

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. PART – III CHEMISTRY

SESSION : 2023-24



ESTD: 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A⁺, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

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**DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS
COLLEGE, DURG (C.G.)**



**Syllabus
for
B.Sc. (Chemistry) - III**

Session 2023-24

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
 Approved syllabus for
B.Sc. CHEMISTRY by the members of Board of Studies for the Session
2023-24
 Syllabus and Marking Scheme for B.Sc. Part III (2023-24)

Paper No.	Course Code	Title of the Paper	Marks Allotted in Theory	
			Max	Min
I	BCH-07	INORGANIC CHEMISTRY	33	33
II	BCH-08	ORGANIC CHEMISTRY	33	
III	BCH-09	PHYSICAL CHEMISTRY	34	
	BCHL-03	Practical	50	17
Total			150	50

03 Theory papers	100
01 Practical	50
Total Marks	150

Note: 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.

The syllabus for B.Sc. Chemistry is hereby approved for the session 2023-24.

NAME AND SIGNATURE:

Chairperson /H.O.D <i>Abkhane</i>	Departmental members:
Subject Expert <i>M. Manabey</i>	<i>Geetha</i>
(University Nominee)	<i>M. K.</i>
Subject Expert..... <i>S. L.</i>	<i>Mukun</i>
Representative.....	<i>[Signature]</i>
(Industry)	<i>[Signature]</i>
Representative..... <i>Agarwal</i>	<i>[Signature]</i>
(Alumni)	<i>[Signature]</i>
Representative <i>[Signature]</i>	<i>[Signature]</i>
(Professor Science Faculty Other Dept.)	<i>[Signature]</i>
	<i>[Signature]</i>
	<i>[Signature]</i>
	<i>[Signature]</i>

B. Sc. Part - III (CHEMISTRY)

2023-24

PAPER- I (BCH – 07)

INORGANIC CHEMISTRY

Course Outcome (CO):

After completion of the course, students would be able:

CO1: To understand about limitation of VBT and concept of CFT and its limitations.

CO2: To explain magnetic properties of complexes and interpret spectra of transition metal complexes.

CO3: To understand nomenclature, classification, structure and properties of organometallics.

CO4: To understand trace and essential elements in biological process structure and mechanism of hemoglobin.

CO5: To understand role of hard and soft acids and bases, biopolymers in chemistry and their structure.

B. Sc. Part - III (CHEMISTRY)

2023-24

PAPER- I (BCH – 07)

INORGANIC CHEMISTRY

Max. Marks - 33

UNIT-I

METAL-LIGAND BONDING IN TRANSITION METAL COMPLEXES

- (A) Limitations of valence bond theory, Limitation of Crystal Field Theory, Application of CFSE, tetragonal distortions from octahedral geometry, Jahn–Teller distortion, square planar geometry. Qualitative aspect of Ligand field and MO Theory.
- (B) Thermodynamic and kinetic aspects of metal complexes. A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes, Trans- effect, theories of trans effect. Mechanism of substitution reactions of square planar complexes.

UNIT-II

MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES

Types of magnetic behavior, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of μ_{so} (spin only) and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

Electronic spectra of Transition Metal Complexes.

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectro-chemical series. Orgel-energy level diagram for d_1 and d_2 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

UNIT-III

ORGANOMETALLIC CHEMISTRY

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18-electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series.

Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π -acceptor behavior of CO (MO diagram of CO to be discussed), Zeise's salt: Preparation and structure.

Catalysis by Organometallic Compounds –

Study of the following industrial processes and their mechanism :

1. Alkene hydrogenation (Wilkinson's Catalyst)
2. Polymerization of ethane using Ziegler – Natta Catalyst

UNIT IV

BIOINORGANIC CHEMISTRY

Essential and trace elements in biological processes, Excess and deficiency of some trace metals, Toxicity of some metal ions (Hg, Pb, Cd and As), metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca^{2+} and Mg^{2+} , nitrogen fixation.

