গড়গাঁও মহাবিদ্যালয়

GARGAON COLLEGE

TEACHING PLAN

DEPARTMENT OF CHEMISTRY

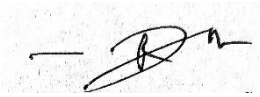
JULY 2021 - JUNE 2022

GARGAON COLLEGE
TEACHING PLAN
Course: B. Sc.
Session: Odd semester, 2021

Subject: CHEMISTRY
Name of the Teacher: Mr. RANJIT DUTTA
Methods to be applied: Lecture, analytical and activity method, Group Work, Assessment for Learning, Assignments and Exercises, Group Activities and Discussions and Assessments.
Teaching Materials: White Board, Marker, Duster, text books, lectures, etc.

Paper Code/Title	**Allotted Unit/ Topic**	**No. of Classes required**	**Detail of the topics to be taught & class required**	**No. of tutorials**
Inorganic Chemistry C-101	Unit III: Chemical Bonding	26	● Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. [2] ● Packing of ions in crystals. Born-Lande equation with derivation, lattice energy, Madelung constant [2] ● Born-Haber cycle and its application, Solvation energy. [2] ● Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach). [2] ● Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Resonance and resonance energy [2] ● Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl, BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given). Formal charge [4] ● Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ- and π- bond approach) and bond lengths. [3] ● Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. [2] ● Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. [2] ● Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids. [2]	3

			● Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) [3]	
CHEMISTRY-C-101-LAB	Inorganic Chemistry	30	● Titrimetric analysis ● Acid-base titrations ● Oxidation-reduction titrimetry	1
CHEMISTRY-GE-101-LAB	Inorganic Chemistry Lab	30	● Inorganic Volumetric Analysis [30]	1
CHEMISTRY-C-301	Unit III: Chemistry of s and p Block Elements	30	● 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]	2
CHEMISTRY-C-301-LAB	Inorganic Lab	26	● Inorganic Qualitative analysis	2



Signature of Faculty

GARGAON COLLEGE
TEACHING PLAN
Course: B. Sc.
Session: Odd semester 2021

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

PaperCode/Title	Allotted Unit/ Topic	No. of Class required	Detail of the topics to be taught & class required	No. of tutorials
CHEMISTRY C-102	Unit I: Liquid State	6	• Qualitative treatment of the structure of the liquid state [1] • Radial distribution function [1] • physical properties of liquids : vapour pressure, Surface tension, viscosity [4] • Explanation of cleansing action of detergents [1]	3
	UNIT:IV Ionic equilibrium	20	• Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization [2] • ionization constant and ionic product of water [4] • pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment) [5] • Salt hydrolysis, Henderson equation [4] • Buffer solutions, solubility product [4]	3
CHEMISTRY C102-LAB	Physical Chemistry	10	• Surface tension measurements [4] • Determination of viscosity [4] • pH-metric titration [8]	5
CHEMISTRY -C-303	UNIT: II Chemical Kinetics	18	• 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	• 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	• 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	• Cell constant [2] • conductometric titration [8]	2
CHEMISTRY -C-502	UNIT: II Molecular Spectroscopy	24	• 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	• Study the 200-500 nm absorbance spectra of KMnO4 and K2Cr2O7 (in 0.1 M H2SO4) and λ determine the max values • Verify Lambert-Beer's law and determine the concentration of KMnO4 • Viva Voce [2]	5

GARGAON COLLEGE

TEACHING PLAN

Course: B. Sc.

Session: Even semester 2022

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

Paper Code/Title	**Allotted Unit/ Topic**	**No. of Class required**	**Detail of the topics to be taught & class required**	**No. of tutorials**
CHEMISTRY - C-202	UNIT: I Chemical Thermodynamics	36	• 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] • Heats of reactions: standard states; enthalpy of formation of molecules and ions [4] • bond energy, bond dissociation energy and resonance energy [3] • Adiabatic flame temperature, explosion temperature [3] • Second Law: Concept of entropy [4] • Calculation of entropy change for reversible and irreversible processes [4] • Third Law, Gibbs and Helmholtz energy, Free energy change and spontaneity [5] • Gibbs-Helmholtz equation; Maxwell relations [5]	4
CHEMISTRY - C-202 Lab	Physical Chemistry Laboratory	12	• Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide[4]	4

