

CHOICE BASED CREDIT SYSTEM

(CBCS)

Guru Jambheshwar University of Science and Technology, Hisar

Revised Scheme and Syllabi
for

Undergraduate Course:

B. SC. PHYSICAL SCIENCES

**(PHYSICS/GEOGRAPHY, CHEMISTRY/
ELECTRONICS/ COMPUTER SCIENCE/ COMPUTER
APPLICATIONS, MATHEMATICS)**

Under

The Faculty of Physical Sciences and Technology



w.e.f. Academic Session 2018-19

The Revised/consolidated scheme and syllabi of First Year of B.Sc. (Physical Sciences: Physics/Geography, Chemistry/Electronics/Computer Science/Computer Applications, Mathematics) as approved by the competent authority is as under:

Semester-I

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CXL- 101	Language Skills Compulsory Course-I	English-I	2	2	80	20	100
CPL- 102	Core Course-I (Physics)	Mechanics-I	2	2	80	20	100
CPL- 103	Core Course-II (Physics)	Electricity and Magnetism-I	2	2	80	20	100
CGL- 102	Core Course-I (Geography)	Physical Geography-I	2	2	80	20	100
CGL- 103	Core Course-II (Geography)	Physical Geography-II	2	2	80	20	100
CCL- 104	Core Course-I (Chemistry)	Inorganic Chemistry-I(Atomic structure and Bonding)	2	2	80	20	100
CCL- 105	Core Course-II (Chemistry)	Organic Chemistry-I(General Organic Chemistry and Aliphatic Hydrocarbons)	2	2	80	20	100
CEL- 104	Core Course-I (Electronics))	Network Analysis and Electronic Devices	2	2	80	20	100
CEL- 105	Core Course-II (Electronics))	Analog Electronics	2	2	80	20	100
CCsL- 104	Core Course-I (Computer Science)	Fundamentals of Computer	2	2	80	20	100
CCsL- 105	Core Course-II (Computer Science)	Programming in 'C'	2	2	80	20	100
CCaL- 104	Core Course- I (Computer Applications)	Computer Fundamentals and Operating System	2	2	80	20	100
CCaL- 105	Core Course- II (Computer Applications)	Office Automation Tools	2	2	80	20	100
CML- 106	Core Course-I (Mathematics)	Algebra	4	4	80	20	100
CML- 107	Core Course-I (Mathematics)	Calculus	4	4	80	20	100
CYL- 111	Awareness Program Compulsory Course	Environmental Studies	2	2	80	20	100
CPP- 108*	Practical-I (Physics)	Physics Lab-I	2	4	50	-	50
CGP- 108*	Practical-I (Geography)	Geography Lab-I	2	4	50	-	50
CCP- 109*	Practical-I (Chemistry)	Chemistry Lab-I	2	4	50	-	50
CEP- 109*	Practical-I (Electronics)	Electronics Lab-I(Network Analysis and Analog	2	4	50	-	50

		Electronics)					
CCsP- 109*	Practical-I (Computer Science)	Computer Lab-I (Based on Fundamentals of Computer & Programming in 'C')	2	4	50	-	50
CCaP- 109*	Practical- I (Computer Applications)	Computer Lab-I	2	4	50	-	50
CMP- 110*	Practical-I (Mathematics)	Mathematics Lab-I	1.5	3	50	-	50

- The practical examination to be conducted annually with Second semester examination.

