

# FACULTY OF SCIENCES

## SYLLABUS

### FOR

## B.Sc. (Hons.) Chemistry

(Semester I-II)

Session: 2018-19



## KHALSA COLLEGE AMRITSAR

*(An Autonomous College)*

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## Scheme of Courses

**Eligibility:-**The candidate having passed 10+2 Examination (Medical and Non-Medical) from a recognized board.

## SCHEME AND SCHEDULE OF COURSES

<b>SEMESTER-I</b>				
<b>S. No.</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Max. Marks</b>	<b>Hrs</b>
1.	CHEM-101	Physical Chemistry-I	50	45
2.	CHEM-102	Inorganic Chemistry-I	50	45
3.	CHEM-103	Organic Chemistry-I	50	45
4.	CHEM-104	Physics-I (Optics)	50	45
5.	CHEM-105	Mathematics-I	50	45
6.	CHEM-106	Communicative English-I	50	45
7.	CHEM-107(A) OR CHEM-107(B)	Punjabi Compulsory-I OR Basic Punjabi-I	50	45
8.	CHEM-108	Organic Chemistry Lab-I	50	45
9.	CHEM-109	Physics Lab-I (Optics Lab)	50	45
<b>TOTAL</b>			<b>450</b>	<b>405</b>
<b>SEMESTER-II</b>				
<b>S. No.</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Max. Marks</b>	<b>Hrs</b>
1.	CHEM-110	Physical Chemistry-II	50	45
2.	CHEM-111	Inorganic Chemistry-II	50	45
3.	CHEM-112	Organic Chemistry-II	50	45
4.	CHEM -113	Physics-II (Modern Physics)	50	45
5.	CHEM -114	Mathematics-II	50	45
6.	CHEM -115	Communicative English-II	50	45
7.	CHEM-116(A) OR CHEM-116(B)	Punjabi Compulsory-II OR Basic Punjabi-II	50	45
8.	CHEM -117	Inorganic Chemistry Lab-I	50	45
9.	CHEM -118	Physics Lab-II	50	45
<b>TOTAL</b>			<b>450</b>	<b>405</b>

Academic Session: 2018-19

<b>SNo</b>	<b>Semester</b>	<b>Maximum marks</b>	<b>Hours Allocated</b>
1	First Semester	450	405
2	Second Semester	450	405
3	Third Semester	400	390
5	Fourth Semester	400	390
5	Fifth Semester	400	360
6	Sixth Semester	350	315
<b>Total</b>		<b>2400</b>	<b>2265</b>

*B.Sc. (Hons)*  
*Chemistry*

*Semester-I*

*B.Sc. (Hons) Chemistry Semester-I*  
**CHEM-101: Physical Chemistry-I**

**45 Hrs.**

**Time: 4 Hrs/week.**

**Max. Marks: 37+13 (Internal Assessment)**

**Instructions for paper setters and candidates**

- I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
- II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
- III. Section-I will consist of nine short questions carrying 1 Mark each.
- IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
- V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

**UNIT- I**

**1. Equation of State: (11Hrs.)**

Kinetic molecular theory of gases, derivation of kinetic gas equation, deduction of gas laws from kinetic gas equation, imperfection in real gases, the compressibility of real gases, isotherms of real gases, equations of state, vander Waal's equation, effect of attractive forces, Liquification of gases, critical phenomenon, P-V isotherms of carbon dioxide, principle of continuity of state, vander Waal's equation and critical constants, principle of corresponding states.

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.

**UNIT-II**

**2.Properties of Liquids: (11 Hrs.)**

The Kinetic molecular description, Intermolecular forces in liquids, Density and methods for its measurements, Vapour pressure and its determination, surface tension and determination of surface tension using capillary rise method and drop formation method, viscosity and measurement of viscosity – Ostwald method, refractivity, molar refractivity, parachor and its measurement, Optical activity and its measurement using polarimeter. Structural differences between solids, liquids and gases. Liquid crystals, Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography.

