Pragna. Patil

Davangere University
Shivagangotri, Davangere-577 002

GRADUATE PROGRAMME
Bachelor of Science (B.Sc.)
Semester Scheme

Subject: CHEMISTRY

I-SEMESTER

(4 Hours of Teaching per Week)

Course Code: (Chem.Core: I-3) FUNDAMENTALS OF CHEMISTRY

Section A: Inorganic Chemistry

Module-1: Atomic Structure

(12 Hours)

Recapitulation of dual nature of matter and radiation. Heisenberg's uncertainty principle, need for new approach to atomic structure. Davison-Germer's experiment, Time independent Schrodinger wave equation for hydrogen atom in Cartesian coordinates (no derivation), need for polar coordinates, transformation of Cartesian coordinates into polar coordinates, significance of ψ and ψ^2, Eigen values and Eigen functions, concept of atomic orbital, radial and angular wave functions, explanation for radial probability distribution curves of 1s, 2s, 3s, 2p and 3p orbitals, node and nodal surface, dependence of angular wave function on quantum numbers, assigning quantum numbers to a given electron in an atom up to atomic number 36, sign of angular wave function, energy level diagram for hydrogen and multi-electron atoms, electronic configuration of elements for 3d and 4d series, exchange energy and its importance in electronic configuration, effective nuclear charge, screening (or shielding) effect, factors affecting shielding effect, Slaters's rules (problems to be solved) and their limitations.

Module-2: Periodic Properties

(5 Hours)

Atomic, covalent, van der Waal's and ionic radii, anomalies in covalent radius, calculation of covalent and ionic radii (Lande's method); Bond energy and its calculation, factors affecting the magnitude of bond energy; Ionization energy, anomalies in ionization energies; Electron gain enthalpy, anomalies in electron gain enthalpy, application of ionization energy and electron gain enthalpy, Electronegativity, anomalies in electronegativity, applications of electronegativity, Pauling and Mulliken's scale of electronegativity.

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Module-3: s-Block Elements **(3 Hours)**

Hydrogen – ortho and para hydrogens, definition, differences in physical propertries. Alkaline earth metals: comparative study of properties – electronic configuration, hydration of ions, electropositive character, flame colouration, oxidation potentials, amphoteric and basic nature, anomalous properties of Be, diagonal relationship between Be and Al.

Section B: Organic Chemistry

Module-1: Classification and Nomenclature of Organic Compounds (4 Hours)

Classification of organic compounds based on structure and based on functional group with examples for each type. Trivial system of naming and its limitations, IUPAC system of nomenclature of organic compounds (open chain compounds only) – covering the main functional groups (alkanes, alkenes, alkynes, alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines and polyfuctional compounds).

Module-2: Purification and Characterization of Organic Compounds (4 Hours)

Crystallization – simple and fractional; Sublimation; Distillation – simple, fractional, azeotropic, vacuum or under reduced pressure, steam; Solvent extraction - batch and continuous, advantages, continuous solid-liquid extraction by soxlhlet apparatus; Estimation of sulphur, phosphorus and halogens in organic compounds (numerical problems to be solved).

Module-3: Reactive Intermediates **(4 Hours)**

Concept of hybridization of carbon (sp^3, sp^2, sp), cleavage of a covalent bond, - homolysis and heterolysis, electronic effects – inductive, hyperconjugation, resonance and electrometric, reactive intermediates: free radicals, carbocations, carbanions – formation, structure and stabilities in each case.

Module-4: Reaction Mechanisms **(8 Hours)**

Types of reactions; *Substitution* – free radical (chlorination of ethane), electrophilic (Friedel-Crafts reaction), nucleophilic (S_N^1 - Reaction of $(CH_3)_3Cl$ with NaOH and S_N^2 - reaction of CH_3Cl with NaOH), *Addition* - free radical (addition of HBr to ethene in presence of peroxide, anti - Markownikoff's addition i.e., Kharash effect to be mentioned), electrophilic (addition of HCl to propene, Markownikoff's rule to be mentioned), nucleophilic addition (addition of HCN to aldehydes), *Elimination* - E1 (ter-butylbromide) and E2 reactions (n-propylbromide).

Section C: Physical Chemistry

Module-1: Colligative Properties

(10 Hours)

Expressions for cocentrations of solids in liquid – normality, molarity, molality, mole fraction, parts per million (ppm), percentage (mass/volume); Raoult's law, relationship between relative lowering of vapour pressure and molecular mass of a solute to be derived; Elevation in boiling point and its relationship to lowering of vapour pressure and molecular mass – to be derived, determination of molecular mass of non volatile solute by Walker Lumsden method; Depression in freezing point – its relationship to lowering of vapour pressure and molecular mass – to be derived, determination of molecular mass of solute by Beckman's method; Osmotice pressure – determination of osmotic pressure by Berkeley and Hartley's method; Isotonic solutions, Reverse osmosis, Plasmolyis, Abnormal molecular mass – van't Hoff's factor – degree of association and dissociation (their relationship with van't Hoff factor to be derived). Problems to be solved with respect to all the colligative properties.

Module-2: Gases

(10 Hours)

Expression for Maxwell distribution of molecular speeds (no derivation), Collision diameter, collision number, collision frequency, mean free path, molar heat capacities of ideal gases - C_v and C_p, effect of temperature on the disribution of molecular speeds, Boltzmann factor and its importance, C_p/C_v ratios for ideal gases, types of molecular velocities and their derivation from Maxwell distribution law, energy distribution as a function of temperature, relationship between most probable velocity, average velocity and root mean square (rms) velocities (Problems to be solved), principle of equipartition of energy.

Critical Phenomena: Real gases, deviation of real gases from ideal behavior, Boyle point and Boyle temperature, PV isotherms of CO_2 (Andrews experiment), relationship between critical constants and van der Waal's constants (derivation), experimental determination of critical constants, reduced pressure, temperature and volume, reduced equation of states, law of corresponding states (Problems to be solved).

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Subject: CHEMISTRY

I-SEMESTER

(3 Hours of Teaching per Week)

Course Code: (Chem.Pr: I-1) VOLUMETRIC ANALYSIS

1. Calibration of pipette, burette and standard flask.
2. Preparation of standard solution of potassium biphthalate, standardization of NaOH solution and estimation of HCl or H_2SO_4.
3. Preparation of standard solution of oxalic acid, standardisation of $KMnO_4$ solution and estimation of Mohr's salt solution.
4. Preparation of standard solution of $ZnSO_4$, standardization of EDTA solution and estimation of Mg.
5. Preparation of standard solution of $ZnSO_4$, standardization of EDTA solution and estimation of hardness in water.
6. Estimation of calcium via calcium oxalate method.
7. Preparation of standard solution of sodium carbonate, standardization of HCl and estimation of sodium carbonate and sodium bicarbonate mixture by Wardens' method.
8. Preparation of standard solution of Mohr's salt, standardization of $K_2Cr_2O_7$ solution and estimation of $FeCl_3$ solution (diphenyl amine indicator).
9. Preparation of standard solution of potassium dichromate, standardization of sodium thiosullphate solution and estimation of copper in copper sulphate solution.
10. Estimation of available chlorine in bleaching powder.

Note: The student has to write a brief procedure for an experiment other than the experiment which is set for the examination, during the first fifteen minutes in the practical examination.

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Subject: CHEMISTRY

II-SEMESTER *(4 Hours of Teaching per Week)*

Course Code: (Chem.Core: II-3) **CONCEPTS OF CHEMISTRY**

Section A: Inorganic Chemistry

Module -1: Ionic Bond mixture *(5 Hours)*

Recapitulation. Lattice Energy, Factors Affecting Lattice Energy, Derivation of Born-Lande Equation and Madelung Constant (Problems to be Solved), Ionic Size and Hydration Energy. Importance of Lattice Energy and Hydration Energy in the Context of Stability and Solubility of Ionic Compounds, Polarization, Polarizing Power and Polarisability of Ions, Fajan's Rules.

Module -2: Covalent Bond *(15 Hours)*

Recapitulation: Formation of Hydrogen Molecule, Potential Energy-inter Nuclear Distance Curve, Polar and Non-polar Bonds, Bond Moment and Dipole Moment – Definition and Explanation of Dipole Moments in Diatomic Molecules - Homo and Hetero (H_2, O_2, Cl_2, Hydracids of Halogens), Polyatomic Molecules (CO_2, H_2O, BF_3, NH_3, CH_4 and CH_3Cl), Electronegativity Difference and Variation of Percentage Ionic Character in Covalent Compounds (Problems to be Solved) – Pauling Method, Hanny-Smyth Method, Dipole Moment Method.

Hybridisation and VSEPR Theory: Hybridisation, Geometry and Bond Angle in ClO_4^-, CO_3^{2-}, PCl_5, ClF_3, I_3^-, SF_6, IF_5; Odd Electron Bond (NO, NO_2)

Resonance: Concept of Resonance, Resonance Energy, Calculation of Resonance Energy, Rules for Writing Contributing Resonance Forms, Resonance Structures of CO_2, NO_3^-, SO_2, and SO_3.

Molecular Orbital Theory: Energy Levels of Molecular Orbitals, Rules for Filling Molecular Orbitals, Molecular Orbital Structure for CO, NO, NO^+ (Difference in Atomic Energy Levels of the Hetero Atoms to be Shown) - Writing up of Molecular Orbital Configuration, Prediction of Stability, Bond Order and Magnetic Properties.

