B.Sc. CHEMISTRY COURSE STRUCTURE

Semester	Part	Subject	Hrs.	Credits	IA	ES	Total
FIRST YEAR							
SEMESTER I	PART II	**INORGANIC & ORGANIC CHEMISTRY- I**	4	4	25	75	100
		LABORATORY COURSE- I	3	2	25	75	100
SEMESTER II	PART II	**PHYSICAL & GENERAL CHEMISTRY- II**	4	4	25	75	100
		LABORATORY COURSE- II	3	2	25	75	100
SECOND YEAR							
SEMESTER III	PART II	**INORGANIC & ORGANIC CHEMISTRY- III**	4	4	25	75	100
		LABORATORY COURSE- III	3	2	25	75	100
SEMESTER IV	PART II	**PHYSICAL & GENERAL CHEMISTRY- IV**	4	4	25	75	100
		LABORATORY COURSE- IV	3	2	25	75	100
THIRD YEAR							
SEMESTER V	PART II	**INORGANIC, ORGANIC &PHYSICAL CHEMISTRY- V**	4	4	25	75	100
		SPECTROSCOPY & MATERIALS SCIENCE-VI	4	4	25	75	100
		LABORATORY COURSE- V	3	2	25	75	100
SEMESTER VI	PART II	**INORGANIC , ORGANIC &PHYSICAL CHEMISTRY- VII**	4	4	25	75	100
		Elective: MEDICINAL CHEMISTRY- VIII (or) GREEN CHEMISTRY&PESTICIDES- VIII	4	4	25	75	100
		LABORATORY COURSE- VI	3	2	25	75	100
			50	44	350	1150	1400

Dr. K.V.Ramana Reddy(BOS)
Loyola Degree College(YSRR)
Pulivendula-516390
9985111465

Dr.P.Gnanakumari(BOS)
S.P.W Degree College
Tirupathi
9704509982

Prof. MCS Sushma(BOS)
S.K.University
Ananthapuram

P. NAGESWARA RAO
A.N.U
Guntur

SV UNIVERSITY. TIRUPATHI
(CBCS UG Proposed syllabus)
Subject: CHEMISTRY
(wef. 2015-2016)

Semester I
Paper I (Inorganic & Organic Chemistry)
60 hrs (4 h / w)

INORGANIC CHEMISTRY-I **30 hrs (2h / w)**

UNIT – I

1. p-block elements: 15h

General characteristics of elements of groups 13, 14, 15

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 silicone

Group – 15: Preparation and reactions of hydrazine, hydroxylamine.

UNIT-II

1 p-block elements: 8h

General characteristics of elements of groups 16 and 17

Group – 16: Classifications of oxides based on (i) Chemical behaviour and (ii) Oxygen content.

Group---17 Inter halogen compounds and pseudo halogens.

2. Organometallic Chemistry

Definition and classification of organometallic compounds, nomenclature, preparation, properties and applications of alkyls of Li and Mg elements **7 h**

ORGANIC CHEMISTRY-I **30hrs (2h /w)**

UNIT-III

1. Structural theory in Organic Chemistry **10 h**

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents including neutral molecules like H_2O, 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 acides (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).

UNIT-IV

1.Acyclic Hydrocarbons **6 h**

CK. VKALYAN REDDY 04/6/11

Alkenes – Preparation of alkenes . Properties: Addition of hydrogen – heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H_2O, HOX, H_2SO_4 with mechanism and addition of HBr in the presence of peroxide (anti – Markonikov's addition). Dienes – Types of dienes, reactions of conjugated dines – 1,2 and 1,4 addition of HBr to 1,3 – butadiene and Diel's – Alder reaction.

Alkynes – Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acedtylides). Preperation of higher acetylenes, Metal ammonia reductions Physical properties. Chemical reactivity – electrophilic addition of X_2, HX, H_2O (Tautomerism), Oxidation with $KMnO_4$, OsO_4, reduction and Polymerisation reaction of acetylene.

2. Alicyclic hydrocarbons (Cycloalkanes) **4 h**

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

UNIT-V

1. Benzene and its reactivity **10h**

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 Craft's 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 (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens

(Explanation by taking minimum of one example from each type)

LABORATORY COURSE-60 hrs (3 h / w)

Practical-I (At the end of Semester-I)

Qualitative inorganic analysis

Qualitative Analysis and Inorganic preparations:

Analysis of simple salt containing the following one anion and cation

Analysis of Anions: Carbonate, sulphate, chloride, bromide, iodide, acetate, nitrate, borate, phosphate,

Analysis of cations: Lead, copper, cadmium, iron, aluminum, zinc, manganese, nickel, calcium, strontium, barium, potassium and ammonium.