Semester-II

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CXL- 201	Language Skills Compulsory Course-II	English-II	2	2	80	20	100
CPL- 202	Core Course-III (Physics)	Mechanics-II	2	2	80	20	100
CPL- 203	Core Course-IV (Physics)	Electricity, Magnetism and EMT-II	2	2	80	20	100
CGL- 202	Core Course-III (Geography)	Human Geography-I	2	2	80	20	100
CGL- 203	Core Course-IV (Geography)	Human Geography-II	2	2	80	20	100
CCL- 204	Core Course-III (Chemistry)	Physical Chemistry- I (Chemical Energetics and Equilibria)	2	2	80	20	100
CCL- 205	Core Course-IV (Chemistry)	Organic Chemistry- II (Functional Group Organic Chemistry)	2	2	80	20	100
CEL- 204	Core Course-III (Electronics)	Linear and Digital Integrated circuits	2	2	80	20	100
CEL- 205	Core Course-IV (Electronics))	Digital Electronics	2	2	80	20	100
CCsL- 204	Core Course-III (Computer Science)	Data Structure using 'C'	2	2	80	20	100
CCsL- 205	Core Course-IV (Computer Science)	Computer Organisation	2	2	80	20	100
CCaL- 204	Core Course- III (Computer Applications)	Information Technology	2	2	80	20	100
CCaL- 205	Core Course- IV (Computer Applications)	Programming in 'C'	2	2	80	20	100
CML- 206	Core Course-III (Mathematics)	Vector Calculus and Geometry	4	4	80	20	100
CML- 207	Core Course-IV (Mathematics)	Ordinary Differential Equations and Laplace Transformations	4	4	80	20	100
CPP- 208	Practical-II	Physics Lab-II	2	4	50	-	50

	(Physics)						
CGP- 208	Practical-II (Geography)	Geography Lab-II	2	4	50	-	50
CPP-209	Practical-II (Chemistry)	Chemistry Lab-II	2	4	50	-	50
CEP-209	Practical-II (Electronics)	Linear Integrated circuits and Digital Electronics Lab	2	4	50	-	50
CCsP-209	Practical-II (Computer Science)	Computer Lab-II (Based on Data Structure using 'C')	2	4	50	-	50
CCaP-209	Practical-II (Computer Applications)	Computer Lab- II	2	4	50	-	50
CMP-210	Practical-II (Mathematics)	Mathematics Lab-II	1.5	3	50	-	50

Note:

- (1) **The subject combinations under B.Sc. (Physical Sciences)are :**
 - (i) **B.Sc. (Physical Sciences: Physics, Chemistry, Mathematics)**
 - (ii) **B.Sc. (Physical Sciences: Geography, Computer Science, Mathematics)**
 - (iii) **B.Sc. (Physical Sciences: Physics, Electronics, Mathematics)**
 - (iv) **B.Sc. (Physical Sciences: Physics, Computer Science, Mathematics)**
 - (v) **B.Sc. (Physical Sciences: Physics, Computer Applications, Mathematics)**
- (2) *The scheme and syllabus of Mathematics papers is also implemented to BA (with Mathematics) Courses. However, the marking scheme in case of BA courses (Mathematics Subject) will be same as decided by the concerned Board of Studies/Faculty of Humanities and Social Sciences.*
- (3) *For the students of B.Sc. Geography, the core papers of Physics is to be replaced by Core papers of the Geography; for Computer Science, the core papers of Chemistry is to be replaced by Core papers of the Computer Sciences; for Electronics the core papers of Chemistry is to be replaced by Core papers of the Electronics and similarly for Computer Applications, the core papers of Chemistry is to be replaced by Core papers of the Computer Applications as decided by the respective Board of studies/Faculty of Engineering and Technology.*
- (4) **Definition of Credit:**
*1 credit=1 Hr. Lecture (L) per week
1 credit= 2 Hrs. Practical (P) per week
2 Hrs. = 3 periods of approx. 40/45 minutes*
- (5) *Practical examinations (both odd and even semester's practicals of 50 marks each) to be held annually with even semesters. The marks of Odd semester practicals may be reflected in the DMC of Even semester with code and nomenclature, to be shown separately for each semester.*
- (6) *The distribution of internal assessment marks of 20 is based on the marks obtained by the student in one Minor test of 12 marks to be conducted preferably in the month of November for Odd Semester and in the month of April for Even Semester. A student is required to pass the individual paper with 35% marks overall including internal assessment based on minor test. He may not be given any additional chance for minor test. However, the student also needs to pass the external examination individually with 35% marks. There will be maximum 4 marks for attendance (1 mark for attendance of 71-75%, 2 marks for attendance of 76-80%, 3 marks for attendance of 81-85% and 4 marks for attendance above 85%). The remaining 4 marks are for Extracurricular activities including assignments.*
- (7) *The Batches of 20 or more can be opted for various courses as per requirement for all practical purposes by the college/institution. The evaluation of Practical may be distributed as 20% marks for lab record, 50% marks for performance during the examination and 30% marks for Viva Voce examination.*

