NAGARJUNA GOVERNMENT COLLEGE,

NALGONDA

(AUTONOMOUS)

RE-ACCREDITED BY NAAC WITH "A" GRADE

BOARD OF STUDIES MEETING 2014-15

DEPARMENT OF CHEMISTRY

NAGARJUNA GOVT.COLLEGE,NALGONDA

(AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

Board of studies in the Department of chemistry has been constituted with the following members for the year 2014-2015

SNO	CATEGORY	NAME & DESIGNATION	Phone No
1	Chairman Board of studies	Sri.K.Prabhakar Reddy. N.G.College,Nalgonda.	9440577656
2	University Nominee	Annapoorna R.S. Butti Dr.S.R.Annapurna ,Asso.prof., M.G.University,Nalgonda.	8498055022
3	Subject expert from out side the college	Dr.M.Vasantha, Asso.prof., M.G.University,Nalgonda	9849216947
4	Subject expert from out side the college	Dr.A.Bhanuprasad, Principal GDC, Ramanapet,Nalgonda (Dist)	9848385850
5	Members: All The Faculty members of the Dept.	1). Sri P.Yedukondalu,	9849056316
		2). Sri.M.Venkateswarlu	9441709821
		3). Sri.P.Ravi Kumar,	9440208972
		4). Dr.Ch.Govardhan	9848057671
		5) .Dr.K.Venkatakrishna	9441993436
		6). Sri.k.Ravi	9160616309

Submitted by

In-Charge /Chairman BOS

CHAIRMAN
Board of Studies in Chemistry
Dept. of Chemistry
Nagarjuna Govt College
( ) NALGONDA

proposals approved

Principal/ Chairman academic council

NAGARJUNA GOVERNMENT COLLEGE (AUTONOMOUS),NALGONDA

ALLOCATION OF CREDITS AT SUBJECT LEVEL

COURSE: B.Sc (SCIENCE)

SUBJECT: CHEMISTRY

SNO	SEMESTER	MODULE(PAPER)	hours per week	MAX.MARKS	CREDITS
1	1 (CORE)	ORGANIC & GENERAL CHEMISTRY	04	100	3
2	II (CORE)	PHYSICAL & INORGANIC CHEMISTRY	04	100	3
3	PRACTICALS	SEMI MICRO ANALYSIS	3	50	2
4	III (CORE)	ORGANIC & GENERAL CHEMISTRY	04	100	3
5	IV (CORE)	PHYSICAL & IN ORGANIC CHEMISTRY	04	100	3
6	PRACTICALS	VOLUMETRIC ANALYSIS	3	50	2
7	V (CORE)	ORGANIC & SPECTROSCOPY	03	100	3
8	V - (Advance) Elective –I	SOLVENT EXTRACTION CHROMATOGRAPHY, CLASSIFICATION PAPER, TLC COLUMN, HPLC, GLC	03	100	2
9	V -(Advance) Elective –II	DRUGS ,FORMULATIONS PESTICIDES, ALKALOIDS, TERPENOIDS			
10	Practical's	Preparation and functional group identification of organic compounds	3	50	02
11	VI (CORE)	PHYSICAL CHEMISTRY & GREEN CHEMISTRY ,INORGANIC CHEMISTRY	3	100	03
12	VI -(SKILL BASED) Elective –I	MACROMOLECULES, METERIAL SCIENCE,NONO METERIALS ,CATALYSIS	3	100	2
13	VI -(SKILL BASED) Elective –II	SPECTRAL PROBLEMS BASED ON NMR,MASS,IR,UV SPECTRAL DATA			
14	PRACTICALS	PHYSICAL CHEMISTRY PRACTICALS	3	50	2
15	TOTAL			1000	30
16	PROJECT WORK				1

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COLLEGE: **NAGARJUNA GOVT.COLLEGE,NALGONDA** COURSE: **B.Sc**
YEAR: **2014-15** SUBJECT: **CHEMISTRY**
NAME OF THE MODULE : **ORGANIC & GENRAL CHEMISTRY** SEMESTER: **I**
NATURE OF THE MODULE: **CORE**

MODE OF THE LEARING : **REGULAR**

UNIT-I

Structural theory in Organic Chemistry & Acyclic Hydrocarbons

I. Structural theory in Organic Chemistry 8 hr

Types of bond fission and organic reagents (Electrophilic. Nucleophilic. and free radical reagents including neutral molecules like H_20. NH_3 & $AlCl_3$). Bond polarization : Factors influencing the polarization of covalent bonds, electro negativity inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes, carbanions, carbenes and nitrenes.

Types of Organic reactions : Addition – electrophilic, nucleophilic and free radical. Substitution – electrophilic, nucleophilic and free radical. Elimination – Examples (mechanism not required)

2. Acyclic Hydrocarbons 8 hr

Alkanes – IUPAC Nomenclature of Hydrocarbons. Method of preparation: Hydrogenation of alkynes, Wurtz reaction, Kolbe's electrolysis, Corey House reaction. Chemical reactivity – inert nature, free radical substitution mechanism. Halogenation example – reactivity, selectivity and orientation.

