

SCHEME
B.Sc. (CHEMISTRY) Part-I (SEMESTER-1st & 2nd)
PROGRAMME CODE: CHEB3PUP
SESSIONS: 2023-2024, 2024-2025 and 2025-2026


Paper Code	Title of Paper	Hours/ week	Max Marks			Credits	Examination Time (Hours)
			Total marks	External Exam (marks)	Internal Assessment (marks)		
Semester-1 st							
CHEB1101T	INORGANIC CHEMISTRY-I	03	50	35	15	02	03
CHEB1102T	ORGANIC CHEMISTRY-I	03	50	35	15	02	03
CHEB1103P	CHEMISTRY PRACTICALS-I	04	50	35	15	02	03

Semester-2 nd	Title of Paper	Hours/ Week	Total marks	External Exam (marks)	Internal Assessment (marks)	Credits	Examination Time (Hours)
CHEB1202T	PHYSICAL CHEMISTRY-I	03	50	35	15	02	03
CHEB1203P	CHEMISTRY TRACTICALS-II	04	50	35	15	02	03

Drug Abuse: Problem, Management and Prevention*: 100(MM)
 Qualifying Paper

70 (ESE)

30(IA)


 8.8.23
 Professor & Head,
 Deptt. of Chemistry
 Punjabi University, Patiala

INORGANIC CHEMISTRY-I
Paper Code: CHEB1101T

Max Marks: 50 marks
End Semester Exam: 35 marks
Internal Assessment: 15 marks
Pass Marks: 35%

40 hrs; Credits: 02
Time allowed: 3 hrs
3 hrs/week

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 6 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 1 mark each. Use of scientific non-programmable calculator is allowed.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions (Section C-9th question being compulsory) selecting two questions from each of A & B Sections.

Section - A

Atomic Structure

6 hrs

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of Ψ and Ψ^2 quantum numbers, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of some elements (first 20 elements of modern periodic table).

Periodic Properties

5 hrs.

Position of element in the periodic table effective nuclear charge and its calculations. Atomic and ionic radii, ionization energy, electronic affinity and electronegativity-definition & their trends in periodic table.

Chemistry of Noble gases

5 hrs.

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

s-Block Elements

6 hrs.

General electronic configurations, Comparative study, diagonal relationships, solvation and complexation tendencies including their function in biosystems.

Section - B

Chemical Bonding - I

8 hrs.

Covalent Bond-Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. BeF_2 , BF_3 , CH_4 , PF_5 , SF_6 , IF_7 , SnCl_2 , XeF_4 , BF_4^- , PF_6^- , SnCl_6^{2-} .

Chemical Bonding - II

10 hrs

Valence shell electron pair repulsion (VSEPR) theory to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2 , and H_2O . MO theory, homonuclear (elements and ions of 1st and 2nd row), and heteronuclear (BO , CN , CO^+ , NO^+ , CO , CN), diatomic molecules, multicenter bonding in electron deficient molecule (Boranes) percentage ionic character from dipole moment and electronegativity difference (qualitative analysis).

ORGANIC CHEMISTRY-I Paper Code: CHEB1102T

Max Marks: 50 marks
End Semester Exam: 35 marks
Internal Assessment: 15 marks
Pass Marks: 35%

40 hrs; Credits: 02
Time allowed: 3 hrs
3 hrs/week

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 6 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 1 mark each. Use of scientific non-programmable calculator is allowed.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions (Section C 9th question being compulsory) selecting two questions from each of A & B Sections.

Section - A

Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Van der Waals interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

6 Hrs

Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with half-headed and double headed arrows, homolytic and heterolytic bond breaking. Types of reagents of organic reactions-Electrophiles & Nucleophiles. Reactive intermediates-carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Methods of determination of reaction mechanism (intermediates & isotope effect).

6 Hrs

Alkanes

Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

6 Hrs

Section – B

Cycloalkanes

Cycloalkanes--nomenclature, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane & cyclobutane), theory of strain less rings. The case of cyclopropane ring: banana bonds. **4 Hrs**


Alkenes

Nomenclature of alkenes-methods of formation, mechanisms and dehydration of alcohols and dehydrohalogenation of alkyl halides regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions-Markownikoff's rule, hydroboration-oxidation, Epoxidation, ozonolysis. **10 Hrs**

Dienes And Alkynes

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation. Chemical reactions-1, 2 & 1,4-additions and Diels-Alder reaction.

Nomenclature, structure and bonding in alkynes. Three methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions hydroboration-oxidation. metal-ammonia reductions. **8 Hrs**


8.8.23
Professor & Head,
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Gurukul University, Patiala

CHEMISTRY PRACTICALS-I
Paper Code: CHEB1103P

Max Marks: 50
Semester Paper: 35
Internal Assessment: 15
Pass Marks: 35%

04 hrs/week
Time allowed: 3 hrs
Credits: 02

INSTRUCTIONS FOR THE PAPER SETTERS EXAMINERS & CANDIDATES


The Practical Examinations will be held in the one morning session (one day) that will be of 3 hours duration. During this session students will perform following two types of experiments:

- (a). Semi micro analysis along with
- (b). Crystallization of the given sample.

