DEPARTMENT OF CHEMISTRY
U. G. PROGRAMME
SYLLABUS
(B. Sc. Chemistry I to VI Semester)
2017-18

GOVERNMENT CITY COLLEGE
(AUTONOMOUS)
RE-ACCREDITED WITH "A" GRADE BY NAAC
(Affiliated to Osmania University, Hyderabad)
Hyderabad – 500 002

Government City College (Autonomous), Hyderabad
DEPARTMENT OF CHEMISTRY
B. Sc. COURSE STRUCTURE

	Semester	Paper	Title of the Paper	Contact hours per Week	No. of credits allotted	Marks for Internal Assessment	Marks for Semester End Examination	Total Marks
I	I	Core I	Module -1	4	3	20	80	100
		Practical IA	Semi micro Analysis-1A	3	1	4	21	25
	II	Core II	Moldule -2	4	3	20	80	100
		Practical IB	Semi micro Analysis-1B	3	1	4	21	25
II	III	Core III	Moldule -3	4	3	20	80	100
		Practical IIA	Gravimetric and Volumetric analysis-II A	3	1	4	21	25
	IV	Core IV	Moldule -4	4	3	20	80	100
		Practical II B	Gravimetric and Volumetric analysis- II B	3	1	4	21	25
		General Elective	Chemistry In Everyday life	2	2	0	50	50
III	V	Core V	Advanced Chemistry-1	3	3	25	75	100

		Advanced Elective I	Chemistry and Industry-I	3	2	25	75	100
		Advanced Elective II	Polymer Chemistry	3	2	25	75	100
		Practical IIIA	Organic Synthesis and TLC	3	2	10	40	50
		Practicals IVA	Kinetics,pH metry and Distribution	3	2	10	40	50
	VI	Core VI	Advanced Chemistry-2	3	3	25	75	100
		Applied Elective I	Chemistry and Industry-II	3	2	25	75	100
		Applied Elective II	Industrial Chemistry	3	2	25	75	100
		Practical IIIB	Identification of Organic Compounds	3	2	10	40	50
		Practical IV	Electrochemistry ,Colorimetry, Adsorption	3	2	20	80	100
		Project Work	Student has to complete one project from any subject in his/her course					

Note: As and when Osmania University implements the CBCS for the Second year UG courses, the Govt City College shall implement the same "In toto".

Question paper model

Semester I to IV

GOVERNMENT CITY COLLEGE

(AUTONOMOUS)

NAAC Re-accredited with "A"

SUBJECT-CHEMISTRY

SEMESTER – / MODULE-

Name of the module-

Time – 3hours **Max Marks: 80**

Section –A

I. Short Answer Questions: (5x4M=20M)

(Answer any five questions)

1.
2.
3.
4.
5.
6.
7.
8.

(Two questions should be given from each unit)

Section –B

II. Essay Questions (4x15M=60M)

(Answer all the questions)

9.(A) or (B)

10. (A) or (B)

11.(A) or (B)

12. .(A) or (B)

(Two questions should be given from each unit with internal choice)

Question paper model

Semester V &VI

GOVERNMENT CITY COLLEGE

(AUTONOMOUS)

NAAC RE-accredited with "A"

SUBJECT-CHEMISTRY

SEMESTER – / MODULE-

Name of the module-

Time – 2½hours **Max Marks: 75**

Section –A

III. Very Short Answer Questions: (5x2=10)

(Answer all questions)

1.
2.
3.
4.
5.

(At least one question should be given from each unit)

II. Short answer Questions: (7x5=35)

(Answer any seven)

6.
7.
8.
9.
10.
11.
12.
13.
14.

(Three questions should be given from each unit)

IV. Essay Questions (3x10=30)
(Answer all the questions)

15. (A or B)
16. (A or B)
17. (A or B)

Internal assessment model
(For CBCS)
I & II year

Max.marks:20

I. Written exam
Average of two (each of 15marks) 15 marks

II. Assignments 05 marks

Internal assessment model
(For CBCS)
III year

Max.marks:25

I. Written exam
Average of two (each of 20marks) 20 marks

II. Assignments 05 marks

GOVT. CITY COLLEGE, HYDERABAD
(AUTONOMOUS Re- ACCREDITED WITH "A" GRADE BY NAAC)

I B. Sc CHEMISTRY I SEMESTER Module I 60h (4 h / w)
(SYLLABUS WITH EFFECT FROM 2017-18)

	UNIT-I Inorganic Chemistry	**15h**
I	s - block elements	2
II	p-block elements (up to groups15)	7
III	General Principles of Inorganic qualitative analysis	6
	UNIT II Organic Chemistry	**15h**
I	Structural theory in Organic Chemistry	06
II	Acyclic Hydrocarbons(up to alkynes)	06
III	Alicyclic Hydrocarbons	3
	Unit-III Physical Chemistry	**15h**
I	Atomic Structure&elementary quantum mechanics (up to Schrodinger wave equation for H-atom)	
II	Gaseous state	5
III	Liquid state	4
	Unit-IV General Chemistry	**15h**
I	Chemical Bonding and Molecular Orbital Theory	11
II	Evaluation of Analytical Data	04

Unit-I (Inorganic Chemistry) **15h(1 hr/week)**

1. s-block elements: **2h**

General Characteristics of groups I and II elements, Diagonal relationship between Li and Mg, Be and Al

2. p-block elements Part-1: **7h**

Group-13:Synthesis and structure of diborane and higher Boranes (B_4Hi_0 and B_5H_9), Boron nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of BX_3

Group - 14: Carbides-Classification - ionic, covalent, interstitial - synthesis.Structures and reactivity. Industrial application. Silicones - Preapartion - a) direct silicon process b) use of Grignard reagent c) aromatic silylation. Classification - straight chain, cyclic and cross-linked.

Group - 15: Nitrides - Classification - ionic, covalent and interstitial. Reactivity - hydrolysis.Preparation and reactions of hydrazine, hydroxyl amine, phosphazenes.

3. General Principles of Inorganic qualitative analysis **6 h**

Anion analysis: Theory of sodium carbonate extract, classification and reactions of anions-$CO3^{2-}$, Cl^-, Br^-, $SO4^{2-}$, $PO4^{3-}$, $BO3^{3-}$$CH3COO^-$, $NO3^-$.

Cation Analysis: Principles involved - Solubility product, common ion effect, general

discussion for the separation and identification of group I individual cations (Hg_2^{2+}, Ag+, Pb+) with flow chart and chemical equations. Principle involved in separation of group II & IV cations.

General discussion for the separation and identification of group II (Hg^2+, Pb^2+, Bi^3+, Cd^2+, Sb^2+), III (Al^3+, Fe^3+), IV ((Mn^2+, Zn^2+) individual cations with flow chart and chemical equations. Application of concept of hydrolysis in group V cation analysis. General discussion for the separation and identification of group V individual cations (Ba^2+, Sr^2+, Ca^2+) with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations (Mg^2+, $NH4^+$).

Unit-II (Organic Chemistry) **15 h (1 hr/week)**

1:Structural Theory in Organic Chemistry **6 h**

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity - inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance - Mesomeric effect, application to (a) acidity of phenol. (b) acidity of carboxylic acids and basicity of anilines. Stability of carbo cations, carbanions and free radicals. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes.

Types of organic reactions: Addition reactions- electrophilic, nucleophilic and free radical. Substitution reactions - electrophilic, nucleophilic and free radical. Elimination and Rearrangement reactions- Examples.

2:Acyclic Hydrocarbons **6 h**

Alkanes- Methods of preparation: Corey-House reaction, Wurtz reaction, from Grignard reagent, Kolbe synthesis. Chemical reactivity - inert nature, free radical substitution, Halogenation example- reactivity, selectivity and orientation.

Alkenes - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev's rule. Properties: Addition of Hydrogen - heat of hydrogenation and stability of alkenes. trans-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). Oxidation (cis - additions) - hydroxylation by $KMnO_4$, OsO_4, trans addition- peracids (via epoxidation), hydroboration, ozonolysis - location of double bond. Dienes - Types of dienes, reactions of conjugated dienes **- 1, 2** and 1,4 addition of HBr to 1,3 - butadiene and Diels - Alder reaction.

Alkynes- Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Acidity of terminal alkynes (formation of metal acetylides) preparation of higher alkynes, Chemical reactivity - electrophilic addition of X_2, HX, H_2O (tautomerism), Oxidation (formation of enediol, 1,2 diones and carboxylic acids) and reduction (Metal-ammonia reduction, catalytic hydrogenation)

3:Alicyclic Hydrocarbons **3 h**

Nomenclature, preapartion by Freunds method, Dickmann, heating dicarboxylic metal salts. Properties - reactivity of cyclo propane and cyclo butane by comparing with alkanes. Stability of cycloalkanes - Baeyer strain theory, Sachse and Mohr predictions and Pitzer strain theory. Conformational structures ofcyclopentane, cyclohexane.

Unit-III (Physical Chemistry) **15 h (1 hr/week)**

1: Atomic structure and elementary quantum mechanics **6 h**

Black body radiation, heat capacities of solids, Rayleigh Jeans law, Planck's radiation law, photoelectric effect,Limitations of classical mechanics, Compton effect, De Broglie's hypothesis. Heisenberg's uncertainty principle, Schrodinger's wave equation and its importance. Physical interpretation of the wave function, significance of y and y^2, a particle in a box, energy levels, wave functions and probability densities. Schrodinger wave equation for H-atom. Separation of variables, radial and angular functions (only equation), hydrogen like wave functions, quantum numbers and their importance.

2:Gaseous State **5h**

Deviation of real gases from ideal behavior. van der Waals equation of state. Critical phenomenon. PV isotherms of real gases, continuity of state. Andrew's isotherms of CO_2. The van der Waal's equation and critical state. Derivation of relationship between critical constants and van der Waal's constants. The law of corresponding states, reduced equation of states. Joule Thomson effect and inversion temperature of a gas. Liquifaction of gases: i) Linde's method based on Joule Thomson effect ii) Claude's method based on adiabatic expansion of a gas.

3: Liquid State **4 h**

Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases. Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only). Liquid crystals, the mesomorphic state: Classification of liquid crystals in to Smectic and Nematic, differences between liquid crystal and solid / liquid. Application of liquid crystals as LCD devices.

Unit - IV (GeneralChemistry) **15 h (1 hr/week)**

1 Chemical Bonding **11 h**

Ionic solids- lattice and solvation energy, solubility of ionic solids, Fajan's rule, polarity and polarizability of ions, covalent nature of ionic bond, covalent bond - Common hybridization and shapes of molecules.

Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of overlapping. Concept of ***a*** and n bonds. Criteria for orbital overlap. LCAO concept.

Types of molecular orbitals- bonding, antibonding and non bonding. MOED of

Homonuclear diatomics - H**2**, N**2**, O**2**,O**2** ,O**2** ,F**2** (unhybridized diagrams only) and

heteronuclear diatomics CO, CN" NO, NO+ and HF. Bond order, stability and magnetic properties.

2 Evaluation of analytical data **4 h**

Significant figures, accuracy and precision. Errors-classification of errors- determinate and indeterminate errors, absolute and relative errors, propagation of errors in mathematical operations - addition, substraction, division and multiplication (with respect to determinate errors).

References:

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001. Chem.
4. Vogel's Qualitative Inorganic Analysis by Svehla
5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn.
6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.
7. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.
8. Qualitative analysis by Welcher and Hahn.
9. Textbook of Inorganic Chemistry by R Gopalan
10. College Practical chemistry by V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati

Unit- II

1. Text book of organic chemistry by Morrison and Boyd.
2. Text book of organic chemistry by Graham Solomons.
3. Text book of organic chemistry by Bruice Yuranis Powla.
4. Text book of organic chemistry by Soni.
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Unit III

1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara..
3. Text Book of Physical Chemistry by Puri and Sharma.
4. Text Book of Physical Chemistry by K. L. Kapoor.

