laptop, Projector, text books, multimedia, applications, software, digital learning resources including video, audio, text, websites, animations and images, lectures, Online Resources etc.

Paper Code/Title	Allotted Unit/ Topic	No. of Classes required	Detail of the topics to be taught & class required	No. of tutorials
CORE COURSE -2 CHMC2	UNIT I: Metals	30	<ul style="list-style-type: none"> • Theory of reduction (Thermodynamic approach) [2] • Role of carbon and other reducing agents [2] • Electrolytic reduction, roasting and calcinations [2] • Method of purification and refining of metals including modern methods like zone refining, vacuum arc process, ion exchange, solvent extraction and electrolytic method, Van- Arkel process and hydrometallurgy [16] • Study of potassium dichromate, manganese dioxide, potassium permanganate, ammonium molybdate, sodium cobaltinitrite, cobalt nitrate, Ni-DMG, vanadium pentoxide) [8] 	4
	Unit IV: EXPERIMENTAL WORK (A)	10	<ul style="list-style-type: none"> • Estimation of Fe(II) or oxalic acid using standardized KMnO₄ solution [4] • Estimation of Fe(II) with K₂Cr₂O₇ using diphenylamine as internal indicator [4] • Viva Voce [2] 	
Fundamentals of Chemistry - 2 MINCHM2	Unit I: Coordination Chemistry	8	<ul style="list-style-type: none"> • Review of Werner's theory [1] • Types of ligands, monodentate, bidentate ambidentate and polydentate ligands (including _ Acceptor and macrocyclic ligands [1] • IUPAC Nomenclature of Co-ordination compounds [1] • Isomerism of 4- and 6- coordinate compounds [1] 	3

			<ul style="list-style-type: none"> • Introduction to Valence Bond and Crystal Field theory [2] • Application of dimethyl glyoxime, EDTA, 8-hydroxy quinoline, 2,2-bipyridyl, and ethylenediamine in analysis [2] 	
Basic Analytical Chemistry (Fuel Chemistry) SEC223	Unit II:	9	<ul style="list-style-type: none"> • Petroleum and Petrochemical Industry: Composition of crude petroleum; Different types of petroleum products and their applications [3] • Principle and process of fractional distillation, Cracking - Thermal and catalytic cracking [3] • Qualitative treatment of nonpetroleum fuels -LPG, CNG, LNG, bio-gas, fuels derived from biomass, fuel from waste; synthetic fuels -gaseous and liquids [3] 	1
		6	<ul style="list-style-type: none"> • Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene [6] 	
Environmental Science VAC-3		6		
Inorganic Chemistry C-401	Unit I: Coordination Chemistry	26	<ul style="list-style-type: none"> • IUPAC nomenclature of coordination compounds, isomerism in coordination compounds [4] • Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes. Labile and inert complexes [2] • Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding [5] • Crystal field theory, measurement of $10Dq$ (Δ_o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of $10Dq$ (Δ_o, Δ_t) [7] • Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry [3] • Jahn-Teller theorem, square planar geometry [2] • Qualitative aspect of Ligand field and MO Theory [3] 	5
	Unit III: Lanthanoids and Actinoids	6	<ul style="list-style-type: none"> • Electronic configuration, oxidation states, color, spectral and magnetic properties [3] • Lanthanide contraction, separation of lanthanides (ion-exchange method only) [3] 	3

CHEMISTRY-C-401-LAB	Inorganic Chemistry practical	28	<ul style="list-style-type: none"> • Gravimetric Analysis [8] • Inorganic Preparation [8] • Chromatography of metal ions [8] • Viva-voce [4] 	4
CHEMISTRY-GE-401	Section A: Inorganic Chemistry Unit II: Coordination Chemistry	8	<ul style="list-style-type: none"> • Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6) [4] • Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT [3] • IUPAC (2005) system of nomenclature [1] 	2
	Unit III: Crystal Field Theory	8	<ul style="list-style-type: none"> • Crystal Field Theory (CFT): Crystal field effect, octahedral symmetry. Crystal field [2] • Stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry [2] • Factors affecting the magnitude of D. Spectrochemical series [2] • Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry [2] 	4
CHEMISTRY-GE-401-LAB	Inorganic Chemistry Practical	20	<ul style="list-style-type: none"> • Qualitative Inorganic Analysis: Salt analysis [18] • Viva – voce [2] 	2
Inorganic Chemistry C-601	Unit III: Reaction Kinetics and Mechanism	18	<ul style="list-style-type: none"> • Introduction to inorganic reaction mechanisms [1] • Substitution reactions in square planar complexes [3] • Trans-effect, theories of trans-effect, mechanism of nucleophilic substitution in square planar complexes [4] • Thermodynamic and kinetic stability, kinetics of octahedral substitution, ligand field effects and reaction rates [6] • Mechanism of substitution in octahedral complexes [4] 	2
	Unit IV: Catalysis by Organometallic Compounds	10	<p>Study of the following industrial processes and their mechanism</p> <ul style="list-style-type: none"> • Alkene hydrogenation (Wilkinson's Catalyst) [3] • Hydroformylation (Co salts) • Wacker Process [3] • Synthetic Gasoline (Fisher Tropsch reaction) [2] • Synthesis gas by metal carbonyl complexes [2] 	1