Compounds of Noble Gases: Structure and Geometry of – XeF_4, XeF_6, XeO_3, $XeOF_4$

Section B: Organic Chemistry

Module -1: Open Chain Compoupds mixture *(12 Hours)*

Alkanes: Methods of Preparation - Kolbe's Synthesis (Mechanism), Corey-House Synthesis, Isomerism in Alkanes (Upto C-5)

Alkenes: General Methods of Preparation - Dehydration of Alcohols (Mechanism), Dehydrohalogenation of Alkyl Halides; Relative Stabilities of Substituted Alkenes, Ozonolysis of Alkenes and its Importance in Detecting the Position of Double Bond, Oxidation with $KMnO_4$, Hydroboration of Alkenes.

Dienes: Nomenclature and Classification, Synthesis of Butadiene from – Alkanes, Acetylene and Ethanol, Addition of Bromine to 1,3-Butadiene (1,2 Addition and 1,4 Addition with Mechanism), Diel's Alder Reaction with Mechanism.

Alkynes: General Methods of Preparation - Dehydrohalogenation of Vicinal and Geminal Dihalides and Higher Alkynes from Terminal Alkynes, Acidity of Alkynes, Mechanism of Addition of HCl to Ethyne.

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Module -2: Cyclic Compounds (8 Hours)

Homocyclic: (a) Alicyclic – Stabilities of Cycloalkanes (C-3 to C-7) Based on Enthalpy of Combustion Values, Baeyers Strain Theory (Calculation of Angle Strain), Sasche - More Theory of Conformations of Cyclohexane,

(b) Aromatic - Arenes and Aromaticity, Structure of Benzene, Resonance, Molecular Orbital Structure, Huckel's Rule of Aromaticity, Orienting Influence on Aromatic Substitution - Activating and Deactivating Substituents, Resonance Structures of Naphthalene and Anthracene. (5 hrs)

Heterocyclic: Classification and Nomenclature of Furan, Thiophene, Pyrrole and Pyridine. Chemical Properties of Pyrrole and Pyridine - Comparison of Baicity and Aromaticity of Pyrrole and Pyridine. (3 hrs)

Section C: Physical Chemistry

Module -1: Chemical Kinetics (7 Hours)

Recapitulation: Second Order Reaction, Differential and Integrated Rate Equations when a=b and $a \neq b$. Determination of Rate Laws (Half Life and Integration Method). Determination of Rate Constant of Saponification of Ethyl Acetate. Collision Theory of Reaction Rates. Steric Factor, Activated Complex. Lindemann's Hypothesis for Unimolecular and Bimolecular Reactions. Experimental Determination of Rate Constant for the Inversion of Cane Sugar Using Polarimeter. Parallel Reactions (Eg. Oxidation of HI by H_2O_2), Consecutive Reactions (Decomposition of Diethyl Ether in Gaseous Phase). Reversible or Opposing Reactions (Reaction Between CO and NO_2, Isomerisation of Ammonium Cyanate).

Module- 2: Liquid Mixtures (7 Hours)

Partially Miscible Liquids – CST of Phenol – Water System, Triethyl Amine – Water System and Nicotine Water System. Effect of Impurity on CST. Determination of CST of Phenol – Water Systems Experimentally.

Completely Miscible Liquids – Vapour Pressure – Composition and Boiling Point – Composition Curves for Nearly Ideal Solutions – Applications in Fractional Distillations. Azeotropic Mixtures – Definition and Examples (Ethanol – Water System, HCl – Water System).

Completely Immiscible Liquids – Principle Steam Distillation, Determination of Molecular Mass.

Module -3: Surface Chemistry (6 Hours)

Introduction - Factors Affecting Absorption by Solids from Solutions - Positive and Negative Absorptions - Effects of Dissolved Substances on the Surface Tension of a Solvent - Gibb's Adsorption Equation (No Derivation) – Applications - Adsorption Isobars – Physisorption and Chemisorption - Adsorption Indicators – Applications, Surface Films on Liquids (Electro Kinetic Phenomena) - Catalytic Activity at Surface, Active Agents and Electro Catalysis.

Subject: CHEMISTRY

II-SEMESTER (3 Hours of Teaching per Week)

Course Code: (Chem.Pra: II-2) ORGANIC QUALITATIVE ANALYSIS

Semi Micro Qualitative Analysis of Organic Compounds - The Following Compounds may be given for the Analysis:

(i) Urea,
(ii) Glucose,
(iii) Aniline,
(iv) Toluidine,
(v) Benzoic Acid,
(vi) Salicylic Acid,
(vii) Cresol,
(viii) Benzaldehyde,
(ix) Acetophenone,
(x) Benzyl Alcohol,
(xi) Toluene,
(xii) Chlorobenzene,
(xiii) Nitrobenzene,
(xiv) Benzamide and
(xv) Acetanilide.

***Note:** The students have to write any two chemical reactions, name of the compound by referring to the literature, the structural formula and should prepare solid derivative.*

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2020-21

DEPARTMENT OF CHEMISTRY
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SYLLABUS FOR III SEMESTER

PAPER: 3 TOTAL NO OF LECTURE HOURS: 50 4hrs/week

INORGANIC CHEMISTRY

Module 1: p-block elements and their compounds 8hrs

Structural aspects: Boron-BF_3-(electron acceptation property), **Boranes**(diborane 3-centered -2 electron bond), carboranes, borazines,phosphazines(wades rules).
Halogens: Basic properties of Iodine(evidences), pseudo-halogens and pseudo-halides: comparison with halogens.
Inter-halogen Compounds:(types and examples)clathrates, ultrameranines, Maddrell's salt, Koroll's salt.

Module2: Corrosion and its control 2 hrs

Types, mechanism of oxidation corrosion, corrosion control - cathodic protection

Module3: Bio-Inorganic chemistry 5hrs

Essential, non essential and trace elements in biological processes.Macro and micro nutrients.Role of metal ions in biological system.**Iron-** function of heme and globin, **zinc-** role of carbonic anhydrase and carboxy peptidase. **Magnesium**in chlorophyll.**Molybdenum-** role of nitrogenise.

Module4:Analytical skills 5hrs

Quantitative Analysis: Precession,accuracy, types of errors, average, standard and relative deviation, Q-test, t-testand F-test (problemsto be solved).
Organic reagents in inorganic quantitative analysis: Advantages and disadvantages of organic reagents in inorganic analysis, use of Nitron, Rhodamine-B, Oxine, DMG, EDTA, Alizarin-S (structures).

ORGANIC CHEMISTRY

Module 5: Organic Compounds containing Halogens 4 hrs

Alky halides: Classification, stereochemistry and effects of solvent on S_N^1,S_N^2. E_1 and E_2 reactions (mechanisms).**Alky halides:** Nucleophilic substitution of arly halides (Ex: Chlorobenzene), relative relatives of alkyl, vinyl, alkenyl, aryl and arakyl halides.**Alky halides:**Reactions of side chain and aromatic ring (Ex. Benzyl chloride).

Module 6: Organic Compounds containing oxygen-I 5hrs

Alcohols: Monohydric alcohols- esterification (mechanism).

Dihydric alcohols: Preparation of glycol from alkenes, chemical reaction of vicinal glycols, oxidative cleavage (using lead tetra acetate and per-iodic acid), pinacol-pinacolone rearrangement (mechanism)
Trihydric alcohols: Manufacture of glycerol from spent lye and molasses, synthesis from propene, reaction of glycerol with Na, oxalic acid, esterification of glycerol with fatty acids.

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Module 7: Phenols 3 hrs

Classification, Acidity of phenols, resonance stabization of phenol and phenoxide ion, effect of substitution on the acidity-electron withdrawing substituents (-NO_2,-Cl,-CN, -CHO and –COOH), electron releasing substituents (-CH_3, –OCH_3 and -NH_2), reactions of phenols – Claisen rearrangement, Gatterman synthesis and Reimer –Tiemann reactions (with $CHCl_3$) with mechanisms.

Module8: Diazo compounds3hrs

Diazo methane: Methods of preparation by Becker et all synthesis, reactions of diazo methane-methylation of carboxylic acids, methylation of aldehydes.
Diazonium chloride: Preparation with mechanism, reactions; and constitution of benzene daizonium chloride.

PHYSICAL CHEMISTRY

Note: *(Numerical problems should be worked out where ever necessary)*

Module 9: Phase equillibria 4 hrs

Gibb's phase rule: Definition and meaning of the terms, problems, differences between system in equilibrium, true and metastable equilibrium. Phase equilibrium of water, sulphur system and KI-water system. Congruent melting point and peritectic reaction.Freezing mixture - essential features and examples.

Module 10: Electrochemistry-I 9hrs

Recapitulation of the terms involved. Debye-Huckel theory of strong electrolytes.Relaxation and electrophoretic effects.Debye-Huckel-Onsager equation.
Transport number: Expression of transport number of ions in terms of velocity, factors fluencing transport number, determination by Hitorf's method using attackble and non attackble electrodes, relationship between Ionic conductance and transport number(derivation),problems.
Principles involved in the conductometric titration: NaOH><HCl, CH_3COOH><NaOH, HCl+CH_3COOH><NaOH, KCl><$AgNO_3$, advantages of conductometric titration.

Module 11: Liquid crystals 2 hrs

Definition, types, examples and uses. Swarm theory of liquid crystals.

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Syllabus for Practical in Chemistry

III Semester **Practical – III** **3 hrs /week**

Systematic semi micro qualitative analysis of salt mixtures for two acid radicals and two basic radicals. The following radicals may be chosen.