Alkenes – Preparation of alkenes (a) by dehydration of alcohols (b) by dehydrohalogenation of alkyl halides (c) dehalogenation of 1,2 dihalides (brief mechanism), Zaitsev's rule. Properties: Addition of hydrogen – heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markownikov's rule, addition of H_2O, HOX, H_2SO_4 with mechanism and addition of HBr in the presence of peroxide (anti - Markownikov's addition). Oxidation - hydroxylation by $KMnO_4$, $0s0_4$, perácids (via epoxidation) hydroboration. Dienes - types of dienes. reactions of conj ugated dines — 1,2 and 1,4 addition to 1,3 — butadiene and Diel's Alder reaction, HBr

Alkynes — Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides). Preperation of higher acetylenes, Metal ammonia reductions Physical properties. Chemical reactivity — electrophilic addition of X_2, HX, H_20 (lautomerism), Oxidation with $KMnO_4$, $0s0_4$, reduction and Polymerisation reaction of acetylene.

UNIT-II

Alicyclic hydrocarbons (Cycloalkanes) ,Aromatic Hydrocarbons

1. Alicyclic hydrocarbons (Cycloalkanes) **4 hrs**

Nomenclature. Preparation by Freunds methods, heating dicarboxylic metal salts. Properties reactivity of cyclopropane and cyclobutane by.comparing with alkane. Stability of cycloalkanes '— Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain theory. Conformational structures of cyclobutane, cyclopentane. cyclohexane.

2. Benicne and its reactivity **7 hrs**

Concept of resonance, resonance energy. Heat of hydrogenation. heat of combustion of Benezene. mention of C-C bond lengths and orbital picture of Benzene.

Concept of aromaticity —- aromaticity (definition). Huckel's rule application to Benzenoid (Benzene, Napthalene) and Non — Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation)

Reactions — General mechanism of electrophilic substitution, mechanism of nitration.

Friedel crafts alkylation and acylation. Orientation of aromatic substitution — Definition of ortho. para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO_2 and Phenolic). Orientation of (i). Amino, methoxy and methyl groups (ij), Carboxyl.

nitro, nitrile, carbonyl and Sulfonic acid groups. (iii). Halogens (Explanation by taking minimum of one example from each type).

3. Polynuclear Hydrocarbons. **3 hrs**

Structure of naphthalene and anthracene (Molecular Orbital diagram and resonance energy) Any two methods of preparation of naphthalene and reactivity. Reactivity towards electrophilic substitution. Nitration and sulfonation as examples.

(General Chemistry-I

INIT III

1. Atomic Structure and elementary quantum mechanics **8 hrs**

Blackbody radiation, Planck's radiation law, photoelectric effect, Compton effect, de Broglie' s hypothesis, Heisenberg's uncertainty principle. Postulates of quantum mechanics. Schrodinger wave equation and a particle in a box energy levels, wave functions and probability densitics. Schrodinger wave equation for H—atom. Separation of variables, Radial and angular functions. hydrogen like wave functions, quantum numbers and their importance.

2. Chemical Bonding . **8hrs**

Valence bond theory, hybridization, VB theory as applied to ClF_3, BrF. $Ni(CO)_4$, XeF_2.

Dipole moment -- orientation of dipoles in an electric field. dipole moment, induced dipole moment, dipole moment and structure of molecules. Molecular orbital theory — LCAO method, construction of MO. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N_2. O_2. HCl, CO and NO). comparision of VB and MO theories.

UNIT-IV

1. Stereochemistry of carbon compounds **10 hrs**

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Stereoisomerism, Stereoisomers: enantiomers. diastereomers- definition and examples. Conformational and configurational isomerism— definition.

Conformational isomerism of ethane and n-butane.

Enantiomers: Optical activity- wave nature of light, plane polarised light. interaction with molecules, optical rotation and specific rotation. Chiral molecules- definition and criteria- absence of plane, Center. and Sn axis of symmetry- asymmetric and disymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde. Lactic acid, Alanine) and disymmetric molecules (trans -1 ,2-dichloro cyclopropane).

Chiral centers: defination— molecules with similar chiral carbon (tartaric acid). definition of mesomers- molecules with dissimilar chiral carbons (2,3-dibromopentane). Number of enantiomers and mesorners- calculation

D.L. and R,S configuration for asymmetric and disymmetric molecules. Cahn-Ingold-Prelog rules.

Racemic mixture- racemisation and resolution techniques.

Diastereomers: definition- geometrical isomerism with reference to alkenes- cis, trans and E,.Z-configuration.