UNIT V

HARD AND SOFT ACIDS AND BASES (HSAB)

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, Applications of HSAB principle

INORGANIC POLYMERS

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones. Silicates, phosphazenes and polyphosphate

REFERENCE BOOK

1. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus, Wiley.
2. Concise Inorganic Chemistry, J. D. Lee, ELBS.
3. Concepts of Models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J. Alexander, John Wiley.
4. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C. H. Langford, Oxford.
5. Inorganic Chemistry, W. W. Porterfield, Addison – Wiley.
6. Inorganic Chemistry, A. G. Sharp, ELBS.
7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agarwal and Agarwal.
10. Advanced Inorganic Chemistry, Puri, Sharma, S. Naginchand.
11. Inorganic Chemistry, Madan, S. Chand.
12. Aadhunik Akarbanic Rasayan, A. K. Shrivastav & P. C. Jain, Goel Pub.
13. Uchchattar Akarbanic Rasayan, satya Prakash & G. D. Tuli, Shyamal Prakashan.
14. Uchchattar Akarbanic Rasayan, Puri & Sharma.
15. Selected topic in Inorganic Chemistry by Madan Malik & Tuli, S. Chand

B. Sc. Part - III (CHEMISTRY)

2023-24

PAPER- II (BCH – 08)

ORGANIC CHEMISTRY

Course Outcome (CO):

After completion of the course, students would be able:

- CO1:** To classify heterocyclic compounds and explain its structure, synthesis and reaction mechanisms.
- CO2:** To discuss the concept, structure, formation of organometallic reagents and synthetic applications of enolates.
- CO3:** To categorize and name various biomolecules and explain their structures and properties.
- CO4:** To describe various polymers and polymerization mechanism, classify synthetic dyes and discuss their chemistry.
- CO5:** To explain basic principles of UV-Visible, IR and Mass spectroscopy, and their applications, the magnetic properties of atomic nucleus and resonance and interpretation of NMR spectra.

B. Sc. Part - III (CHEMISTRY)

2023-24

PAPER- II (BCH – 08)

ORGANIC CHEMISTRY

Max. Marks - 33

UNIT -1

HETEROCYCLIC COMPOUNDS

Classification and nomenclature, Structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole (Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet- Spengler reaction, Pomeranz-Fritsch reaction)

UNIT II

A ORGANOMETALLIC REAGENT

Organomagnesium compounds: Grignard reagents formation, structure and chemical reactions.
Organozinc compounds: formation and chemical reactions.
Organolithium compounds: formation and chemical reactions

B.ORGANOSYNTHESIS VIA INOLATES

Active methylene group, alkylation of diethylmalonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: The Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Robinson annulations reaction.

UNIT-III

BIOMOLECULES

A.CARBOHYDRATES

Occurrence, classification and their biological importance. Monosaccharides: relative and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani Fischer synthesis and Ruff degradation; Disaccharides – Structural comparison of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch and cellulose.

B.AMINO ACIDS, PROTIENS AND NUCLEIC ACIDS

Classification and Nomenclature of amino acids, Configuration and acid base properties of amino acids, Isoelectric Point, Peptide bonds, Protein structure, denaturation/ renaturation, Constituents of nucleic acid, DNA, RNA nucleoside, nucleotides, double helical structure of DNA

UNIT-IV

A, SYNTHETIC POLYMER

Addition or chain growth polymerization, Free radical vinyl polymerization, Ziegler-Natta polymerization, Condensation or Step growth polymerization, polyesters, polyamides, phenols-formaldehyde resins, urea-formaldehyde resins, epoxy resins and polyurethanes, natural and synthetic rubbers

B. SYNTHETIC DYES

Colour and constitution (Electronic Concept). Classification of Dyes. Chemistry of dyes. Chemistry and synthesis of Methyl Orange, Congo Red, Malachite Green, Crystal Violet, phenolphthalein, fluorescein, Alizarine and Indigo.

UNIT-V

A. INFRARED SPECTROSCOPY

Basic principle, IR absorption Band their position and intensity, IR spectra of organic compounds.