SEMESTER I&II
B. SC. PHYSICAL SCIENCES
(CHEMISTRY)

CCL- 104
Core Course-I
INORGANIC CHEMISTRY--I
(ATOMIC STRUCTURE AND BONDING)
(Credits: 02;30 Hrs (2Hrs /week))

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I

Atomic Structure-I

(8 Hours)

Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure.

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).

UNIT-II

Atomic Structure-II

(7 Hours)

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).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

UNIT-III

Chemical Bonding

(8 Hours)

Ionic Bonding: General characteristics of ionic bonding. 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-Landé equation 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.

Concept of resonance and resonating structures in various inorganic and organic compounds.

UNIT-IV

Molecular Structure

(7 Hours)

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.

Reference Books:

- 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.

CCL- 105
Core Course-II
ORGANIC CHEMISTRY--I
(GENERAL ORGANIC CHEMISTRY & ALIPHATIC
HYDROCARBONS)
(Credits: 02, 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I

Fundamentals of Organic Chemistry

(7 Hours)

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-II

Stereochemistry

(8 Hours)

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).

UNIT-III

Aliphatic Hydrocarbons-I

(8 Hours)

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.

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). *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.

UNIT-IV

Aliphatic Hydrocarbons-II

(7 Hours)

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

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 .

Reference Books:

- 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.
- 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.

Practical -I; Chemistry Lab--I
ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS
(Credits: 02, 60 Hours (4hrs. per week))

Marks: 50

Time: 4 Hours

Section A: Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO_4 .
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .
4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. 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 two 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.

Reference Books:

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

CCL 204
Core Course-III
PHYSICAL CHEMISTRY--I
(CHEMICAL ENERGETICS AND EQUILIBRIA)
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I

Chemical Energetics

(8 Hours)

Review of thermodynamics and the Laws of Thermodynamics.

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.

Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

UNIT-II

Chemical Equilibrium

(8 Hours)

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between G and G° , Le Chatelier's principle. Relationships between K_p , K_c and K_x for reactions involving ideal gases.

UNIT-III

Ionic Equilibria-I

(7 Hours)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect.

UNIT-IV

Ionic Equilibria-II

(7 Hours)

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Reference Books:

- 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.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).

CCL 205

Core Course-IV ORGANIC CHEMISTRY--II (FUNCTIONAL GROUP ORGANIC CHEMISTRY) (Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure for all UNITS I-IV.

Aromatic hydrocarbons (7 Hours)

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-II

Alkyl and Aryl Halides (8 Hours)

Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (S_N1 , S_N2 and S_Ni) 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 $NaNH_2/NH_3$).

Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

UNIT-III

Alcohols, Phenols and Ethers (Upto 5 Carbons)

(8 Hours)

Alcohols: *Preparation:* Preparation of 1^o, 2^o and 3^o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO₄, acidic dichromate, conc. HNO₃). 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)

(7 Hours)

(Formaldehyde, acetaldehyde, acetone and benzaldehyde)

Preparation: from acid chlorides and from nitriles.

Reactions – Reaction with HCN, ROH, NaHSO₃, NH₂-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf Verley reduction.

Reference Books:

- 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.

CCP 209
Practical -II
Chemistry Lab--II
CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC
CHEMISTRY
(Credits: 02; 60 Hrs (4Hrs /week))

Marks: 50

Time: 4 Hours

Section A: Physical Chemistry

Thermochemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO₃, NH₄Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of *H*. **Ionic equilibria** pH measurements
 - a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
 - b) Preparation of buffer solutions:
 - (i) Sodium acetate-acetic acid
 - (ii) Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
 - (a) Bromination of Phenol/Aniline
 - (b) Benzoylation of amines/phenols
 - (c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

Reference Books

- 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.
- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).