Inorganic preparations: Any one of the following inorganic preparations:

1)Ferrous ammonium sulphate

2)Tetrammine copper (II) sulphate

SEMESTER- II

Paper II (Physical & General Chemistry)

60 hrs (4 h / w)

PHYSICAL CHEMISTRY-I 30 hrs (2h / w)

UNIT-I

1.Solid state **10h**

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. Bragg's law. Determination of crystal structure by Bragg's method and the powder method. Indexing of planes and structure of NaCl and KCl crystals.

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

UNIT-II

1. Gaseous state **6 h**

Compression factors, deviation of real gases from ideal behavior. Van der Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. The van der Waal's equation and the critical state. Relationship between critical constants and van der Waal's constants. Joule Thomson effect. Liquefaction of gases: i) Linde's method and ii) Claude's method.

2. Liquid state **4 h**

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 Nematic. Differences between liquid crystal and solid/liquid. Application of liquid crystals as LCD devices.

UNIT-III

1. Solutions **10h**

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_2O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water, trimethylamine-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.

GENERAL CHEMISTRY 30 hrs (2h / w)

UNIT-IV

1.Surface chemistry **8 h**

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 adsorption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption

2. Chemical Bonding **7h**

Valence bond theory, hybridization, VB theory as applied to ClF_3, $Ni(CO)_4$, 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 M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N_2, O_2, CO and NO).

UNIT-V

1.Stereochemistry of carbon compounds **15 h**

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: definition- molecules with similar chiral carbon (Tartaric acid), definition of mesomers- molecules with dissimilar chiral carbons (2,3-dibromopentane). Number of enantiomers and mesomers- 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.

LABORATORY COURSE-60 hrs (3 h / w)

Practical-II (At the end of Semester-II)

Qualitative inorganic analysis

Qualitative inorganic analysis and Inorganic preparations:

Analysis of mixture salt containing two anions mixtures containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, sulphate, chloride, bromide, iodide, acetate, nitrate, borate, phosphate

Cations: Lead, copper, iron, aluminum, zinc, manganese, calcium, strontium, barium, potassium and ammonium.

Inorganic preparations: Any one of the following:

1)Potash alum

2)Hexammine cobalt (III) chloride.

3)Potassium trisoxalato chromate

Recommended Text Books and Reference Books

Inorganic Chemistry

1. Concise Inorganic Chemistry by J.D.Lee
2. Basic Inorganic Chemistry by Cotton and Wilkinson
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Inorganic Chemistry by R R Heslop and P.L. Robinson
5. Text book of Inorganic chemistry by R.Gopalan
6. A textbook of qualitative inorganic analysis by A.I. Vogel
7. Inorganic Chemistry by J.E.Huheey
8. Inorganic Chemistry by Chopra and Kapoor
9. Coordination Chemistry by Basalo and Johnson
10. Organometallic Chemistry – An introduction by R.C.Mehrotra and A.Singh
11. Inorganic Chemistry by D.F.Shriver, P.W.Atkins and C.H.Langford
12. Advanced Inorganic Chemistry By Gurudeep Raj
13. Analytical Chemistry by G.L.David Krupadanam, et al, Univ. Press
14. Selected topics in inorganic chemistry by W.D.Malik, G..D.Tuli, R.D.Madan
15. Concepts and models of Inorganic Chemistry by Bodie Douglas, D.McDaniel and J.Alexander
16. Concise coordination chemistry by Gopalan and Ramalingam
17. Satyaprakash's modern inorganic chemistry by R.D.Madan.