			• Calculation of the enthalpy of ionization of ethanoic acid [4] • Study of the solubility of benzoic acid in water and determination of Δ H.[4]	
CHEMISTRY-C- GE- 201	UNIT: 3 Ionic Equilibrium	12	• Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization [4] • ionization constant and ionic product of water [2] • Ionization of weak acids and bases [2] • pH scale, common ion effect, Salt hydrolysis [3] • Buffer solutions, Solubility and solubility product of sparingly soluble salts[4]	3
CHEMISTRY -C- GE-201 Lab	Section A: Physical Chemistry	15	• Determination of heat capacity [4] • Calculation of the enthalpy of ionization of ethanoic acid.[4] • Study of the solubility of benzoic acid in water[4]	3
CHEMISTRY - C-403	UNIT: 1 Conductance	20	• 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	• Determination of cell constant [4] • conductometric titrations [12] • Viva Voce [3]	4
CHEMISTRY -GE-401	UNIT: V Liquids	6	• 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	• 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	• Determination of the surface tension [6] • Determination of viscosity of liquid [6] • Viva Voce [3]	2
CHEMISTRY-DSE-603	Project Work	48	• Project Work [48]	6

Signature of Faculty

GARGAON COLLEGE
TEACHING PLAN
Course: B. Sc.
Session: Odd semester 2021

Subject: **CHEMISTRY**
Name of the Teacher**: Dr. Arandao Narzary**
Methods to be applied: Lecture, practical demonstration, interaction and discussion.
Teaching Materials: White Board, Marker Pen, Duster, Book, Journal, Laptop, Projector, Pointer

Paper Code/Title	**Allotted Unit/ Topic**	**No. of Class required**	**Detail of the topics to be taught & class required**	**No. of tutorials**

CHEMISTRY C-201	N/A			
CHEMISTRY C-302	Unit I: Chemistry of Halogenated Hydrocarbons Part:A Alkyl Halide and Aryl halide Part:B Organometallic compounds	14 2	● 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; SNAr[1] ● Benzyne mechanism[2] ● Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.[3] ● Organometallic compounds of Mg and Li – Use in synthesis of organic compounds.[2]	4
	Unit III: Carbonyl Compounds: Part A:	12	● 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] ● $LiAlH_4$, $NaBH_4$, PDC , PCC , SeO_2, $Pb(OAc)_4$ & HIO_4 .(Synthetic applications only)[2] ● Addition reactions of unsaturated carbonyl compounds: Michael addition. Unsaturated Aldehydes (Acrolein,	7

	Part B	2	Crotonaldehyde, Cinnamaldehyde) Unsaturated Ketone (MVK)[1] ● 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	● Functional group tests for alcohols, carbonyl, and carboxylic acid group[8] ● Preparation by Acetylation[1] ● Preparation by Benzolyation [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 I: Nucleic Acids	9	● Components of nucleic acids, Nucleosides and nucleotides[3] ● 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]	4
	Unit II: Amino Acids, Peptides and Proteins	16	● 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	● Introduction to oils and fats; common fatty acids present in oils and fats[3]	2

			• Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity[5]	
	Unit V: Disconnection approach in Organic Synthesis	10	• Elementary idea about disconnection, Synthon and Synthetic equivalent, Functionall group interconversion (FGI), Functional group addition (FGA)[3] • Simple examples off 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	• 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	• 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
CHEMISTRY-GE-101	*Section B: Organic Chemistry* Unit IV: Stereochemistry	10	• Conformation with respect to ethane, butane and cyclohexane[2] • Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations[2] • Concept of chirality[1] • Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso Compounds. Threo and erythron[3] • Nomenclature: D and L; Cis-trans ;CIP Rules: R/S and E/Z[2]	3
	Unit V: Aliphatic Hydrocarbons Alkanes, Alkene	12	• Preparation and reactions of alkane[4] • Preparation and reactions of alkene[8]	4
CHEMISTRY-GE-101-LAB	Chemistry Practical	15	• Detection of characterized element (N, S, Cl, Br, I) in an organic compound[10] • Separation of mixtures by Chromatography: Measure the R_f value in each case[3] • Viva[2]	2