CHEMISTRY-C-601-LAB	Inorganic Chemistry Practical	28	<ul style="list-style-type: none"> • Qualitative Inorganic Analysis: Salt analysis [25] • Viva – voce [3] 	3
Inorganic Materials of Industrial Importance DSE-601	Unit I: Silicate Industries	16	<ul style="list-style-type: none"> • Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass [6] • Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre [5] • Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements [5] 	1
CHEMISTRY-DSE-601-LAB	Inorganic Materials of Industrial Importance practical	28	<ul style="list-style-type: none"> • Determination of free acidity in ammonium sulphate fertilizer. [6] • Determination of free acidity in ammonium sulphate fertilizer. [6] • Determination of composition of dolomite [6] • Analysis of Cement [3] • Preparation of pigment [4] • Viva Voce [3] 	4
CHEMISTRY-DSE-603	Project Work	48	<ul style="list-style-type: none"> • Project Work [48] 	6



Signature of Faculty

GARGAON COLLEGE
TEACHING PLAN

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Methods to be applied: Lecture, analytical and activity method, interaction and discussion.

Teaching Materials: Green Board, Chalk Pencil, Duster, Book, Journal, Laptop, Projector.

PaperCode/Title	Allotted Unit/ Topic	No. of Class required	Detail of the topics to be taught & class required	No. of tutorials
CHEMISTRY CHMC1	Unit II: Gas	10	<ul style="list-style-type: none">• Derivation of kinetic gas equation [1]• Maxwell distribution of molecular speed, different types of Speeds [2]• Collision properties, Mean free path, determination of collision diameter [1]• Transport phenomenon in gases [1]• Coefficient of viscosity, law of equipartition of energy, degrees of freedom and average energy of a molecule [2]• Molecular basis of heat capacity [1]• Barometric formula and its uses for determination of Avogadro number.[2]• Deviation from ideal behavior, [1]• van der Waals and Dieterici's, Virial equation of state [1]• Boyle's temperature [1]• Critical constants, reduced equation of state [2]• Co-efficient of compressibility and thermal expansion.	5
	UNIT:IV EXPERIMENTAL WORK (A)	10	(i) Determine the surface tension of various liquids by drop number method.[5]	5

			(ii) Determination of viscosity of aqueous solutions at room temperature. [5]	
Basic Analytical Chemistry: SEC123	Unit: II ANALYSIS OF FOOD PRODUCTS	5	<ul style="list-style-type: none"> • Nutritional value of foods, idea about food processing [1] • Food preservations and adulteration.[1] • a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, Turmeric powder, coriander powder and pulse etc [2] • b. Analysis of preservatives and colouring matter.[2] 	1
CHEMISTRY MINCHM1	Unit: II Kinetic Theory of gases	6	<ul style="list-style-type: none"> • Derivation of Kinetic gas equation [2] • Types of molecular velocities & deduction of simple problems on – root mean square speed, most probable speed, collision frequency, collision diameter, mean free path [2] • Heat capacity of gases [1] • Deviation from ideal behaviour [2] • van der Waals equation, van der Waals constant [1] • Critical state of gas, critical constants [1] • Continuity of states & law of corresponding states, degree of freedom, law of equipartition of energy [1] • Viscosity of gases and effect of temperature and pressure on coefficient of viscosity).[1] 	5
CHEMISTRY -C-303	UNIT: I Phase Equilibria	28	<ul style="list-style-type: none"> • Concept of phases, components and degrees of freedom [2] • Derivation of Gibbs Phase Rule for non-reactive and reactive systems [2] • Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria [2] • Phase diagram for one component systems with applications. [2] 	2