5. Physical Chemistry through problems by S.K. Dogra.
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry byLewis Glasstone.

Unit IV

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn.Wiley Publishers 2001.Chem
4. Analytical chemistry by G. L. David Krupadanam, D. Vijaya Prasad, K. Varaprasada Rao, K.L.N. Reddy and C.Sudhakar

LABORATORY COURSE

I Practical Module – IA(Inorganic Chemistry) 45hrs (3 h / w)

Qualitative Analysis & Inorganic preparations:

Analysis of mixtures containing 2 anions
(1simple,1interfering (of different groups) from the following:
Anions:
CO_3^{-2},S^{-2},SO_3^{-2},Cl^-,Br^-,I^-,acetate,NO_3^-,$C_2O_4^{-2}$,tartrate,BO_3^{-3},PO_4^{-3}, Arsenate* & chromate*
.*(not to be given for examination)

Preparations: Any 3 of the following inorganic preparations:
(1)Ferrous ammonium sulphate (2) Tetrammine copper(II) sulphate
(3) Potassium trisoxalatochromate (4) Potash alum $KAl(SO_4)_2.12H_2O$ (5) HexammineCobalt(III) Chloride.

Scheme of Evaluation: Total 25 Marks
Time: 2hrs

1.a brief Procedure for the preparation of Inorganic Compound	**4 Marks**
2.Solubility	**2 Marks**
3. Flame test	**1 Marks**
3.Identification of one anion & one cation	**2*4=16 Marks**
4.Report of one anion & one cation	**1 Marks**
5.Record	**3 Marks**
6.Viva	**2 Marks**
7.Internal Assesement	**4 Marks**

Minimum Qualifying marks: 10 Marks (40%)

GOVERNMENT CITY COLLEGE, HYDERABAD.
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FACULTY OF SCIENCE

B. Sc 1semester (Practical) Examination **Subject: Chemistry**
module: I
(w.e.f 2017-18) Time: 3 Hours
Max. Marks: 25

QUESTION BANK

I. Write a brief procedure to prepare a crude sample of one of the following Inorganic compounds. 4 Marks

1) Tetramminecopper(II) sulphate. **2**) Potashalum $KAl(SO_4)_2.12H_2O$ **3**) Hexamminecobalt (III) chloride

II Analyse the given mixture using semi micro qualitative technique systematically and report two anions present in it. (17 Marks)

1. $Cd(CH_3COO)_2$ + $(NH_4)_3PO_4$ **2.** $Al_2(SO_4)_3$ + $ZnCl_2$ **3.** $AlCl_3$ + $Ba(NO_3)_2$

4. $AlCl_3$ + $Ca(NO_3)_2$ **5.** $AlCl_3$ + $Sr(NO_3)_2$ **6.** $CaCO_3$ + $Mg(NO_3)_2$

7. $Sr(NO_3)_2$ + $MgCO_3$ **8.** $Sr(NO_3)_2$ + $Cd(CH_3COO)_2$ **9.** $MgSO_4$ + NH_4I

10. $FeSO_4$ + NH_4Cl **11.** $Pb(NO_3)_2$ + $(CH_3COO)NH_4$ **12.** $Bi(NO_3)_2$ + $(NH_4)_3PO_4$

13. $ZnCl_2$ + $Ba(CH_3COO)_2$ **14.** $Sr(NO_3)_2$ + NH_4Cl **15.** $CaCO_3$ + NH_4Br

16. $Ba(NO_3)_2$ + MgI_2 **17.** $BaCO_3$ + $(CH_3COO)NH_4$ **18.** $MgSO_4$ + NH_4Br

19. $CdCl_2$ + $(NH_4)_3\ PO_4$ **20.** $NH_4\ NO_3$ + $Pb(CH_3COO)_2$ **21.** $CaCO_3$ + $NH_4\ Br$

22. $Mg\ SO_4$ + $(NH_4)_2CO_3$ **23.** $ZnCl_2$ + $(CH_3COO)\ NH_4$

24. $Al_2(SO_4)_3$ + $(NH_4)_2CO_3$ **25.** $Ba\ (\ NO_3)_2$ + $(CH_3COO)\ NH_4$

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I B. Sc CHEMISTRY **II SEMESTER** **Module II**

60h (4 h / w)

(SYLLABUS WITH EFFECT FROM 2017-18)

UNIT-I Inorganic Chemistry	**15h**
p - block elements (groups 16, 17)	7
Chemistry of Zero Group Elements	2
Chemistry of d-Block elements	6
UNIT II Organic Chemistry	**15h**
Aromatic Hydrocarbons	7
Arenes and Polynuclear Aromatic Hydrocarbons	3
Halogen Compounds	5
Unit-III Physical Chemistry	**15h**
Solutions	5
Dilute Solutions and Colligative Properties	5
Solid State Chemistry	5
Unit-IV General Chemistry	**15h**
Theory of Quantitave analysis	5
Theories of Bonding in Metals	5
Material Science	5

Unit-I (Inorganic Chemistry) **15 h (1 hr/week)**

1 p-block Elements –II
7h

Oxides: Types of oxides (a) Normal- acidic, basic amphoteric and neutral (b) Mixed(c) sub oxide d) peroxide e) superoxide. Structure of oxides of C, N, P, S and Cl - reactivity, thermal stability, hydrolysis.

Oxy acids: Structure and acidic nature of oxyacids of B, C, N, P, S and Cl.Redox properties of oxyacids of Nitrogen: HNO_2 (reaction with $FeSO_4$, $KMnO_4$, $K_2Cr_2O_7$), HNO_3 (reaction with H_2S, Cu), HNO_4 (reaction with KBr, Aniline), $H_2N_2O_2$ (reaction with $KMnO_4$). Redox properties of oxyacids of Potasium: H_3PO_2 (reaction with $HgCl_2$), H_3PO_3 (reaction with $AgNO_3$, $CuSO_4$).

Redox properties of oxyacids of Sulphur: H_2SO_3 (reaction with $KMnO_4$, $K_2Cr_2O_7$), H_2SO_4 (reaction with Zn, Fe, Cu), $H_2S_2O_3$ (reaction with Cu, Au), H_2SO_5 (reaction with KI, $FeSO_4$), $H_2S_2O_8$ (reaction with $FeSO_4$, KI)

Interhalogens- classification- general preparation- structures of AB,AB_3, AB_5 and AB_7 type and reactivity. Poly halides- definition and structure of ICl_2", ICl_4" and I_3" .Comparison of Pseudohalogens with halogens.

2 Chemistry of Zero group elements

2 h

General preparation, structure, bonding and reactivity of Xenon compounds - Oxides, Halides and Oxy-halides. Clatherate compounds and Anomalous behavior of He (II)

3.Chemistry of d-block elements

6 h

Characteristics of d-block elements with special reference to electronic configuration variable valence, ability to form complexes, magnetic properties &catalytic properties. Stability of various oxidation states and SRP Comparative treatment of second and third transition series with their 3d analogues. Study of Ti, Cr and Cu traids. Titanium triad - electronic configuration and reactivity of +3 and +4 states - oxides and halides. Chromium triad - reactivity of +3 and **+6** states. Copper triad - reactivity of +1, +2 and +3 states.

Unit - II(Organic chemistry)

15 h (1 hr/week)

1:Aromatic Hydrocarbons

7h

Concept of aromaticity -definition, Huckel's rule - application to Benzenoids and Non - Benzenoids (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation).

Preapartions: From acetylene, phenols, benzene carboxylic acids and sulphonic acids

Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation,and halogenation, Friedel Craft's alkylation(polyalkylation) and acylation. Orientation of aromatic substitution - Definition of ortho, para, and meta directing groups. Ring activating and deactivating groups with examples. Orientation - (i) activating groups: Amino, methoxy and alkyl groups. (ii) Deactivating groups - carboxy, nitro, nitrile, carbonyl and sulphonic acid& halo groups.

2:Arenes and Polynuclear Aromatic Hydrocarbons

3 h

Preparation of alkyl benzenes by Friedel Craft's alkylation, Friedel Craft's acylation followed by reduction, Wurtz-Fittig reaction. Chemical reactivity: Ring substitution reactions,side chain substitution reactions and oxidation.

Polynuclear hydrocarbons - Structure of naphthalene and anthracene (Molecular Orbital diagram and resonance energy) Reactivity towards electrophilic substitution. Nitration and sulphonation as examples.

3: Halogen compounds

5 hrs

Nomenclature and classification: alkyl (primary, secondary, tertiary), aryl, aralkyl, allyl,

vinyl, benzyl. Chemical reactivity - reduction, formation of RMgX, Nucleophilic

substitution reactions - classification into S_N1 and S_N2 . Mechanism and energy profile diagrams of Sn^1 and S_N^2 reactions. Stereochemistry of S_N2 (Walden Inversion) 2- bromobutane, S_N^1 (Racemisation) 1-bromo-1-phenylpropane explanation of both by taking the example of optically active alkyl halide. Structure and reactivity - Ease hydrolysis - comparison of alkyl, vinyl, allyl, aryl, and benzyl halides.

Unit - III (Physical Chemistry)

15 h (1 hr/week)

1:Solutions

5 h

Liquid - liquid mixtures, ideal liquid mixtures, Raoult's and Henry's laws. Non ideal systems. Azeotropes HCl-H_2O and C_2H_5OH - H_2O systems. Fractional distillation,. Partially miscible liquids- Phenol - Water, Trimethyl amine - Water and Nicotine - Water systems. Lower upper consolute temperatures. Effect of impurity on consolute temperature.Immiscible liquids andsteam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law with solvent extraction.

2: Dilute Solutions & Colligative Properties

5 h

Dilute Solutions, Colligative Properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis - laws of osmotic pressure, its measurement, determination of molecular weight from osmotic pressure. 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 for determining various colligative properties. Abnormal molar mass, Van't hoff factor, degree of dissociation and assocoation of solutes.

3: Solid state Chemistry

5 h

Laws of Crystallography - (i) Law of Constancy of interfacial angles (ii) Law of Symmetry, Symmetry elements in crystals (iii) Law of rationality of indices. Definition of space lattice, unit cell. Bravais Lattices and Seven Crystal systems (a brief review). X- ray diffraction by crystals; Derivation of Bragg's equation, Determination of structure of NaCl, KCl & CsCl (Bragg's method and Powder method

Unit - IV (General Chemistry) **15 h (1 hr/week)**

1:Theory of Quantitative Analysis **5 hours**

Volumetric Analysis: Introduction, standard solutions, indicators, end point, titration curves, Types of titrations: i)neutralization titration- principle, theory of acid base indicators, titration curves and selection of indicators- strong acid - strong base, strong acid -weak base, weak acid-strong base and weak acid -weak base. Gravimetric analysis- Introduction, nucleation, precipitation, growth of precipitate, filtration and washing, drying and incineration of precipitate, coprecipitation and post precipitation. Determination of $Ni^{2}+$

2:Theories of bonding in metals:
5 h

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 n-type and p-type, extrinsic & intrinsic semiconductors, and insulators.