CHEMISTRY-GE-301	*Section B: Organic Chemistry* Unit VII: Carbohydrates	10	• *Carbohydrates*: Classification, and General Properties[3] • Glucose and Fructose (open chain and cyclic structure)[4] • Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose[2] • Mutarotation, ascending and descending in monosaccharides[1]	3
	Unit VIII: Amino Acids, Peptides and Proteins	12	• *Introduction and Preparation of Amino Acids*: Strecker synthesis using Gabriel's phthalimide synthesis [4] • Zwitterion, Isoelectric point and Electrophoresis[2] • *Reactions of Amino acids*: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test[2] • Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins[4]	3
CHEMISTRY-GE-301-LAB	Chemistry Practical	10	• Systematic Qualitative Organic Analysis of Organic Compounds[10	2

GARGAON COLLEGE
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Subject: **CHEMISTRY**
Name of the Teacher: **Dr. Arandao Narzary**
Methods to be applied: Lecture, practical demonstration, interaction and discussion.
Teaching Materials: White Board, Marker Pen, Duster, Book, Journal, Laptop, Projector, Pointer.

Paper Code/Title	Allotted Unit/ Topic	No. of Class required	Detail of the topics to be taught & class required	No. of tutorials
CHEMISTRY-C-201	UnitII: Stereochemistry	16	• Definition and classification of streoisomerism[1] • Representation of organic molecules in two & three dimensions, Fischer, Newmann and Sawhorse Projection formulae and their interconversions[2] • Geometrical isomerism: Restricted rotation about C=C bonds, Physical &	4

			Chemical properties of Geometrical isomers, Cis–trans and, syn-anti isomerism, E/Z notations with C.I.P rules.*Optical [3]* ● *Isomerism:* Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres[4] ● Distereoisomers, meso structures & Epimers, Racemic mixture and resolution[3] ● Threo & Erythro forms, Relative and absolute configuration: D/L and R/S designations[3]	
	Unit III: Chemistry of Aliphatic Hydrocarbons A. Carbon-Carbon sigma bond B. Carbon-Carbon pi bonds:	4 19	● Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, CoreyHouse Reaction, Free radical substitutions: Halogenation -relative reactivity and selectivity[4] ‘ ● Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb[2] ● Reactions. Saytzeff and Hofmann eliminations. Pyrolysis of esters, Chugaev, Wittig and Heck Reaction [4] ● *Reactions of alkenes:* Electrophilic additions, Markownikoff/ Anti Markownikoff addition, Regioselective and Streoselective addition reactions. oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction, syn and anti-hydroxylation, Simple effect ofStreoselectivity & Streospecificit [6] ● 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene[3] ● *Reactions of alkynes:* Acidity, Electrophilic and Nucleophilic additions.	5

			Hydration to form carbonyl compounds, Alkylation of terminal alkynes[4]	
CHEMISTRY-C-201-LAB	Organic Chemistry Practical	9	● Purification of organic compounds by crystallization[2] ● Determination of the melting points[1] ● Effect of impurities on the melting point – mixed melting point of two unknown organic compounds[1] ● Separation of a mixture of two amino acids by paper chromatography[1] ● Separation of a mixture of two sugars by paper chromatography[1] ● Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)[1] ● Viva[2]	2
CHEMISTRY-C-402	UnitII: Polynuclear Aromatic Hydrocarbons	14	● 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 Heterocyclic Compound-II	12 12	● 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 (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene [8] ● Derivatives of furan: Furfural and furoic acid [2] . ● Synthesis and reaction of Pyridine, Pyrimidine, indole, Fischer indole quinoline and isoquinoline [12]	4