Acid radicals: CO_3^{2-}, HCO_3^-, SO_3^{2-}, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, BO_3^{3-}, CH_3COO^-, $C_2O_4^{2-}$

Basic radicals: Pb^{2+}, Bi^{3+}, Cd^{2+}, Fe^{2+}, Al^{3+}, Zn^{2+}, Mn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, Na+, K^+ and NH_4^+

Note: The students have to write the chemical equation for the confirmatory tests for basic radicals identified and write the systematic procedure for the analysis.

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2020 - 21

SYLLABUS FOR IV SEMESTER

PAPER: 4 TOTAL NO OF LECTURE HOURS: 50 4hrs/week

INORGANIC CHEMISTRY

Module 1: Metallurgy and alloys 5hrs

Extraction of Nickel (pentlandite), Manganese (pyrolusite), Titanium (Ilamanite) and their alloys indicating their influence in the properties of steel, Uranium (Pitch Blende)
Purpose of making alloys. Manufacture of ferrochrome alloy.

Module 2: Industrial chemistry-I 5 hrs

Glass: Manufactures by tank furnace, composition and uses of soda, flint, optical, borosilicate and safety glasses. Coloured glasses.
Cement: Setting of cement.
Paint: Requisites, constituents and functions.
Propellants and explosives: Classification, characteristics and requisites. (Composition of nitroglycerin dynamite and RDX)

Module 3: Non-aqueous solvents 5 hrs

Coorination model of solvent, characteristics of ammonia and sulphur dioxide as solvents, advantages, comparative study of chemical reactions: Acid-Base neutralization, redox reaction metathetical reactions. Behavior of ammonia in KNH_2, NH_4Cl, acetic acid, acetamide and sodium-electrical properties. Comparison in the behavior of H_2O and ammonia.

Module 4: Chromatographic skills 5 hrs

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Introduction : *Paper chromatography*-principle, R_f value(problems), separation of IV group basic radicals, separation of D-glucose, D-xylose and lactose; *Column chromatography*- principle and techniques, separation of methylene blue and malachite green on alumina. *Thin layer chromatography* – principle and techniques, separation of carbohydrates and amino acids,
HPLC -characteristics, principle, instrumentation, application in forensic toxicology.

ORGANIC CHEMISTRY

Module 5: Organic compounds containing oxygen – II 8 hrs

Aldehydes andKetones: Structure and reactivity of carbonyl group, mechanism of aldol condensation, perkin'sreaction , benzoin condensation, Knoevenagel condensation reactions.

Carboxylic acids: Mono and dicarboxylic acids, acidityof carboxylic acids, effect of substitutes on the acidity: *nature of substituent*(+I group: formic acid, acetic acid, propanoicacid), (-I group: fluoro, chloro, bromo andiodoacetic acid), (acetic acid and benzoic acid), *Position of subsituent*(butanoic acid, 2-cholorobutanoic acid and 3-cholorobutanoic acid), *number of substituents*(acetic acid, chloroacetic acid, dichloroacetic acid and trichloroacetic acid) - pK_avalues to be analysed. Effect of heat on α, β, γ – hydroxy acids.

Derivatives of Carboxylic acids: Preparation and reaction of acid chlorides, acid amides, and acid anhydrides. (Blow up *Acid chloride:* preparation using $SOCl_2$ and PCl_5, reactions: hydrolysis, alcoholysis, ammonolysis, reduction. Preparation of alkyl amides, acetic anhydride and Friedel-craft's reaction. *Acid amides:* Preparation from acetyl chloride and acetic anhydride, chemical stability to resonance-basic and acidic character, reactions: hydrolysis, reduction, and dehydration, reaction with nitrous acid. *Acid anhydrides:* preparation from carboxylic acid and sodium salts of carboxylic acids. reactions: hydrolysis, alcoholysis, reduction and Friedel- craft's reaction).

Module 6: Organic compounds containing nitrogen 7 hrs

Amines: Classification with examples, synthesis of amines by reduction of nitro compounds. Hoffmann's degradation method with mechanism, Basic property of amines – comparative study of – (1) methyl amine, dimenthyl amine and trimethyl amine, (2) methyl amine and aniline, p-nitro aniline and p-toluidine, (3) aniline, p-nitro aniline and p-toluidine, (4) aniline, N-methyl aniline and N, N-dimethyl aniline. Separation of mixture of amines by Heinseberg's method.

Amino acids and proteins: Classification, methods of synthesis (pthallimide, malonic ester and Strecker synthesis). ***Peptides:*** Carbobenzoxy method of synthesis. ***Proteins:*** Primary and secondary structures of proteins, denature of proteins.

PHYSICAL CHEMISTRY

Note: *(Numerical problems should be worked out where ever necessary)*

Module 7: Electrochemistry - II 10 hrs

Recaptulation:- Convention for the representation of galvanic cell(Daniel cell), electromotive force – definition, determination of emf by using potentiomater. Standard cell- definition, construction and working of Weston-Cadmium cell. Reference electrode- definition, construction and working of calomel electrode and glass electrode. Liquid junction potential- definition and significance. Concentration cells- definition, types.

Application of emf measurements: Determination of p^H of a solution using glass electrode, determination of solubility of sparingly soluble salt(AgCl), potentiometric titrations- definition, advantages, potentiometric titration of (i) redox reaction(FAS><$K_2Cr_2O_7$) and (ii) precipitation reaction ($AgNO_3$><KCl).

Batteries- primary and secondary cells, construction, working and electrode reactions of dry cells, Lead-Acid battery, fuel cells- construction and working of hydrogen-oxygen fuel cell.

Module 8: Solid state chemistry 5Hrs

Definition of the terms crystal lattice, unit cell, lattice points. Laws of Crystallography- 1) Law of constancy of interfacial angles, 2) Law of rationality of indices and 3) Laws of symmetry.

Elements of symmetry- plane, axis and centre of symmetry, Bravais lattice, Weiss and Miller indices and calculation. Bragg's equation (X-ray diffraction) to be derived. Determination of structure of NaCl by X-ray diffraction studies. Isomorphism and its properties (to be mentioned).

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Syllabus for Practical in Chemistry

IV Semester

Practical – IV

3 hrs /week

Physical Chemistry Experiments (Non – instrumental)

1. (a) Determination of distribution coefficient of benzoic acid between benzene and water.
   (b) Determination of distribution coefficient of iodine between CCl_4 and water.
2. Chromatographic separation of Cu^{2+}, Ni^{2+} and Fe^{3+} by paper chromatography and determination of R_f value.
3. Separation of amino acids by thin layer chromatography / column chromatography and determination of R_f value.
4. Determination of density and viscosity of the given liquid using specific gravity bottle and Ostwald viscometer.
5. Determination of density and surface tension of the given liquid using specific gravity bottle and stalagmometer.
6. Determination of molecular mass by Walker-Lumbsden method.
7. Determination of percentage composition of a binary mixture by viscosity method.
8. Determination of rate constant of decomposition of H_2O_2 catalysed by Fe^{3+}.
9. Determination of rate constant of decomposition of saponification of ethyl acetate.
10. Determination of percentage of electrolyte in phenol-water system by miscibility temperature method.
11. Determination of transition temperature of the salt hydrate.
12. Determination of critical solution temperature of phenol-water system.

Note: during the first fifteen minutes at the practical examination, students have to write brief procedure for an experiment other than the experiment which is set for the examination.

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Appróved by the BOS:

Chairman: Prof. Chimatadar

Members:

1. Prof. Govindaraja Reddy
2. Prof. Dr. J.B. Raj
3. Prof. B.S. Usha
4. Prof.

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DAVANGERE UNIVERSITY

Department of Chemistry UG Studies, Shivagangothri, Davangere - 577002

Subject: Chemistry

Syllabus: CBCS - Core

2016 - 17 Onwards

Coures code,Course titles, Teaching hours Allocation of Marks and Credits.

Course No	Course code	Sem	Titles of the Course	Work load	IA - Marks	Theory/ Practical Marks	Total	Credits
1	Core:1.1 Chemistry Code:16SA-76	I	Fundamentals of Chemistry	4	20	80	100	4
	Che Practical:1.1		Practical -I Trimetry	3	10	40	50	3
2	Core:2.2 Chemistry Code:16SB-76	II	Basic concepts in Chemistry	4	20	80	100	4
	Che Practical:2.2		Practical -II Qualitive analysis of organic compounds	3	10	40	50	3
3	Core:3.3 Chemistry Code:16SC-76	III	Selected topics in Chemistry -I	4	20	80	100	4
	Che Practical:3.3		Practical -III Qualitive analysis of Inorgani compounds	3	10	40	50	3
4	Core:4.4 Chemistry Code:16SD-76	IV	Selected topics in Chemistry -II	4	20	80	100	4
	Che Practical:4.4		Practical -IV Physical Chemistry Non Electrical Expt.	3	10	40	50	3
5	Core:5.5 Chemistry Code:16SE-76	V	Modren concept of Chemistry -I	3	20	80	100	3
	Che Practical:5.5		Practical -V Gravimetry.	3	10	40	50	3
6	Core:5.6A Chemistry Code:16SEA-76	VI-A	Applied Chemistry -I	3	20	80	100	3
	Che Practical:5.6A		Practical -VIA Organic Preparation & Estimation.	3	10	40	50	3
6	Core:5.6B Chemistry Code:16SEB-76	VI-B	Chemistry elective	3	20	80	100	4
	Che Practical:5.6B		Practical -VIB Chemistry-elective experiments.	3	10	40	50	3
7	Core:6.7 Chemistry Code:16SF-76	VII	Modren concept of Chemistry -II	3	20	80	100	3
	Che Practical:6.7		Practical -VII Physical chemistry Experiments. (Electrical & Instrumental)	3	10	40	50	3
8	Core:6.8 Chemistry Code:16SF-76	VIII	Applied Chemistry -II	3	20	80	100	3
	Che Practical:6.8		Practical -VIII Analytical Method.	3	10	40	50	3
			TOTAL:	28T-2 4P	240	960	1200	52

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CHAIRMAN 26.12.16
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2020-21

SYLLABUS FOR III SEMESTER

PAPER: 3 | TOTAL NO OF LECTURE HOURS: 50 | 4hrs/week

INORGANIC CHEMISTRY

Module 1: p-block elements and their compounds — 8 hrs

Structural aspects: Boron-BF_3 (electron acceptation property). **Boranes** (diborane 3-centered -2 electron bond), carboranes, borazines, phosphazines (wades rules).