3: Material Science

5 h

Classification of materials- classification as metals, ceramics, organic polymers, composites, biological materials etc. The property of super conductivity of materials. Super conducting materials- elements, alloys and compounds. Properties of super conductors- zero resistivity, Meisener effect and thermal properties. Composites- meaning of composites, advanced composites, classification -particle rein forced fiber reinforced and structural composites general characters of composite materials-Particle- reinforced composites - large particle and dispersion-strengthened composite. Fiber reinforced composites (continuous and discontinuous fiber composites). **References**

Unit I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn

4. Wiley Publishers 2001. Chem
5. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.
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3. Text Book of Physical Chemistry by Puri and Sharma
4. Text Book of Physical Chemistry by K. L. Kapoor
5. Physical Chemistry through problems by S.K. Dogra.
6. Elements of Physical Chemistry by Lewis and Glasstone.
7. Material science by Kakani & Kakani

Unit IV

1. Vogel's Text Book of Quantitative Analysis by G.H.Jeffery, J.Bassett, J.Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999.
2. Quantitative Analysis by Day and Underwood Prentice Hall (India) VI Edn..
3. Nano: The Essentials by T. Pradeep, McGraw-Hill Education.
4. Chemistry of nanomaterials: Synthesis, Properties and applications by CNR Rao et.al.
5. Nanostructured Materials and Nanotechnology, edited by Hari Singh Nalwa, Academic Press
6. College Practical chemistry by V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati

LABORATORY COURSE-

I Practical Paper module IB (Inorganic Chemistry)
45 hrs (3 h / w)

Qualitative Analysis:
Analysis of mixtures containing 2 anions & 2 Cations
Anions:
CO_3^{-2},S^{-2},SO_3^{-2},Cl^-,Br^-,I^-,acetate,NO_3^-,$C_2O_4^{-2}$,tartrate,BO_3^{-3},PO_4^{-3}, Arsenate* & chromate*

.*(not to be given for examination)

Cations:

Pb^{+2},Cu^{+2}, Bi^{+3},Cd^{+2}, tin,antimony,iron,Al^{+3},Zn^{+2},Mn^{+2},Ni^{+2},Co^{+3},Ca^{+2},Sr^{+2},Ba^{+2},K^+,NH_4^+.* (not to be given for examination)

Scheme of Evaluation: Total 50Marks **Time: 3hrs**

1.a brief Procedure writing for the Identification of Two Cations and Two anions	4 **Marks**
2.Solubility	**2 Marks**
3.Flame Test	**1 Marks**
3.Identification of two anions & two cations	**4*2=8 Marks**
4.Report of the two anions & two cations	**1 Marks**
5.Record	**3 Marks**
6.Viva	**2 Marks**
7.Internal Assesement	**4 Marks**

Minimum Qualifying marks: 10 Marks (40%)

GOVERNMENT CITY COLLEGE, HYDERABAD
(Autonomous) Affiliated to Osmania University

FACULTY OF SCIENCE

B. Sc II semester (Practical) Examination **Subject: Chemistry module: II**
(w.e.f 2017-18) Time: 3 Hours) Max. Marks: 25

QUESTION BANK

I. Write brief procedure along with group separation table for the identification of anions & cations in the following mixture:4 Marks

1. Cl^- , SO_4^{-2}, , Bi^{+3} , Al^{+3} 2. S^{-2} , NO_3^- , Cd^{+2} , Ca^{+2} 3. CO_3^{-2}, CH_3COO^- , Ag^+ , NH_4^+ 4. S^{-2} , PO_4^{-3} , Cu^{+2}, Zn^{+2} 5. NO_3^- , Cl^- , Ni^{+2} , Ba^{+2} 6. Br^- , SO_4^{-2} , K^+ , Zn^{+2} 7. CO_3^{-2} , SO_4^{-2} , Cr^{+3} , Sr^{+2} 8. CH_3COO^- ,SO_4^{-2} Hg_2^{+2}, NH_4^+ 9. Cl^- , BO_2^- , Cd^{+2} , Al^{+3} 10. CO_3^{-2} , I^- , Sn^{+2} ,

Mg^{+2} 11. NO_3^- , Br^- Sb^{+3} , Ca^{+2} 12. CO_3^{-2} , SO_4^{-2} , Hg^{+2}, NH_4^+

II Analyse the given mixture using semi micro qualitative technique systematically and report two cations present in it. ``` (17 Marks)

1. $Cd(CH_3COO)_2$ + $(NH_4)_3 PO_4$ 2. $Al_2(SO_4)_3$ + $ZnCl_2$ 3. $AlCl_3$ + $Ba(NO_3)_2$

4. $AlCl_3$ + $Ca(NO_3)_2$ 5. $AlCl_3$ + $Sr(NO_3)_2$ 6. $CaCO_3$ + $Mg(NO_3)_2$

7. $Sr(NO_3)_2$ + $MgCO_3$ 8. $Sr(NO_3)_2$ + $Cd(CH_3COO)_2$ 9. $MgSO_4$ + NH_4I

10. $FeSO_4$ + NH_4Cl 11. $Pb(NO_3)_2$ + $(CH_3COO)NH_4$ 12. $Bi(NO_3)_2$ + $(NH_4)_3 PO_4$

13. $ZnCl_2$ + $Ba(CH_3COO)_2$ 14. $Sr(NO_3)_2$ + NH_4Cl 15. $CaCO_3$ + NH_4Br

16. $Ba(NO_3)_2$ + MgI_2 17. $BaCO_3$ + $(CH_3COO)NH_4$ 18. $MgSO_4$ + NH_4Br

19. $CdCl_2$ + $(NH_4)_3 PO_4$ 20. NH_4NO_3 + $Pb(CH_3COO)_2$ 21. $CaCO_3$ + NH_4Br

22. $MgSO_4$ + $(NH_4)_2CO_3$ 23. $ZnCl_2$ + $(CH_3COO)NH_4$

24. $Al_2(SO_4)_3$ + $(NH_4)_2CO_3$ 25. $Ba(NO_3)_2$ + $(CH_3COO)NH_4$

GOVT.CITY COLLEGE, HYDERABAD
(AUTONOMOUS Re-ACCREDITED WITH "A" GRADE BY NAAC)
SYLLABUS (2017-18 ONWARDS)
B.Sc II Year CHEMISTRY III SEMESTER Module III 60h (4h/w)

	UNIT-I Inorganic Chemistry	**15h**
I	f - block elements	6
II	Symmetry of Molecules	5
III	Non Aqueous Solvents	4
	UNIT II Organic Chemistry	**15h**
I	Alcohols	6
II	Ethers and Epoxides	2
III	Carbonyl Compounds	7
	Unit-III Physical Chemistry	**15h**
I	Phase Rule	6
II	Colloids	7
III	surface chemistry	2
	Unit-IV General Chemistry	**15h**
I	Nanomaterials	3
II	Stereochemistry of carbon compounds	10
III	Conformational Analysis	2

Unit-I (Inorganic Chemistry) 15 h (1 hr/week)

1: Chemistry of f-block elements: 6 h

Chemistry of Lanthanides: Position in periodic table, Electronic structure, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, anomalous behavior of post lanthanides-complexation- type of donor ligands preferred. Magnetic properties- paramagnetism. Colour and spectra, f-f transitions -occurrence and separation

- ion exchange method, solvent extraction.

Chemistry of actinides- general features - electronic configuration, oxidation state, actinide contraction, colour and complex formation. Comparison with lanthanides.

2: Symmetry of molecules 5 h

Symmetry operations and symmetry elements in molecules. Definition of Axis of symmetry types of C_n, Plane of symmetry (oh, ov, ad) Center of symmetry and improper rotational axis of symmetry (S_n). Explanation with examples.

3: Non - aqueous solvents 4 h

Classification and characteristics of a solvent. Reactions in liquid ammonia - physical properties, auto-ionisation, examples of ammono acids and ammono bases. Reactions in liquid ammonia - precipitation, neutralization, solvolysis, solvation - solutions of metals in ammonia, complex formation, redox reactions. Reactions in HF - autoionisation, reactions in HF - precipitation, acid - base reactions, protonation.

Unit - II (Organic chemistry) 15 h (1 hr/week)

1: Alcohols 6 hrs

Preaparation: 1°, 2° and 3° alchols using Griganard reagent, Ester hydrolysis, Reduction of Carbonyl compounds, carboxylic acids and esters. Physical properties: H-bonding, Boiling point and Solubility. Reactions with Sodium, HX/$ZnCl_2$ (Lucas reagent), esterification, oxidation with PCC, alk. $KMnO_4$, acidic dichromates, conc. HNO_3 and Oppenauer oxidation.

Diols: Pinacol - pinacolone rearrangement

Phenols: Preapartion: (i) from diazonium salts of anilines, (ii) from benzene sulphonic acids and (iii) Cumene hydroperoxide method.

Properties: Acidic nature, formation of phenoxide and reaction with R-X, electrophilic substitution nitration, halogenation and sulphonation. Riemer Tiemann reaction, Gattermann-Koch reaction, Azo-coupling reaction, Schotton-Boumann raction, Houben- Hoesch condensation, $FeCl_3$ reaction.

2: Ethers and epoxides 2 hrs

Nomenclature, preparation by (a) Williamson's synthesis (b) from alkenes by the action of conc. H_2SO_4. Physical properties - Absence of Hydrogen bonding, insoluble in water, low boiling point. Chemical properties - inert nature, action of conc. H_2SO_4 and HI.

3 Carbonyl compounds 7 h

Nomenclature of aliphatic and aromatic carbonyl compounds and isomerism.

Praparation of aldehydes & ketones from acid chloride, 1,3-dithianes, nitriles and from carboxylic acids. Special methods of preparing aromatic aldehydes and ketones by (a) Oxidation

of arenes (b) Hydrolysis of benzal halides Physical properties - absence of Hydrogen bonding. Keto-enol tautomerism, polarisability of carbonyl groups, reactivity of the carbonyl groups in aldehydes and ketones. Chemical reactivity: Addition of [a] $NaHSO_3$ (b) HCN (c) RMgX (d) NH_3 (e) RNH_2 (f) NH_2OH(g) PhNHNH (h) 2,4DNP (Schiff bases). Addition of H_2O to form hydrate (unstable), comparison with chloral hydrate (stable), addition of alcohols - hemi acetal and acetal formation. Base catalysed reactions with mechanism- Aldol, Cannizaro reaction, Perkin reaction, Benzoin condensation, haloform reaction, Knoevengeal condensation. Oxidation reactions - $KMnO_4$ oxidation and auto oxidation, reduction - catalytic hydrogenation, Clemmenson's reduction, Wolf- kishner reduction, Meerwein Pondoff Verly reduction, reduction with LAH, $NaBH_4$. Analysis - 2,4 -DNP test, Tollen's test, Fehlings test, Scihffs test, haloform test (with equations).

UNIT - III (Physical Chemistry) 15 hr (1h / week)

1: Phase Rule **6 h**

Statement and meaning of the terms - Phase, Component and degrees of freedom, Gibb's Phase rule, phase equilibria of one component system - water system. Phase equilibria of two-component system - Solid-Liquid equilibria, simple eutectic - Pb-Ag system, desilverisation of lead. Solid solutions - compound with congruent melting point - Mg- Zn system and incongruent melting point - NaCl-H_2O system.

2: Colloids **7 h**

Definition of colloids. Classification of colloids. Solids in liquids (sols): preparations and properties - (including Kinetic, Optical and Electrical stability of colloids) Protective action. Hardy-Schultz law, Gold number. Liquids in liquids (emulsions): Types of emulsions, preparation and emusifier. Liquids in solids (gels); Classification, preparations and properties, General applications of colloids.

Micelles: Classification of surface active agents. Surfactant action, micellization and micellar interactions, Structure of micelles - spherical and laminar. Critical micellar concentration (CMC). Factors affecting the CMC of surfactants. Counter ion binding to micelles.

3.surface chemistry

Adsorption: Types of adsorption, Factors influencing adsorption. Freundlich adsorption isotherm. Langmuir theory of unilayer adsorption isotherm. Applications.

UNIT - IV (General Chemistry) ***15 hr (1h / week)***

1: Nanomaterials: ***3h***

Nano structured materials - Definition, size, description of graphene, fullerenes, carbon nano tubes. Synthetic techniques, bottom-up-sol-gel method, top-down, electro deposition method. Production of carbon nano tubes - arc discharge, laser vaporization methods. General applications of nano materials.