2. General Principles of Inorganic qualitative analysis 4 hrs.

Solubility product. common ion effect, characteristic reactions of anions, elimination of interfering anions, separation of cations into groups. group reagents, testing of cations

PRACTICALS :

PREPARATIONS OF ANY THREE OF THE INORGANIC COMPOUNDS:

1. **Ferrous Ammonium Sulphate.**
2. **Tetrammine Cupper(II) Sulphate.**
3. **Potassium Tris Oxalate Chrimate.**
4. **Potash Alum $KAI(SO_4).12\ H_2O$.**
5. **Hexammine Cobalt (III)Chloride.**

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COLLEGE: **NAGARJUNA GOVT.COLLEGE,NALGONDA** COURSE: **B.Sc**
YEAR: **2014-15** SUBJECT: **CHEMISTRY**
NAME OF THE MODULE : **ORGANIC & GENRAL CHEMISTRY** SEMESTER: **II**
NATURE OF THE MODULE: **CORE**

MODE OF THE LEARING : **REGULAR**

UNIT - I	**Inorganic Chemistry — I** **1. s-block elements:** General characteristics of groups I & II elements, diagonal relationship between Li & Mg, Be & Al.	**3 hrs**
	2. p-block elements: General characteristics of elements of groups 13, 14,and 15	**12 hr**
	Group 13: Synthesis and structure of diborane and higher boranes (B_4H_{10} and B_5H_9) boron-nitrogen compounds ($B_3N_3H_6$ and BN) Group 14: Preparation and applications of silanes and silicones. Graphitic compounds. Group 15: Preparation and reactions of hydrazine, hydroxylamine. phosphazenes.	
UNIT -II	**1.GENRAL CHARACTERISTICS OF GROUPS I6 and 17**	**8 hrs**
	Group - 16: Classifications of oxides based on (i) Chemical behaviour and (ii) Oxygen content. Group - 17: Inter halogen compounds and pseudo halogens	
	2. Organo metallic Chemistry	**7 hrs**
	Definition and classification of organometallic compounds, nomenclature. preparation. properties and applications of alkyls of 1, 2 and 13 group elements.	
	PHYSICAL CHEMISTRY **Gaseous state , Liquid state, Solid State Solutions , Colloids and surface chemistry I**	
UNIT-III	**1.Gaseous state**	**6 hrs**
	Compression factors, deviation of real gases from ideal behavior. Van der Waal's equation of state. PV - Isotherms of real gases, Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. The Vander Waal's equation and the critical state. Relationship between critical constants and Vander Waal' constants. The law of corresponding states and reduced equation of states. Joule Thomson effect. Liquefaction of gases: i) Linde's method and ii) Claude's method.	**10 hrs**

2.SOLID STATE — 10 hrs

Symmetry in crystals, Law of constancy of interfacial angles. The law of rationality of indices.The Law of symmetry.Definition of lattice point,space lattice,unit cell . Bravis lattices and crystal systems. X-ray diffraction and crystal structure,Braggs Law.Determination of crystal structure .Braggs law Determination of crystal structure by Braggs method and the powder method .Indexing of planes and structure of NaCl and KCl crystal,

Defects in crystals. Stoichiometric and non-stoichiometric defects. Band theory of semiconductors .Extrinsic and intrinsic semiconductors, n and p type semiconductors and their applications in photo electrochemical cells.

UNIT_IV

1. Liquid state — 2 hrs

Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases. Liquid crystals, the mesomorphic state. Classification of liquid crystals into Smectic and Nernatic. Differences between liquid crystal and solid/liquid. Application of liquid crystals as LCD devices.

2. Solutions — 6 hrs

Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions. Vapour pressure — composition and vapour pressure- temperature curves. Azeotropes-HCl-H_20, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water. Triethylamine-water, nicotine-water systems. Effect of impurity on consulate temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

3. Colloids and surface chemistry — 6 hrs

Definition of colloids. Solids in liquids(sols), preparation, purification,properties - kinetic,optical,electrical. Stability of colloids, Hardy- Schulze law, protective colloid. Liquids in liquids (emulsions) preparation, properties, uses. Liquids in solids (gels) preparation, uses. Adsorption: Physical adsoption, chemisorption. Freundlich, Langm uir adsorption isotherms. Applications of adsorption.

PRACTICALS : — 60 hrs.

Qualitative analysis:

Analasysis of mixture contain two anions (one simple & one interfering) and two cations (of different groups) from the following

2.anions : carbonate, sulfide, sulphate ,chloride, bromide, iodide ,acetate, nitrate ,oxalate ,tatorate borate, phosphate , arsenate , and chromate.

3. Cations : lead,copper, bismuth ,cadmium ,tin, antimony ,iron, aluminum ,zinc ,manganese ,nickel ,cobalt ,calcium, strontium,barium, potassium and ammonium

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DEPARTMENT OF CHEMISTRY
B.Sc II YEAR III SEMESTER,SYLLABUS
PAPER-III

UNIT-I

1. Halogen compounds — **4hrs**

Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl halides. Chemical Reactivity, formation of RMgX

Nucleophilic aliphatic substitution reaction- classification into SN I and SN2 Energy profile diagram of SN1 and SN2 reactions. Stereochemistry of SN2 (Walden Inversion) SN I (Racemisation). Explanation of both by taking the example of optically active alkyl halide — 2bromobutane, Ease of hydrolysis — comparision of alkyl, benzyl, alkyl, vinyl and aryl halides.

2. Hydroxy compoupds — **6 hrs**

Nomenclature and classification of.hydroxyl compounds.

Alcohols: Preparation with hydroboration reaction, Griganard synthesis of alcohols.

Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from Cumene.

Physical properties — Hydrogen bonding (intermolecular and intramalecular).