Organic Chemistry

1. Organic Chemistry By R T Morrison and R.N.Boyd
2. Organic Chemistry by G.Mare loudan, Purdue Univ
3. Text book of Organic Chemistry by Ferguson
4. Problems and their solutions in organic Chemistry by I.L.Finar
5. Reaction mechanisms in Organic Chemistry by S.M.Mukherji and S.P.Singh
6. A guide book to mechanisms in Organic Chemistry by Peter Sykes
7. Organic spectroscopy by J.R.Dyer
8. Organic Spectroscopy by William Kemp
9. Comprehensive practical organic qualitative analysis by V.K.Ahluwalia & Sumta Dhingra
10. Text book of Organic Chemistry by K.S.Mukherjee
11. Organic Chemistry by L.G.Wade Jr, Maya Shankar Singh
12. Elementary organic spectroscopy by Y.R. Sharma
13. Chemistry & Industry by Gurdeep R. Chatwal
14. Drugs by David Krupadanam
15. Pharmacodynamics by R.C.Srivastava, Subit Ghosh
16. Analytical Chemistry by David Krupadanam
17. Green Chemistry – V.K.Ahluwalia
18. Organic Synthesis by V.K.Ahluwalia and R.Agarwal
19. New trends in Green Chemistry –by V.K.Ahluwalia & M.Kidwai
20. Industrial Chemistry by B.K.Sharmai
21. Industrial Chemistry byM.G.Arora
22. Synthetic Drugs by O.D.Tyagi & M.Yadav
23. Medicinal Chemistry by Ashutoshkar
24. Medicinal Chemistry by P.Parimoo
25. Pharmacology & Pharmacotherapeutics by R.S Satoskar & S.D.Bhandenkar
26. Medicinal Chemistry by Kadametal P-I & P.II

27. Vogel's Qualitative organic analysis.
28. Laboratory manual of Organic Chemistry by Raj K Bansal

Physical Chemistry books.

1.Principles of physical chemistry by Prutton and Marron
2.Physical chemistry by Peter Atkins, Julio D. Paula
3. Elements of Physical Chemistry by Peter Atkins, Julio D. Paula
4. Text book of Physical Chemistry by P.L.Soni, O.P.Dharmarha and Q.N.Dash
5. Solid State Chemistry and its applications by Anthony R. West
6. Text book of physical chemistry by K L Kapoor
7.Text book of physical chemistry by M.V.Sangaranarayanan
8.Thermodynamics by J Jayaram and J C Kuriakose
9..Introductory Quantum Chemistry by A K Chandra
10.Physical Chemistry by J W Moore
11.Kinetics and mechanism by J W Moore and R G Pearson
12.Fundamentals of photochemistry by K K Rohtagi Mukharjee
13.Chemical thermodynamics by R P Rastogi and S S Misra
14.Advanced physical chemistry by Gurudeep Raj
15.Text book of physical chemistry by S Glasstone
16.Fundamentals of Molecular spectroscopy by C.N.Banwell and E.M.McCash
17.Nanochemistry by Geoffrey Ozin and Andre Arsenault
18.Catalysis: Concepts and green applications by Gadi Rotherberg
19.Green Chemistry: Theory and practice by P.T.Anastas and J.C.Warner
20.Polymer Science by Gowriker, Viswanathan and Jayadev Sridhar
21.Polymer Chemistry by Bilmayere.

SEMESTER – III

Paper-III (INORGANIC & ORGANIC CHEMISTRY) 60 hrs (4 h / w)

(Inorganic Chemistry) 30 h (2h/w)

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 to form complexes. Stability of various oxidation Comparative treatment of second and third transition series with their 3d analogues. 9 h

2 **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, Band theory, formation of bands, explanation of conductors, semiconductors and insulators. 6h

UNIT II

3.Metal carbonyls and related compounds – EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni. 7 h

4. Chemistry of f-lock elements: Chemistry of lanthanides – electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties, 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 8 h

(Organic Chemistry) 30 h (2h/w)

UNIT – III

1. **Halogen compounds** **5 h**

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 S_N1 and S_N2.

Energy profile diagram of S_N1 and S_N2 reactions. Stereochemistry of S_N2 (Walden Inversion) S_N1 (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 compounds** **5 h**

Nomenclature and classification of hydroxy compounds.

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

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

Physical properties- Hydrogen bonding (intermolecular and intramolecular). 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. oxidation of alcohols by CrO_3, $KMnO_4$.
g. special reaction of phenols: Bromination, Kolb-Schmidt reaction, Riemer-Tiemann reaction, Fries rearrangement, azocoupling.

Identification of alcohols by oxidation with $KMnO_4$, ceric ammonium nitrate, lucas reagent and phenols by reaction with $FeCl_3$.

Polyhydroxy compounds: Pinacol-Pinacolone rearrangement.

UNIT-IV

1. Carbonyl compounds **10 h**

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) $NaHSO_3$, b) HCN, c) RMgX, d) NH_2OH, e)$PhNHNH_2$, 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 $LiAlH_4$ and $NaBH_4$.