2: Stereochemistry of carbon compounds **10 h**

Isomerism: Definition of isomers. Classification of isomers: Constitutional and Stereoisomers – definition and examples. Constitutional isomers: chain, functional and positional isomers.

Stereoisomers: enantiomers and diastereomers - definitions and examples.

Optical activity: Definition, wave nature of light, plane polarised light, optical rotation and specific rotation, chiral centers. Chiral molecules: definition and criteria - absence of plane, center and S_n axis of symmetry - asymmetric and dissymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde, Lactic acid, Alanine) and disymmetric molecules (trans-1,2-dichlorocyclopropane). Molecules with constitutionally symmetrical chiral carbons (Tartaric acid) Molecules with constitutionally unsymmetrical chiral carbons (2,3-dibromopentane) Number of enantiomers and mesomers - calculation.

D, L &, R, S configuration for asymmetric and disymmetric molecules (Allenes, spiro compounds and biphenyls), Cahn-Ingold-Prelog rules. Racemic mixture, Racemisation and Resolution techniques. Geometrical isomerism with reference to alkenes and cyclo alkanes- cis, trans and E, Z configuration.

3: Conformational analysis **2 h**

Classification of stereoisomers based on energy. Definition and examples of conformational and configurational isomers. Conformational analysis of ethane, n- butane, 1,2-dichloroethane,2-chloroethanol and methylcyclohexane

LABORATORY COURSE-II Practical Paper-IIA (Inorganic chemistry) 45hrs (3h/w)

I.Titrimetric analysis:

Determination of :

1) Carbonate
2) Bicarbonate
3) Cabonate & BiCarbonate in a mixture
4) Estimation of Alkali content in Antacid using HCl
5) Fe(II) using $K_2Cr_2O_7$
6) Fe(II) using $KMnO_4$ with oxalic acid as primary standard.

II. Gravimetric analysis:

Determination of : 1) Barium as $BaSO_4$ 2) Sulphate as $BaSO_4$

GOVT.CITY COLLEGE , HYDERABAD
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B.Sc II YEAR (PRACTICAL) EXAMINATIONS
CHEMISTRY PAPER-II

Time: 3hrs **Max Marks:25**

QUESTION BANK

I. Write a brief procedure for the following experiment & mention the principle involved in it. (Time= 10minutes) (3Marks)

1. Estimate the amount of Barium as BaSO4 gravimetrically in the given solution using dil.H_2SO_4 or $(NH_4)_2SO_4$.
2. Estimate the amount of Sulphate as $BaSO_4$ gravimetrically in the given solution using $BaCl_2$ solution.

II. Carry out any one experiment allotted from the following: (15marks)

1) Estimate the amount of Na_2CO_3 present in the given solution. You are provided with
(a) a pure sample of Na_2CO_3 (b) an approximate 0.1M solution of HCl.
2) Estimate the amount of NaHCO3 present in the given solution. You are provided with
(a) a pure sample of Na_2CO_3 (b) an approximate 0.1M solution of HCl.
3) Estimate the amount of carbonate & bicarbonate in the given mixture. You are provided with
(a) a pure sample of Na_2CO_3 (b) an approximate 0.1M solution of HCl
4) Estimate the amount of of Alkali content in the given Antacid using HCl
You are provided with (a) a pure sample of Na_2CO_3 (b) an approximate 0.1M solution of HCl

5) Estimate the amount of Fe^{+2} present in the given solution(dichrometrically). You are provided with a pure sample of $K_2Cr_2O_7$ solid.
6) Estimate the amount of Fe^{+2} present in the given solution. You are provided with
(a) a pure sample of oxalic acid (b) an approximate 0.02M $KMnO_4$.

III. Record and Class Work 2 marks
IV. Viva (pertaining to volumetric analysis) 2 marks
V.Internal Assesement 3 Marks

Referances:

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.

2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.

3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001.

4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn.

5. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.

6. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.

7. Textbook of Inorganic Chemistry by R Gopalan

8. College Practical chemistry by V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati

Unit- II

1. Text book of organic chemistry by Soni.

2. General Organic chemistry by Sachin Kumar Ghosh.

3. Text book of organic chemistry by Morrison and Boyd.

4. Text book of organic chemistry by Graham Solomons.

5. Text book of organic chemistry by Bruice Yuranis Powla.

6. Text book of organic chemistry by C N pillai

Unit III

1. Principles of physical chemistry by Prutton and Marron.

2. Text Book of Physical Chemistry by Soni and Dharmahara..

3. Text Book of Physical Chemistry by Puri and Sharma.

4. Text Book of Physical Chemistry by K. L. Kapoor.

5. Colloidal and surface chemistry , M. Satake, Y. Hayashi, Y.Mido, S.A.Iqbal and M.S.sethi

6. Material science by Kakani & Kakani

Unit IV

1. Text book of organic chemistry by Morrison and Boyd

2. Text book of organic chemistry by Graham solomons

3. Text book of organic chemistry by Sony

4. Text book of organic chemistry by Bruice yuranis Powla

5. General Organic chemistry by Sachin kumar Ghosh

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REVISED COMMON CORE SYLLABUS (2010-11 ONWARDS,FOR ADMITTED Iyr 09-10)

B.Sc II Year CHEMISTRY IV SEMESTER PAPER IV 62h(4h/w)

	UNIT-I Inorganic Chemistry	**15h**
I	**Coordination Compounds**	7
II	**Organometallic Chemistry**	4
III	Metal Carbonyl and related compounds	4
	UNIT II Organic Chemistry	**15h**
I	Carboxylic Acids and derivatives	6
II	Synthesis based on Carbanions	3
III	Nitro Hydro Componds	6
	Unit-III Physical Chemistry	**15h**
I	Electrochemistry	8
II	EMF and applications	7
	Unit-IV General Chemistry	**15h**
I	Pericyclic reactions	5
II	Synthetic strategies	5
III	Assymetric Synthesis	5

UNIT-I Inorganic Chemistry-1 **15h**

Coordination Compounds : 7h

Simple inorganic molecules and coordination complexes. Nomenclature - IUPAC rules,

Brief review of Werner's theory, Sidgwick's electronic interpretation and EAN rule and their limitations. (Valence bond theory (VBT) - postulates and application to (a)tetrahedral complexes $[Ni(NH_3)_4]^{2+}$, , $[NiCl_4]^{2-}$, and $[Ni(CO)_4]$ (b) square planar complexes $[Ni(CN)4]^{2-}$, $[Cu(NH_3)4]^{2+}$, $[PtCl4]^{2-}$ (c) octahedral complexes $[Fe(CN)6]^{4-}$, $[Fe(CN)6]^{-3}$, $[FeF_6]^{4-}$, $[Co(NH_3)_6]^{3}+$, $[CoF_6]^{3-}$. Limitations of VBT). 2. Coordination number, coordination geometries of metal ions, types of ligands. 3. Isomerism in coordination compounds, stereo isomerism - (a) geometrical isomerism in (i) square planar metal complexes of the type $[MA_2B_2]$, $[MA_2BC]$, $[M(AB)_2]$, [MABCD]. (ii) Octahedral metal complexes of the type $[MA_4B_2]$, $[M(AA)_2B_2]$, $[MA_3B_3]$ using suitable examples, (b) Optical isomerism in (i). tetrahedral complexes [MABCD], (ii). Octahedral complexes $[M(AA)_2B_2]$, $[M(AA)_3]$ using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.

2:Organometallic Chemistry **4 h**

Definition, nomenclature and classification of organometallic compounds. Methods of preparation, properties and applications of alkyl and aryl compounds of Li, Mg & Al. Preparation and properties of ferrocene.

3: Metal carbonyls and related compounds **4 h**

18 valence electron rule, classification of metal carbonyls: $Ni(CO)_4$, $Fe(CO)_5$, $Fe_2(CO)_9$, $Fe_3(CO)_{12}$ and $Cr(CO)_6$, Preparation and properties of Ni(CO)4.

II (Organic chemistry) 15 h (1 hr/week)

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

Nomenclature, classification and methods of preparation a) Hydrolysis of Nitriles, amides and esters. b) Carbonation of Grignard reagents. Special methods of preparation of Aromatic Acids. Oxidation of the side chain of Arenes. Hydrolysis of benzotrichlorides. Kolbe reaction. Physical properties- hydrogen bonding, dimeric association, acidity - strength of acids with the examples of trimethyl acetic acid and trichloro acetic acid, Relative differences in the acidity of Aromatic, aliphatic acids & phenols. Chemical properties - Reactions involving H, OH and COOH groups -salt formation, anhydride formation, Acid halide formation, Esterification (mechanism) & Amide formation. Reduction of acid to the corresponding primary alcohol - via ester or acid chloride. Degradation of carboxylic acids by Huns Diecker reaction, Schmidt reaction (Decarboxylation). Arndt - Eistert synthesis, Halogenation by Hell - Volhard - Zelensky reaction. Carboxylic acid Derivatives - Reactions of acid halides, Acid anhydrides, acid amides and esters (mechanism of ester hydrolysis by base and acid)

2. Synthesis based on Carbanions **3h**

Acidity of a-Hydrogens of withdrawing groups, structure of carbanion. Preparation of Aceto acetic ester (ethylacetoester) by Claisen condensation and synthetic application of Aceto acetic ester. (a) Acid hydrolysis and ketonic hydrolysis: Butanone, 3-Methyl 2- butanone. Preparation of (i) monocarboxylic acids ii) dicarboxylic acids (b) malonic ester synthetic applications. Preparation of (i) substituted mono carboxylic acids and (ii) substituted dicarboxylic acids.

3 Nitro hydrocarbons: **6 h**

Nomenclature and classification of nitro hydrocarbons. Structure. Tautomerism of nitroalkanes leading to aci

and keto form. Preparation of Nitroalkanes. Reactivity - halogenation, reaction with HNO_2 (Nitrous acid), Nef reaction, Mannich reaction, Michael addition and reduction. Aromatic Nitro hydrocarbons: Nomenclature, Preparation of Nitrobenzene by Nitration. Physical properties, chemical reactivity - orientation of electrophilic substitution on nitrobenzene. Reduction reaction of Nitrobenzenes in different media.

Unit - III (Physical Chemistry) 15 hr (1h / week)

1: Electrochemistry & EMF **15 h**

Electrical transport - conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of specific and equivalent conductance with dilution. Migration of ions and Kholrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf's method for attackable electrodes. Applications of conductivity measurements: Determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Electrolyte and Galvanic cells - reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurement. Computation of EMF. Types of reversible electrodes- the gas electrode, metal-metal ion, metal- insoluble salt and redox electrodes. Electrode reactions, Nernst equation, cell EMF and single electrode potential, standard Hydrogen electrode - reference electrodes (calamel electrode) - standard electrode potential, sign conventions, electrochemical series and its significance.

Applications of EMF measurements, Calculation of thermodynamic quantities of cell reactions (AG, AH and K). Determination of pH using hydrogen electrode, glass electrode and quinhydrone electrode, Solubility product of AgCl. Potentiometric titrations.

Unit-IV General Chemistry **15h**

1: Pericyclic Reactions **5h**

Concerted reactions, Molecular orbitals of ethene, 1,3-butadiene and allyl radical. Symmetry properties, HOMO, LUMO, Thermal and photochemical pericyclic reactions. Types of pericyclic reactions - electrocyclic, cycloaddition and sigmatropic reactions - one example each and their explanation by FMO theory.

2: Synthetic Strategies **5h**

Terminology - Target molecule (TM), Disconnection approach - Retrosynthesis, Synthon, Synthetic equivalent (SE), Functional group interconversion (FGI), Linear, Convergent synthesis. Retrosynthetic analysis of the following molecules: 1) acetophenone 2) cyclohexene and 3) phenylethylbromide.