			<ul style="list-style-type: none"> • Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, [6] • Solid solutions [1] • Three component systems, water-chloroform-acetic acid system, triangular plots. [2] • Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and nonideal) [4] • Azeotropes, lever rule [2] • Partial miscibility of liquids, CST [2] • Miscible pairs & steam distillation. [2] • Nernst distribution law: its derivation and applications [1] 	
CHEMISTRY -C-303-LAB	Physical Chemistry Practical	28	<ul style="list-style-type: none"> • Acid hydrolysis of methyl acetate with hydrochloric acid [4] • Saponification of ethyl acetate [4] • Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal [6] 	3
CHEMISTRY GE-301	UNIT: I Solutions	8	<ul style="list-style-type: none"> • Thermodynamics of ideal solutions: Ideal solutions and Raoult's law [1] • Deviations from Raoult's law – non-ideal solutions. [1] • Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. [1] • Distillation of solutions. Azeotropes. [2] • Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. [1] • Immiscibility of liquids-Principle of steam distillation [1] • Nernst distribution law and its applications & solvent extraction [2] 	2
	Unit II: Phase Equilibrium	8	<ul style="list-style-type: none"> • Phases, components and degrees of freedom of a system [2] 	1

			<ul style="list-style-type: none"> • Criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic deviation. [1] • Phase diagrams of one-component systems (water and sulphur) [2] • Two component systems involving eutectics, congruent and incongruent melting points (lead –silver, FeCl₃-H₂O and Na-K only) [3] 	
CHEMISTRY GE-301 Lab	Section A: Physical Chemistry	10	<ul style="list-style-type: none"> • Cell constant [2] • conductometric titration [8] 	2
CHEMISTRY -C-502	UNIT: I Quantum Chemistry	24	<ul style="list-style-type: none"> • Background and Postulates of QM [3] • Schrödinger equation and its application to free particle and “particle-in-a-box” (1-D; 2D; 3D) [5] • Simple harmonic oscillator: derivation and applications [6] • Angular momentum: Commutation rules [5] • Rigid rotator model of rotation of diatomic molecule and discussion of solution [5] • Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates [2] • Setting up of Schrödinger equation for many-electron atoms (He, Li). [2] • Statement of variation theorem and application to simple systems [2] 	4
CHEMISTRY -DSE-502	Unit IV: Future Trends in Green Chemistry	6	<ul style="list-style-type: none"> • Green Chemistry Introduction and synthesis [1] • Green Chemistry in Sustainable development [2] • Combinatorial green chemistry [2] • Biominimetic and multi-functional reagents [1] 	2
CHEMISTRY - C-502 Lab	Physical Chemistry Practical	28	<ul style="list-style-type: none"> • Study the 200-500 nm absorbance spectra of KMnO₄ and K₂Cr₂O₇ (in 0.1 M H₂SO₄) and λ determine the max values 	5

			<ul style="list-style-type: none">• Verify Lambert-Beer's law and determine the concentration of KMnO_4• Viva Voce [2]	
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GARGAON COLLEGE

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Name of the Teacher: DR. SAHEEN SHEHNAZ BEGUM

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CHEMISTRY CHMC2	UNIT: II SOLIDS	6	<ul style="list-style-type: none">• Basic laws of crystallography, crystal system [1]• Crystal lattice, Miller indices, and simple face centered and body centered cubic lattice [1]• Number of points in a unit cell. [1]• X-Ray diffraction study of crystals, Bragg's law [1]• Determination of crystal structure- introduction to powder and single crystal methods of structure analysis [2]• Crystal structure of NaCl & KCl [1]• Packing of crystals, closed packed structure, radius ratio [1]• Crystal defect-point defects [1]• Conductors, semiconductors and insulators from band theory [2]	4
SKILL ENHANCEMENT COURSE	Unit: 1	9	<ul style="list-style-type: none">• Review of energy sources & Classification of fuels and their calorific value [2]• Coal: Uses, Carbonification & composition [2]• Coal gas, producer gas and water gas—composition and uses. [1]• Fractionation of coal tar [1]• Uses of coal tar bases chemicals.[2]	

