

Chaudhary Bansi Lal University, Bhiwani

(A State University established under Haryana Act No. 25 of 2014)



Examination Scheme

&

Syllabus

For

B.Sc. CHEMISTRY

(SEMESTER- I to VI)

(w.e.f. 2020-21)

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Chaudhary Bansi Lal University, Bhiwani
(A State University established under Haryana Act No. 25 of 2014)

Study & Evaluation Scheme

of

B.Sc. CHEMISTRY

Summary

Programme : B.Sc.

Duration : Three-year full time (Six Semesters)

Medium : English

Minimum Required Attendance : 75%

Total Credits : 36 (Chemistry)*

Assessment/Evaluation

Internal Marks	Major Test (End Semester Exam) Marks	Total Marks
10	40	50

Internal Evaluation (Theory)

Minor Test	Attendance	Assignment	Total Marks
05	03	02	10

Duration of Examination

Major Test (End Semester Exam)	Internal (Minor Test)
3 hrs.	1 hrs.

Question Paper Structure*

There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

**Excluding Credits of Skill enhancement course*

Skill enhancement course will have different question paper structure.

CHAUDHARY BANSILAL UNIVERSITY, BHIWANI

Scheme & Syllabi of Chemistry Papers for B.Sc. under CBCS (Semester I to VI)

(w.e.f. 2020-21)

SEMESTER-I						
Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	(Lectures/ Practical Classes)	Marks (External + Internal)	
20UCHE101	ATOMIC STRUCTURE & BONDING AND GENERAL ORGANIC CHEMISTRY-I	Core	2	2	40+10 = 50	
20UCHE102	STATES OF MATTER AND ALIPHATIC HYDROCARBONS	Core	2	2	40+10 = 50	
20UCHE103	PRACTICAL-I	Core	2	6	40 + 10 = 50	
SEMESTER-II						
20UCHE201	CHEMISTRY of s & p BLOCK ELEMENTS AND AROMATIC HYDROCARBONS ALKYL AND ARYL HALIDES	Core	2	2	40 + 10 = 50	
20UCHE202	CHEMICAL ENERGETICS AND FUNCTIONAL GROUP ORGANIC CHEMISTRY-I	Core	2	2	40 + 10 = 50	
20UCHE203	PRACTICAL-II	Core	2	6	40 + 10 = 50	

SEMESTER-III

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	(Lectures/ Practical Classes)	Marks (External + Internal)
20UCHE301	CHEMICAL EQUILIBRIA AND FUNCTIONAL GROUP ORGANIC CHEMISTRY-II	Core	2	2	40 +10 = 50
20UCHE302	COORDINATION CHEMISTRY AND CHEMICAL KINETICS	Core	2	2	40 +10 = 50
20UCHE303	PRACTICAL-III	Core	2	6	40 +10 = 50

SEMESTER-IV

20UCHE401	FUNCTIONAL GROUP ORGANIC CHEMISTRY-III AND ELECTROCHEMISTRY	Core	2	2	40 +10 = 50
20UCHE402	SOLUTIONS & PHASE EQUILIBRIUM AND CHEMISTRY OF BIOMOLECULES	Core	2	2	40 + 10 = 50
20UCHE403	PRACTICAL-IV	Core	2	6	40 +10 = 50

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SEMESTER-V						
Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	(Lectures/ Practical Classes)	Marks (External + Internal)	
Select One: 20UCHE501	Select any one a. ORGANOMETALLICS & BIOINORGANIC CHEMISTRY OF HETEROCYCLIC COMPOUNDS	Discipline Specific Elective	2	2	40 + 10 = 50	
20UCHE502	Select any one a. ORGANIC SPECTROSCOPY-I b. CHEMISTRY OF POLYMERS	Discipline Specific Elective	2	2	40 + 10 = 50	
20UCHE503	PRACTICAL-V		2	6	40 + 10 = 50	
SEMESTER-VI						
20UCHE601	Select any one a. ORGANIC SPECTROSCOPY-II b. INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	Discipline Specific Elective	2	2	40 + 10 = 50	
20UCHE602	Select any one a. QUANTUM MECHANICS b. MOLECULAR SPECTROSCOPY c. CHEMISTRY OF COSMETICS & PERFUMES	Discipline Specific Elective	2	2	40 + 10 = 50	
20UCHE603	PRACTICAL-VI		2	2	40 + 10 = 50	

Note: Skill Enhancement Courses are listed as follows to be offered in Semester IV, V & VI.