3: Asymmetric synthesis **5h**

Definition and classification of stereoslective reactions: substrate, product stereoselective reactions, enantio and diastereo selective reactions. Stereospecific reaction - definition - example - dehalogenation of 1,2-dibromides induced by iodide ion. Enantoselective reactions - definition - example -Reduction of Ethylacetoacetate by Yeast. Diastereoselective reaction-definition-example: Acid catalysed dehydration of 1-phenylproponal and Grignard addition to 2-phenyl propanal. Definition and explanation of enantiomeric excess and diastereomeric excess.

References:

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1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
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3. Text Book of Physical Chemistry by Puri and Sharma.
4. Text Book of Physical Chemistry by K. L. Kapoor.
5. Physical Chemistry through problems by S.K. Dogra.
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry byLewis Glasstone.
8. Industrial Electrochemistry, D. Pletcher, Chapman & Hall

Unit IV

1. Text book of organic chemistry by Morrison and Boyd
2. Text book of organic chemistry by Graham solomons
3. Fundamentals of organic synthesis and retrosynthetic analysis

4. by Ratna Kumar Kar
5. Organic synthesis by Dr. Jagadamba Singh and Dr. L.D.S. Yadav
6. Stereochemistry of organic compounds by D. Nasipuri
7. Organic chemistry by Clayden, Greeves, Warren and Wothers
8. Fundamentals of Asymmetric Synthesis by G. L. David Krupadanam

LABORATORY COURSE-II Practical Paper-IIB (Inorganic chemistry) 45h(3h/w)

I.Titrimetric analysis:

Determination of :

1) Cu(II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard
2) Zinc using EDTA
3) Hardness of water
4) Zinc by ferrocyanide.
5) Estimation of vinegar

II. Gravimetric analysis:

Determination of : 1)Nickel as Ni-DMG complex 2) Magnesium as magnesium pyrophosphate 3)Lead as lead chromate

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B.Sc II YEAR (PRACTICAL) EXAMINATIONS
CHEMISTRY PAPER-IIB

Time: 3hrs **Max Marks:25**

QUESTION BANK

I. Write a brief procedure for the following experiment & mention the principle involved in it. (Time= 10minutes) (3 Marks)

1. Estimate the amount of lead as $PbCrO_4$ gravimetrically in the given solution using K_2CrO_4 solution.
2. Estimate the amount of nickel as Ni-DMG gravimetrically in the given solution using DMG solution.
3. Estimate the amount of magnesium as magnesium pyro-phosphate gravimetrically in the given solution using ammonium phosphate solution.

II. Carry out any one experiment allotted from the following: (15marks)

1) Estimate the amount of $K_2Cr_2O_7$ present in the given solution. You are provided with
   (a) a pure sample of solid $K_2Cr_2O_7$ (b) an approximate 0.1M solution of hypo.
2) Estimate the amount of Zn^{+2} ion present in the given solution complexometrically. You are provided with
   (a) a pure sample of $ZnSO_4/MgSO_4.7H_2O$ (b) an approximate 0.01M solution of EDTA.
3) Estimate the hardness of the given water sample complexometrically. You are provided with
   (a) a pure sample of $ZnSO_4/MgSO_4.7H_2O$ (b) an approximate 0.05M solution of EDTA.
4) Estimate the amount of Zn^{+2} present in the given solution. You are provided with
   (a) a pure sample of $ZnSO_4$ (b) an approximate 0.05M Potassium ferrocyanide.
5) Estimation of vinegar present in the given solution. You are provided with
   (a) a pure sample of oxalic acid (b) an approximate 0.1M NaOH solution
6) Estimate the amount of Cu^{+2} present in the given solution iodometrically. You are provided with
   (a) a pure sample of solid $K_2Cr_2O_7$ (b) an approximate 0.1M solution of hypo.

III. Record and Class Work	2 marks
IV. Viva (pertaining to volumetric analysis)	2 marks
V.Internal Assesement	3 Marks

Subject:Chemistry Practical Papers: IIA & IIB

SCHEME OF VALUATION Total Marks :25M

	Marks
I. Writing the principle and brief procedure.	03
II.1. Preparation of standard solution.	04
(a) Weighing and writing w1, w2 up to 4^{th} decimal place.	02
(b) Calculation of molarity.	02
2. Standardisation of link solution	05
(a) Tabulation of readings	1
(b) Titration	03
Error up to 3% -5% :3	
Error up to 6%-8% :1	
(c) Calculation of Molariy.	01
3. Estimation.	05
(a) Tabulation of readings	01
(b) Titration	03
Error up to 3% -5% :3	
Error up to 6%-8% :1	
(c) Calculation of Molarity	01
4. Result	01
III. Record and Class Work	(2 marks)
IV. Viva (pertaining to volumetric analysis)	(2 marks)
V.Internal Assessment	(3 Marks)

CHEMISTRY IN EVERYDAY LIFE

(For students other than Chemistry)

Semester – IV No. of credits: 2

Course : General Elective No. of hours :2h/wk

Objectives

1. *To make non-chemistry students to get exposed to day to day chemistry related materials and science.*
2. *To learn the terms and definitions in general chemistry and use of popularly used chemicals.*

Unit-1: Chemistry of fuels

1.1 Energy-renewable and non-renewable sources.
1.2 Classification of fuels, solid, liquid and gaseous fuels- coal, petroleum, biogas. Nuclear fuels.
1.3 Calorific value of fuels and its determination.
1.4 Alternate fuels- bio diesel, bio alcohols, and fuel cells

Unit-2: Agricultural Chemistry (10 h)

2.1 Fertilizers: Fertilizers- natural, synthetic, mixed, NPK fertilizers. Excessive use of fertilizers and its impact on the environment. Bio-fertilizers.
2.2. Plant nutrients: micro and macronutrients and their role.
2.2 Pesticides: Classifications- herbicides, insecticides, fungicides- repellants – fumigants,defoliants

Unit -3: Food Science (8 h)
3.1 Food additives: Artificial sweeteners, Functional food additives, adulteration, food laws. Food colours - permitted and non – permitted- Toxicology. Flavours – natural and synthetic- Toxicology .Other functional additives- Soft drinks- formulation Health drinks, preservatives
3.2 Food adulteration: Common adulterants used in different foods, analysis of detection and prevention
3.3 Water quality parameters - Total dissolved solids - hardness - dissolved oxygen – water treatment - sterilization - Chlorination – Ozonisation.

Unit-4: Consumer Products (9 h)
4.1 Soaps – Introduction, detergent action of soap. Toilet soap, bathing bars, washing soaps, liquid soap manufacture- additives, fillers and flavors. Significance of acidity and alkalinity
4.2. Detergents-Introduction, detergent action, Common detergent chemicals-additives, excipients, colors and flavours. Enzymes used in commercial detergents. Environmental hazards
4.3. Cosmetics- Introduction, classification – bathing oils, face creams, toilet powder, skin products, dental cosmetics, hair dyes, shaving cream, shampoo, general formulation of each type. Toxicology of cosmetics

Unit-5: Articles used in daily life (8 h)
5.1 Polymers:Thermoplastic and thermosetting plastics. Use of PET, HDPE, PVC, PVA, PU.Recycling of plastics.Biodegradable plastics. Environmental hazards of plastics
5.2 Glass: composition, types and uses
5.3 Cement: composition and setting of cement
5.4 Dyes: classification based on application
5.5 Pharmaceuticals: Chemotherapy- types of drugs- analgesics, antipyretics, antihistamines,antacids, tranquilizers, sedatives, antibiotics - Misuse of drugs

Text Books

1. A.K.Biswas, *Frontiers in Applied Chemistry*, Narosa publishing house, 1989
2. B.K. Sharma,*Industrial Chemistry*, 13th ed. , Krishnaprakash Media Pvt Ltd Meerut, 2002.
3.Telugu Academi,Intermediate Second year Chemistry,Re Print 2011.

References

1. O.P.Vermain and A.CNarula., *Applied chemistry*, New age international Chennai,1995.
2. V.T .Thiagarajan, *Pharmaceutical chemistry*, K.S.C. Desikan & Co, Chennai,1995.

GOVT.CITY COLLEGE, HYDERABAD
(AUTONOMOUS Re-ACCREDITED WITH "A" GRADE BY NAAC)
IV SEMESTER EXAMINATIONS
GENERAL ELECTIVE (CHEMISTRY)
MODEL PAPER

Time: 2hrs Max Marks: 50

Section-A

Answer any four of the following questions: 4× 5= 20

1.

2.

3.

4.

5.

6.

Section-B

Answer any three of the following questions: 3 × 10= 30

7.

8.

9.

10.

11.

GOVERNMENT CITY COLLEGE, HYDERABAD

B.Sc III YEAR CHEMISTRY SEMESTER V PAPER – V (Core) 14+14+14 (42 hrs)

From 2016-17 onwards

1	**Unit - 1 (Inorganic Chemistry)**	**14 hrs**
	Coordination Chemistry	**10 hrs**
	Spectral and Magnetic properties of Metal Complexes	**4 hrs**
2	**Unit - II (Organic Chemistry)**	**14 hrs**
	Nitrogen Compounds	**9 hrs**
	Heterocyclic Compounds	**5 hrs**
3	**Unit - III (Physical Chemistry)**	**14 hrs**
	Chemical Kinetics	**9 hrs**
	Photo Chemistry	**5 hrs**
4	**Unit IV (Laboratory courses at the end of VI Semester Papers III & IV**	**180 hrs (6 hrs/w)**

Paper - V

Unit -1 (Inorganic Chemistry) 14 hrs

1.Coordination Chemistry: 10 hrs

IUPAC nomenclature, bonding theories - review of Werner's theory and Sedgwick'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.

2.Spectral and magnetic properties of metal complexes: 4 Hrs Electronic absorption spectrum of $[Ti(H20)6]^{3+}$ ion. Types of magnetic behavior, spin-only formula, calculation of magnetic moments, experimental determination of magnetic susceptibility - Gouy method.

Unit II - Organic Chemistry:

1.Nitrogen compounds: 9 h

Nitro hydrocarbons: Nomenclature and classification - nitro hydrocarbons - structure. Tautomerism of

nitroalkanes leading to aci and keto form. Preparation of Nitroalkanes.

Reactivity - halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Michael addition and reduction.

Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1°, 2°, 3° Amines and Quartemary ammonium compounds. Preparative methods -1. Ammonolysis of alkyl halides /. • 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-aqueous medium), steric effects and substituent effects. Use of amine salts as phase transfer catalysts. Chemical properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation e) Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines - Bromination and Nitration, oxidation of aryl and 3° Amines. Diazotization

Cyanides and isocyanides: Nomenclature (aliphatic and aromatic) structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation.

i

2.HeterocycIic **Compounds:** **5 hrs**

Introduction and definition: Simple 5 membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring system - presence in important natural products like hemoglobin and chlorophyll. Numbering the ring systems as per Greek letter and Numbers. Aromatic character - 6- electron system (four-electrons from two double bonds and a pair of non-bonded electrons from the hetero atom). Tendency to undergo substitution reactions. Resonance structures: Indicating electron surplus carbons and electron deficient hetero atom. Explanation of feebly acidic character of pyrrole, electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions. Reactivity of furan as 1,3-diene, Diels Alder reactions (one example). Sulphonation of thiophene purification of Benzene obtained from coal tar). Preparation of furan, Pyrrole and thiophene from 1,4,- dicarbonyl compounds only, Paul-Knorr synthesis, structure of pyridine, Basicity - Aromaticity - Comparison with pyrrole - one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction - chichibabin reaction.

Unit-Ill (Physical chemistry)

1.Chemical kinetics: 9 hrs

Rate of reaction, factors influencing the rate of a reaction-concentration, temperature, pressure, solvent, light, catalyst. Experimental methods to determine the rate of reaction. Definition of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for time half change. Methods to determine the order of reactions. Kinetics of complex reactions (first order only): opposing reactions, parallel reaction^, consecutive reactions and chain reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Theories of reaction rates- collision theory-derivation of rate constant for bimolecular reaction. The transition state theory (elementary treatment).