	Unit V: Terpenes	7	● Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Neral and α-terpineol[7]	1
CHEMISTRY-C-402-LAB	Organic Chemistry Practical	14	● Qualitative analysis of unknown organic compounds [14]	2
CHEMISTRY-C-602	Unit I: Organic Spectroscopy *NMR Spectroscopy:*	15	● 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] ● Interpetation of NMR spectra of simple compounds[2] ● Applications of IR, UV, NMR and Mass for identification of simple organicmolecules[8]	2
	Unit II: Carbohydrates	16	● 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; Assecnding and descending in monosaccharide[1] ● Interconversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation [3]	2
	Unit III: Dyes	8	● 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	● Qualitative analysis of unknown organic compounds containing monofunctional groups [14]	3

			● 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]	
CHEMISTRY-DSE-603	Dissertation (*Project Work*)	30	● Project Work [30]	2
CHEMISTRY-GE-201	Section *B: Organic Chemistry* Unit IV: Aromatic Hydrocarbons	8	● 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	● 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] ● *Aryl Halides*: *Preparation*: (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	● *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

(Signature)

GARGAON COLLEGE
TEACHING PLAN
Course: B. Sc.
Session: Odd semester 2021

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

Paper Code/Title	**Allotted Unit/ Topic**	**No. of Class required**	**Detail of the topics to be taught & class required**	**No. of tutorials**
CHEMISTRY C-302	Unit II: Alcohols, Phenols, Ethers and Epoxides	14	**Alcohols** ● preparation, properties and relative reactivity of 1°, 2°, 3° alcohols Bouvaelt-Blanc Reduction Preparation and properties of glycols Oxidation by OsO4, alkaline KMnO4, periodic acid and lead Tetraacetate Pinacol Pinacolone Rearrangement *Trihydric alcohols* : Glycerol /Preparation & Properties [8] **Phenols** ● Preparation and properties; Acidity and factors effecting it Ring substitution reactions,	4

			Reimer–Tiemann and Kolbe's–Schmidt Reactions Fries and Claisen rearrangements with mechanism [3] **Ether and Epoxides** ● Preparation and reactions with acids Reaction of epoxide with alcohols ammonia derivatives and LiAlH4 [3]	
	Unit IV: Carboxylic Acids and their Derivatives:	12	● 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 sustitution 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	• Functional group tests for alcohols, carbonyl, and carboxylic acid group [8] • Preparation by Acetylation [1] • Preparation by Benzolyation [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	• 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	• 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	8

			of curcumin (haldi), azadirachtin (neem), vitamin C.	
CHEMISTRY-C-501-LAB	Organic Chemistry practical	8	• 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-GE-101	Unit III: Fundamentals of Organic Chemistry	8	• Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis [2] • Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals [2] • Strength of organic acids and bases: Comparative study with emphasis on factors affecting *p*K values. Aromaticity: Benzenoids and Hückel's rule [2]	3
CHEMISTRY-GE-101-LAB	Chemistry Practical	15	• Detection of characterized element (N, S, Cl, Br, I) in an organic compound [10] • Separation of mixtures by Chromatography: Measure the R*f* value in each case [3] • Viva [2]	2
CHEMISTRY-GE-301	*Section B: Organic Chemistry* Unit V: Carboxylic acids	6	• *Carboxylic acids (aliphatic and aromatic)*: Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelinsky Reaction [2] • *Carboxylic acid derivatives (aliphatic): (upto 5 carbons)* Preparation: Acid chlorides,	3

	and their derivatives		anhydrides, Esters and Amides from acids and their interconversion [2] ● Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin Condensation [2]	
	Unit VI: Amines and Diazonium Salts	6	● *Amines (Aliphatic and Aromatic)*: (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] ● *Diazonium salts*: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes [2]	3
CHEMISTRY-GE-301-LAB	Chemistry Practical	10	● Systematic Qualitative Organic Analysis of Organic Compounds[10]	2

GARGAON COLLEGE
TEACHING PLAN
Course: B. Sc.
Session: Even semester 2022

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.