B. UV-VISIBLE SPECTROSCOPY

Beer Lambert's law, effect of Conjugation, Types of electronic transitions λ_{max} , Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption Visible spectrum and colour

C. NMR SPECTROSCOPY

Basic principles of Proton Magnetic Resonance, Tetramethyl silane (TMS) as internal standard, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant (J); Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple organic compounds. ^{13}C MR spectroscopy: Principle and applications

REFERENCE BOOKS

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, L. G. Wade Jr. Prentice Hall.
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Organic Chemistry, Vol I, II, III S. M. Mukherjee, S. P. Singh and R. P. Kapoor, Wiley Easters (New Age).
5. Organic Chemistry, F. A. Carey, McGraw Hill.
6. Introduction to Organic Chemistry, Struiweisser, Heathcock and Kosover, Macmillan.
7. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Wiley & Sons (1976).
8. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.
9. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
10. Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.
11. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.

B. Sc. III (CHEMISTRY)

2023-24

PAPER- III (BCH-09)

PHYSICAL CHEMISTRY

Course Outcome (CO):

After completion of the course, the students will be able

- CO1:** To explain the fundamentals/concepts/principles/postulates of quantum mechanics, Schrodinger wave equation and its applications.
- CO2:** To compare the basic ideas of Valence Bond Theory and Molecular Orbital Theory and apply LCAO method, coefficients of hybrid orbitals and Huckel MOT and its application
- CO3:** To describe the fundamentals and application of electromagnetic spectrum, microwave, infrared, Raman, electronic spectroscopy.
- CO4:** To discuss the principles and applications in electrochemistry.
- CO5:** To illustrate electrochemical cell and its applications, analyze problems and apply the principles/concepts in finding their solutions.

B. Sc. Part - III (CHEMISTRY)

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PAPER- III (BCH - 09)

PHYSICAL CHEMISTRY

Max Marks 34

UNIT-I

QUANTUM MECHANICS-I

Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. Operator: Hamiltonian operator, angular momentum operator, Laplacian operator, postulate of quantum mechanics, eigen values, eigen function, Schrodinger time independent wave equation, physical significance of ψ & ψ^2 , application of Schrodinger wave equation to particle in a one-dimensional box, hydrogen atom (separation into three equations) radial and angular wave functions.

UNIT-II

QUANTUM MECHANICS-II

Quantum Mechanical approach of Molecular orbital theory, basic ideas-criteria for forming M.O. and A.O., LCAO approximation, formation of H_2^+ ion, calculation of energy levels from wave functions, bonding and antibonding wave functions, Concept of σ , σ^* , π , π^* orbitals and their characteristics, Hybrid orbitals-sp, sp^2 , sp^3 . Calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H_2 , comparison of M.O. and V.B. models. Huckel theory, application of Huckel theory to ethene, propene, etc

UNIT-III

SPECTROSCOPY

Introduction: Characterization of Electromagnetic radiation, regions of the spectrum, representation of spectra, width and intensity of spectral transition, Rotational Spectrum of Diatomic molecules. Energy levels of a rigid rotor, selection rules, determination of bond length, qualitative description of non-rigid rotator, isotopic effect.

Vibrational Spectroscopy: Fundamental vibration and their symmetry, vibrating diatomic molecules, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, anharmonic oscillator.

Raman spectrum: Concept of polarizability, quantum theory of Raman spectra, stokes and antistokes lines, pure rotational and pure vibrational Raman spectra. Applications of Raman Spectra.

Electronic Spectroscopy: Basic principles, Electronic Spectra of diatomic molecule, Franck-Condon principle, types of electronic transition, application of electronic spectra.

UNIT-IV

ELECTROCHEMISTRY-I

- A. Electrolytic conductance: Specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titrations.

- B. Theories of strong electrolyte: Limitations of Ostwald's dilution law, weak and strong electrolytes, Elementary ideas of Debye – Huckel - Onsager's equation for strong electrolytes, relaxation and electrophoretic effects.
- C. Migration of ions: Transport number, Determination by Hittorf method and moving boundary method, ionic strength.