CHEMISTRY MINCHM2	Unit II Solids	9	<ul style="list-style-type: none"> • Forms of solids, unit cells, crystal systems [1] • Bravais lattice, types and identification of lattice planes. [2] • Miller and Weiss indices [1] • Laws of crystallography- Law of constancy of interfacial angles. Law of rational indices. [2] • X-Ray diffraction by crystals. Bragg's law.[1] • Structure of NaCl, KCl and CsCl (qualitative treatment only). [1] • Defects in crystals. Liquid crystals [2] 	1
	Unit IV Experimental Work	20	<ul style="list-style-type: none"> • pH -metry and (i) pH- metric titration; (a) strong acid vs. strong base (b) weak acid vs. strong base [4] • (ii) Preparation of buffer solutions of different pH (a) sodium acetate-acetic acid (b) ammonium chloride-ammonium hydroxide[2] • Determine the surface tension of various liquids by drop number method. [4] • Determination of viscosity of aqueous solutions at room temperature. [4] 	3
CHEMISTRY - C-403	UNIT: II Electrochemistry	28	<ul style="list-style-type: none"> • Quantitative aspects of Faraday's laws of electrolysis [4] • Chemical cells, reversible and irreversible cells with examples [3] • EMF measurement, LJP & Nernst Equation [2] • Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH [6] • Hydrogen, quinone-hydroquinone, glass and SbO/Sb₂O₃ electrodes. [2] • Concentration cells with and without transference [2] • Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation) [2] 	3

CHEMISTRY - C-403 -LAB	Physical Chemistry Practical	16	<ul style="list-style-type: none"> • Determination of cell constant [4] • conductometric titrations [12] • Viva Voce [3] 	4
CHEMISTRY -GE-401	UNIT: IV Kinetic Theory of Gases	8	<ul style="list-style-type: none"> • Kinetic Theory of Gases: Postulates and derivation [2] • Deviation of real gases from ideal behaviour and causes [1] • van der Waals equation of state for real gases. Boyle temperature [1] • Critical phenomena, critical constants and their calculation from van der Waals equation [1]. • Andrews isotherms of CO₂. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies and importance & temperature dependence of these distributions. [3] • Most probable, average and root mean square velocities • Collision number and mean free path of molecules. [1] • Viscosity of gases, effect of temperature/pressure on coefficient of viscosity [2] 	1
	UNIT: VI Solids	8	<ul style="list-style-type: none"> • Forms of solids. Symmetry elements, unit cells, crystal systems [1] • Bravais lattice types and identification of lattice planes [1] • Laws of Crystallography - Law of constancy of interfacial angles [1] • Law of rational indices. Miller indices. Bragg's law. [2] • Structures of NaCl (qualitative treatment only). [1] • Defects in crystals. Glasses and liquid crystals [2] 	1
CHEMISTRY -GE-401-LAB	Section B: Physical Chemistry Practical	12	<ul style="list-style-type: none"> • Determination of the surface tension [6] • Determination of viscosity of liquid [6] • Viva Voce [3] 	2
DSE-601	Inorganic Materials of Industrial Importance: UNIT IV: Batteries	6	<ul style="list-style-type: none"> • Primary and secondary batteries [1] • Battery components and their role and Characteristics [1] 	1

			<ul style="list-style-type: none"> Working of: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.[4] 	
CHEMISTRY-DSE-603	Project Work	48	<ul style="list-style-type: none"> Project Work [48] 	6

Sabeer Shekhar Begum

Signature of Faculty

GARGAON COLLEGE**TEACHING PLAN**

Course: B. Sc./ FYUGP

Session: Odd semester 2023

Subject: CHEMISTRY**Name of the Teacher:** Dr. PLABAN JYOTI SARMA**Methods to be applied:** Lecture, analytical and activity method, interaction and discussion.**Teaching Materials:** Green Board, Chalk Pencil, Duster, Book, Journal, Laptop, Projector.