Paper Code/Title	Allotted Unit/ Topic	No. of Class required	Detail of the topics to be taught & class required	No. of tutorials

CHEMISTRY-C-201	Unit I: Basic Organic Chemistry	8	● ***Organic Compounds****:* Classification and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties [2] ● ***Electronic effects****:* Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment [2] ● Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes, Nitrenes [2] ● Organic acids and bases; their relative strength, Hard and soft acids & bases. Energy profile diagrams of one step, two steps & three steps reactions, Activation energy, Kinetically Controlled & Thermodynamically Controlled reactions [2]	4
	Unit IV: Cycloalkanes and Conformational analysis:	10	● Cycloalkanes: Preparation and their relative stability, Baeyer strain theory Conformation analysis of alkanes (Ethane and Butane): Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams [10]	5

	Unit V: Aromatic Hydrocarbons	12	● *Aromaticity:* Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples [5] ● Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism [4] ● Directing effects of the groups [3]	
CHEMISTRY-C-201-LAB	Organic Chemistry Practical	9	● Purification of organic compounds by crystallization [2] ● Determination of the melting points [1] ● Effect of impurities on the melting point – mixed melting point of two unknown organic compounds [1] ● Separation of a mixture of two amino acids by paper chromatography [1] ● Separation of a mixture of two sugars by paper chromatography [1] ● Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC) [1] ● Viva [2]	2
CHEMISTRY-C-402	Unit I: Nitrogen Containing Functional Groups	16	● **Amine**s: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid [10] ● Diazonium Salts: Preparation and their synthetic applications. Diazomethane & Diazoacetic Ester with synthetic application [6]	2

	Unit IV: Alkaloids	6	● 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	● Qualitative analysis of unknown organic compounds	2
CHEMISTRY-C-602	Unit I: Organic Spectroscopy	15	● ***UV Spectroscopy****:* Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λmax 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	● Introduction and classification of polymers [6] ● Polymerisation reactions -Addition and condensation -Mechanism of cationic,	2

			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	● 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 (*Project Work*)	30	● Project Work [30]	2
CHEMISTRY-GE-201	Section *B: Organic Chemistry* Unit VI: Alcohols, Phenols and Ethers (Up to 5 Carbons)	8	● *Alcohols*: 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, *alk*. KMnO4, acidic dichromate, conc. HNO3). Diols: (Up to 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement [2] ● *Phenols*: (Phenol case): Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer- Tiemann Reaction, Schotten – Baumann Reaction [2] ● *Ethers (aliphatic and aromatic)* Cleavage of ethers with HI [2] ● *Aldehydes and ketones (aliphatic and aromatic):* (Formaldehye, 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	2

			Condensation. Clemensen Reduction and Wolff Kishner Reduction. Meerwein-Pondorff Verley Reduction [2]	
CHEMISTRY-GE-201-LAB	Chemistry Practical	5	• *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

Signature of the teacher

GARGAON COLLEGE
TEACHING PLAN
Course: B. Sc.
Session: Odd semester, 2021

Subject: CHEMISTRY
Name of the Teacher: DR. PAKIZA BEGUM
Methods to be applied: Lecture, Group Work, Flipped Classroom, Problem-Based Learning, 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**

Inorganic Chemistry **C-101**	Unit I: Atomic Structure	14	• Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of Ψ and Ψ^2. [4] • Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. [3] • Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. [2] • Shapes of s, p, d and f- orbitals. Contour boundary and probability diagrams. [2] • Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations. Variation of orbital energy with atomic number]. [3]	2
	Unit III: Chemical Bonding	26	• Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. [2] • Packing of ions in crystals. Born-Lande equation with derivation, lattice energy, Madelung constant [2] • Born-Haber cycle and its application, Solvation energy. [2] • Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach). [2] • Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Resonance and resonance energy [2] • Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl, BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given). Formal charge [4] • Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ- and π- bond approach) and bond lengths. [3] • Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. [2] • Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. [2] • Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids. [2] • Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions,	3