UNIT-V

ELECTROCHEMISTRY-II

- A. Electrochemical cell and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells, EMF of the cell and effect of temperature on EMF of the cell, Nernst equation, Calculation of ΔG , ΔH and ΔS for cell reactions.
- B. Single electrode potential : standard hydrogen electrode, calomel electrode, quinhydrone electrode, redox electrodes, electrochemical series.
- C. Concentration cell with and without transport, liquid - junction potential, application of concentration cells in determining of valency of ions, solubility product and activity coefficient.
- D. Corrosion-types, theories and prevention.

REFERENCE BOOK

1. Physical chemistry, G.M.Barrow. International Student Edition McGraw Hill.
2. University General Chemistry, CNR Rao, Macmillan.
3. Physical Chemistry R.A.Alberty, Wiley Eastn.
4. The elements of Physical Chemistry P.W.Alkin,Oxford.
5. Physical Chemistry through problems, S.K.Dogra, Wiley Eastern.
6. Physical Chemistry B.D.Khosla.
7. Physical Chemistry, Puri & Sharma.
8. Bhoutic Rasayan, Puri & Sharma.
9. Bhoutic Rasayan, P.L.Soni.
10. Bhoutic Rasayan, Bahl & Tuli.
11. Physical Chemistry, R.L.Kapoor, Vol- I-IV.
12. Introduction to Quantum Chemistry, A.K.Chandra,Tata McGraw Hill.
13. Quantum Chemistry, Ira N.Levine, Prentice Hall

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper will be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (No Multiple choice questions, No 'Fill in the blank' type Questions)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows :

Question Type	MM 34 (Marks x No. of Questions)
A (Very short Answer)	1x9 = 09
B (Short Answer)	2x5 = 10
C (Long Answer)	3x5= 15

DEPARTMENT OF CHEMISTRY

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B.Sc. Part- III PRACTICAL

BCHL-03: LAB COURSE -03

After completion of the course, the students would be able:

CO1: To understand the gravimetric analysis.

CO2: To apply the various rearrangement reactions in synthesis.

CO3: To learn about synthesis of inorganic complexes.

CO4: To learn about synthesis of organic compounds.

CO5: To understand the application of Lambert-Beer's law, Kohlrausch law, colligative property etc using instruments/apparatus.

DEPARTMENT OF CHEMISTRY

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B.Sc. Part- III PRACTICAL

BCHL-03: LAB COURSE -03

Max mark 50

INORGANIC CHEMISTRY

Gravimetry Analysis:

Estimation of nickel (II) using Dimethylglyoxime (DMG).

Estimation of copper as CuSCN

Estimation of iron as Fe_2O_3 by precipitating iron as $\text{Fe}(\text{OH})_3$.

Estimation of Al (III) by precipitating with oxine and weighing as $\text{Al}(\text{oxine})_3$ (aluminium oxinate).

Estimation of Barium as BaSO_4

Inorganic Preparations:

- ☑ Tetraamminecopper (II) sulphate, $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$
- ☑ Cis and trans $\text{K}[\text{Cr}(\text{C}_2\text{O}_4)_2 \cdot (\text{H}_2\text{O})_2]$ Potassium dioxalatodiaquachromate(III)
- ☑ Tetraamminecarbonatocobalt (III) ion
- ☑ Potassium tris(oxalate)ferrate(III)/ Sodium tris(oxalate)ferrate(III)
- ☑ $\text{Cu}(\text{I})$ thiourea complex, Bis (2,4-pentanedionate) zinc hydrate; Double salts (Chrome alum/ Mohr's salt)

ORGANIC CHEMISTRY

Preparation of organic compound

- Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-,m-, p- anisidine) and phenols (β -naphthol, vanillin, salicylic acid)
 - ☑ Benzoylation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, panisidine) and one of the following phenols (β -naphthol, resorcinol, p cresol) by Schotten-Baumann reaction.
 - ☑ Bromination of any one of the following: a. Acetanilide by conventional methods b. Acetanilide using green approach (Bromate-bromide method)
 - ☑ Nitration of any one of the following: a. Acetanilide/nitrobenzene by conventional method b. Salicylic acid by green approach (using ceric ammonium nitrate).
 - ☑ Reduction of p-nitrobenzaldehyde by sodium borohydride.
 - ☑ Hydrolysis of amides and esters.
 - ☑ Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
 - ☑ Benzylisothiuronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).
 - ☑ Aldol condensation using either conventional or green method.
- Benzil-Benzilic acid rearrangement.
- ☐ Preparation of sodium polyacrylate.