Analysis of aldehydes and ketones with a) 2,4-DNT test, b) Tollen's test, c) Fehling text, d) Schiff test, e) Haloform test (with equatioN

UNIT-V

1. Carboxylic acids and derivatives **6 h.**

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.
b) hydrolysis by benzotrichlorides.
c) Kolbe reaction.

Physical properties: Hydrogen bonding, dimeric association, acidity- strength of acids with examples of trimethyl acetic acid and trichloroacetic acid. Relative differences in the acidities of aromatic and aliphatic acids.

Chemical properties: Reactions involving H, OH and COOH groups- salt formation, anhydride 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- Zelinsky reaction.

Derivatives of carboxylic acids: Reaction of acid chlorides, acid anhydrides, acid amides, esters (Mechanism of the hydrolysis of esters by acids and bases)

2. Active methylene compounds **4 h**

Acetoacetic esters: preparation by Claisen condensation, keto-enol tautomerism. 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).
b) dicarboxylic acids (succinic acid and adipic acid).
c) α,ß-unsaturated carboxylic acids (crotonic acid).

Reaction with urea.

LABORATORY COURSE – III(at the end of semester III **60 hrs (3 h / w)**
Practical Paper – III (Inorganic Chemistry)

I. Titrimetric analysis:

1) Determination of carbonate and bicarbonate in a mixture
2) Determination of Fe(II) using $K_2Cr_2O_7$
3) Determination of Fe(II) using $KMnO_4$ with oxalic acid as primary standard.
4) Determination of Cu(II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard

II. Gravimetric analysis (any one of the following)

1) Determination of barium as barium sulphate
2) Determination of nickel as Ni-DMG complex
2) Determination of magnesium as magnesium pyrophosphate.

SEMESTER – IV

Paper-IV (PHYSICAL & GENERAL CHEMISTRY) 60 hrs (4 h / w)

(Physical Chemistry) 30 h (2h/w)

UNIT-I

1.Dilute solutions **10h**

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.

UNIT-II

1.Electrochemistry-1 **10 h**

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 limitations. Ostwald's dilution law. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only). Definition of transport number, determination by Hittorf's method. Application of conductivity measurements-determination of dissociation constant (K_a) of an acid, determination of solubility product of sparingly soluble salt, conductometric titrations. Types of reversible electrodes- the gas electrode, metal-metal ion, metal-insoluble salt and redox electrodes. Electrode reactions, Nernst equation, single electrode potential,

UNIT-III

1.Electrochemistry-II **4h**

standard Hydrogen electrode, reference electrodes, standard electrode potential, sign convention, electrochemical series and its significance. Reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Applications of EMF measurements - Potentiometric titrations.

2.Phase rule **6 h**

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.– NaCl- water system. Freezing mixtures.

(K V RATNAM REDDY)

(General chemistry-) **30 h (2h/w)**

UNIT-IV

1. Molecular symmetry **6h**

Concept of symmetry in chemistry-symmetry operations, symmetry 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, point group.

Introductory treatment to:

Asymmetric (Chiral) synthesis **4 h**

Definitions-Asymmetric synthesis, enantiomeric excess, diastereomeric excess. stereospecific reaction, definition, example, dehalogenation of 1,2-dibromides by I⁻. stereoselective reaction, definition, example, acid catalysed dehydration of 1-phenylproponol.

a) Pericyclic Reactions: 6 h

Concerted reactions, Molecular orbitals, Symmetry properties HOMO, LUMO, Thermal and Photochemical Pericyclic reactions. Types of Pericyclic reactions-electrocyclic, cyclo addition and sigmatropic reactions- one example each.

UNIT-V

3.Theory of quantitative analysis **8 hrs**

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

b) 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.

4.Evaluation of analytical data. **6 h**

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.

LABORATORY COURSE – IV(at the end of semester IV)

60 hrs (3 h / w)

Practical Paper – IV

I. Titrimetric analysis:

1)Determination of Zn by Ferrocyanide
2) Determination of Cu(II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard
3)Determination of Zinc using EDTA
4)Determination of Mg by EDTA
5)Determination of hardness of water

II. Gravimetric analysis (any one of the following)

1) Determination of sulphate as barium sulphate
2) Determination of nickel as Ni-DMG complex

(K V RAMANA REDDY)

SEMESTER-V

Paper – V (INORGANIC, PHYSICAL & ORGANIC CHEMISTRY) 60 hrs (4h / w)

UNIT – I (Inorganic Chemistry)

10 h

1. **Coordination Chemistry:** IUPAC nomenclature, bonding theories – review of Werner's theory and Sidgwick's concept of coordination, Valence bond theory, geometries of coordination 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 crystal-field 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.