Effect of hydrogen bonding on boiling point and solubilitiy in water.

Chemical properties:

(a) . acidic nature of phenols.

(b) . formation of alkoxides/phenoxides and their reaction with RX.

(c) .replacement of OH by X, using PCl_5. PCl_3. PBr_3 $SOCl_2$ and with $HX/ZnCl_2$.

(d) .esterification by acids (mechanism).

(e) .dehydration of alcohols.

(f) special reaction of phenols: Bromination, Kolb-Schmidt reaction. Riemer-Tiemann reaction. Fries rearrangement. azocoupling.

3. Carboxylic acids and derivatives — **6 hrs**

Nomenclature, classification and structure of carboxylic acids.

Methods of preparation by a) hydrolysis of nitriles, amides and esters.

b) carbonation of Grignard reagents.

Special methods of preparation of aromatic acids by a) oxidation of side chain. h) hydrolysis by benzotrichlorides, c) Kolbe reaction.

Physical properties: Hydrogen bonding, dimeric association, acidity- strength of acids

	UNIT-II	the acidities of aromatic and aliphatic acids. Chemical properties.: Reactions involving H, OH and COOH groups-salt formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction. decarboxylation by Schimdt reaction. Arndt-Eistert synthesis, halogenation by Hell-Volhard- Zehnsky reaction. Derivatives of carboxylic acids: Reaction of acid chlorides, acid anhydrides. acid amides, esters (mechanism of the hydrolysis of esters by acids and bases). **1. Carbonyl compounds** Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl group. • Synthesis of aldehydes from acid chlorides. Synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. • Physical properties: absence of hydrogen bonding, keto-enol tautomerism. reactivity of carbonyl group in aldehydes and ketones. • Nucleophilic addition reaction with a) $NaHSO_3$ h) HCN, c) RMgX. d) NH_2OH. e)PhNHNH2, f) 2,4 DNPH, g) Alcohols-formation of hemiacetal and acetal. • Halogenation using PCl_5 with mechanism. • Base catalysed reactions: a) Aldol, b) Cannizzaro reaction, c) Perkin reaction, d) Benzoin condensation, e) Haloform reaction, f) Knoevenagel reaction. • Oxidation of aldehydes- Baeyer-Villiger oxidation of ketones. • Reduction: Clemmensen reduction, Wolf-Kishner reduction, MPV reduction. reduction with LiAlH4 and NaBH4. Analysis of aldehydes and ketones with a) 2,4-DNP test. h) Tollen's test, c) Fehling test, d) Schiff test e) Haloform test (with equation). **2. Active methylene compounds** Acetoacetic esters: preparation by Claisen condensation, keto-enol tauomerism. Acid hydrolysis and ketonic hydrolysis. Preparation of a) monocarboxylic acids.b)dicarboxylic acids.Reaction with urea.Malonic ester: preparation from acetic acid.Synthetic applications: Preparation of a)monocarboxylic acids (propionic acid and n-Butyric acid)(h)Dicarboxylic acids (succinic acid and adipic acid).,-unsaturatedcarboxylic acids (crotonic acid).Reaction with urea. **3.Exercises in interconversion**	**10 hrs** **4 hrs**

(GENRAL CHEMISTRY)

UNIT III

1. Molecular symmetry — 2 hrs

Concept of symmetry in chemistry-symmetry operations, symmeti:y elements. Rotational axis of symmetry and types of rotational axes. Planes of symmetry and types of planes. Improper rotational axis of symmetry. Inversion centre. Identity element. The symmetry operations of a molecule frm a group. F'lo chart for the identification of molecular point group.

2. Theory of quantitative analysis — 8 hrs ~~5hrs~~

a) Principles of volumetric analysis. Theories of acid-base, redox. complexometric. iodometric and precipitation titrations, choice of indicators for these titrations.

a) Principles of gravimetric analysis: precipitation. coagulation, peptization, coprecipitation, post precipitation, digestion, filtration and washing of' precipitate, drying and ignition, precipitation from homogenous solutions, requirements of gravimetric analysis.

3. Evaluation of analytical data. — 4 hrs ~~8 hrs~~

Theory of errors, idea of significant figures and its importance, accuracy -- methods of expressing accuracy, error analysis and minimization of errors, precision — methods of expressing precision, standard deviation and confidence limit.

UNIT IV

Introductory treatment to:

a) Pericyclic Reactions — 5 hrs ~~4 hrs~~

Concerted reactions, Molecular orbitals, Syrnrn'try properties HOMO. LUMO. Thermal and photochemical pericyclic reactions. Types of pericyclic reactions — electrocyclic, cycloaddition and sigmatropic reactions - one example each.

b) Synthetic strategies — 4 hrs ~~5 hrs~~

'Terminology — Disconnection •(dix), Symbol ( ). synthon. synthetic equivalent (St). Functional group interconvenrsion (FGI), Linear, C'onvergent and Conbinatorial syntheses, Target molecule TM, Retrosynthesis of the following molecules

1) acetophenone 2) cyclohexene 3) phenylethyibromide

c) Asymmetric (Chiral) synthesis — 4 hrs

1)etinitions- Asymmetric synthesis, enantiomeric excess. diastereomeric excess, stereospecific reaction, definition, example, dehalogenation of 1 .2-dibromides by I-, stereoselective reaction, definition, example, aci catalysed dehydration of I-. phenylpropanol.