**UNIT- III**

**3. The First Law of Thermodynamics: (7 Hrs.)**

Thermodynamic terms and basic concepts, Intensive and extensive properties, State functions and differentials, thermodynamic processes, reversibility, irreversibility, Nature of heat and work, Conservation of energy, Zeroth law of thermodynamics, various statements of first law, internal energy (U) and enthalpy (H). Reversible isothermal expansion of ideal and real gases,

Molar heat capacity at constant pressure  $C_p$  and at constant volume  $C_v$ , relation between  $C_p$  and  $C_v$ , Reversible adiabatic expansion of ideal and real gases, The T-V, P-V and P-T relationships, Joule Thomson effect.

**4. Thermochemistry :** (4 Hrs.)

The reaction enthalpy, standard enthalpies, Hess's law and reaction enthalpies, Kirchoff's equation. Relation between H and U for reactions, calorimetric measurements, varieties of enthalpy changes. Bond energy and bond dissociation energy.

**UNIT-IV**

**5. The Second Law of Thermodynamics:** (12 Hrs.)

Spontaneous change, Carnot Cycle, conclusions from Carnot cycle, efficiency of heat engines, second law of thermodynamics, entropy, entropy as a state function, Clausius inequality, entropy as criterion of spontaneity, natural processes, different types of entropy changes under isothermal and non-isothermal conditions, entropy change in irreversible processes.

Helmholtz function (A), Gibbs function (G), standard molar free energy changes, Maxwell relations, dependence of free energy functions on temperature and pressure, total differential equations. Gibbs Helmholtz equations, thermodynamic criteria for spontaneity. Heat capacity at low temperature, Nernst heat theorem, third law of thermodynamics and its application

**Suggested Books**

**ESSENTIAL:**

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).
2. Physical Chemistry by T. Engel & P. Reid, 1st ed., Pearson Education, 2006.

**FURTHER READING:**

1. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (Indian Print)
2. Physical Chemistry by G. M. Barrow, 6th Ed., New York, McGraw Hill, 1996.
3. Physical Chemistry by R. J. Silbey, R. A. Albert & Mounji G. Bawendi, 4th Ed., New York: John Wiley, 2005.

*B.Sc. (Hons) Chemistry Semester-I*  
**CHEM -102: Inorganic Chemistry-I**

**45 Hrs.**

**Time: 4 Hrs/week.**

**Max. Marks: 37+13 (Internal Assessment)**

**Instructions for paper setters and candidates**

- I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
- II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
- III. Section-I will consist of nine short questions carrying 1 Mark each.
- IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
- V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

**UNIT- I**

**1. Atomic Structure:**

**(6 Hrs)**

Schrodinger's Wave equation, Significance of  $\Psi$  and  $\Psi^2$ , The four quantum numbers and their significance, Radial and angular probability, The shapes of s, p, d and f orbitals, Recall of relative energies of atomic orbitals as a function of atomic number, effective nuclear charge and shielding effect, Slater rules, Calculation of screening constant, Recapitulation of fundamental properties of atoms such as atomic volume, the sizes of atoms, ionization energy, electron affinity and their periodic trends, Factors effecting periodic properties.

**2. Chemical Bonding-I**

**(6 Hrs)**

**Electronegativity and Polarity of bond:** Electronegativity, different scales and methods of determination, Recent advances in electronegativity theory, variation of electronegativity, Group electronegativity, Polarities of bonds and molecules, Dipole moments, Percentage of ionic character from dipole moment and electronegativity difference.

**UNIT-II**

**3. Chemical Bonding-I I (Valence Bond theory and Molecular Orbital Theory) (11 Hrs)**

Valence bond (VB) approach, Resonance structures, Bond angles and shapes of molecules and ions (containing bond pairs and lone pairs), Criterion of bond strength and bond length, Molecular orbitals (MO) approach of bonding (LCAO Method), Symmetry and overlap, symmetry of molecular orbitals, Bonding in Homonuclear molecules ( $H_2$  to  $Ne_2$ ) and NO, CO,  $CN^+$ ,  $CO^+$ ,  $CN^-$ , HF, HCl,  $BeH_2$ ,  $CO_2$ , Comparison of VB and MO theories.