Halogens: Basic properties of Iodine (evidences), pseudo-halogens and pseudo-halides: comparison with halogens.

Inter-halogen Compounds: (types and examples) clathrates, ultrameranines, Maddrell's salt, Koroll's salt.

Module2: Corrosion and its control — 2 hrs

Types, mechanism of oxidation corrosion, corrosion control - cathodic protection

Module3: Bio-Inorganic chemistry — 5 hrs

Essential, non essential and trace elements in biological processes. Macro and micro nutrients. Role of metal ions in biological system. **Iron**- function of heme and globin,coordination environment of haemoglobin **zinc**- role of carbonic anhydrase and carboxy peptidase. **Magnesium** in chlorophyll. **Molybdenum**- role of nitrogenase.

Module4: Analytical skills — 5 hrs

Quantitative Analysis: Precession, accuracy, types of errors, average, standard and relative deviation, Q-test, t-testand F-test (problemsto be solved).

Organic reagents in inorganic quantitative analysis: Advantages and disadvantages of organic reagents in inorganic analysis, use of Nitron, Rhodamine-B, Oxine, DMG, EDTA, Alizarin-S (structures).

ORGANIC CHEMISTRY

Module 5: Organic compounds containing halogens — 4 hrs

Alkyl halides: Classification, stereochemistry and effects of solvent on S_N^1,S_N^2. E_1 and E_2 reactions (mechanisms). **Aryl halides:** Nucleophilic substitution of arly halides (Ex. Chlorobenzene), relative relatives of alkyl, vinyl, alkenyl, aryl and arakyl halides. **Aralkyl halides:** Reactions of side chain and aromatic ring halogenations & oxidation.(Ex. Benzyl chloride).

Module 6: Organic compounds containing oxygen-I — 5 hrs

Alcohols: Monohydric alcohols- esterification (mechanism).

Dihydric alcohols: Preparation of glycol from alkenes, chemical reaction of vicinal glycols, oxidative cleavage (using lead tetra acetate and per-iodic acid), pinacol-pinacolone rearrangement (mechanism)

Trihydric alcohols: Manufacture of glycerol from spent lye and molasses, synthesis from propene, reaction of glycerol with Na, oxalic acid, esterification of glycerol with fatty acids, explosives – TNG and cordite.

Module 7: Phenols — 3 hrs

Classification, Acidity of phenols, resonance stabization of phenol and phenoxide ion, effect of substitution on the acidity-electron withdrawing substituents ($-NO_2$,-Cl,-CN, -CHO and –COOH), electron releasing substituents ($-CH_3$, $-OCH_3$ and $-NH_2$), reactions of phenols – Claisen rearrangement, Gatterman synthesis and Reimer –Tiemann reactions (with $CHCl_3$) with mechanisms.

Module8: Diazo compounds — 3 hrs

Diazo methane: Methods of preparation by Becker et all synthesis, reactions of diazo methane-methylation of carboxylic acids, methylation of aldehydes.
Diazonium chloride: Preparation with mechanism, reactions; and constitution of benzene daizonium chloride.

PHYSICAL CHEMISTRY

Note: *(Numerical problems should be worked out where ever necessary)*

Module 9: Phase equillibria — 4 hrs

Gibb's phase rule: Definition and meaning of the terms, problems, differences between system in equilibrium, true and metastable equilibrium. Phase equilibrium of water, sulphur system and KI-water system. Congruent melting point and peritectic reaction. Freezing mixture - essential features and examples.

Module 10: Electrochemistry-I — 9 hrs

Recapitulation of the terms involved. Debye-Huckel theory of strong electrolytes. Relaxation and electrophoretic effects. Debye-Huckel-Onsager equation.
Transport number: Expression of transport number of ions in terms of velocity, factors fluencing transport number, determination by Hitorf's method using attackble and non attackble electrodes, relationship between ionic conductance and transport number(derivation),problems.
Principles involved in the conductometric titration: NaOH><HCl, CH_3COOH><NaOH, HCl+CH_3COOH><NaOH, KCl><$AgNO_3$, advantages of conductometric titration.

Module 11: Liquid crystals — 2 hrs

Definition, types, examples and uses. Swarm theory of liquid crystals.

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Syllabus for Practical in Chemistry

III Semester | Practical – III | 3 hrs /week

Systematic semi micro qualitative analysis of salt mixtures for two acid radicals and two basic radicals. The following radicals may be chosen.

Acid radicals: CO_3^{2-}, HCO_3^-, SO_3^{2-}, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, BO_3^{3-}, CH_3COO^-, $C_2O_4^{2-}$

Basic radicals: Pb^{2+}, Bi^{3+}, Cd^{2+}, Fe^{2+}, Al^{3+}, Zn^{2+}, Mn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, Na+, K^+ and NH_4^+

Note: The students have to write the chemical equation for the confirmatory tests for basic radicals identified and write the systematic procedure for the analysis.

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2020-21

SYLLABUS FOR IV SEMESTER

PAPER: 4

TOTAL NO OF LECTURE HOURS: 50 4hrs/week

INORGANIC CHEMISTRY

Module 1: Metallurgy and alloys 5 hrs

Extraction of Nickel (pentlandite), Manganese (pyrolusite), Titanium (Ilmanite) and their alloys indicating their influence on the properties of steel including chromium, corbon and nickel, uranium (Pitch Blende). Purpose of making alloys. Manufacture of ferrochrome alloy.

Module 2: Industrial chemistry-I 5 hrs

Glass: Manufactures by tank furnace, composition and uses of soda, flint, optical, borosilicate and safety glasses. Coloured glasses.
Cement: Setting of cement.
Paint: Requisites, constituents and functions.
Propellants and explosives: Classification, characteristics and requisites. (Composition of TNT, dynamite and RDX).

Module 3: Non-aqueous solvents 5 hrs

Coorination model of solvent, characteristics of ammonia and sulphur dioxide as solvents, advantages, comparative study of chemical reactions: Acid-Base neutralization, redox reaction metathetical reactions. Behavior of ammonia in KNH_2, NH_4Cl, acetic acid, acetamide and sodium-electrical properties. Comparison in the behavior of H_2O and ammonia.

Module 4: Chromatographic skills 5 hrs

Introduction : *Paper chromatography*-principle, R_f value(problems), separation of IV group basic radicals, separation of D-glucose, D-xylose and lactose; *Column chromatography*- principle and techniques, separation of methylene blue and malachite green on alumina. *Thin layer chromatography* – principle and techniques, separation of carbohydrates and amino acids,
HPLC -characteristics, principle, instrumentation, application in forensic toxicology.

ORGANIC CHEMISTRY

Module 5: Organic compounds containing oxygen – II 8 hrs

Aldehydes and Ketones: Structure and reactivity of carbonyl group, mechanism of aldol condensation, perkin'sreaction , benzoin condensation, Knoevenagel condensation reactions.

Carboxylic acids: Mono and dicarboxylic acids, acidityof carboxylic acids, effect of substitutes on the acidity: ***nature of substituent*** (+I group: formic acid, acetic acid, propanoicacid), (-I group: fluoro, chloro, bromo andiodoacetic acid), (acetic acid and benzoic acid), ***position of subsituent*** (butanoic acid, 2-cholorobutanoic acid and 3-cholorobutanoic acid), ***number of substituents*** (acetic acid, chloroacetic acid, dichloroacetic acid and trichloroacetic acid) - pK$_a$ values to be analysed. Effect of heat on α, β, γ – hydroxy acids.

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alcoholysis, ammonolysis, reduction. Preparation of alkyl amides, acetic anhydride and Friedel-craft's reaction. ***Acid amides:*** Preparation from acetyl chloride and acetic anhydride, chemical stability to resonance-basic and acidic character, reactions: hydrolysis, reduction, and dehydration, reaction with nitrous acid. ***Acid anhydrides:*** preparation from carboxylic acid and sodium salts of carboxylic acids, reactions: hydrolysis, alcoholysis, reduction and Friedel- Craft's reaction).

Module 6: Organic compounds containing nitrogen . 7 hrs

Amines: Classification with examples, synthesis of amines by reduction of nitro compounds, Hoffmann's degradation method with mechanism, Basic property of amines – comparative study of – (1) methyl amine, dimenthyl amine and trimethyl amine, (2) methyl amine and aniline, p-nitro aniline and p-toluidine, (3) aniline, p-nitro aniline and p-toluidine, (4) aniline, N-methyl aniline and N, N-dimethyl aniline. Separation of mixture of amines by Heinseberg's method.
Amino acids and proteins: Classification, methods of synthesis (pthallimide, malonic ester and Strecker synthesis). ***Peptides:*** Carbobenzoxy method of synthesis. ***Proteins:*** Primary and secondary structures of proteins, denature of proteins.