Paper setter will enlist five different mixtures and the examiner will randomly distribute these mixtures amongst the students. Each candidate will analyze one mixture along with crystallization of the given sample. Students are permitted to consult the books for the scheme of tests for semimicro analysis.

Semi-micro analysis:

1. Cation analysis, separation, and identification of ions from Groups I, II, III, IV, V and VI. Anion analysis (2 cations and 2 anions with no interference).
15 Marks
2. Crystallizations:
 - (i). Phthalic acid from hot water;
 - (ii). Acetanilide from boiling water;
 - (iii). Naphthalene from ethanol;
 - (iv). Benzoic acid from water.05 marks
3. Viva Voce:
10 Marks
4. Practical Note Book:
05 Marks


8.8.23
Professor & Head,
Deptt. of Chemistry
Punjab University, Patiala

B.Sc. CHEMISTRY-PART-I (SEMESTER-2nd)

Semester-2 nd	Title of Paper	Hours/Week	Total marks	External Exam (marks)	Internal Assessment (marks)	Credits	Examination Time (Hours)
CHEB1201T	INORGANIC CHEMISTRY-II	03	50	35	15	02	03
CHEB1202T	PHYSICAL CHEMISTRY-I	03	50	35	15	02	03
CHEB1203P	CHEMISTRY TRACTICALS-II	04	50	35	15	02	03

Drug Abuse: Problem, Management and Prevention*: 100(MM)
Qualifying Paper

70 (ESE)

30(IA)



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Professor & Head,
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INORGANIC CHEMISTRY-II
Paper Code: CHEB1201T

Max Marks: 50 marks
End Semester Exam: 35 marks
Internal Assessment: 15 marks
Pass Marks: 35%

40 hrs; Credits: 02
Time allowed: 3 hrs
3hrs/week

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 6 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 1 mark each. Use of scientific non-programmable calculator is allowed.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions (Section C 9th question being compulsory) selecting two questions from each of A & B Sections.

Section – A

p - Block Elements (Group 13)

5 hrs.

Comparative study (including diagonal relationship) of groups 13 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13; hydrides of boron-diborane and higher boranes, borazine, borohydrides.

p - Block Elements (Group 14-17)

18 hrs.

Comparative study (including diagonal relationship) of groups 14-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 14-17; fullerenes, silicates (structural principle), basic properties of interhalogens and polyhalides.

Section - B

Chemistry of Lanthanide Elements


Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.

5 Hrs

Ionic Solids

12 hrs.

Concept of close packing, Ionic structures, (NaCl type, Zinc blende, Wurzite, CaF₂, and antiferite), radius ratio rule and coordination number, Limitation of radius ratio rule, lattice defects, semiconductors, and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond-free electron, valence bond and bond theories.


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PHYSICAL CHEMISTRY-I
Paper Code: CHEB1202T

Max Marks: 50 marks
End Semester Exam: 35 marks
Internal Assessment: 15 marks
Pass Marks: 35%

40 hrs; Credits: 02
Time allowed: 3 hrs
3 hrs/week

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 6 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 1 mark each. Use of scientific non-programmable calculator is allowed.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions (Section C 9th question being compulsory) selecting two questions from each of A & B Sections.

Section - A

10 Hrs.

Mathematical Concepts

Logarithmic relations, linear graphs and calculation of slopes, differentiation of functions like kx , e^x , x^n , $\sin x$, $\log x$, partial differentiation and reciprocity relations. Integration of some useful/relevant functions permutations and combinations. Factorials.

Evaluation of Analytical Data

Terms of mean and median, precision and accuracy in chemical analysis, determining accuracy of methods, improving accuracy of analysis, linear least squares curve fitting, types of errors, standard deviation, confidence limits, rejection of measurements (F-test & Q-test) numerical problems related to evaluation of analytical data.

6 Hrs.

Section - B

6 Hrs.

Liquid State

Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholesteric phases. Thermography and seven segment cells.

Gaseous State

10 Hrs

Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquefaction of gases (based on Joule-Thomson effect).

CHEMISTRY PRACTICALS-II
Paper Code: CHEB1203P

Max Marks: 50
Semester Paper: 35
Internal Assessment: 15
Pass Marks: 35%

04 hrs/week
Time allowed: 3 hrs
Credit: 02

**INSTRUCTIONS FOR THE PAPER SETTERS EXAMINERS &
CANDIDATES**

In this session in morning students will perform physical and organic chemistry practical. Examiner will again conduct viva-voce of students.

(A). The examiner should preferably give different liquids solids to the candidates for the determination of boiling point/melting point and crystallization from the list of liquids/solids by the paper setter.