**UNIT- III**

**4. The Periodic Table and Chemical Periodicity**

**(11 Hrs)**

The relationship between chemical periodicity and electronic structure of the atom, The long form of the periodic Table – Classification of elements in s, p, d and f-block of elements, Periodicity in oxidation state of valence, metallic/non-metallic character, oxidizing or reducing

behavior, acidic and basic character of oxides, trends in bond type with position of element and with oxidation state for a given element, trends in the stability of compounds and regularities in methods used for extraction of elements from their compounds, Trends in the stability of coordination complexes; Anomalous behavior of elements of 2<sup>nd</sup> short period (Li to F) compared to other members in the same groups of s & p block elements; The diagonal behavior between elements, the inert pair effect, variability of oxidation states of transition elements, color, magnetic properties and other characteristics of transition elements.

#### UNIT- IV

##### **5. Hydrogen**

**(4 Hrs)**

Its unique position in the periodic table, isotopes, ortho and para hydrogen, Industrial production, Hydrides and their chemistry; Heavy water, Hydrogen bonding, Hydrates.

##### **6. Acids-bases:**

**(7 Hrs)**

Various definitions of acids and bases, A generalized acid-base concept, Measurement of acid-base strength, Lewis interactions in non-polar solvents, Systematics of Lewis acid-base interactions, Bond energies, steric effects, solvation effects and acid-base anomalies, Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

#### Suggested Books

##### ESSENTIAL:

1. Cotton F.A., Wilkinson G.W. and Gaus P.L., Basic Inorganic Chemistry, Pubs: John Wiley & Sons, 1987.
2. Lee J.D., Concise Inorganic Chemistry, 4<sup>th</sup> edition, Pubs: ELBS, 1991.
3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry : Principles of Structures and Reactivity; 4<sup>th</sup> Edition, Pubs: Harper Collins, 1993.
4. Greenwood N.N. and Earnshaw A., Chemistry of the Elements, 2<sup>nd</sup> edition., Pubs: Butterworth/Heinemann, 1997.

##### FURTHER READING:

1. Cotton F.A. and Wilkinson G., Murillo C.A., Bochmann M., Advanced Inorg. Chemistry, 6<sup>th</sup> Edition, Pubs: John Wiley & Sons. Inc., 1999.
2. Shriver D.F., Atkins F.W. and Langford C.M., Inorganic Chemistry; 3<sup>rd</sup> Edition, Pubs: Oxford University Press, 1999.
3. Douglas B., Daniel D. Mc and Alexander J., Concepts of Models of Inorganic Chemistry, Pubs: John Wiley, 1987.
4. Gray H.B., Electrons and Chemical Bonding, Pubs: W.A., J Benjamin Inc., 1965.



*B.Sc. (Hons) Chemistry Semester-I*  
**CHEM -103: Organic Chemistry-I**

**45 Hrs.**

**Time: 4 Hrs/week.**

**Max. Marks: 37+13 (Internal Assessment)**

**Instructions for paper setters and candidates**

- I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
- II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
- III. Section-I will consist of nine short questions carrying 1 Mark each.
- IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
- V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

**UNIT-I**

**1. Structure and Bonding (4 Hrs)**

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonds, vander Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive, field effects and hydrogen bonding.

**2. Mechanism of Organic Reactions (7 Hrs)**

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations.

Reactive intermediates – carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

**UNIT-II**

**3. Stereochemistry of Organic Compounds (11 Hrs)**

Concept of isomerism. Types of isomerism.

Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism – conformational analysis of ethane and n-butane; conformational analysis of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivative. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

### UNIT-III

#### **4. Alkanes and Cycloalkanes**

(11 Hrs)

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources and methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids). Physical properties and chemical reactions of alkanes.

Mechanism of free radical halogenation of alkanes : orientation, reactivity and selectivity.

Cycloalkanes – nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring ; banana bonds.