Paper Code/Title	Allotted Unit/ Topic	No. of Cls required	Detail of the topics to be taught & class required	No. of tutorials
CORE COURSE -1 CHMC1	Unit I: Periodic properties	6	<ul style="list-style-type: none"> Effective nuclear charge (screening constant – Slater's rule [2]. Ionic and covalent radii, ionization [2] potential, electron affinity and electro negativity (Pauling, Mulliken's and Allred-Rochow Scales).[2]. 	3
	Unit I: Bonding and structure	4	<ul style="list-style-type: none"> Ionic Bonding: Energy consideration in ionic bonding, [1] lattice Energy. Born - Haber cycle and its application, [1] polarizing power and polarizability. Fajan's rule, Bond moment, dipole moment and percentage ionic character. [2]. 	3
Fundamentals of Chemistry – 1 MINCHM1	Unit I: Atomic Structure	3	<ul style="list-style-type: none"> Time independent Schrödinger wave equation ($H=E$). Significance of Ψ and Ψ^2 Schrodinger equation for Hydrogen atom (qualitative treatment only). [3]. 	1
	Unit I: Chemical Bonding and Molecular Structure-1	6	<ul style="list-style-type: none"> Ionic Bonding: Energy consideration in ionic bonding, [2]. Lattice Energy and Solvation Energy and their importance in the context of Stability and Solubility of ionic compounds. Polarizing power and polarizability. [2] Fajan's rule, dipole moment and percentage ionic character. Hydrogen Bonding.[2] 	2
	Inorganic Qualitative Analysis	10	<ul style="list-style-type: none"> Analysis of samples containing 4 radicals including interfering radicals, phosphate, borate and fluoride.[8]. Viva-Voce [2] 	3

Basic Analytical Chemistry SEC123	Unit III: Chromatography	4	<ul style="list-style-type: none"> • Definition, general introduction on principles of chromatography, paper chromatography, TLC etc. [2] • a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}). [1] • b. To compare paint samples by TLC method. [1] 	2
	Unit III: Ion-exchange	4	<ul style="list-style-type: none"> • Column, ion-exchange chromatography etc. [2]. • Determination of ion exchange capacity of anion /cation exchange resin (using batch procedure if use of 2 column is not feasible). [2]. 	
CHEMISTRY-C-301	Unit III: Chemistry of s and p Block Elements	30	<ul style="list-style-type: none"> • Inert pair effect, Relative stability of different oxidation states, diagonal relationship anomalous behaviour of first member of each group. [12] • Allotropy and catenation. Complex, formation tendency of s and p block elements [5] • Chemistry of Boron, Carbon, Nitrogen, Oxygen, halogens, Phosphorus, Sulphur. [13] 	5
	Unit V: Inorganic Polymers	8	<ul style="list-style-type: none"> • Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. [4] • Borazines, silicates and phosphazenes, and polysulphates. [4] 	2
CHEMISTRY-C-301-LAB	Inorganic Chemistry Practical	28	<ul style="list-style-type: none"> • Iodo / Iodimetric Titrations [12] • Inorganic preparations [14] • Viva Voce [2] 	3
CHEMISTRY-DSE-501	Unit IV: Electro-analytical methods	05	<ul style="list-style-type: none"> • Theory of thermo-gravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture [5] 	2
	Unit IV: Electro-analytical methods	10	<ul style="list-style-type: none"> • Classification of electro-analytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values. [10] 	2
	Unit V: Separation techniques	15	<ul style="list-style-type: none"> • Solvent extraction [7] • Chromatography [8] 	2

CHEMISTRY-DSE-501-PRACT	Analytical Methods in Chemistry Practical	28	<ul style="list-style-type: none"> • Paper chromatographic separation of Fe^{3+}, Al^{3+}, Cr^{3+}, Ag^+, Hg_2^{2+}, and Pb^{2+}. [6] • Determine the pH of the given aerated drinks fruit juices, shampoos and soaps. [6] • Determination of dissolved oxygen in water. [8] • Analysis of soil: determination of pH of soil. [6] • Viva Voce [2] 	5
CHEMISTRY-DSE-502	Unit III: Examples of Green Synthesis/ Reactions and some real-world cases	12	<ul style="list-style-type: none"> • Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate • Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine) • Surfactants for carbon dioxide- replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry-cleaning garments 	4

GARGAON COLLEGE**TEACHING PLAN**

Course: B. Sc./FYUGP

Session: Even semester 2024

Subject: CHEMISTRY**Name of the Teacher:** Dr. PLABAN JYOTI SARMA**Methods to be applied:** Lecture, analytical and activity method, interaction and discussion.**Teaching Materials:** Green Board, Chalk Pencil, Duster, Book, Journal, Laptop, Projector.