			induced dipole interactions, Instantaneous dipole-induced dipole interactions. Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) [3]	
	Unit IV: Oxidation-Reduction	4	● Redox equations, Standard Electrode Potential and its application to inorganic reactions. [2] ● Principles involved in volumetric analysis to be carried out in class. [2]	2
CHEMISTRY-C-101-LAB	Inorganic Chemistry	30	● Titrimetric analysis ● Acid-base titrations ● Oxidation-reduction titrimetry	1
CHEMISTRY-GE-101	Unit I: Atomic Structure	14	● Ionic Bonding: General characteristics of ionic Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de-Broglie's relation, Heisenberg Uncertainty principle. [2] ● Hydrogen atom spectra. Need of a new approach to atomic structure. [2] ● What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of Ψ and Ψ^2, Schrödinger equation for hydrogen atom. [2] ● Radial and angular parts of the hydogenic wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). [2] ● Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. [2] ● Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of s, p and d atomic orbitals, nodal planes. ● Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). Rules for filling electrons in various orbitals, electronic configurations of the atoms. [2] ● Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations. [2]	4
CHEMISTRY-GE-101-LAB	Inorganic Chemistry	30	● Inorganic Volumetric Analysis [30]	1
Inorganic Chemistry C-301	Unit I: General	6	● Chief modes of occurrence of metals based on standard electrode potentials [1]	2

	Principles of Metallurgy		● 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]	
	Unit II: Acids and Bases	8	● 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]	3
	Unit IV: Noble gases	8	● Occurrence and uses, rationalization of inertness of noble gases, Clathrates [2] ● Preparation and properties of XeF_2, XeF_4 and XeF_6 [2] ● Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF_2) [2] ● Molecular shapes of noble gas compounds (VSEPR theory) [2]	1
MM-302	Inorganic Lab	26	● Inorganic Qualitative analysis	2
MM-503	UNIT –I: Organometallic compounds	12	● Definition, electron count, 18 electron rule, isolobal analogy [2] ● Structure and bonding in some Organometallic compounds (Metal –Olefins compound, metal – ligand sigma-bonded compounds, ferrocene). [3] ● Oxidative addition and reductive elimination reaction. [2] ● Uses of some organometallic compounds in catalysis (Wilkinson's catalyst, Vaska's compound and $HCo(CO)_4$) [3] ● Metal carbonyls: Structure, bonding and IR spectral studies of terminal and bridged carbonyls. [2]	2
	UNIT-III: Error in quantitative analysis	10	● Accuracy, precession, deviation, standard deviation, classification of errors, minimization of errors, significant figures. [5] ● Indicators: Choice of indicators in neutralization, redox, adsorption and complexometric reactions. [5]	2
	UNIT IV: Organic reagents in	10	● Cupferron, dithizone, benzoin- oxime, 1-nitroso-2- naphthol, diphenyl carbazide, diphenyl carbazone, salicylaldoxime [5] ● 1,10- phenanthroline, magneson, thiourea, zinc uranyl acetate, oxine [5]	1

	inorganic analysis			
MM-504	Inorganic Lab.	16	● Volumetric titrations ● Estimation of total hardness of water samples	1
MM-508	Inorganic Lab.	14	● Quantitative analysis	1
NM-501	Unit I: Nuclear Chemistry	6	● Mass defect and binding energy, packing fraction, stability of nucleus, neutron-proton ratio [2] ● Artificial radioactivity, nuclear fission, nuclear reactors, separation of isotopes. [2] ● Detection and measurement of radioactivity by GM counter. Application of radioisotopes in agriculture, medicine and industry. Radiocarbon dating. [2]	2
NM-502	Inorganic Lab.		● Volumetric analysis	

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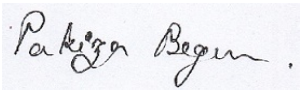
Paper Code/Title	**Allotted Unit/ Topic**	**No. of Class required**	**Detail of the topics to be taught & class required**	**No. of tutorials**
C-201			NA	
Inorganic Chemistry **C-401**	Unit I: Coordination Chemistry	26	● IUPAC nomenclature of coordination compounds, isomerism in coordination compounds [4] ● Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate	