PHYSICAL CHEMISTRY

Note: *(Numerical problems should be worked out where ever necessary)*

Module 7: Electrochemistry - II 10 hrs

Recaptulation:-Convention for the representation of galvanic cell (Daniel cell), electromotive force – definition, determination of emf by using potentiometer. Standard cell- definition, construction and working of Weston-Cadmium cell. Reference electrode- definition, construction and working of calomel electrode and glass electrode. Liquid junction potential- definition and significance. Concentration cells- definition, types.

Application of emf measurements: Determination of p^H of a solution using glass electrode, determination of solubility of sparingly soluble salt (AgCl), potentiometric titrations- definition, advantages, potentiometric titration of (i) redox reaction(FAS><$K_2Cr_2O_7$) and (ii) precipitation reaction ($AgNO_3$><KCl).

Batteries- primary and secondary cells, construction, working and electrode reactions of dry cells, Lead-Acid battery, fuel cells- construction and working of hydrogen-oxygen fuel cell.

Module 8: Solid state chemistry 5 Hrs

Definition of the terms crystal lattice, unit cell, lattice points. Laws of Crystallography- 1) Law of constancy of interfacial angles, 2) Law of rationality of indices and 3) Laws of symmetry.

Elements of symmetry- plane, axis and centre of symmetry, Bravais lattice, Weiss and Miller indices and calculation. Bragg's equation (X-ray diffraction) to be derived. Determination of structure of NaCl by X-ray diffraction studies. Isomorphism and its properties (preliminary aspects).

Syllabus for Practical in Chemistry

IV Semester — Practical – IV — 3 hrs /week

Physical Chemistry Experiments (Non – instrumental)

1. (a) Determination of distribution coefficient of benzoic acid between benzene and water.
   (b) Determination of distribution coefficient of iodine between CCl_4 and water.
2. Chromatographic separation of Cu^{2+}, Ni^{2+} and Fe^{3+} by paper chromatography and determination of R_f value.
3. Separation of amino acids by thin layer chromatography / column chromatography and determination of R_f value.
4. Determination of density and viscosity of the given liquid using specific gravity bottle and Ostwald viscometer.
5. Determination of density and surface tension of the given liquid using specific gravity bottle and stalagmometer.
6. Determination of molecular mass by Walker-Lumbsden method.
7. Determination of percentage composition of a binary mixture by viscosity method.
8. Determination of rate constant of decomposition of H_2O_2 catalysed by Fe^{3+}.
9. Determination of rate constant of decomposition of saponification of ethyl acetate.
10. Determination of percentage of electrolyte in phenol-water system by miscibility temperature method.
11. Determination of transition temperature of the salt hydrate.
12. Determination of critical solution temperature of phenol-water system.

Note: During the first fifteen minutes at the practical examination, students have to write brief procedure for an experiment other than the experiment which is set for the examination.

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Approved by the BOS:

Chairman: Prof. Chimatadar

Members:

1. Prof. Govindaraja Reddy
2. Prof. Venkatesh
3. Prof. Dr. J.B. Raj
4. Prof. B.S. Usha

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Chemistry

CBCS

DAVANGERE UNIVERSITY

Department of Chemistry UG Studies, Shivagangothri, Davangere - 577002

Subject: Chemistry

Syllabus: CBCS - Core

2016 - 17 Onwards

Coures code,Course titles, Teaching hours Allocation of Marks and Credits.

140/18-19
12/6/18

Course No	Course code	Sem	Titles of the Course	Work load	IA - Marks	Theory/ Practical Marks	Total	Credits
1	Core:1.1 Chemistry Code:16SA-76	I	Fundamentals of Chemistry	4	20	80	100	4
	Che Practical:1.1		Practical -I Trimetry	3	10	40	50	3
2	Core:2.2 Chemistry Code:16SB-76	II	Basic concepts in Chemistry	4	20	80	100	4
	Che Practical:2.2		Practical -II Qualitive analysis of organic compounds	3	10	40	50	3
3	Core:3.3 Chemistry Code:16SC-76	III	Selected topics in Chemistry -I	4	20	80	100	4
	Che Practical:3.3		Practical -III Qualitive analysis of Inorgani compounds	3	10	40	50	3
4	Core:4.4 Chemistry Code:16SD-76	IV	Selected topics in Chemistry -II	4	20	80	100	4
	Che Practical:4.4		Practical -IV Physical Chemistry Non Electrical Expt.	3	10	40	50	3
5	Core:5.5 Chemistry Code:16SE-76	V	Modren concept of Chemistry -I	3	20	80	100	3
	Che Practical:5.5		Practical -V Gravimetry.	3	10	40	50	3
6	Core:5.6A Chemistry Code:16SEA-76	VI-A	Applied Chemistry -I	3	20	80	100	3
	Che Practical:5.6A		Practical -VIA Organic Preparation & Estimation.	3	10	40	50	3
6	Core:5.6B Chemistry Code:16SEB-76	VI-B	Chemistry elective	3	20	80	100	4
	Che Practical:5.6B		Practical -VIB Chemistry-elective experiments.	3	10	40	50	3
	Core:6.7 Chemistry Code:16SF-76	VII	Modren concept of Chemistry -II	3	20	80	100	3
	Che Practical:6.7		Practical -VII Physical chemistry Experiments (Electrical & Instrumental)	3	10	40	50	3
	Core:6.8 Chemistry Code:16SF-76	VIII	Applied Chemistry -II	3	20	80	100	3
	Che Practical:6.8		Practical -VIII Analytical Method	3	10	40	50	3
			TOTAL	[illegible]	240	960	1200	52

Sl No 6(a) One Compendly 11/6/18 BB
To KB Kalyana Head of Chemistry

BoS members
1 B.S. Lakha
2 [illegible]

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CHAIRMAN
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B.Sc., CHEMISTRY SYLLABUS

FIFTH SEMESTER

Total number of lecture hours: 4 5 hrs3hrs/wk

PAPER-V: MODERN CONCEPTS OF CHEMISTRY- I

Inorganic chemistry 15hrs

Module-1 d-block elements: 7hrs

Recaptulation. Oxidation state-minimum and maximum oxidation states, reason, anomalies, relative stabilities of various oxidation states, formation of ionic and covalent compounds on the basis of oxidation states, interpretation of acidic, basic and neutral nature of metal oxides.Formation of interstitial and non-stoichiometric compounds, formation of alloys.

Magnetic properties: Para, Dia, Ferri, Ferro and anti -ferro magnetism, origin of paramagnetism, application of magnetic properties in recording tapes, magnetic susceptibility and its experimental determination using Gouy's apparatus, calculation of magnetic moments of metal ion in complexes.

Colour of metal complexes on the basis of CFT, Standard Oxidation and Reduction potentials-explanation, differences between 3d,4d and 5d series.

Module-2 Industrial Chemistry: II 8 hrs

Electroplating: Purpose of electroplating, nature of deposit, principles of good electroplating, methods of cleaning articles, electroplating of NI, Cr, andAu.

Electroless plating - Definition, preparation of active surface, plating bath, electroless plating of Copper.

Refractories: Definition, classification, pyro metric cone equitant and its values, RUL test, properties of refractories, composition and uses of silica, fireclay and zirconia bricks, Silicon carbide-manufacture, structure and uses.

Abrasives: Properties, Moh's scale of hardness, classification-examples, preparation and uses of Alundum.

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Fuels: HCV and LCV. Dulong's formula, problems, characterizes of a good fuel, advantages of gaseous fuels. Manufacture of synthetic petrol by Fischer-Tropsch method.

Organic Chemistry

15 Hrs

Module-3 Stereochemistry of organic compounds:

10hrs

Concept of Isomerism: Recapitulation optical isomerism, geometrical isomerism. Elements of symmetry-Plane of symmetry, Axis of symmetry, Centre of symmetry.

Molecular chirality- enantiomers, diasteromers and their properties.Optical isomerism in Lactic acid and Tartaric acid.Mesocompounds.Homotopic,enantiotopic and diastereotopichydrogens.Optical activity without assymetric carbons- Allene derivatives, Biphenyl derivatives.R & S notations for molecules having one and two asymmetric carbons (Cahn- Ingold- prelog system).

Threo and erythro enantiomers.Recemisation, resolution of racemic mixture (mechanical, chemical biochemical& adsorption methods). Walden inversion, asymmetric synthesis.Optical purity (Problems to be solved).

Geometric isomerism: Determination of configuration of geometrical isomers- Physical methods,method of cyclisation and method of conversion into compound of known configuration. E and Z notations.Geometrical isomerism of oximes- Syn- and anti- aldoximes and ketoximes.Determination of configuration of oximes, Beckmann rearrangement.

Conformational isomers: Factors affecting stability of conformations. Conformational analysis of ethane, 1,2 -dichloroethane, propane, ethylene glycol and cyclohexane. Differences between conformation and configuration.

Module-4 Active methylene compounds:

5 hrs

Acidity of active methylene compounds. Preparation and synthetic applications of diethylmalonate (mono carboxylic acids, dicarboxylic acids, Keto acids, amino acids, barbituric acid).Preparation of ethyl acetoacetate by Claisen condensation with mechanism.synthetic applications (mono carboxylic acid, α, β-unsaturated acids, ketones and 4-methyl uracil, antipyrine). Keto-enoltautomerism.Spectroscopic evidence for the existence of keto and enol forms of ethylacetoacetate.