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CHAIRMAN, Board of Studies in Chemistry, Dept. of Chemistry, Nagarjuna Govt. College

SEMESTER IV

IN ORGANIC CHEMISTRY

UNIT-I

1.Chemistry of d-block elements: Characteristics of d-block elements with special reference to electronic configuration, variable valence,' magnetic properties, catalytic properties and ability treatment of second and third transition series with their 3d analogues., Study of Ti,Cr and Cu traids in respect of electronic configuration and reactivity Of different oxidation states.

2.Chemistry of f-block elements: Chemistry of lanthanides — electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties, spectral properties and separation of lanthanides by ion exchange and solvent extraction methods. Chemistry of actinides — electronic configuration, oxidation states, actinide contraction. position of actinides in the periodic table, comparison with lanthanides in terms of magnetic properties. spectral properties and complex formation.

UNIT II

1.Theories of bonding in metals: Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Bond theory, formation of bands, explanation of conductors, semiconductors and insulators.

2.Metal carbonyls and related compounds — EAN ruie, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni. Metal nitrosyls and metallocenes (only ferrocene).

(PHYSICAL CHEMISTRY)

UNIT III

1. **Phase rule**

Concept of phase, components, degree of freedom. Derivation of Gibbs phase rule. Phase equilibrium of one component — water system. Phase equilibrium of two-component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, desilverisation of lead. Solid solutions-compound with congruent melting point- (Mg-Zn) system, cnpound with incongruent melting point- NaCl- water system. Freezing mixtures.

2. Dilute solutions

Colligative properties. Raoult's law, relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determination. Osmosis, osmotic pressure, experimental determination. Theory of dilute solutions. Determination of molecular weight of non-volatile solute from osmotic pressure. Abnormal colligative properties. Van't Hoff factor, degree of dissociation and association. 5 hrs

UNIT-IV

1). Electrochemistry

Specific conductance, equivalent conductance, measurement of equivalent conductance. Variation of equivalent conductance with dilution. Migration of ions,Kohlrausch's law. Arrhenius theory of electrolyte dissociation and its 1imtations1stwald's dilution law. Debye-Huckel-Onsagar's equation ofr ctrcrnu (elementary treatment only). Definition of transport number, determination by Hittorf's method. Applicat4on of conductivity measurements-determinatio;n of dissociation constant (Ka) of an acid. determination of solubility product of sparingly soluble salt, conductomeric titration. Types of reversible electrodes-the gas electrode, metal-metal ion, metal-insoluble salt and redox electrodes 8hrs

Electrode reactions, Nernst equation, single electrode potential, standard Hydrogen electrode, reference electrodes, standard electrode potential. sign, convention, electrochern ical series and its significance. 17 hrs

Reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Applications of EMF measurenients, Calculation of thermodynamic quantities of cell reactions (AG, AH and K). determination of p[I using quinhydrone electrode, Solubility product of AgCl. Potentionetric titrations..

LABORATORY COURSE –II

Practical Paper –II(Inorganic Chemistry) **90 hrs (3h/w)**

I. **Titrimetric analysis:**

1.Calibration of weights.

2. Determination of carbonate and bicarbonate in a mixture.

3. Determination of Fe (II) Using $K_2cr_2o_7$

4. Determination of Fe (II) using $KMNO_4$

5. Determination of Cu (II) using $Na_2s_2o_3$

6. Determination of Zn using EDTA

7. Determination of hardness of water

8. Determination of Zn by ferrocyanide

II. Gravimetric Analysis (Any three of following)

1. Determination of Barium as barium sulphate .
2. Determination of sulphate as barium sulphate .
3. Determination of lead as lead chromate.
4. Determination of nickel as Ni-DMG complex.
5. Determination of magnesium as magnesium pyrophosphate.

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		V SEMISTER **Organic Chemistry**	
	UNIT – I	**1. Nitrogen compounds** Nitro hydrocarbons: Nomenclature and classification – nitro hydrocarbons – structure. Tautomerism of nitroalkanes leading to aci and keto form. Preparation of Nitroalkanes. Reactivity – halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Michael addition and reduction. Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1^0, 2^0, 3^0 Amines and Quarternary ammonium compounds. Preparative methods -1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction (mechanism). 4. Reduction of Amides and Schmidt reaction. Physical properties and basic character – Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline – comparative basic strength of aniline, N-methylaniline and N,N-dimethyl aniline (in aqueous and non-aqueous medium), steric effects and substituent effects. Use of amine salts as phase transfer catalysts. Chemical properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation e) Reaction with Nitrous acid of 1^0, 2^0, 3^0 (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines – Bromination and Nitration. oxidation of aryl and 3^0 Amines. Diazotization Cyanides and isocyanides: Nomenclature (aliphatic and aromatic) structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation	**9hrs**
	UNIT-II	**1. Heterocyclic Compounds** Introduction and definition: Simple 5 membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring system – presence in important natural products like hemoglobin and chlorophyll. Numbering the ring systems	**5 hrs**