			effect, polynuclear complexes. Labile and inert complexes [2] ● Werner's theory, valance 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]	
	Unit II: Transition Elements	18	● General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. [7] ● Stability of various oxidation states and e.m.f. (Latimer and Bsworth diagrams). [4] ● Difference between the first, second and third transition series. [3] ● Chemistry of Ti, V, Cr, Mn, Fe and Co in various oxidation states (excluding their metallurgy) [4]	1
	Unit III: Lanthanoids and Actinoids	6	● Electronic configuration, oxidation states, color, spectral and magnetic properties [3] ● Lanthanide contraction, separation of lanthanides (ion-exchange method only) [3]	3
	Unit IV: Bioinorganic Chemistry	10	● Metal ion present in biological systems, classification of elements according to their action in biological system. Geo chemical effect on distribution of metals. [3] ● Sodium/ K-pump, carbonic anhydrase and carboxypeptidase. [2] ● 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, Haemoglobin, storage and transfer of iron. [2]	
CHEMISTRY-C-401-LAB	Inorganic Chemistry practical	28	● Gravimetric Analysis [8] ● Inorganic Preparation [8] ● Chromatography of metal ions [8] ● Viva-voce [4]	2

CHEMISTRY-GE-401 (Section A: Inorganic Chemistry **)**	Unit I: Transition Series Elements (3d series)	12	● General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties [4] ● Ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu. [4] ● Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction [2] ● Separation of lanthanides (ion exchange method only). [2]	2
	Unit II: Coordination Chemistry	8	● 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	● 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]	3
CHEMISTRY-GE-401-LAB	Inorganic Chemistry Practical	20	● Qualitative Inorganic Analysis: Salt analysis [18] ● Viva – voce [2]	2
Inorganic Chemistry C-601	Unit I: Theoretical Principles in Qualitative Analysis (H_2S Scheme)	10	● Basic principles involved in analysis of cations and anions and solubility products, common ion effect. [3] ● Principles involved in separation of cations into groups and choice of group reagents. [4] ● Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II [3]	1
	Unit II: Organometallic compounds	22	● Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. [2] ● Metal carbonyls: 18 electron rules, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. [2]	3

			● General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. [2] ● Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe,Co and Ni using VBT. [2] ● π-acceptor behavior of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding. [3] ● Zeise's salt: preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls. [2] ● Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium(dimer), concept of multicentre bonding in these compounds. [3] ● Role of triethylaluminium in polymerization of ethane (Ziegler-Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium. [3] ● Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of Benzene [3]	
	Unit IV: Catalysis by Organometallic Compounds	10	● Study of the following industrial processes and their mechanism ● 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]	2
CHEMISTRY-C-601-LAB	Inorganic Chemistry Practical	28	● Qualitative Inorganic Analysis: Salt analysis [25] ● Viva – voce [3]	3
Inorganic Materials of Industrial Importance **DSE-601**	Unit I: Silicate Industries	16	● 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.	1

			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]	
CHEMISTRY-DSE-601-LAB	Inorganic Materials of Industrial Importance practical	28	● 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	● Project Work [48]	6



Signature of Faculty

GARGAON COLLEGE
TEACHING PLAN
Course: B. Sc.
Session: Odd semester 2021

Subject: CHEMISTRY
Name of the Teacher: DR. SAHEEN SHEHNAZ BEGUM
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. req	Detail of the topics to be taught & class required	No. of tutorials
CHEMISTRY-C-102	Unit I: Gaseous state	18	• Kinetic molecular model of a gas: postulates and derivation [2] • Collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence [2] • Relation between mean free path and coefficient of viscosity [1] • Calculation of σ from η, variation of viscosity with temperature and pressure. [1]	5

			• Maxwell distribution and evaluation of molecular velocities (average, root mean square and most probable) and average kinetic energy [1] • Law of equipartition of energy [1] • Degrees of freedom and molecular basis of heat capacities [1] • Behaviour of real gases: Deviations from ideal gas behaviour [1] • Compressibility factor, *Z*, and its variation with pressure for different gases. [1] • Causes of deviation from ideal behavior: van der Waals equation of state, its derivation and application [1] • Other equations of state (Berthelot, Dietrici) [1] • Virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature. [3] • Isotherms of real gases and their comparison with van der Waals isotherms [2] • Continuity of states, critical state [1] • Relation between critical constants and van der Waals constants [1] • Law of corresponding states. [1]	
	Unit III: Solid state	16	• Nature of the solid state [1] • Law of constancy of interfacial angles, law of rational indices [1] • Miller indices [1] • Elementary ideas of symmetry, symmetry elements and symmetry operations [2] • Qualitative idea of point and space groups [1] • Seven crystal systems and fourteen Bravais lattices [2] • X-ray diffraction, Bragg's law [1] • Rotating crystal method [2]	2