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02

Physical chemistry 15 hrs

Module –5 Thermodynamics I

15 hrs

Recapitulation: - System, Surroundings, Process, Extensive and intensive properties. I law of thermodynamics.

Thermodynamic-definition of C_P and C_V - Derivation of relationship between C_P and C_V.

Kirchoff's equation a) Derivation of effect of temperature on the enthalpy of reaction b) Derivation of effect of pressure on the enthalpy of reaction. [Problems to be solved]. Statement of Second law of thermodynamics [Clausius& Kelvin]. Spontaneous process, Cyclic process. Heat engine.

Carnot's Cycle: - Derivation of efficiency of heat engine. Statement of Carnot's theorem - Problem to be solved. Entropy - Physical significance of entropy. Second law of thermodynamics in terms of entropy. Entropy - Change during reversible and irreversible process - Entropy Change in phase transition [Problems to be solved] - Derivation of entropy change in reversible and isothermal - expansion of an ideal gas a) T and V are variables b) P and T are variables - problems to be solved.

Helmoltz free energy or Work function - Significance.Derivation of variation of Work function with temp and volume.

Gibb's free energy - Physical significance - Derivation of Gibb's Helmoltz equation and its applications. Derivation of Clausius - Clayperon equation and its applications - problems based on integrated form of Clausius - Clayperon equation.

Maxwell's thermodynamic relations - Derivation.

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FIFTH SEMESTER

Total number of lecture hours: 45 hrs 3 hrs/wk

PAPER-VI - APPLIED CHEMISTRY-i

Inorganic chemistry 15 hrs

Module-1 f-block elements: 6 hrs

Lanthanides: Electronic configuration, ionic size, magnetic properties, complex formation, lanthanides contraction, cause and its consequences, separation of lanthanides by Ion-Exchange method. uses of lanthanides and their compounds.

Actinides: Electronic configuration, colour, absorption spectra of actinide ions, comparison between lanthanides and actinides. Extraction/production and uses of Thorium(monazite) and Plutonium(Uranium-238).

Module-2 Metallic nitrosyl complexes: 5 hrs

Introducton, Bonding in metallic nitrosyl complexes containing NO^+ ion, NO^- ion, and NO^+ and NO^- together, their formation from NO molecule, calculation of EAN of CMA in metallic nitrosyls. IUPAC names, preparation, properties, uses and structures of nitroso ferrous sulphate and sodium nitroprosside.

Module-3 Principles of Gravimetric analysis: 2 hrs

Steps involved in gravimetric analysis, gravimetric factor and its calculation, conditions of precipitation, co-precipitation and post precipitation, industrial applications.

Module-4 Powder metallurgy: 2 hrs

Introduction, advantages, disadvantages and limitations, manufacturing process, applications of powder metallurgy.

Organic Chemistry 15 Hrs

Module-5 Spectroscopy of organic compounds: 4hrs

Principles of spectroscopy, ultraviolet (uv) absorption spectroscopy -absorption laws- Beer-Lambert Law. Types of electronic transitions, concept of chromophores and

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auxochromes. Hypsochromic and Bathochromic shifts, effect of conjugation on uv absorption. Ex: acetone &methylvinyl ketone, acetone & acetophenone, Cyclohexanal & Benzaldehyde.

Woodward-fieser rules for calculating absorption maximum in dienes (Problmes to be solved).

Applications of UV spectroscopy- determination of confugaration of geometrical isomers(cis- stilbene&tran-stilbene), determination of strength of hydrogen bonding (acetone in water & acetone in hexane).The UV spectra of acetone and 2-methyl-1,3-butadiene.

Infrared absorption spectroscopy: 4hrs

Principle of IR spectroscopy.Molecular vibrations-stretching and bending modes of vibration.Intensity and position of IR bands.Finger print region. Functional group region (O-H in alcohols & phenols, C=O in aldehydes & ketones, C-N in amines & amides, C-H in aliphatic & aromatic compounds, N-H in amines and C-O in alcohols..The IR spectra of sec-butylalcohol,phenol,3-pentanone and benzamide.

Applications of IR spectrascopy- Study of keto-enoltautomerism, geometrical isomerism (Cis- & trans- 1,2- dichlroethene),distinction between intramolecular hydrogen bonding & intermolecular hydrogen bonding.

NMR Spectroscopy: 4hrs

Basic principles of nuclear magnetic resonance, position of signals, Internal standards. chemical shift. Factors influencing chemical shift- Inductive effect (CH_3F,CH_3Cl& CH_3Br to be considered), hydrogen bonding effect, anisotropic effects (Deshielding of aldehyde proton & ethylene protons, Shielding of acetylene protons).Number of signals.Splitting of the signals. Application in structural identification of simple organic molecules-1,1,2-trichloroethane,1,1-dichloroethane, p-xylene, ethanol, acetaldehyde and Benzoicacid. The NMR spectra of propionaldehyde, isopropyl bromide 1, 3-dichloropropane, ethyl bromide and toluene.

Mass Spectrometry: 3hrs

Basic principles, instrumentation, base peaks, molecular ion, Mclafferty rearrangement (butanal to considered). The nitrogen rule.Application mass spectrometry- the mass spectra of 1-bromopropane, toluene, 1-butanol &benzaldehyde.

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Physical Chemistry 15hrs

Note: Numerical problems should be worked out in S.I. units only.

Module-6 - Photochemistry: 8hrs

Photochemical and thermo chemical reactions: Definition, examples and differences. Laws governing absorption of light, Lambat's law, Beer'slaw, Lambart-Beer's law, absorption coefficient and their significance.Molar absorption coefficient, molar extinction coefficient and their significance.Construction, working and applications (to be mentioned) of spectrophotometer.

Laws of photo-chemistry: Grotthus-Draper's law, of photochemical equivalence (problems on Einstein law). Quantum yield, high and low quantum yield, reasons for the deviation (problems on quantum efficiency). Primary and Secondary process. Mechanism of photolysis of hydrogen iodide, photosynthesis of hydrogen bromide and hydrogen chloride: Fluorescence, phosphorescence, Ghemiluminescence.Bioluminescence, Photosensitization and photo-inhibitors with examples.

Module-7 Elementary Quantum Mechanics: 7hrs

Classical mechanics-limitation, black body radiation, Plank's radiation law derivation. Postulates of quantum mechanics, derivation of Schrodinger wave equation based on the postulates of quantum mechanics. Eigen values and Eigen functions and their significance, Hamiltonian, Linear and Laplacian' operaters. Schrodinger wave equation for a particle in a one-dimensional box. Quantization energy and zero point energy.

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SIXTH SEMESTER

Total number of lecture hours: 45 hrs 3 hrs/wk

PAPER-VII – MODERN CONCEPTS OF CHEMISTRY-II

Inorganic Chemistry 15hrs

Module-1 Coordination Chemistry 10hrs

Recapitulation: Nomenclature of dinuclear bridged complexes, cheletange agents, detection of formation of complexes (colour, conductivity and PH), 18 electron rule.

Bonding in complexes recapitulation: Crystal field theory, features of CFT, crystal field splitting of deorbitals in octahedral, tetrahedral and square planar complexes, factors affecting crystal field splitting, spectro chemical series, difference between low and high spin complexes on the basis of CFT, colour of the complexes, magnetic properties in octahedral, tetrahedral and square planar complexes. Calculation of number of unpaired electrons in complex, pairing energy and CFSE. Applications of CFT and its limitations.

Stability of complexes. Kinetic Vs thermodynamic stability (properties of CMI, legands and chelats), experimental determination of stability constant (any one method).

Applications of complexes. In metallurgy, qualitative and quantativeanalysis, sis – platin in cancer therapy, Na_2 EDTA in the treatment of heavy metal poising (Hg and Pb) and in photography.

Module-2 Nanomaterial: 5hrs

Introduction, definition, preparation of nanoparticles from chemical vapour condensation and gas condensation process, carbon nanotubes – electrical, vibrational, thermal and mechanical properties. Applications of carbon nanotubes. General applications of nanomaterial. In medicine, electronics and communications and catalysis.

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Organic Chemistry 15 Hrs

Module-3 Carbohydrates 8hrs

Classificationand nomenclature of monosaccharides (aldotrioses, aldotetroses, aldopentoses&aldohexoses).Mechanism of osazone formation from D(+)-glucose. Conversion of glucose into fructose.Conversion of aldopentose into aldohexose. Determination of configuration of D(+)-glucose and D(-)-fructose. Epimerisation (conversion of glucose into mannose), difference between epimers and anomers. Formation of glycosides. Determination of ring size of D(+)-glucose & D(-)-fructose (six-membered ring structures). Conformational structures of glucose, sucrose and maltose.Anomericeffect(glucose as an example). Concept of mutarotation with mechanism.

Disaccharides: Elucidation of structure of maltose and sucrose.Fischer and Haworth structures of cellubiose and lactose.

Polysaccharides: Partial Structure of starch(amylose and amylopectin) and cellulose.

Module-4 Oils and fats 3hrs

Occurrence, extraction of oils and fats. Common fatty acids, glycerides- simple & mixed.Hydrogenation of unsaturated oils.Hydrogenolysis of oils and fats. Definition, determination and significance of saponification value, iodine value and acid value. Calculation of saponification value of triolein and tripalmitin, Manufacture of soap by hot process.Mechanism of cleansing action of soap.Synthetic detergents, superiority of detergents over soaps. Types of detergents (cationic, anionic and non-ionic). Animal and plant waxes.