MSD

2023

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	(Lectures/Practical Classes)	Marks (External + Internal)
20UCHE404	GREEN CHEMISTRY	SEC-II	3	3	40+10 =50
20UCHE504	ENVIRONMENTAL CHEMISTRY	SEC-III	3	3	40+10 =50
20UCHE604	ANAYTICAL CHEMISTRY	SEC-IV	3	3	40+10 =50

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Semester –I

ATOMIC STRUCTURE & BONDING AND
GENERAL ORGANIC CHEMISTRY-I
(Theory)

Credits: 2

Maximum Marks: 50

External: 40

Internal: 10

Time: 3 hrs

Note: The examiner is requested to set nine questions in all by formulating two questions of 8 marks each from each UNIT and one compulsory question (Question No. 1 based on entire syllabus will consist of eight short answer type questions each of one mark). The student is required to attempt five questions in all selecting one question from each UNIT and compulsory Question No. 1.

UNIT-I

Atomic Structure: *Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle, Hydrogen atom Spectra*

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydrogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s).

UNIT-II

Chemical Bonding: *Review of Ionic Bonding: General characteristics and Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds.*

Statement of Born-Landéequation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of *s-p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO⁺. Comparison of VB and MO approaches.

UNIT-III

Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles.

Reactive Intermediates: Carbocations, Carbanions and free radicals.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.

Aromaticity: Benzenoids and Hückel's rule.

UNIT-IV

Stereochemistry: Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

Suggested Readings:

- Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
- Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
- Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.

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- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

Semester –I

20UCHE102: STATES OF MATTER AND

ALIPHATIC HYDROCARBONS

(Theory)

Credits: 2

Maximum Marks: 50

External: 40

Internal: 10

Time: 3 hrs

Note: The examiner is requested to set nine questions in all by formulating two questions of 8 marks each from each UNIT and one compulsory question (Question No. 1 based on entire syllabus will consist of eight short answer type questions each of one mark). The student is required to attempt five questions in all selecting one question from each UNIT and compulsory Question No. 1.

UNIT-I

Kinetic Theory of Gases Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO₂. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

UNIT-II

Liquids 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).

Solids Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X-Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Glasses and liquid crystals.

UNIT-III

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

Cycloalkanes: nomenclature, synthesis of cycloalkanes and their derivatives – photochemical (2+2)cycloaddition reactions, dehalogenation of -dihalides, pyrolysis of calcium or barium salts of dicarboxylic acids, Baeyer's strain theory and its limitations., theory of strainless rings.

Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction).

UNIT-IV

Alkenes: Reactions: cis-addition (alk. KMnO_4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alk. KMnO_4 .

Suggested Readings:

- Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
- Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
- Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
- Petrucci, R.Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

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- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
- Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S. • Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

Semester –I

20UCHE103: PRACTICAL-I

Credit: 2

Maximum Marks: 50

Time: 3 hrs

PRACTICAL-I

A: Inorganic Chemistry

40 (2x20)

1. Estimation of oxalic acid by titrating it with KMnO_4 .
2. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .
3. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.

B: Physical Chemistry

4. Determination of surface tension (use of organic solvents is excluded)
 - Surface tension of the given liquid using a stalagmometer by drop weight method and drop number method.
5. Determination of viscosity (use of organic solvents is excluded)
 - Determination of the relative viscosity of a liquid or dilute solution using an Ostwald's viscometer.

C: Organic Chemistry

6. To study the process of sublimation of (i) camphor and (ii) phthalic acid.
7. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)
 - (a) Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography.
 - (b) Identify and separate the sugars present in the given mixture by paper chromatography.

Note book: 5 Marks

Viva voce: 5 Marks

Suggested Readings:

- Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
- Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

- Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011)
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

Semester –II

20UCHE201: CHEMISTRY of s & p BLOCK ELEMENTS AND AROMATIC HYDROCARBONS ALKYL AND ARYL HALIDES (Theory)

Credits: 2

Maximum Marks: 50

External: 40

Internal: 10

Time: 3 hrs

Note: The examiner is requested to set nine questions in all by formulating two questions of 8 marks each from each UNIT and one compulsory question (Question No. 1 based on entire syllabus will consist of eight short answer type questions each of one mark). The student is required to attempt five questions in all selecting one question from each UNIT and compulsory Question No. 1.

UNIT-I

Chemistry of s Block Elements: Diagonal relationship, Anomalous behaviour of Lithium and Beryllium compared to other elements in the same, group, salient features of hydrides, oxides, halides, hydroxides (methods of preparation excluded), behaviour of solution in liquid NH_3 , Complex formation tendency of s-block elements; structure of the following complexes: crown ethers and cryptates of Group

I.

Chemistry of p Block Elements: Boron family (13th group): Diborane: Preparation, properties and structure (as an example of electron deficient compound and multicenter bonding), Borazine chemical properties and structure, relative strength of Trihalides of Boron as Lewis acids, structure of aluminium(III) chloride.