UNIT-II

1. **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–Gouymethod. **5h**
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. **5h**

UNIT- III (Organic chemistry) 5h

1.Nitro hydrocarbons: Nomenclature and classification-nitro hydrocarbons, structure .Tautomerism of nitroalkanes leading to aci and keto form, Preaparation of Nitroalkanes, reactivity –halogenation, reaction with HONO (Nitrous acid) , Nef reaction and Mannich reaction leading to Micheal addition and reduction.

UNIT – IV

1.Nitrogen compounds 15h

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).

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-aqucous 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). Electrophillic substitution of Aromatic amines- Bromination aned Nitration. Oxidation of aryl and Tertiary amines, Diazotization.

(K VIJAYANAND REDDY)

UNIT- V (PHYSICAL CHEMISTRY)

1.Thermodynamics **20 h**

The first law of thermodynamics-statement, definition of internal energy and enthalpy. Heat capacities and their relationship. Joule-Thomson effect- coefficient. Calculation of w, 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.

Second law of thermodynamics. Different Statements of the law. Carnot cycle and its efficiency. Carnot theorem. Concept of entropy, entropy as a state function, entropy changes in reversible, and irreversible processes. Energy changes in spontaneous and equilibrium processes.

(K V RATHNA REDDY)

SEMESTER-V

Paper – V (Spectroscopy & Materials science) **60 hrs (4h / w)**

UNIT- I

Molecular Spectroscopy **20 h**

(i) 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 (σ,π, n) . Selection rules for electronic spectra. Types of electronic transitions in molecules effect of conjugation. Concept of chromophore.

(ii) Infra red spectroscopy

Energy levels of simple harmonic oscillator, molecular vibration spectrum, selection rules. Determination of force constant. Qualitative relation of force constant to bond energies. Anharmonic motion of real molecules and energy levels. Modes of vibrations in polyatomic molecules. Characteristic absorption bands of various functional groups. Finger print nature of infrared spectrum.

(iii) Proton magnetic resonance spectroscopy (^{1}H-NMR)

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals – spin-spin coupling, coupling constants. Applications of NMR with suitable examples – ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

UNIT – II

Spectrophotometry **8 h**

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

UNIT-III

Separation techniques **12 h**

Solvent extraction: Principle and process,

Batch extraction, continuous extraction and counter current extraction. Application – Determination of Iron (III)

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

UNIT-IV (Materials science) **10 h**

Superconductivity, characteristics of superconductors, Meissner effect, types of superconductors and applications.

Nanomaterials-. Properties and applications of nano-materials. Composites-definition, general characteristics , particle reinforce and fiber reinforce composites and their applications.

UNIT-V Catalysis **10h**

Homogeneous and heterogeneous catalysis, comparision with examples. Kinetics of acid and base catalyzed reactions, - hydrolysis of an ester, inversion of cane sugar, mutarortation of glucose. Kinetics of specific base catalysed reactions, base catalysed conversion of acetone to diacetone alcohol.

Enzyme catalysis: Classification, characteristics of enzyme catalysis. Kinetics of enzyme catalysed reactions. Factors affecting the enzyme catalysis- effect of temperature , pH, concentration and inhibitor.

Lab - V

Practical paper-V

Part A(Organic Chemistry)

60 hrs (3 h / w)

1. Synthesis of Organic Compounds

i. Aromatic electrophilic substitution Nitration: Preparation of nitro benzene and 2,4,6-tribromo phenol.