		as per Greek letter and Numbers. Aromatic character – 6- electron system (four-electrons from two double bonds and a pair of non-bonded electrons from the hetero atom). Tendency to undergo substitution reactions. Resonance structures: Indicating electron surplus carbons and electron deficient hetero atom. Explanation of feebly acidic character of pyrrole, electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions. Reactivity of furan as 1,3-diene, Diels Alder reactions (one example). Sulphonation of thiophene purification of Benzene obtained from coal tar). Preparation of furan, Pyrrole and thiophene from 1,4,- dicarbonyl compounds only, Paul-Knorr synthesis, structure of pyridine, Basicity – Aromaticity – Comparison with pyrrole – one method of preparation and properties – Reactivity towards Nucleophilic substitution reaction – chichibabin reaction. **2. Carbohydrates** Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structureal elucidation: Evidences for straight chain pentahydroxy aldehyde structure (Acetylation, reduction to n-hexane, cyanohydrin formation, reduction of Tollen's and Fehling's reagents and oxidation to gluconic and saccharic acid). Number of optically active isomers possible for the structure, configuration of glucose based on D-glyceraldehyde as primary standard (no proof for configuration is required). Evidence for cyclic structure of glucose (some negative aldehydes tests and mutarotation). Cyclic structure of glucose. Decomposition of cyclic structure (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). Different ways of writing pyranose structure (Haworth formula and chair conformationa formula). Structure of fructose: Evidence of 2 -- ketohexose structure (formation of penta	**6 hrs** **8 hrs**

		acetate, formation of cyanohydrin its hydrolysis and reduction by HI to give 2-Carboxy-nhexane). Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure and Haworth formula). Interconversion of Monosaccharides: Aldopentose to aldo hexose – eg: Arabinose to DGlucose, D-Mannose (Kiliani - Fischer method). Epimers, Epimerisation – Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose eg: D-glucose to Darabinose by Ruff'f degradation. Aldohexose (+) (glucose) to ketohexose (-) (Fructose) and Ketohexose (fructose) to aldohexose (Glucose)	
	UNIT -III	**1. Aminoacids and proteins** Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gama amino acids. Natural and essential amino acids – definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, valine and leucene) by following methods: a) from halogenated carboxylic acid b) Malonic ester synthesis c) strecker's synthesis. Physical properties: Optical activity of naturally occurring amino acids: L-configuration, irrespective of sign rotation, Zwitterion structure – salt like character - solubility, melting points, amphoteric character , definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups – lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins. **2. Mass Spectrometry**: Basic principles – Molecular ion / parent ion, fragment ions / daughter ions. Theory – formation of parent ions. Representation of mass spectrum. Identification of parent ion, (M+1), (M+2), base peaks (relative abundance 100%) Determination of molecular formula – Mass spectra of ethylbenzene, acetophenone, n-butyl amine and 1-proponal.	**5hrs** **5hrs**

UNIT-IV	**1.Reactivity of metal complexes:** 1. Labile and inert complexes, ligand substitution reactions – SN1 and SN2, substitution reactions of square planar complexes – Trans effect and applications of trans effect.	4hrs
	2. Stability of metal complexes: Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.	4 hrs
	2. HARD ~~CAN~~ AND SOFT ACIDS ,BASES (HSAB); **Classification, pearson's concept of hardness and softness, application of HSAB principles- stability of compounds/complexes, predicting the feasibility of reaction**	4 hrs
	4.Bio inorganic chemistry: Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride (Cl-). Metalloporphyrins – hemoglobin, structure and Function, Chlorophyll, structure and role in photosynthesis.	4hrs

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V - SEMESTER – CHEMISTRY SYLLABUS

Paper – 6th Paper

physical chemistry

Unit-I	**1. Chemical kinetics** Rate of reaction, factors influencing the rate of a reaction-concentration, temperature, pressure, solvent, light, catalyst. Experimental methods to determine the rate of reaction. Definition of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for time half change. Methods to determine the order of reactions. Kinetics of complex reactions (first order only): opposing reactions, parallel reactions, consecutive reactions and chain reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Theories of reaction rates- collision theory-derivation of rate constant for bimolecular reaction. The transition state theory (elementary treatment).	**9 hrs**
UNIT -II	**1. Photochemistry** Difference between thermal and photochemical processes. Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence. Quantum yield. Ferrioxalate actinometry. Photochemical hydrogen- chlorine, hydrogen-bromine reaction. Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing). Photosensitized reactions- energy transfer processes (simple example) **2. Thermodynamics -I** The first law of thermodynamics-statement, definition of internal energy and enthalpy. Heat capacities and their relationship. Joule's law-Joule-Thomson coefficient. Calculation of w, q, dU and dH for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. State function. Temperature dependence of enthalpy of formation-Kirchoff's equation.	**5 hrs** **6hrs**