Paper Code/Title	Allotted Unit/ Topic	No. of Cls required	Detail of the topics to be taught & class required	No. of tutorials
CORE COURSE -2 CHMC2	Unit I: Non-Transition elements	9	<ul style="list-style-type: none">a) Boron: wade's rule, nomenclature of closo, nido and arachno boranes, structure of boron hydrides [2]c) Carbon: Fullerenes (C₆₀) [2]d) Silicon: silicones, classifications and structure of silicates. Zeolites, use of Zeolites as catalyst and molecular sieve, aluminosilicates. [2]e) Nitrogen: Hydrazine, hydroxylamine and hydrazoic acid. [1]f) Phosphorus: Phosphines, oxy acids of phosphorus, organophosphorus compounds. [2]	4
	Unit IV: EXPERIMENTAL WORK (A)	10	<ul style="list-style-type: none">(i) Estimation of Fe(II) or oxalic acid using standardized KMnO₄ solution.[4](ii) Estimation of Fe(II) with K₂Cr₂O₇ using diphenylamine as internal indicator [4]Viva Voce [2]	4
Fundamentals of Chemistry - 2 MINCHM2	Unit I: Chemical Bonding and Molecular Structure-2	8	<ul style="list-style-type: none">Covalent Bonding: VB Approach- Concept of hybridization [2]Resonance and Resonance energy: Study of some inorganic and organic compounds [2]Molecular Orbital Approach: LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combination of atomic orbitals, non-bonding combination of	3

			orbitals, MO treatment of homonuclear diatomic molecules and heteronuclear diatomic molecules such as CO, NO and NO ⁺ . [4].	
Basic Analytical Chemistry (Fuel Chemistry) SEC223	Unit III: Lubricants	6	<ul style="list-style-type: none"> Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting), Solid and semisolid lubricants, synthetic lubricants.[3] Properties of lubricants – viscosity index, cloud point, pore point.[3] 	2
CHEMISTRY -C-401	Unit II: Transition Elements	18	<ul style="list-style-type: none"> General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, and ability to form complexes. [8] Stability of various oxidation states and e.m.f. (Latimer and Bsworth diagrams). Difference between the first, second and third transition series. [5] Chemistry of Ti, V, Cr, Mn, Fe and Co in various oxidation states (excluding their metallurgy) [5] 	4
	Unit IV: Bioinorganic Chemistry	10	<ul style="list-style-type: none"> Metal ion present in biological systems, classification of elements according to their action in biological system. Geo chemical effect on distribution of metals. Sodium/ K-pump, carbonic anhydrase and carboxypeptidase. [5] Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, use of chelating agents in medicine. [3] Iron and its application in bio-systems, Hemoglobin, storage and transfer of iron. [2] 	3
CHEMISTRY-C-401-LAB	Inorganic Chemistry practical	28	<ul style="list-style-type: none"> Gravimetric Analysis [8] Inorganic Preparation [8] Chromatography of metal ions [8] Viva-voce [4] 	4
CHEMISTRY-C-601	Unit I: Theoretical Principles in Qualitative Analysis (H ₂ S Scheme)	10	<ul style="list-style-type: none"> Basic principles involved in analysis of cations and anions and solubility products, common ion effect. [4] Principles involved in separation of cations into groups and choice of group reagents. [3] 	3

			<ul style="list-style-type: none"> Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II. [3] 	
	Unit II: Organometallic compounds	22	<ul style="list-style-type: none"> Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. [3] Metal carbonyls [10] Zeise's salt [3] Metal Alkyls. [3] Ferrocene [3] 	4
CHEMISTRY-C-601-LAB	Inorganic Chemistry Practical	28	<ul style="list-style-type: none"> Qualitative Inorganic Analysis: Salt analysis [25] Viva – voce [3] 	3
CHEMISTRY-DSE-601	Unit II: Fertilizers	8	<ul style="list-style-type: none"> Different types of fertilizers [2] Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate. [6] 	3
CHEMISTRY-DSE-601-LAB	Inorganic Materials of Industrial Importance practical	28	<ul style="list-style-type: none"> Determination of free acidity in ammonium sulphate fertilizer. [6] Determination of free acidity in ammonium sulphate fertilizer. [6] Determination of composition of dolomite [6] Analysis of Cement [3] Preparation of pigment [4] Viva Voce [3] 	4
CHEMISTRY-DSE-603	Project Work	48	<ul style="list-style-type: none"> Project Work [48] 	6
CHEMISTRY-GE-401	Unit I: Transition Series Elements (3d series)	12	<ul style="list-style-type: none"> General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu [8] <i>Lanthanoids and actinoids:</i> Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only). [4] 	3
CHEMISTRY-GE-401-LAB	Section A: Inorganic Chemistry	14	<ul style="list-style-type: none"> Semi-micro qualitative analysis using H₂S of mixtures [11] Viva Voce [3] 	2