Module-5 Amino acids and proteins: 4hrs

Recapitulation: Definition and classification of amino acids.

Methods of synthesis of amino acids-Strecker's synthesis, phthalimide synthesis and malonic ester synthesis.Configuration of amino acids, acid-base properties of amino acids, the isoelectric point of amino acids.Separation of amino acids by electrophoresis.N-terminal and C-terminal amino acids.

Peptides: Peptide bond. Carbobenzoxy method of synthesis of peptides.Use of di-tert-butyldicarbonate (t-BOC) and dicyclohexylcarbodiimide (DCC) in peptide synthesis.

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Physical Chemistry 15Hrs

(Note-Problems are to solved in SI Units)

Module - 6 Molecular Spectroscopy: 12Hrs

Introduction, spectrum of electromagnetic radiations, interaction of EMR with molecules, absoption and emission-spectrum, quantisation of different forms of energies (rotation, vibration and electronic) in molecules.

Types of molecular spectra: Diatomic molecule as a rigid rotator, expression for moment of inertia - problem to solved. Rotational energy and wave - number of spectral lines (problems), rotational energy - level diagram. Selection rule and its applications - intensitives of spectral lines - determination of moment of inertia and bond length of diatomic molecules.

Infrared Spectroscopy: Vibrational spectra of diatomic molecules, diatomic molecule as a simple harmonic oscillator (one - dimensional), Anharmonicity, Morse potential, dissociation energies, Hook's law and force constant - problems to be solved. Vibrational-energy level diagram. Zero - point energy.

Vibration - Rotation Spectra: Energy expression (no derivation), PQR bands and vibration - rotation spectrum of a diatomic molecule.

Module - 7 Radiation Chemistry: 3 hrs

Ion pair yield, G-Value, Primary and Secondary process, radiolysis of water. Dosimeter - Fricke dosimeter, Cericsulphate dosimeter biological effects of radiation.

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SIXTH SEMESTER

Total number of lecture hours: 45 hrs 3 hrs/wk

PAPER-VIII - APPLIED CHEMISTRY-II

Inorganic Chemistry 15hrs

Module-1 Inorganic Polymers: 3hrs

Silicons - definition, types manufacture, physical properties and applications.

Flourcarbons - definition, properties and users, manufacture of Teflon and its uses.

Module-2 Instrumental Methods of Analysis: 5hrs

Thermogravimetry analysis, instrumentation, TG curves, factors affecting TGA. Applications - drying temperature, Curie point, analysis of alloys and absorbed gases.

Atomic absorption spectroscopy (AAS) - principle, instrumentation, hallow cathode lamp, and total consumption burner. Applications determination of Lead in Petrol and Mg in tap water.

Module-3 Water Pollution

Definition, sources an dtoxicity of Pb, Cd, Hg and As, oils and pesticides. Treatment of biological and non-biological wastes, recycling and utilization of waste water.

Module-4: Acids and Bases

Lux-Flood theory, Cady-Esley theory and Usanovich concept of acids and bases, Hard and soft acids and bases: definition, classification, characteristic, Peterson's HSAB principle, limitations and applications.

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Organic Chemistry 15 Hrs

Module-5 Alkoloids: 4hrs

Definition, occurrence & extraction of alkaloids.Elucidation of structure of nicotine.synthesis of nicotine by Spath process. Elucidation of structure of ephedrine.Nagai synthesis of ephedrine.Structure and uses of atropine, cocaine, quinine and piperine.

Module-6:Terpenes: 4hrs

Definition, classification and isolation of terpens.Isoprene rule. Structure of geraniol, limonene and zingiberene..Structural elucidation of citral.Synthesis of citral from methyl heptenone.Elucidation of structure of menthol.Kotz and Hessel synthesis of menthol. Synthesis of camphor(Haller process).

Module-7:Vitamins: 3hrs

Classification and biological importance of vitamins.synthesis of vitamin C from D(+) Glucose, synthesis of vitamin A.Synthesis of vitamin B_1(Williams etal.). Structures of vitaminB_2 and vitamin D.

Module-8 Hormones: 2hrs

Biological importance of hormones.Synthesis of adrenaline and thyroxin.

Module-9 Nucleic acids: 2hrs

Recapitulation: Definition of nucleosides and nucleotides. Purine and pyrimidine bases.

Structures of Purine and pyrimidine bases. Synthesis of nucleosides (synthesis of adenosine) and nucleotides(Synthesis of adenosine-5^1-phosphate).

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PHYSICAL CHEMISTRY

15hrs

Note: Problems to worked out in SI units

Module-10: Thermodynamics –II

6hrs

Nernst heat theorem- standard entropy- absolute entropy- third law of thermodynamics- statement and its limitation-, partial molar quantities- partial molar free energy (chemical potential)- variation of chemical potential with temperature and pressure- Gibb's Duhem equation (derivation)- Duhem Margules equation- definition of fugacity, activity and activity coefficient(Problems).

Module -11: Quantum mechanics

6 hrs

Definition of system, assembly and ensemble- types of ensemble, occupation number, macro and micro state, statistical weight factor, configuration probability.

Distinguish between classical and quantum statistical mechanics. Postulates of statistical mechanics. Derivation of Maxwell Boltzmann distribution law. Relationship between entropy and thermodynamic probability. Partition function:- definition, derivation for rotational and vibrational partition function.

Expression for thermodynamic functions in terms of partition function (no derivation)- internal energy, enthalpy, entropy, Helmoltz free energy, Gibb's free energy(problems).

Module -12: Molecular structure:

3hrs

Additive, constitutive and additive- constitutive properties- definition with example.

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Polarization, induced, orientation and molar polarization- Clausius-Mosolt equation and its importance (no derivation)

Dipole moment- definition, unit, explanation (BF_3, NH_3)- pentaatomic molecules($SiCl_4$, CCl_4)

Differentiations between cis-trans isomers (1,2-dichloroethene).

B.Sc V Sem Chemistry Laboratory syllabus

Practical-V

3hrs per week

GRAVIMETRY

List of Experiments:

1. Estimation of Barium in barium chloride solution as barium sulphate.
2. Estimation of Sulphate as barium sulphate.
3. Estimation of Iron in iron ore solution as Iron oxide.
4. Estimation of Aluminium in potash alum as aluminium oxide.
5. Estimation of Nickel as nickel dimethyl glyoximate.
6. Estimation of Copper as cuprous thiocyanate.
7. Estimation of Magnesium as oxinate using 8-hydroxy quinoline.
8. Estimation of Zinc as zinc oxide.
9. Estimation of Lead as lead chromate.
10. Electro gravimetric estimation of copper or nickel.

B.Sc V Sem Chemistry Laboratory syllabus

Practical-VI

3h per week

ORGANIC PREPARATION AND ESTIMATIONS

List of Experiments: (one preparation and Estimation should be given)

PART-A

1. Estimation of Amino acid by formal titration method.
2. Estimation of aspirin by base hydrolysis method.
3. Estimation of Aniline.
4. Estimation of Phenol.
5. Estimation of an ester by hydrolysis method.
6. Estimation of glucose by Benedict's method.
7. Estimation of Saponification value of coconut oil.

PART-B

1. Preparation of acetanilide from aniline. (Acetylation)
2. Preparation of Aspirin from Salicylic acid. (Acetylation)
3. Bromination of acetanilide.
4. Preparation of methyl orange.
5. Oxidation of toluene or benzyl alcohol or benzaldehyde to salicylic acid.
6. Nitration of benzene or nitrobenzene to dinitrobenzene.
7. Preparation of Grignard reagent (ethyl magnesium iodide).
8. preparation of Nylon-66.

B.Sc VI Semester Chemistry Laboratory syllabus

Practical-VII 3h per week

Physical chemistry practical (Electrical and instrumental)

1. Determination of pH of acidic buffer (acetic acid – sodium hydroxide) at different concentrations and calculation of the acid using pH meter
2. Potentiometric titrations: a) Mohr's salt solution > < dichromate solution.
3. Conductometric titration: a) Hydrochloric acid > < sodium hydroxide.
   b) mixture of acetic acid and Hydrochloric acid > < sodium hydroxide
4. Colorimetric titration: a) Copper (II) using ammonia b) Iron (III) using thiocyanate.
5. Determination of rate constant for the inversion of cane sugar using polarimeter.
6. Determination of pKa value of acetic acid by Conductometric method.
7. Determination of pKa value of dibasic acid by Potentiometric method.
8. Determination of percentage composition of binary mixture using Abbe's refractometer.
9. Determination of cell constant (0.1 N solution of KCl to be provided) and determination of equivalent conductance at infinite dilution for a strong electrolyte.

B.Sc VI Semester Chemistry Laboratory syllabus

Practical-VIII 3h per week

Analytical methods (analytical and electro-analytical experiments)

1. Determination of total chlorine content in polluted water by iodometric method.
2. Determination of carbon dioxide in water by titrimetric method.
3. Determination of acetic acid in commercial vinegar using sodium hydroxide and alkali content in antacid tablets using hydrochloric acid.
4. Determination of saponification value of ethyl acetate conductometrically.
5. Estimation of iodine present in common salt and available oxygen hydrogen peroxide..
6. Separation and estimation of either Mg(II) or Fe(II) by solvent extraction.
7. Determination of unknown concentration of pot. Permanganate and pot. Dichromate mixture by/ spectrophotometric method.
8. Estimation of protein by colorimetric method.
9. Estimation of cholesterol by colorimetric method.
10. Estimation of cobolt present in chloropentaamine(III) chloride complex.