			● Powder pattern method. [1] ● Analysis of powder [1] diffraction patterns of NaCl, CsCl and KCl. [2] ● Defects in crystals. [1] ● Glasses and liquid crystals [1]	
CHEMISTRY-C-102-LAB	GROUP A & GROUP B	15	● Surface tension measurements.[5] ● Viscosity measurement using Ostwald's viscometer [5] ● pH metry [5]	1
CHEMISTRY-C-303	UNIT: I Phase Equilibria	28	● 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] ● 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]	2
CHEMISTRY-C-303-LAB	Physical Chemistry Practical	28	● Acid hydrolysis of methyl acetate with hydrochloric acid [4]	3

			• Saponification of ethyl acetate [4] • Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal [6]	
CHEMISTRY GE-301	UNIT: I Solutions	8	• 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	• Phases, components and degrees of freedom of a system [2] • 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-H_2O and Na-K only) [3]	1
CHEMISTRY GE-301 Lab	Section A: Physical Chemistry	10	• Cell constant [2] • conductometric titration [8]	2
CHEMISTRY-C-502	UNIT: I Quantum Chemistry	24	• 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]	4

			● 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]	
CHEMISTRY-DSE-502	Unit IV: Future Trends in Green Chemistry	6	● 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	● Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M $H2SO_4$) and λ determine the max values ● Verify Lambert-Beer's law and determine the concentration of $KMnO_4$ ● Viva Voce [2]	5

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

Paper Code/Title	Allotted Unit/ Topic	No. of Cl required	Detail of the topics to be taught & class required	No. of tutorials
CHEMISTRY-C-202	Unit II: Systems of Variable Composition	8	• Partial molar quantities [2] • Dependence of thermodynamic parameters on composition [2] • Gibbs-Duhem equation, chemical potential of ideal mixtures [3] • Change in thermodynamic functions in mixing of ideal gases [2]	2
	Unit III: Chemical Equilibrium	8	• Criteria of thermodynamic equilibrium [1] • Degree of advancement of reaction [1] • Chemical equilibria in ideal gases [1] • Concept of fugacity. [1] • Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. [2] • Coupling of exoergic and endoergic reactions. [1] • Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. [2] • Free energy of mixing and spontaneity [1] • Thermodynamic derivation of relations between the various equilibrium constants K_P, K_C and K_X. [1] • Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase. [1]	4
	Unit IV: Solutions and Colligative Properties	8	• Dilute solutions [1] • Lowering of vapour pressure [1] • Raoult's and Henry's Laws and their applications. [1] • Excess thermodynamic functions. [1] • Thermodynamic derivation using chemical potential to derive relations between the four colligative	2

			properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. [5] • Applications in calculating molar masses of normal, dissociated and associated solutes in solution. [2]	
CHEMISTRY-C-202-LAB	Thermochemistry	6	• Heat capacity of a calorimeter for different volumes [2] • Heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide. [2] • Enthalpy of ionization of ethanoic acid [2]	4
CHEMISTRY-C-403	UNIT: II Electrochemistry	28	• 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	• Determination of cell constant [4] • conductometric titrations [12] • Viva Voce [3]	4

CHEMISTRY-GE-401	UNIT: IV Kinetic Theory of Gases	8	• 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 CO_2. 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	• 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	• Determination of the surface tension [6] • Determination of viscosity of liquid [6] • Viva Voce [3]	2
DSE-601	Inorganic Materials of Industrial	6	• Primary and secondary batteries [1]	1

	Importance: UNIT IV: Batteries		• Battery components and their role and Characteristics [1] • Working of: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.[4]	
CHEMISTRY-DSE-603	Project Work	48	• Project Work [48]	6

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Signature of Faculty