(B). The paper setter will provide a list of five physical chemistry experiments. The examiner will allot one experiment randomly to each candidate. The candidate will write theory, brief procedure and general calculations of the experiment in the first 10 minutes and thereafter perform the actual experiment.

Determination of melting points


Naphthalene 80-82°C, Benzoic acid 121.5-122°C, Urea 132.5-133°C, Succinic acid 184.5-185°C, Cinnamic acid 132.5-133°C, Salicylic acid 157.5-158°C, Acetanilide, 113.5-114°C, *m*-Dinitrobenzene 88-90°C, *p*-Dichlorobenzene 50-52°C, Aspirin 133-135°C.

Determination of boiling points

Ethanol 78°C, Cyclohexane 81.4°C, Toluene 110.6°C & Benzene, 80°C.

Physical Chemistry Experiments

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. Viscosity & Surface Tension of pure liquids.
4. To determine the viscosity and surface tension of C₂H₅OH and glycerin solution in water
5. Molecular weight determined by Rast method.


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DETAILS OF DISTRIBUTION OF MARKS

- | | |
|---|------------|
| 1. Melting point/boiling point/crystallization: | 05 marks |
| 2. Physical chemistry experiments: | 15 marks |
| (a). Initial write up | (05 marks) |
| (b). Performance of Experiment | (10 marks) |
| 3. Viva-voce: | 10 marks |
| 4. Practical Note Book: | 05 marks |



8.8.23

Professor & Head,
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BOOKS SUGGESTED-THEORY COURSES:

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. Doaglas. D. McDaniel and I. Alexander, John Wiley.
4. *Inorganic Chemistry*. D.E. Shriver, P. W. Aikins and C.H. Langford. <Oxford.
5. *Inorganic Chemistry*. W. W. Porterfield Addison. Wesley.
6. *Inorganic Chemistry*. A.G. Sharpe, ELBS.
7. *Inorganic Chemistry*. G.L. Miessler and O.A. Tarr, Prentice Hall.
8. *Organic Chemistry*. Morrison and Boyd, Prentice Hall.
9. *Organic Chemistry*. L.G. Wade Jr. Prentice Hall.
10. *Fundamentals of Organic Chemistry*. Solomons, John Wiley.
11. *Organic Chemistry*. Vol. I, II & III. S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International)
12. *Organic Chemistry*. F.A. Aarey, McGraw Hill India.
13. *Introduction to Organic Chemistry*. Stretwieser, Heathcock and Kosover, Machmilan.
14. *Physical Chemistry*. G.M. Barrow, International Student Edition. McGraw Hill.
15. *Basic Programming with Application*. V.K. Jain, I'ata McGraw Hill.
16. *Computers and Common. Sense*. B. Ryal and Shely, Prentice Hall.
17. *University General Chemistry*. C.N.B. Rao. Macmillan.
18. *Physical Chemistry*. R.A. Alberty, Wiley Eastern Ltd.
19. *The Elements of Physical Chemistry*, P. Aikins, Oxford.
20. *Physical Chemistry Through Problems*. S.K. Dogra and S. Dogra. Wiley Eastern Ltd.

BOOKS SUGGESTED-PRACTICAL COURSES:

1. *Vogel's Qualitative Inorganic Analysis*, revised, Svehla, Orient Longman.
2. *Vogel's Textbook of Quantitative Inorganic Analysis* (revised), J. Basseff, R.C. Dennerly, G.H. Jeffery and J. Mendham, ELBS.
3. *Standard Methods of Chemical Analysis*, W. Scott the Technical Press.
4. *Experimental Inorganic Chemistry*: W.G. Palmer, Cambridge.
5. *Handbook of Preparative Inorganic Chemistry*. Vol. I & II, Brauer, Academic Press.
6. *Inorganic Synthesis*, McGraw Hill.
7. *Experimental Organic Chemistry*. Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
8. *Laboratory Manual in Organic Chemistry*. R.K. Bansal, Wiley Eastern.'
9. *Vogel's Textbook of Practical Organic Chemistry*. B.S. Furniss, A.I. Harnaford, V. P.w.G. Smith and A.R. Tatchell, ELBS. -.
10. *Experiments in General Chemistry*. C.N.R. Rao and U.e. Aggarwal. East- West Press.
11. *Experiments in Physical Chemistry*. R.C. Dass and B. Behra, Tata McGraw Hill.
12. *Advanced Practical Physical Chemistry*, J.B. Yadav, Goel Publishing House.
13. *Advanced Experimental Chemistry*. Vol. I : Physical, J.N. Gurtu and R. Kapoor, S. Chand & CO.
14. *Selected Experiments in Physical Chemistry*, N.G. Mukherjee, J.N. Ghose & Sons.
15. *Experiments in Physical Chemistry*. J.E. Ghosh, Bharati Bhavan.