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11. Estimation of Ni present in hexamine nickel(II) chloride complex.
12. Estimation of sodium/ potassium by flame photometry.
13. Estimation of ascorbic acid present in citrus fruits.

Reference books

1. Advance inorganic chemistry, 5th ed.F.A cotton and Wilkinson, John Willey and sons, 1988.
2. Inorganic chemistry, 3rd ed. Shriver and Atkins, Oxford university Press, 1999.
3. Concepts and models in inorganic chemistry, 2nd ed. Douglas, Mcdanial and Alexander.
4. Inorganic chemistry, J. D. Lee, ELBS ed. 1991
5. Theoretical principals of inorganic chemistry, 4th ed. G.S. manku", Tata. McGraw Hill, 1996.
6. Modern Inorganic chemistry by R.D. Madan , S. chand.
7. Inorganic chemistry by R. L. Madan, Mallik and G. R. Tuli
8. Solid state chemistry and its application, R. A. West John Weilly and sons.
9. Engineering chemistry by Jain and Jain. Dhanaptai publishing company limited, 4779/23 Ansari road, Daryagdng, New Dehli-110002.
10. Modern aspects of Inorganic chemistry, H.J. Emeleus and A.G. sharpe. ELBS ed.
11. Organometallic chemistry, a unifiles approaches R. C. Mehrotra and A. Singh and Willey Eastern, New Delhi.
12. Elements of statistical thermodynamics by E.K. Nash, Wesley, 1974.
13. Statistical thermodynamics, M. C. Gupta, Willey Eastern ltd, 1990.
14. Statistical mechanics by Doley.
15. Text book of polymer science- Billmeyer, Willey Intersection.
16. Fundamentals of molecular spectroscopy- Banwell, Tata McGraw Hill. 1975.
17. Introduction to molecular spectroscopy -. G. M. Barrow, McGraw Hill, NewYork, 1962.
18. Organic chemistry- Morrison, Boyd-PHI public.
19. Organic chemistry by Ahluwalia.
20. Modern orgnic chemistry, S.P. shulka, G. L.Trivedi, S. Chand public.
21. Organic chemistry bruice, Pearson.
22. College chemistry L.Indira, Himalaya publication house.
23. Organic chemistry, I.l. Finar, ELBS Longmann, vol. I and II. 1984.
24. UG- organic chemistty, Jagadambha singh, LDS Yadav. Vol. I, II and III
25. Medical chemistry Ashutoshkar New Age international publication 3rd ed.
26. Analytical chemistry, Gray. D. Christian, 5th ed. John Wiley dnd sons.
27. Organic chemistry by Jagmohan, Himalaya publishing house.
28. Principles of bioinorganic chemistry, vikas publication, New Dehli,2001.
29. Concise coordination chemistry R. Gopalan and V. Ramalingam.
30. Vogels text book of quantiataive analysis – G.H. Jaffery, J. Bassell. Et al. ELBS 5th ed. 1996.

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31. Instrumental methods of analysis, H. Kaur, Pragati edition.
32. Industrial chemistry by B.K. Sharma.
33. Introduction to green chemistry, Ryan,M.A., American Chemical Society, Washigton DC(2002).
34. Green Chemistry: An Introductory Text, RSC Publishing, ii edn, 2010.
35. Introduction to Green Chemistry, Marcel Dekker (2001) by Matlack.
36. Environmental chemistry, by A.K. De. New age international publishers.
37. Perspectives in environmental Studies by Koushik-Koushik, New age international publishers.
38. Text book of Physical Chemistry by Soni, Dharmarha and Dash, Sultan chand and Sons.
39. A text book of Environmental Chemistry and pollution Control, by S.S. Dara, S Chand.
40. Experiments in Applied Chemistry by Sunita Rattan, S.K. Kataria and sons, publisher of engineering and computer books, New Delhi.

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Question paper pattern:

Davanagere University

B.Sc., Chemistry Theory Question paper

Paper-V: (CBCS-Core)

Time: 3 hrs. Modern Concepts of Chemistry-I Max Marks: 80

Note: All parts are compulsory.

PART-A

Write brief note on any TEN of the following: 10 X 02=20

1. Why 3d elements form interstitial and non- stoichiometric compounds?
2. Explain Moh's scale of hardness.
3. Write the composition and uses of zirconia bricks.
4. Mention the characteristics of a good fuel.
5. Define: a) axis of symmetry and b) center of symmetry.
6. What are the properties of Diasteromers?
7. Distinguish between conformation and configuration.
8. Write note on: Keto-enol tautomerism.
9. Mention the criteria for the feasibility of a process.
10. Explain the physical significance of entropy.
11. Problem on effect of temperature on enthalpy of the reaction.
12. Problem on efficiency of a heat engine.

PART-B

Answer any SIX of the following: 06 X 05=30

13. a) How is synthetic petrol manufactured by Fischer-Tropsch method? (4M)

    b) What is RUL test? (1M)

14. a) Describe the manufacture of Alundum. (3M)

    b) Distinguish between HCV and LCV. (2M)

15. a) Explain the optical isomerism in tartaric acid. (3M)

    b) Write the spectroscopic evidences for the existence of keto and enol form of ethyl acetoacetate. (2M)

16. a)Discuss the factors effecting the stability of conformations.(3M)

    b)Explain the acidity of active methylene compounds.(2M)

17. a) Derive expression for the variation of work function with temperature and Volume (4M)

    b)Write the significance of work function.(1M)

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18. a) Derive the relationship between C_p and C_v. (3M)

b) Problem on entropy change. (2M)

19. a) How are racemic mixture resolved by mechanical and chemical method? (4M)

b) State second law of thermodynamics. (1M).

20. a) How are abrasives classified? Write examples. (2M)

b) Discribe the electroless plating of copper. (3M)

03 X 10=30

Answer any THREE of the following:

21. a) Problem on Dulongs formula. (3M)

b) How is the magnetic susceptibility of a substance determined by Gouy's apparatus. (4M)

c) Describe the preparation of Alumdum. (3M)

22. a) Write note on: i) Walden inversion ii) Beckmann rearrangement (4M)

b) Explain: i) Syn- and anti- aldoximes ii) E and Z notations iii) Recemisation. (6M)

23. Derive: i) Clausius-Clayperon equation ii) Gibb's-Helmoltz eqution. (5+5M)

24. a) How are barbuteric acid, amino acids and keto acids synthesized using Diethylmalonate? (6M)

b)Describe the Carnot's cycle. (4M)

25. a) Explain the differences between 3d,4d, and 5d series.(4M)

b) Describe the process of electroplating of Gold. Explain the principles of electroplating. (6M)

26. a) Discuss the mechanism of preparation of ethyl acetoacetate by Claisen condensation. What are Threo and erythro enantiomers? (4+2M)

b) Derive Maxwell's thermodynamic relations. (4M).

Signature of the UG board members:

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DEPARTMENT OF CHEMISTRY

SYLLABUS FOR CHEMISTRY ELECTIVE

FIFTH SEMESTER

Total number of lecture hours: 45 hrs ~~5hrs~~3 hrs/wk

PAPER-VI -CHEMISTRY ELECTIVE

Inorganic Chemistry 15hrs

Module-1 Agro chemistry: Fertilizers: 5 hrs

Requisites of a good fertilizer, types. Manufacture of: Urea by ammonium carbonate, ammonium sulphate by Sindri process, CAN, ammonium phosphate and superphosphate of lime. Straight, compound, mixed and complete fertilizers. Requirement of NPK fertilizers per hectare for various crops (wheat), paddy, millets, maze and pulses

Module-2 Chemical aspects of biotechnology: 3hrs

Introduction, permutation, merits, favorable conditions, and its types. Manufacture of acetic acid and vitmins by permutation. Deamination.

Module-3 Organo metallic componds 7hrs

Definition, classification based on the nature of metal – carbon bond with examples (ionic, sp and multi centered bonds), structural aspects of Zeiss salt and ferrocene, methyl lithium, dimethyle beryllium and trimethylaluminium. EAN role for metal carbonyls.Preparation structure and bonding aspects of mononuclear and polynuclear carbonyls of 3D metal series, π acceptor behavior of CO, synergic effects (VB approach) – (MO diagram of CO for synergic effect, synergic effect to IR frequencies).

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Organic Chemistry 15hrs

Module 4: Green Chemistry 8Hrs

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following:

- Green solvents-supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes.
- Selection of starting materials; avoidance of unnecessary derivatization - careful use of blocking / protecting groups.
- Energy requirements for reactions - alternative sources of energy: use of microwaves and ultrasonic energy.

Module 5: Green Synthesis 7Hrs

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).
2. Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols: microwave assisted reactions in organic solvents: Diels-Alder reaction and Decarboxylation reaction.
3. Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine).
4. Surfactants for carbon dioxide - replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.

Physical Chemistry 15hrs

Note (Problems are to solved in SI Units)

Module-6 Polymers: 4Hrs

Definition, Classification, Addition and Condensation Polymerisation – examples –degree of Polymerization, number average, weight average, average molecular weights – Problems to be solved. Determination of molar mass of polymers by Ostwald's Viscosity method. Problems based on intrinsic viscosity – molecular mass relationship.

Functionality and its importance: 8Hrs

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