Preparation of urea formaldehyde.

Preparation of methyl orange.

1. The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.
2. Qualitative Analysis Analysis of an organic mixture containing two solid components using water, NaHCO_3 , NaOH for separation and preparation of suitable derivatives.
3. Extraction of caffeine from tea leaves.
4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.
5. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy. (Spectra to be provided).
6. Estimation of glycine by Sorenson's formalin method.
7. Study of the titration curve of glycine.
8. Estimation of proteins by Lowry's method.
9. Study of the action of salivary amylase on starch at optimum conditions.
10. Effect of temperature on the action of salivary amylase.

PHYSICAL CHEMISTRY

Conductometry

1. Determination of cell constant
2. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
3. Perform the following conductometric titrations:
 - i. Strong acid vs. strong base
 - ii. Weak acid vs. strong base
 - iii. Mixture of strong acid and weak acid vs. strong base
4. To determine the strength of the given acid conductometrically using standard alkali solution.
5. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically
6. To study the saponification of ethyl acetate conductometrically.

Potentiometry/pH metry

Perform the following potentio/pH metric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Dibasic acid vs. strong base
- iv. Potassium dichromate vs. Mohr's salt
- v. Determination of pK_a of monobasic acid

UV/ Visible spectroscopy

1. Verify Lambert-Beer's law and determine the concentration of $\text{CuSO}_4/\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ in a solution of unknown concentration.
2. Determine the concentrations of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ in a mixture.
3. Study the kinetics of iodination of propanone in acidic medium.
4. Determine the amount of iron present in a sample using 1,10-phenanthroline.
5. Determine the dissociation constant of an indicator (phenolphthalein).
6. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.
7. Study of pH-dependence of the UV-Vis spectrum (200-500 nm) of potassium dichromate.
8. Spectral characteristics study (UV) of given compounds (acetone, acetaldehyde, acetic acid, etc.) in water.
9. Absorption spectra of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ (in 0.1 M H_2SO_4) and determine λ_{max} values.

Note: Experiments may be added/deleted subject to availability of time and facilities

Reference books

1. Vogel, A.I. Quantitative Organic Analysis, Part 3, Pearson (2012).31
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
4. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
5. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000)
6. Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.

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B.Sc. III

Time: 8Hrs.

Chemistry Practical Examination

Five experiments are to be performed:

M.M. 50

1. Inorganic – Two experiments to be performed.

Gravimetric estimation compulsory carrying
(Manipulation **03** marks).

08 marks

Any one experiment from synthesis and analysis carrying **04 marks**

2. Organic – Two experiments to be performed.

Qualitative analysis of organic mixture containing two solid components
compulsory carrying **08 marks**

(**03 marks** for each compound and **02 marks** for separation).

One experiment from synthesis of organic compound (single step) carrying

04 marks

3. Physical– One Physical experiment carrying

12 marks

4. Sessional –

04 marks

5. Viva voce –

10 marks

In case of ex-student **01** mark each will be added to gravimetric analysis and qualitative analysis of organic mixture and **02** marks in physical experiment

NAME AND SIGNATURE:

Chairperson /H.O.D <i>A. Beni</i> Subject Expert (University Nominee) Subject Expert..... Subject Expert..... <i>S. J.</i> Subject Expert..... <i>M. M. Mabej</i> Representative..... (Industry) Representative..... <i>M. Agrawal</i> (Alumni) Representative <i>[Signature]</i> (Professor Science Faculty Other Dept.)	Departmental members: <i>[Signature]</i> <i>[Signature]</i> <i>[Signature]</i> <i>[Signature]</i> <i>M. Agrawal</i> <i>[Signature]</i> <i>[Signature]</i> <i>[Signature]</i> <i>[Signature]</i>
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