2.Photochemistry 5 hrs

Difference between thermal and photochemical processes. Laws of photochemistry-Grothus- Drapers law and Stark-Einstein's law of photochemical equivalence. Quantum yield. Ferrioxalate actinometry. Photochemical hydrogen- chlorine, hydrogen-bromine reaction. Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing). Photosensitized reactions- energy transfer processes (simple example)

Unit IV:Laboratory courses at the end of VI Semester Papers III & IV 180 hrs (6hrs /w)

GOVERNMENT CITY COLLEGE, HYDERABAD

B.Sc. Ill YEAR CHEMISTRY SEMESTER V PAPER - VII (Advanced Elective I) 14+13+15 (42 hrs)

From 2016-17 onwards

1	Unit-I(Physico Chemical Methods of analysis	16Hrs
	Seperation Technics	12Hrs
	Spectro Photometry	4Hrs
2	Unit-II(Drugs)	17Hrs
	Drugs	17 Hrs
3	Unit-III(Macromolecules and Material Science)	17Hrs
	Macromolecules	10 Hrs
	Material Science	5Hrs

Paper VII:Chemistry and Industry

Unit - I Physico Chemical Methods of analysis

1. Sepearation Techniques: 12Hrs

1.Solvent extraction:

Principle and process, Batch extraction, continuous extraction and counter current extraction. Application - Determination of Iron (III)

2.Chromatography:

Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, Rf values, factors effecting Rf values.

a. Paper Chromatography: Principles, Rf values, experimental procedures, choice of paper and solvent systems, developments of chromatogram - ascending, descending and radial. Two dimensional chromatography, applications.
b. Thin layer Chromatography (TLC): Advantages. Principles, factors effecting Rf values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications.
c. Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation technique. Applications
d. High Performance Liquid Chromatography (HPLC): Principles and Applications.
e. Gas Liquid Chromatography (GLC): Principles and Application

2. Spectrophotometry 4 Hrs

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 manganese sulphate 3.Iron (III) with thiocyanate.

Unit - II (Drugs) : 17 Hrs

1. Drugs

- Introduction: Drug, disease (definition), Historical evolution, Sources - Plant, Animal synthetic, Biotechnology and human gene therapy
- Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors - brief teartment) Metabolites and Anti metabolites.
- Nomenclature: Chemical name, Generic name and trade names with examples
- Classification: Classification based on structures and therapeutic activity with one example each.
- Synthesis: Synthesis and therapeutic activity of the following drugs., L-Dopa, Chloroquin, Omeprazole, Albuterol and ciprofloxacin.
- Drug Development: Pencillin, Separation and isolation, structures of different pencillins

- HIV-AIDS: Immunity - CD-4 cells, CD-8 cells Retrovirus, replication in human body. Investigation available, prevention of AIDS. Drugs available - examples with structures: PIS: Indinavir (Crixivan), Nelfinavir (Viracept), NNRTIS: Efavirenz (Susrtiva), Nevirapine (Viramune) NRTIs: Abacavir (Ziagen), Lamivudine (Epivir, 3TC) Zidovudine (Retravir, AZT, ZDV)

- Monographs of drugs: Eg Paracetamol, Sulpha methoxazole (Tablets)

Unit-Ill: (Macromolecules and materials Science)

1. **Macromolecules** **lOhrs**

Classification of polymers, chemistry of polymerization, chain polymerization, step polymerization, coordination polymerization - tacticity. Molecular weight of polymers- number average and weight average molecular weight, degree of polymerization, determination of molecular weight of polymers by viscometry, Osmometry and light scattering methods. Kinetics of free radical polymerization, derivation of rate law. Preparation and industrial application of polyethylene, PVC, Teflon, polyacrylonitrile, terelene and Nylon66. Introduction to biodegradability.

2. **Materials science** **5hrs**

Superconductivity, characteristics of superconductors, Meissner effect, types of superconductors and applications. Nanomaterials,synthetic techniques,bottom-up-sol-gel method, top-down,electro deposition method. Properties and applications of nano-materials

Unit IV :Laboratory courses at the end of VI Semester Papers III & IV 180 Hrs(6h/week)

GOVERNMENT CITY COLLEGE, HYDERABAD

B.Sc. III YEAR CHEMISTRY SEMESTER V (Advanced Elective II) 10+17+17 (44 hrs)

1	**Unit-I Introduction to Polymer**	**10 Hrs**
2	**Unit II: Kinetic, mechanism & techniques for polymerization and polymer degradation**	**17 Hrs**
3	**Unit 3: Industrial polymers & polymer processing**	**17 Hrs**

UNIT 1 : INTRODUCTION TO POLYMER (10 hours)

1.1 Monomers, Oligomers, Polymers and their characteristics

1.2 Classification of polymers : Natural synthetic, linear, cross linked and network; plastics, elastomers, fibres, Homopolymers and Co-polymers

1.3 Bonding in polymers : Primary and secondary bond forces in polymers ; cohesive energy and decomposition of polymers.

1.4 Determination of Molecular mass of polymers: Number Average molecular mass (M_n) and Weight average molecular mass (Mw) of polymers and determination by (i) viscosity (ii) Light scattering method (iii) Gel Permeation Chromatography (iv) osmometry and ultracentrifuging.

Molecular weight determination of high polymers by different methods.

UNIT 2 : KINETIC, MECHANIISM & TECHNIQUES FOR POLYMERIZATION AND POLYMER DEGRADATION : (17 hours)

2.1 Chain growth polymerization :

Cationic, anionic, free radical polymerization, Stereo regular polymers : Ziegler Natta polymers.

2.2 Polycondensation-non catalysed, acid catalysed polymerization, molecular weight distribution, Step growth polymers

Techniques for polymerization and polymer degradation

2.3 Bulk, Solution, Emulsion, Suspension, Melt polycondensation, solution polycondensation interfacial and gas phase polymerization

2.4 Types of Polymer Degradation, Thermal degradation, mechanical degradation, photodegradation, Photo stabilizers.

2.5 Solid and gas phase polymerization

UNIT 3: INDUSTRIAL POLYMERS & POLYMER PROCESSING :(17 hours)

3.1 Raw material, preparation, fibre forming polymers, elastomeric material.

3.2 Thermoplastics : Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester.

3.3 Thermosetting Plastics : Phenol formaldehyde and expoxide resin.

3.4 Elastomers : Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene. Conducting Polymers : Elementary ideas ; examples : poly sulphur nitriles, poly phenylene, poly pyrrole and poly acetylene.

3.5 Compounding:

Polymer Additives: Fillers, Plasticizers antioxidants and thermal stabilizers fire retardants and colourants.

3.6 Processing Techniques:

Calendaring, die casting, compression moulding, injection moulding, blow moulding, extrusion moulding and reinforcing.

LABORATORY COURSE – IIIA

Practical Module –III(Organic Chemistry) 45 Hrs (3h/week)

1. Synthesis of Organic Compounds

i. Aromatic electrophilic substitution Nitration: Preparation of nitro benzene and p-nitro acetanilide,

ii. Halogenation: Preparation of p-bromo acetanilide - preparation of 2,4,6- tribromo phenol.

iii. Diazotization and coupling: Preparation of pheyl azo P-napthol

iv. Oxidation: Preparation of benzoic acid from benzoyl chloride

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

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

vii. Methylation: Preparation β-napthyl methyl ether(Neroline)

viii. Condensation: Preparation of benzilidine aniline,Acetanilide

2. Thin layer Chromatography & Column Chromatography(Demonstration)

i. Preparation of the TLC plates. Checking the purity of the compounds by TLC: Acetylation of salicyclic acid, aniline, Benzoylation of Aniline and Phenol Determination of Rf values and identification of organic compounds by TLC: preparation and separation of 2,4-dinitrophenyl hydrazones of acetione and 2-butanone using toluene and light petroleum(40:60)

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

GOVERNMENT CITY COLLEGE, HYDERABAD
(Autonomous) Affiliated to Osmania University
FACULTY OF SCIENCE

B. Sc III semester (Practical) Examination **Subject: Chemistry Module: IIIA**
(w.e.f 2017-18) **Time: 3 Hours)** **Max. Marks: 40**

I. Write a brief procedure with chemical equation & prepare a pure sample of one of the compounds given & submit the crude & recrystallised samples. (10)

1.Acetanilide 2.p-Bromo acetanilide 3.$PhNO_2$ 4.β-Naphthyl methyl ether 5 PhCOOH(from PhCOC1) 6.PhCHNHPh (Benzilidine Aniline) 7.Phenyl azo β –Naphthol 8.m-mtro aniline(from m-dinitro benzene) 9. 2,4,6-Tribromo phenol 10 .Methyl p-Nitro benzoate(from p-Nitro benzoic acid) 11.p-Nitro acetanilide

SCHEME OF EVALUATION **Total Marks 50**

Internal Marks	10
Practical Examination	40

Marks

1.Procedure writing and Chemical Equation 5+3=8 Preparation
7 a.Crude Sample
6 b.Recrystallization
1

II.Identification of Organic Compond 15 a.Ignition Test
4 b.Physical Constant
MP/BP 4 c.Solubility
7 III.Viva on Identification/TLC
5

IV.Record 5

GOVERNMENT CITY COLLEGE, HYDERABAD
(Autonomous) Affiliated to Osmania University
FACULTY OF SCIENCE

B. Sc III semester (Practical) Examination **Subject: Chemistry Module: IIIA**
(w.e.f 2016-17) **Time: 3 Hours** **Max. Marks: 40**

II. Write a brief procedure with chemical equation & prepare a pure sample of one of the compounds given & submit the crude & recrystallised samples. (8)

1.Acetanilide 2.p-Bromo acetanilide 3.$PhNO_2$ 4.β-Naphthyl methyl ether 5 PhCOOH(from PhCOC1) 6.PhCHNHPh (Benzilidine Aniline) 7.Phenyl azo β –Naphthol 8.m-mtro aniline(from m-dinitro benzene) 9. 2,4,6-Tribromo phenol 10 .Methyl p-Nitro benzoate(from p-Nitro benzoic acid) 11.p-Nitro acetanilide

III. Identify the functional group Class present in the given organic compound & report its nature, physical constant,solubility (22Marks)

1.Phenol 2.o-Cresol 3.m-Cresol 4.p-Cresol 5.β-Napthol 6.Aniline 7.p-Toluidine 8.Glucose 9.Benzoic Acid 10.Fructose 11.Benzaldehyde 12.Acetaldehyde 13.Urea 14.BenzoPhenone 15.Acetophenone

Laboratory Course -IVA

Practical module IV (Physical Chemistry) 45hrs (3 h / w)

1. **Chemical kinetics**

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

ii. Determination of rate of decomposition of hydrogen peroxide.

iii. Determination of overall order of saponification of ethyl acetate

2. **Distribution law**

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

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

3. **pH metry**

i. Preparation phosphate buffer solutions

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

GOVERNMENT CITY COLLEGE, HYDERABAD
(Autonomous) Affiliated to Osmania University
FACULTY OF SCIENCE

B. Sc III semester (Practical) Examination **Subject: Chemistry module: IVA**
(w.e.f 2017-18) **Time: 3 Hours)** **Max. Marks: 40**

Carryout any one experiment allotted from the following.(with principle & brief procedure)

1.Verify the order & calculate the rate constant of acid catalysed hydrolysis of methyl acetate from a kinetic study at , room temperature

2. Determine the order of reaction & rate constant from a kinetic study of Fe(Ill) catalysed decomposition of H_2O_2 at room temperature

3.Find the order & rate constant of the saponification reaction involving Ethyl Acetate-NaOH from a kinetic study at room temperature

4. Prove that Ethyl Acetate-NaOH reaction follows 2^{nd} order kinetics & compare the rate constants obtained from the graph with the calculated value