UNIT -III	**Thermodynamics -II** Second law of thermodynamics. Different Statements of the law. Carnot cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature. Concept of entropy, entropy as a state function, entropy changes in cyclic, reversible, and irreversible processes and reversible phase change. Calculation of entropy changes with changes in V & T and P&T. Entropy of mixing inert perfect gases. Entropy changes in spontaneous and equilibrium processes. The Gibbs (G) and Hlmholtz (A) energies. A & G as criteria for thermodynamic equilibrium and spontaneity-advantage over entropy change. Gibbs equations and the Maxwell relations. Variation of G with P, V and T.	**10 hrs**
UNIT-IV	**Inorganic chemistry** **1. Coordination Chemistry:** IUPAC nomenclature, bonding theories – review of Werner's theory and Sidgwick's concept of coordination, Valence bond theory, geometries ofcoordination numbers 4-tetrahedral and square planar and 6-octahedral and its limitations, crystal filed theory, splitting of d-orbitals in octahedral, tetrahedral and square-planar complexes – low spin and high spin complexes factors affecting crystalfield splitting energy, merits and demerits of crystal-field theory. Isomerism in coordination compounds – structural isomerism and stereo isomerism, stereochemistry of complexes with 4 and 6 coordination numbers.	**10 hrs**
	5. Spectral and magnetic properties of metal complexes: Electronic absorption spectrum of $[Ti(H_2O)_6]^{3+}$ ion. Types of magnetic behavior, spin-only formula, calculation of magnetic moments, experimental determination of magnetic susceptibility – Gouy method.	**4 hrs**

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VI - SEMESTER – CHEMISTRY SYLLABUS

Paper – 7th Paper

Physico Chemical methods of analysis

Unit – I	**1. Separation techniques** 1. Solvent extraction: Principle and process, Batch extraction, continuous extraction and counter current extraction. Application – Determination of Iron (III) 2. Chromatography: Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, Rf values, factors effecting Rf values. a. Paper Chromatography: Principles, Rf values, experimental procedures, choice of paper and solvent systems, developments of chromatogram – ascending, descending and radial. Two dimensional chromatography, applications. b. Thin layer Chromatography (TLC): Advantages. Principles, factors effecting Rf values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications. c. Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation technique. Applications d. High Performance Liquid Chromatography (HPLC): Principles and Applications. e. Gas Liquid Chromatography (GLC): Principles and Applications	**10 hrs**
UNIT -II	**2. Spectrophotometry** General features of absorption – spectroscopy, Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert law for quantitative analysis of 1. Chromium in $K_2Cr_2O_7$ 2. Manganese in manganous sulphate 3. Iron (III) with thiocyanate. **2.Electronic spectroscopy:** Interaction of electromagnetic radiation with molecules and types of molecular spectra. Potential energy curves for bonding and antibonding molecular orbitals. Energy levels of molecules (ó,ð, n) . Selection rules for electronic spectra. Types of electronic transitions in molecules effect of conjugation. Concept of chromophore. **1. Infra red spectroscopy**	4 hrs **4 hrs** **4 hrs**

i) Aqueous phase reactions ii) Reactions in ionic liquids iii) Solid supported synthesis
iv) Solvent free reactions (solid phase reactions)
ii) Green catalysts: i) Phase transfer catalysts (PTC) ii) Biocatalysts
Microwave and Ultrasound assisted green synthesis:

1. Aldol condensation
2. Cannizzaro reaction
3. Diels-Alder reactions
4. Strecker synthesis
5. Willaimson synthesis
6. Dieckmann condensation

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VI - SEMESTER – CHEMISTRY SYLLABUS

Paper – 8th Paper

Drugs,Macromolecules,Material Science & Catalysis

Unit – I	**Drugs, ~~formulations~~** **1. Drugs** **1.** Introduction: Drug, disease (definition), Historical evolution, Sources – Plant, Animal synthetic, Biotechnology and human gene therapy **2.**Terminology:Pharmacy,Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors – brief teartment) Metabolites and Anti metabolites. **3.** Nomenclature: Chemical name, Generic name and trade names with examples **4.** Classification: Classification based on structures and therapeutic activity with one example each. **5.** Synthesis: Synthesis and therapeutic activity of the following drugs., L-Dopa, Chloroquin, Omeprazole, Albuterol and ciprofloxacin.	**11 hrs** 13
UNIT-II	**DRUG DEVLOPMENT-HIV -AIDS AND FOR ~~FR~~MULATIONS** **1. Drug Development**:- Pencillin, Separation and isolation, structures of different pencillins **2. HIV-AIDS**:-Immunity – CD-4 cells, CD-8 cells Retrovirus, replication in human body. Investigation available, prevention of AIDS. Drugs available – examples with structures: PIS: Indinavir (Crixivan), Nelfinavir (Viracept), NNRTIS: Efavirenz (Susrtiva), Nevirapine (Viramune) NRTIs: Abacavir (Ziagen), Lamivudine (Epivir, 3TC) Zidovudine (Retravir, AZT, ZDV) Monographs of drugs: Eg Paracetamol, Sulpha methoxazole (Tablets) **3. Formulations** Need of conversion of drugs into medicine. Additives and their role (brief account only). Different types of formulations	**7 hrs**
UNIT-III	**Macromolecules, and Super Conductivity** **1. Macromolecules** Classification of polymers, chemistry of polymerization, chain polymerization, step polymerization, coordination polymerization – tacticity. Molecular weight of polymersnumber average and weight average molecular weight, degree of polymerization, determination of molecular weight of polymers by viscometry, Osmometry	**10 hrs**