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

2. Organic Qualitative Analysis:

Reactions of the following functional groups present in organic compounds

Alchols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic Primary Amines, Amides and Simple sugars

Part B (Physical Chemistry)

1. Distribution law

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

2. Colorimetry

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

3. Surface tension and viscosity of liquids.

4. Adsorption

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

(K V RAMANA REDDY)

SEMESTER-VI

Paper – VII (Inorganic, Organic and Physical chemistry) 60 hrs (4h / w)

UNIT-I

1. **Reactivity of metal complexes:** Labile and inert complexes, ligand substitution reactions – S_N1 and S_N2, substitution reactions of square planar complexes – Trans effect and applications of trans effect. **5h**
2. **Bioinorganic 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. 5 h

UNIT-II

1. **Chemical kinetics** **10 h**

Rate of reaction, factors affecting the rate of a reaction –concentration, temperature, pressure , solvent, light, catalysts. 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. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

2. **Photochemistry** **5 h**

Difference between thermal and photochemical processes. Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence. Quantum yield-Photochemical reaction mechanism- hydrogen- chlorine, hydrogen-bromine reaction. Qualitative description of fluorescence, phosphorescence, Photosensitized reactions- energy transfer processes (simple example)

UNIT- III

Heterocyclic Compounds **10 h**

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring system – present in important natural products like hemoglobin and chlorophyll. Numbering the ring systems 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.

UNIT-IV

Carbohydrates **15 h**

Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses..Chemical properties in support of ring structure. 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 conformational formula). Structure of fructose: Evidence of 2 – ketohexose structure (formation of pentaacetate, formation of cyanohydrin its hydrolysis and reduction by HI to give 2-Carboxy-n-hexane). Same osazone formation from glucose and fructose, cyclic structure for fructose (Furanose structure and Haworth formula).

Interconversion of Monosaccharides: Aldopentose to aldo hexose – Arabinose to D-Glucose, D-Mannose (Kiliani - Fischer method). Epimers, Epimerisation – Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose- D-glucose to D-arabinose by Ruff degradation. Aldohexose (+) (glucose) to ketohexose (-) (Fructose) and Ketohexose (fructose) to aldohexose (Glucose)

UNIT- V

Amino acids and proteins **10h**

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: Zwitter ion 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.

SEMESTER-VI

Paper – VIII (ELECTIVE-I) (Medicinal chemistry) **60 hrs (4h / w)**

UNIT-I **8h**

Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors – brief treartment) Metabolites and Anti metabolites.

UNIT-II **8h**

Nomenclature: Chemical name, Generic name and trade names with examples

Classification: Classification based on structures and therapeutic activity with one example each, Administration of drugs

UNIT-III **25h**

.Synthesis and therapeutic activity of the following

a) Chemotheraputic Drugs

1.Sulphadrugs(Sulphamethoxazole) 2.Antibiotics(B-Lactam Antibiotics, Macrolide Antibiotics, 3. Anti malarial Drugs(chloroquine)

b) Psycho theraputic Drugs:

1.Anti pyretics(Paracetamol) 2.Hypnotics, 3.Tranquilizers(Diazepam,) 4.Levodopa

UNIT-IV **10h**

Pharmacodynamic Drugs:

1. Antiasthma Drugs (Solbutamol) 3. Antianginals (Glycerol Trinitrate, 4) 4)Diuretics(Frusemide)

UNIT-V **9h**

HIV-AIDS: Immunity – CD-4cells, CD-8cells, Retro virus, Replication in human body, Investigation available, prevention of AIDS, Drugs available – examples with structures: PIS: Indivanir (crixivan), Nelfinavir(Viracept).

Reference text Books:

1. Medicinal Chemistry by Dr. B.V.Ramana
2. Synthetic Drugs by O.D.Tyagi & M.Yadav
3. Medicinal Chemistry by Ashutoshkar
4. Medicinal Chemistry by P.Parimoo
5. Pharmacology & Pharmacotherapeutics by R.S Satoshkar & S.D.Bhandenkar
6. Medicinal Chemistry by Kadametal P-I & P.II
7. European Pharmacopoeia

(K.V.RAMANA REDDY)

SEMESTER-VI

Paper – VIII (ELECTIVE) (Green chemistry & Pesticides) 60 hrs (4h / w)

UNIT-I 10h

Introduction-Definition of green Chemistry, need of green chemistry, basic principles of green chemistry, Green oxidant - Hydrogen peroxide.

Green synthesis-Evalution of the type of the reaction i) Rearrangements (100% atom economic), ii) Addition reaction (100% atom economic), Pericyclic reactions (no by-product).

Organic reactions by Sonication method: apparatus required examples of sonochemical

reactions (Heck, Hundsdiecker and Wittig reactions).