5.Using graphical method, verify the order & determine the rate constant of Ethyl Acetate - NaOH reaction from a kinetic study at room temperature

6.Determine the distribution coefficient & molecular state of I_2 in CCl_4 from the study of distribution of Iodine between CCl_4 & water

7. From a study of distribution of Bezoic Acid between Toluene &water prove that Bezoic Acid exists-asDimer in Toluene & determine the distribution coefficient

SCHEME OF EVALUATION **Total Marks 50**

Internal Marks	10
Practical Examination	40

For kinetics / distribution coefficient/Instrumentation experiments **Marks**

I.Principle and procedure with equations 4+3=07

II.a. Five sets of reasonable experimental readings, proper tabulation 12 b.Calculation and result 5 c. Graph 6

III.Record 5

IV.Viva 5

GOVERNMENT CITY COLLEGE, HYDERABAD

B.Sc III YEAR CHEMISTRY SEMESTER VI PAPER - VI (Core)16+16+16 (48 hrs)

From 2017-18 onwards

1	**Unit - 1 (Inorganic Chemistry)**	**16 hrs**
	Reactivity of metal Complexes **Stability of metal Complexes**	**4hrs** **4 hrs**
	Hard and Soft acids bases (HSAB)	**4 hrs**
	Bioinorganic Chemistry	**4 hrs**
2	**Unit - II (Organic Chemistry)**	**16hrs**
	Carbohydrates **Amino acids and proteins**	**6 hrs** **5 hrs**
	Mass spectrometry	**5 hrs**
3	**Unit - III (Physical Chemistry)**	**16 hrs**
	Thermodynamics	**16 hrs**
4	**Unit IV (Laboratory courses at the end of VI Semester Module III & IV**	**180 hrs (6 hrs /w)**

Unit - I (Inorganic Chemistry):

l.Reactivity of metal complexes: **4Hrs** Labile and inert complexes, ligand substitution reactions - SNI and SN2, substitution reactions of square planar complexes - Trans effect and applications of trans effect.

2.Stability of metal complexes: **4Hrs** 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

3.Hard and soft acids bases (HSAB): **4Hrs** Classification, Pearson's concept of hardness and softness, application of HSAB principles - Stability of compounds / complexes, predicting the feasibility of a reaction.

4.Bioinorganic Chemistry: **4Hrs** Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride (C1'). Metalloporphyrins - hemoglobin, structure and function, Chlorophyll, structure and role in photosynthesis.

UNIT - II (Organic Chemistry)

1..Carbohydrates: **6 hrs**

Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Evidences for straight chain

pentahydroxy aldehyde structure (Acetylation, reduction to n-hexane, cyanohydrin formation, reduction of Tollen's and Fehling's reagents and oxidation to gluconic and saccharic acid). Number of optically active isomers possible for the structure, configuration of glucose based on D-glyceraldehyde as primary standard (no proof for configuration is required). Evidence for cyclic structure of glucose (some negative aldehydes tests and mutarotation). Cyclic structure of glucose. Decomposition of cyclic structure (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). Different ways of writing pyranose structure (Haworth formula and chair conformationa formula). Structure of fructose: Evidence of 2 - ketohexose structure (formation of pent* acetate, formation of cyanohydrin its hydrolysis and reduction by HI to give 2-Carboxy-n- hexane). Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure and Haworth formula). Interconversion of Monosaccharides: Aldopentose to aldo hexose - eg: Arabinose to D- Glucose, D-Mannose (Kiliani - Fischer method). Epimers, Epimerisation - Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose eg: D-glucose to D- arabinose by Ruff f degradation. Aldohexose (+) (glucose) to ketohexose (-) (Fructose) and Ketohexose (fructose) to aldohexose (Glucose)

2. Amino acids and proteins **5 hrs**

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gama amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucene) by following methods: a) from halogenated carboxylic acid b) Malonic ester synthesis c) strecker's synthesis. Physical properties: Optical activity of naturally occurring amino acids: L-configuration, irrespective of sign rotation, Zwitterion structure - salt like character - solubility, melting points, amphoteric character , definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

3. Mass Spectrometry: **5 hrs** Basic principles - Molecular ion / parent ion, fragment ions / daughter ions. Theory - formation of parent ions. Representation of mass spectrum. Identification of parent ion, (M+l), (M+2), base peaks (relative abundance 100%) Determination of molecular formula - Mass spectra of ethylbenzene, acetophenone, n-butyl amine and 1-proponal.

Unit-Ill (physical chemistry)

1. Thermodynamics: **16 Hrs**

The first law of thermodynamics-statement, definition of internal energy and enthalpy. Heat capacities and their relationship. Joule's law-Joule-Thomson coefficient. Calculation of w, q, dU and dH for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. State function.Temperature dependence of enthalpy of formation-Kirchoffs equation.

Second law of thermodynamics. Different Statements of the law. Carnot cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature. Concept of entropy, entropy as a state function, entropy changes in cyclic, reversible, and irreversible processes and reversible phase change. Calculation of entropy changes

with changes in V & T and P&T. Entropy of mixing inert perfect gases. Entropy changes in spontaneous and equilibrium processes.
The Gibbs (G) and Hlmholtz (A) energies. A & G as criteria for thermodynamic equilibrium and spontaneity-advantage over entropy change. Gibbs equations and the Maxwell relations. Variation of G with P, V and T

GOVERNMENT CITY COLLEGE, HYDERABAD **B.Sc.**

IIl YEAR CHEMISTRY SEMESTER VI PAPER – VIII (Applied Elective I) 14+13+15 (42 hrs)

1	**Unit-I (Physico Chemical Methods of analysis)**	**14Hrs**
	Molecular Spectroscopy	**14Hrs**
2.	**Unit-II(Formulations,Pesticides,Green Chemistry)**	**13Hrs**
	Formulations	**03Hrs**
	Pesticides	**05Hrs**
	Green Chemistry	**05 Hrs**
3.	**Unit-III(Material Science -Composites,Catalysis)**	**15 Hrs**
	Material Science-Composites	**3Hrs**
	Catalysis	**12 Hrs**
4.	**Unit-IV (Laboratory Courses at the end of VI semester Paper III & IV**	**180Hrs (6 Hrs/week)**

Unit-I (Physico Chemical Methods of analysis)

Molecular spectroscopy **14 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)Raman spectroscopy:

Concept of polarizavility, selection rules, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

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

Principles of nuclear magnetic resonace,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.

(V)Spectral interpretation:

Interpretation of IR, UV-Visible, 'H-NMR and mass spectral data of the following compounds 1. Phenyl acetylene 2. Acetophenone 3.Cinnamic Acid 4. para-nitro aniline.

Unit-II (Formulations,Pesticides and Green Chemistry)

1.Formulations **3 h**

Need of conversion of drugs into medicine. Additives and their role (brief account only)
Different types of formulations

1. Pesticides **5 h** Introduction to pesticides - types - Insecticides, Fungicides, Herbicides, Weedicides, Rodenticides plant growth regulators, Pheremones and Hormones. Brief discussion with examples, Structure and uses.

Synthesis and presnt status of the following. DDT, BHC, Malathion, Parathion, Endrin, Baygon, 2,4-D and Endo-sulphon

3.Green Chemistry **5h**

Introduction: Definition of green Chemistry, need of green chemistry, basi|c principles of green chemistry

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).

Selection of solvent:

i) A.queous phase reactions ii) Reactions in ionic liquids iii) Solid supported synthesis iv) Solvent free reactions (solid phase reactions)

ii) Green catalysts: i) Phase transfer catalysts (PTC) ii) Biocatalysts Microwave and Ultrasound assisted green synthesis:

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

Unit - III (Materials science- Composites and Catalysis)

1.Composites **3hrs**

Composites-definition, general characteristics, particle reinforce and fiber reinforce composites and their applications.

2.Catalysis **12hrs**

Homogeneous and heterogeneous catalysis, comparision with examples. Kinetics of specific acid catalyzed reactions, inversion of cane sugar. Kinetics of specific base catalyzed reactions, base catalyzed conversion of acetone to diacetone alcohol. Acid and base catalyzed reactions- hydrolysis of esters, mutarotation of glucose. Catalytic activity at surfaces. Mechanisms of heterogeneous catalysis. Langmuir-Hinshelwood mechanism Enzyme catalysis: Classification, characteristics of enzyme catalysis. Kinetics of enzyme catalyzed reactions-Michaelis Menton law, significance of Michaelis constant (K_m) and maximum velocity (V_{max}). Factors affecting enzyme catalysis- effect of temperature, pH, concentration and inhibitor. Catalytic efficiency. Mechanism of oxidation of ethanol by alcohol dehydrogenase.

GOVERNMENT CITY COLLEGE, HYDERABAD

B.Sc. Ill YEAR CHEMISTRY SEMESTER VI (Applied Elective II) 15+15+15=45hrs

1	**Unit I Industrial fuels**	**15 Hrs**
2	**Unit II Chemistry and agriculture**	**15 Hrs**
3	**Unit III Pollution and chemical toxicology**	**15 Hrs**

UNIT-1 : Industrial fuels (15 h)

1.1 Energy Sources: non-renewable, classification of fuels: solid, liquid and gaseous. Calorific value of fuels and its determination.

1.2 Solid fuels

Coal: types - properties and uses - lignite, sub-bituminous coal, bituminous coal and anthracite. Cooking and non-coking coal.

1.3 Liquid fuels

Refining of crude petroleum and uses of fractions. Hydrodesulphurisation. Cracking: thermal and catalytic (fixed bed and fluidised bed cataylsis). Octane number. Production and uses of tetraethyl lead, ETBE and MTBE.

1.4 Gaseous fuels

Natural gas and gobar gas: production, composition and uses., Gobar electric cell.

UNIT-2 : Chemistry and agriculture(15 h)

2.1Fertilizers

NPK, representation,superphosphate, triple superphosphate, uses of mixed fertilizers. Micronutrients and their role, biofertilizers, plant growth harmones.

2.2 Pesticides

Classification of pesticides with examples.

Insectides; stomach poisons, contact insecticides, fumigants. Manufacture and uses of insecticides. DDT, BHC (gammaxane: Conformation of gamma isomer) pyrethrin. Mention of aldrin, dieldrin,endrin and pentachlorophenel (and its Na salts) and Biopesticides.

Herbicides: Manufacture of 2,4-D and 2,4,5-T

Fungicides: Preparation of Bordeaux mixture. Mention of lime-sulphur, creosote oil and formula.

2.3 Sugar industry

Double sulphitation process. Refining and grading of sugar. Saccharin: synthesis and use as a sugar substitute - aspartame. Ethanol: manufacture from molasses by fermentation.

UNIT-3 : Pollution and chemical toxicology(15 h)

3.1 Pollution: Air pollution - Acid rain. Green house effect (global warming), ozone layer depletion - photochemical oxidants. Control of air pollution. Water pollution - organic pollutants, Chemical oxygen demand (COD), Biological oxygen demand (BOD), total organic carbon. International standards for water and air quality and regulations

3.2 Chemical toxicology: Effect of toxic chemicals on enzymes. Lead, mercury and cyanide pollution and their biochemical effects. Carbon monoxide, sulfur dioxide, oxides of nitrogen, ozone - biochemical effects.

3.3 Quality control: ISI specification. Patent: Purpose and procedures

LABORATORY COURSE – IIIB

Practical Module –III(Organic Chemistry) 45 Hrs (3h/week)

I. Organic Qualitative Analysis:

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

ii. Separation of two component mixtures

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

II. Demonstration experiments:

1. Steam distillation experiment: separation of ortho and para nitro phenols,Seperation of water,DMSo etc by Rota evaporator

2) Microwave assisted Green synthesis, two examples: 1. Hydrolysis of Benzamide 2. Oxidation of Toluene.