	UNIT-IV	and light scattering methods. Kinetics of free radical polymerization, derivation of rate law. Preparation and industrial application of polyethylene, PVC, Teflon, polyacrylonitrile, terelene and Nylon66. Introduction to biodegradability. **2. Super Conductivity** Superconductivity, characteristics of superconductors, Meissner effect, types of superconductors and applications. **1. Catalysis** Homogeneous and heterogeneous catalysis, comparision with examples. Kinetics of specific acid catalyzed reactions, inversion of cane sugar. Kinetics of specific base catalyzed reactions, base catalyzed conversion of acetone to diacetone alcohol. Acid and base catalyzed reactions- hydrolysis of esters, mutarotation of glucose. Catalytic activity at surfaces. Mechanisms of heterogeneous catalysis. Langmuir-Hinshelwood mechanism. Enzyme catalysis: Classification, characteristics of enzyme catalysis. Kinetics of enzyme catalyzed reactions-Michaelis Menton law, significance of Michaelis constant (K_m) and maximum velocity (V_{max}). Factors affecting enzyme catalysis- effect of temperature, pH, concentration and inhibitor. Catalytic efficiency. Mechanism of oxidation of ethanol by alcohol dehydrogenase. Nanomaterials- synthetic techniques, bottom-up-sol-gel method, top-down-electro ,deposition method. Properties and applications of nano-materials Composites-definition, general characteristics, particle reinforce and fiber reinforce composites and their applications.	**4 hrs** 12 **10 hrs** **4 hrs**

B.Sc. III Year

LABORATORY COURSE – III

Practical Paper – III (Organic Chemistry) 90 hrs (3 h / w)

1. Synthesis of Organic Compounds

i. Aromatic electrophilic substitution Nitration: Preparation of nitro benzene and p-nitro acetanilide, Halogenation: Preparation of p-bromo acetanilide – preparation of 2,4,6-tribromo phenol.

ii. Diazotization and coupling: Preparation of pheyl azo â-napthol

iii. Oxidation: Preparation of benzoic acid from benzoyl chloride

iv. Reduction: Preparation of m-nitro aniline from m-dinitro benzene

v. Esterfication: Preparation of methyl p-nitro benzoate from p-nitro benzoic acid.

vi. Methylation: Preparation of â-napthyl methyl ether

Condensation: Preparation of benzilidine aniline and Benzoyl aniline.

2. Thin layer Chromatography & Column Chromatography

i. Preparation of the TLC plates. Checking the purity of the compounds by TLC: Acetylation of salicyclic acid, aniline, Benzoylation of Aniline and Phenol

Determination of Rf values and identification of organic compounds by TLC: preparation and separation of 2,4-dinitrophenyl hydrazones of acetione and 2-butanone using toluene and light petroleum(40:60)

ii. Separation of ortho & para nitro aniline mixture by column chromatography

3. Organic Qualitative Analysis:

i. Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

ii. Separation of two component mixtures

1) Aniline + Naphthalene 2) Benzoic acid + Benzophenone 3) p-Cresol + Chlorobenzene.

4. Demonstration experiments:

1. Steam distillation experiment: separation of ortho and para nitro phenols 2) Microwave assisted Green synthesis, two examples: 1. Hydrolysis of Benzamide 2. Oxidation of Toluene

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LABORATORY COURSE - IV

Practical Paper IV (Physical Chemistry) 90hrs (3 h / w)

1. Chemical kinetics

i. Determination of specific reaction rate of the hydrolysis of methyl acetate catalyzed by hydrogen ion at room temperature.

ii. Determination of rate of decomposition of hydrogen peroxide.

iii. Determination of overall order of saponification of ethyl acetate

2. Distribution law

i. Determination of distribution coefficient of iodine between water and carbon Tetrachloride.

ii. Determination of molecular status and partition coefficient of benzoic acid in Toluene and water.

3. Electrochemistry

i. Determination of concentration of HCl conductometrically using standard NaOH solution.

ii. Determination of concentration of acetic acid conductometrically using standard NaOH solution.

iii. Determination of dissociation constant (K_a) of acetic acid by conductivity measurements.

iv. Determination of solubility and solubility product of $BaSO_4$.

v. Determination of redox potentials of $Fe^{2+}/Fe^{3+}$by potentiometric titration of ferrous ammonium sulphate vs. potassium dichromate.

4. pH metry

i. Preparation phosphate buffer solutions

ii. pH metric titration of weak acid, acetic acid with strong base NaOH and calculation of dissociation constant.

5. Colorimetry

i. Verification of Beer-Lambert law for $KMnO_4$, $K_2Cr_2O_7$ and determination of concentration of the given solution.

ii. Verification of Beer-Lambert law for $CuSO_4$ and determination of concentration of the given solution.

iii. Composition of complex of Cu^{2+} - EDTA disodium salt

6. Adsorption

i. Surface tension and viscosity of liquids.

ii. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.