UNIT-II 15h

Selection of solvent:

Aqueous phase reactions ii) Reactions in ionic liquids, Simple preparation types properties and application, ionic liquids in organicreactions (Heckreaction, Suzuki reactions, epoxidation). iii) Solid supported synthesis

Super critical CO_2:Preparation, properties and applications. (decaffeination, dry cleaning)

UNIT-III 15 h

Microwave and Ultrasound assisted green synthesis:

Apparatus required, examples of MAOS (synthesis of fused anthro quinones, acetalization of a byproduct of sugar industry, 1, 3-dipolar cycloaddition of nitrones to fluorinated dipolarophiles, Leukart reductive amination of ketones)

Advantages and disadvantages of MAOS.

Aldol condensation-Cannizzaro reaction-Diels-Alder reactions-Strecker's synthesis

UNIT-IV 10h

Green catalysis:

Heterogeneous catalysis, use of geolites, silica, alumina, clay polymers, cyclodextrine, supported catalysis- biocatalysis: Enzymes, microbes

Phase transfer catalysis (micellar/surfactant)

UNIT-V 10h

Pesticides

Introduction to pesticides – types – Insecticides, Fungicides, Herbicides, Weedicides, Rodenticides plant growth regulators, Pheremones and Hormones.

Mention the structure and uses of the following; Malathion, Parathion, Endrin, Baygon,

Lab - VI

Practical paper-VI

Part A(Organic Chemistry):

60 hrs (3 h / w)

Organic Qualitative Analysis:

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

Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic Primary Amines, Amides and Simple sugars

2) Separation of two component mixtures only for demonstration

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

Part B (Physical Chemistry):

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.

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

Reference text Books:

1. Green Chemistry Theory and Practice. P.T.Anatas and J.C. Warner
2. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
3. Green Chemistry: Introductory Text M.Lancaster Royal Society of Chemistry (London)
4. Principles and practice of heterogeneous catalysis, Thomas J.M., Thomas M.J., John Wiley
5. Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava, Narosa Publications
6. Green Chemistry V.K. Ahluwalia Narosa , New Delhi.

(K V RAMANA MOORTY)

S.V. UNIVERSITY: TIRUPATHI

Assessment of theory and lab course

Evaluation of theory

Evaluation of theory by both internal and external exams

Internal evaluation in each semester – 25 marks

Weightage-15 marks (Unit test-average of two tests)
05-seminar/quiz/assignment
05-attendance

External evaluation in each semester -75marks
question paper pattern is same for all semesters including electives and follows as:

Question paper includes part A and part B

Part-A(general choice)-25 marks

includes eight questions Each question carries 5 marks
Should answer five out of 8 questions (5x5)
Minimum one question from each unit is compulsory

Part -B(internal choice)-50 marks

contains five questions. Each question carries 10 marks
should answer all the questions
One question from each unit compulsory

Laboratory courses-method of assessment

Lab-I at the end of semester-II
Lab-II at the end of semester-IV
Lab-III at the end of semester-V
Lab-IV at the end of semester-VI
Each practical paper carries 50 marks.
Assessment of all practical papers only by external valuation
Duration of exam for all theory & practical papers must be 3 hrs

Dr.K.V.Ramana Reddy(BOS)
Loyola Degree College(YSRR)
Pulivendula-516390
9985111465

Dr.P.Gnanakumari(BOS)
S.P.W Degree College
Tirupathi
9704509982

Prof. MCS Sushma(BOS)
S.K.University
Ananthapuram

B. NAGESWARA RAO
A.N.U.

B.Sc. Chemistry (Semester-Wise)

MODEL QUESTION PAPER(External)

Duration : 3 Hours Maximum Marks: 75

PART –A

Answer any FIVE of the following Questions. Each Carries 5 Marks. 5 X 5 = 25

1.

2.

3.

4.

5.

6.

7.

8.

PART-B

Answer all the questions. Each question carries 10 Marks. 5 X 10 = 50

UNIT-I In ternal Choice
9 OR 10

UNIT- II In ternal Choice
11 OR 12

UNIT- III In ternal Choice
13 OR 14

UNIT- IV In ternal Choice
15 OR 16

UNIT- V In ternal Choice
17 OR 18

Dr.K.V.Ramana Reddy(BOS)
Loyola Degree College(YSRR)
Pulivendula-516390
9985111465

Dr.P.Gnanakumari(BOS)
S.P.W Degree College
Tirupathi
9704509982

Prof. MCS Sushma(BOS)
S.K.University
Ananthapuram

P. NAGESWARARAO
A.N.U.
Guntur