GOVERNMENT CITY COLLEGE, HYDERABAD
(Autonomous) Affiliated to Osmania University
FACULTY OF SCIENCE
B. Sc III semester (Practical) Examination **Subject: Chemistry**
Module: IIIB
(w.e.f 2017-18) **Time: 3 Hours)** **Max. Marks: 40**

Write a brief procedure with chemical equation

IV. Identify the functional group present in the given organic compound & report its nature, physical constant,solubility & functional group tests. Prepare a solid derivative & submit(25)

1.Phenol 2.o-Cresol 3.m-Cresol 4.p-Cresol 5.β-Napthol 6.Aniline 7.p-Toluidine 8.Glucose 9.Benzoic Acid 10.Fructose 11.Benzaldehyde 12.Acetaldehyde 13.Urea 14.BenzoPhenone 15.Acetophenone

SCHEME OF EVALUATION **Total Marks 50**

Internal Marks	10
Practical Examination	40
	Marks
1.Procedure writing and Chemical Equation(Green Synthesis)	5+3=8
II.Identification of Organic Compond	22 a.Ignition Test 2 b.Physical Constant MP/BP 2 c.Solubility 5 d.Functional Group Tests (Min 3 tests) 3*3=09 e.Derivative 3 f.Result 1
III.Viva on Identification/TLC	5
IV.Record	5

Laboratory Course -IVB

Practical module IV (Physical Chemistry) 45hrs (3 h / w)

1.Electrochemistry

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

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

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

iv. Determination of solubility and solubility product of BaSO/}

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

2.Colorimetry

i. Verification of Beer-Lambert law for KMn04 , [illegible] and determination of concentration of the given solution.

ii. Verification of Beer-Lambert law for CUSO4 and determination of concentration of the given solution.

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

3.Adsorption

i. Surface tension and viscosity of liquids.

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

4. Project Work: ,

NOTE: Apart from the experiments the project work shall also be included in the Laboratory Examination.

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FACULTY OF SCIENCE

B. Sc III semester (Practical) Examination **Subject: Chemistry module: IVB**
(w.e.f 2017-18) **Time: 3 Hours)** **Max. Marks: 40**

Carryout any one experiment allotted from the following.(with principle & brief procedure)

1.Verify Fraeundlich adsorption isotherm for the system adsorption of Acetic acid on animal Charcoal

2.Determine ionization constant k, of Acetic acid by conductivity measurements.

3.Determine the density & surface tension of the given liquid at room temperature (density & surface tension of water are given)

4.Determine the density and viscosity of the given liquid at room temperature (density & viscosity of water are given)

5.Determine the strength of given strong acid (HC1) by a conduct metric titration against a standard 0.5M NaOH solution

6.Estimate the amount of HCI present in the given solution, by titrating it against a 0.5M NaOH Solution conductometricaliy

7.Determine the concentration of given W.A(CH_3COOH) by titrating it against a 0.5M NaOH conductometricaliy

8.Estimate the amount of WA (CH_3COOH) present in the given solution, by titrating it against a 0.5M NaOH Solution Conductometrically

9.Find the amount of Cr^{+6} present in the given solution colorimetrically from the verification of Beer's law for $K_2Cr_2O_7$solution

10.Find the amount of Mn^{+2}present in the given solution from a study of verification of Beer's law of $KMnO_4$ solution colorimetric method

11.Verify Beer's law for solution $K_2Cr_2O_7$ & estimate the amount of Cr^{+6} present in the given solution colorimetrically.

12.Verify Beer's law for $KMnO_4$ solution &estimate the amount of Mn^{+2}present in the given solution colorimetrically

13.Determine the strength of HCI by potentiometric titration, using 0.1 M NaOH.

14.Determine redox potential of Fe^{2+}/Fe^{3+} by potentiometric titration using Ferrous Ammonium Sulphate.

SCHEME OF EVALUATION **Total Marks 50**

Internal Marks	10
Practical Examination	40

For kinetics / distribution coefficient experiments **Marks**

SCHEME OF EVALUATION **Total Marks 50**

Internal Marks	10
Practical Examination	40

Instrumentation experiments	**Marks**
I.Principle and procedure with equations	4+3=07
II.a. 10-15 sets of reasonable experimental readings, proper tabulation and result	12 b.Calculation 5 c. Graph 6
III.Record	5
IV.Viva	5

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. Modem Inorganic Chemistry by C F Bell and K A K Lott
6. University Chemistry by Bruce Mahan
7. Qualitative Inorganic analysis by A.I.Vogel
8. A textbook of qualitative inorganic analysis by A.I. Vogel
9. Inorganic Chemistry by J.E.Huheey
10. Inorganic Chemistry by Chopra and Kapoor
11. Coordination Chemistry by Basalo and Johnson
12. Organometallic Chemistry - An introduction by R.C.Mehrotra and A.Singh
13. Inorganic Chemistry by D.F.Shriver, P.W.Atkins and C.H.Langford
14. Inorganic Chemistry by Philips and Williams, Lab Manuals
15. Introduction to inorganic reactions mechanisms by A.C.Lockhart
16. Theoretical inorganic chemistry by McDay and J.Selbin
17. Chemical bonding and molecular geometry by R.J.Gillepsy and P.L.Popelier
18. Advanced Inorganic Chemistry By Gurudeep Raj
19. Analytical chemistry by Gary D Christian, Wiley India
20. Analytical Chemistry by G.L.David Krupadanam, et al, Univ. Press
21. Selected topics in inorganic chemistry by W.D.Malik, G..D.Tuli, R.D.Madan
22. Concepts and models of Inorganic Chemistry by Bodie Douglas, D.McDaniel and J.Alexander
23. Modem Inorganic Chemistry by William L. Jolly
24. Concise coordination chemistry by Gopalan and Ramalingam
25. Satyaprakash's modern inorganic chemistry by R.D.Madan.

Recommended Text Books and Reference Books Organic Chemistry

1. Organic Chemistry By R T Morrison and R.N.Boyd
2. Organic Chemistry by T.J.Solomons
3. Organic Chemistry by L.G.Wade Sr
4. Organic Chemistry by D.Cram, G.S.Hammond and Herdricks
5. Modem Organic Chemistry by J.D.Roberts and M.C.Caserio
6. Text book of Organic Chemistry by Ferguson
7. Problems and their solutions in organic Chemistry by I.L.Finar
8. Reaction mechanisms in Organic Chemistry by S.M.Mukherji and S.P.Singh
9. A guide book to mechanisms in Organic Chemistry by Peter Sykes
10. Organic spectroscopy by J.R.Dyer
11. Organic Spectroscopy by William Kemp
12. Fundamentals of organic synthesis amd retrosynthetic analysis by Ratna Kumar Kar
13. Comprehensive practical organic qualitative analysis by V.K.Ahluwaiia & Sumta Dhingra
14. Comprehensive practical organic chemistry: Preparation and quantitative analysis by V.K.Ahluwaiia

and Reena Agarwal.

15. Organic Chemistry by Janice Gorzynski
16. Organic Chemistry by Stanley H Pine
17. Fundamentals of Organic Chemistry by John Me Murray, Eric Simanek
18. Organic Chemistry by Francis A Carey
19. Text book of Organic Chemistry by K.S.Mukherjee
20. Organic Chemistry by Bhupinder Meha & Manju Mehta
21. Organic Chemistry by L.G.Wade Jr, Maya Shankar Singh
22. Elementary organic spectroscopy by Y.R. Sharma
23. Chemistry & Industry by Gurdeep R. Chatwal
24. Applied Chemistry by Jayashree Ghosh
25. Drugs by David Krupadanam
26. Pharmacodynamics by R.C.Srivastava, Subit Ghosh
27. Analytical Chemistry by David Krupadanam
28. Green Chemistry - V.K.Ahluwaiia
29. Organic Synthesis by V.K.Ahluwaiia and R.Agarwal
30. New trends in Green Chemistry -by V.K.Ahluwaiia & M.Kidwai
31. Industrial Chemistry by B.K.Sharma
32. Industrial Chemistry by Banerji
33. Industrial Chemistry byM.G.Arora
36. Industrial Chemistry by O.P.Veramani & A.K.Narula 35 Synthetic Drugs by O.D.Tyagi & M.Yadav 36. Medicinal Chemistry by Ashutoshkar
37. Medicinal Chemistry by P.Parimoo 38 Pharmacology & Pharmacotherapeutics by R.S Satoshkar & S.D.Bhandenkar
39. Medicinal Chemistry by Kadametal P-I & P.II
40. European Pharmacopoeia
41. Vogel's Qualitative organic analysis.
42. Laboratory manual of Organic Chemistry by Raj K Bansal

Physical chemistry books.

1. Physical chemistry A molecular approach by Donald A. Mcquarrie and John D. Simon.
2. Physical chemistry by G M Barrow
3. Principles of physical chemistry by Prutton and Marron
4. Physical chemistry by Peter Atkins, Julio D. Paula
5. Physical Chemistry by Ira N Levine
6. Elements of Physical Chemistry by Peter Atkins, Julio D. Paula
7. Text book of Physical Chemistry by P.L.Soni, O.P.Dharmarha and Q.N.Dash
8. Solid State Chemistry and its applications by Anthony R. West 9 Text book of physical chemistry by K L Kapoor
10. Thermodynamics for Chemists by S Glasston
11. Chemical Kinetics by K J Laidler
12. An Introduction to Electrochemistry by S Glasston
13. Physical chemistry through problems By S K Dogra
14. Thermodynamics by J Jayaram and J C Kuriakose
15. Introductory Quantum Chemistry by A K Chandra
16. Physical Chemistry by J W Moore
17. Kinetics and mechanism by J W Moore and R G Pearson
18. Fundamentals of photochemistry by K K Rohtagi Mukharjee
19. Chemical thermodynamics by R P Rastogi and S S Misra
20. Advanced physical chemistry by Gurudeep Raj
21. Physical chemistry by G W castellan
22. Physical chemistry by Silbey, Alberty and Bawendi.

23. Elements of physical chemistry by Glasstone and Lewis
24. Text book of physical chemistry by S Glasstone
25. Fundamentals of Molecular spectroscopy by C.N.Banwell and E.M.McCash
26. Nanochemistry by Geoffrey Ozin and Andre Arsenault
27. Catalysis: Concepts and green applications by Gadi Rotherberg
28. Green Chemistry: Theory and practice by P.T.Anastas and J.C.Wbmer
29. Polymer Science by Gowriker, Viswanathan and Jayadev Sridhar
30. Introduction polymer Chemistry By G.S.Misra
31. Polymer Chemistry by Bilmayer
32. Kinetics and Mechanism of Chemical Transformations by Rajaram and Kuriacose.
33. Senior practical physical chemistry by Khosla

Subject Electives:

34. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995.
35. G.S. Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited, 1996. Reference Books
36. F. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971.
37. A. Kumar and S. K. Gupta, Fundamentals and Polymer Science and Engineering, Tata McGraw-Hill, 1978.
38. Norris shreve, r. And joseph a. Brink, jr. Chemical process industries, 4th ed.; Mc graw - hill Kogakusha, ltd: 1977.
39. Subba rao, n. S. Biofertilizers in agriculture; oxford and IBH publishing co.: New delhi, 1982.
40. De,a.k. Environmental chemistry 2nd ed.; wiley eastern Ltd., 1987.
41. Stanley e. Mahanen, introduction to industrial chemistry.
42. Jugal, Kishore, Agrawal, Practicals in Engineering Chemistry; Oxford and IBH Publishing Co., New Delhi, 1976.
43. College Chemistry –IV Chemistry and Industry by Gurudeep R.Chatwal ,Himalya Publishing House.
44. Unified Chemistry-IV Chemistry and Industry by Dasharath Domal ,Kalyani Publishers
45. B.Sc III year Paper-IV Chemistry and Industry by Telugu AKademi