Carbon family and (14th group)

Catenation, Carbides, fluorocarbons, silicates (structural aspects), silicons-general method of preparations, properties and uses.

UNIT-II

Nitrogen family(15th group) Oxides: Structure of oxides of nitrogen and phosphorus, Oxyacids: Structure and relative acid strengths of oxy acids of nitrogen and phosphorus, structure of white, yellow and Red phosphorus.

Oxygen family (16th group) : Oxy acids of sulphur – structure and acidic strength, Hydrogen Peroxide –properties and uses.

Halogen family (17th group): Interhalogen compounds (their properties and structures), Hydra and oxy acids of chlorine – structure and comparison of acid strength, cationic nature of Iodine.

Chemistry of Noble Gases: Chemistry of xenon, structure and bonding in fluorides, oxides and oxyfluorides of xenon.

UNIT-III

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Aromatic hydrocarbons:Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

UNIT-III

Alkyl and Aryl Halides

Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions.

Preparation: from alkenes and alcohols; Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $\text{NaNH}_2/\text{NH}_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Suggested Readings:

- Lee, J.D., 2008, 5th Edition, John Wiley And Sons Ltd.
- Cotton, F.A., Wilkinson, G., Gaus, P.L., 1995, 3rd Edition John Wiley.
- Greenwood, N.N. & Earnshaw, 1997, Butterworth-Heinemann.
- Cotton, F.A. & Wilkinson, G., 1999, Wiley.

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- Rodger, G.E., 2002, Cengage Learning India.
- Miessler, G. L. & Donald, A. Tarr., 2010, 4th Ed., Pearson.
- Atkin, P. Shriver & Atkins's, 2010, 5th Ed. Oxford University Press.
- Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010

Semester –II

20UCHE202:CHEMICAL ENERGETICS AND FUNCTIONAL GROUP ORGANIC CHEMISTRY-I) (Theory)

Credits: 2

Maximum Marks: 50

External: 40

Internal: 10

Time: 3 hrs

Note: The examiner is requested to set nine questions in all by formulating two questions of 8 marks each from each UNIT and one compulsory question (Question No. 1 based on entire syllabus will consist of eight short answer type questions each of one mark). The student is required to attempt five questions in all selecting one question from each UNIT and compulsory Question No. 1.

UNIT-I

Thermodynamics-I: Zeroth Law of thermodynamics, First law of thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law – Joule – Thomson coefficient for ideal gas and real gas: and inversion temperature. Calculation of w , q , dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Temperature dependence of enthalpy, Kirchoffs equation. Bond energies and applications of bond energies.

UNIT-II

Thermodynamics-II: Second law of thermodynamics, Carnot's cycles and its efficiency, Concept of entropy – entropy as a state function, entropy as a function of V & T , entropy as a function of P & T ,

MMS

entropy change in physical change, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. Third law of thermodynamics: Nernst heat theorem, statement of concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

Unit-III

Alcohols: Preparation: Preparation of 1°, 2° and 3° alcohols: using Grignard reagent, Esterhydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO_4 , acidic dichromate, conc. HNO_3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben-Hoesch Condensation, Schotten-Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Unit IV

Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde) Preparation: from acid chlorides and from nitriles. Reactions – Reaction with HCN, ROH, NaHSO_3 , NH_2 -G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf Verley reduction.

Suggested Readings

- Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S. • Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
- Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007). • Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).

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- Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
- Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
- Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985)

Semester –II

20UCHE203: PRACTICAL-II

Credit: 2

Maximum Marks: 50

Time: 3 hrs

PRACTICAL-II

A: Inorganic Chemistry

40(2x20)

1. Iodo/Iodimetric Titrations

- Estimation of Cu(II) using sodium thiosulphate solution (Iodometrically)

2. Inorganic preparations

- Cuprous Chloride, Cu_2Cl_2
- Aluminium potassium sulphate $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ (Potash alum) or Chrome alum.
- Prussian blue

B: Physical Chemistry

3. Thermochemistry

- Determination of heat capacity of calorimeter for different volumes.
- Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
- Determination of enthalpy of ionization of acetic acid.
- Determination of integral enthalpy of solution of salts (KNO_3 , NH_4Cl).
- Determination of enthalpy of hydration of copper sulphate.
- Study of the solubility of benzoic acid in water and determination of ΔH . i. Strong acid vs. strong base

C: Organic Chemistry

- Checking the calibration of the thermometer.

MAS

5. Purification of organic compounds by crystallization using the following solvents: Water, Alcohol, Alcohol-Water.
6. Preparation and purification through crystallization
 - Iodoform from ethanol (or acetone)
 - p-Bromoacetanilide from acetanilide.
7. Determination of the melting points of unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus).
8. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.

Note book: 5
Viva voce: 5

Suggested Readings:

- Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
- Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
- Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011)
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