#### **5. Alkenes, Cycloalkenes**

Nomenclature of alkenes, methods of formation, mechanisms of 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, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$  Polymerization of alkenes. substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Methods of formation, conformation and Chemical reactions of cycloalkenes.

### UNIT-IV

#### **6. Dienes and Alkynes**

(12 Hrs)

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

Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

#### **7. Arenes and Aromaticity**

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene : Molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture.

Aromaticity: The Huckel rule, aromatic ions, Aromatic electrophilic substitution -general pattern of mechanism, role of sigma and pi complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivations. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyls.

### **Suggested Books**

#### ESSENTIAL :

1. Morrison R.T. and Boyd P.S., Organic Chemistry, 7<sup>th</sup>Edn., Pubs: Allyn and Bacon Inc.,

Boston, 2006

2. Mukerji S. M., Singh S. P. and Kapoor R. P., Organic Chemistry Second Edition Vol. I/II, Pubs: Wiley Eastern Ltd., New Delhi, 2010

**FURTHER READING :**

1. Wade L.G.Jr., Organic Chemistry, Pubs:Prentice-Hall,1990.
2. Solomons G., Fundamentals of Organic Chemistry, Pubs: John Wiley,2002.
3. Carey F.A., Organic Chemistry, Pubs: McGraw-Hill, Inc, 2003.
4. Streitwieser A., Jr. and Heathcock C.H., Introduction to Organic Chemistry, 3<sup>rd</sup>Edn., Pubs: MacMillan Pub. Co., N.Y,1992.

*B.Sc. (Hons) Chemistry Semester-I*  
**CHEM -104: Physics-I**  
*Optics*

**45 Hrs.**

**Time: 4 Hrs/week.**

**Max. Marks: 37+13 (Internal Assessment)**

**Instructions for paper setters and candidates**

- I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
- II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
- III. Section-I will consist of nine short questions carrying 1 Mark each.
- IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
- V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

**UNIT-I**

**1. Interference of Light**

**11Hrs**

Superposition of light waves and interference, young's double slit experiment, Distribution of intensity in young's double slit experiment, Conditions for sustained interference pattern, Coherent sources of light, Temporal and spatial coherence, coherence, Interference pattern by division of wave front, Fresnel Biprism, Fresnel double mirror, Llyod's single mirror, Displacement of fringes

**UNIT-II**

**2. Interference by Division of Amplitude**

**11Hrs**

Change of phase on reflection, Interference in thin films due to reflected and transmitted light, Need for extended source for interference by division of amplitude, Fringes of equal inclination and equal thickness , non reflecting films, Newton's Rings, Michelson Interferometer, Fabry Perot interferometer, Distribution of intensity in Fabry Perot fringes.

**UNIT-III**

**3. Diffraction:**

**11Hrs**

Huygen's fresnel theory, half-period zones, Zone plate, Distinction between fresnel and fraunhoffer diffraction. Fraunhoffer diffraction at rectangular and circular apertures, Effect of

diffraction in optical imaging, Resolving power of telescope in diffraction grating, its use as a spectroscopic element and its resolving power, Resolving power of microscope. Resolving power of fabry-perot interferometer.

#### UNIT-IV

#### 4. Polarization:

12Hrs

Transverse nature of light, Plane Polarized light, Elliptically polarized light, wire grid polarizer, Sheet polarizer, Malus Law, Brewster Law, Polarization by reflection, Scattering, Double reflection, Nicol prism, Retardation plates, Production Analysis of polarized light, Quarter and half wave plates. Optical activity, specific rotation, half shade polarimeter.

#### Text Reference Books:

1. Fundamentals of Optics, F.A. Jenkins and Harvey E White, (Mcgraw Hill) 4th edition,
2. Optics; V.K. Sharma and T.S. Bhatia, S.Vikas and Co.
3. Optics, Ajoy Ghatak, (McMillan Indian) 2nd edition, 7th reprint, 1997
4. Introduction to Atomic Spectra, H.E. White (Mcgraw Hill, Book Co., Inc., New York)
5. Laser Fundamentals, W.T. Silfvast (Foundation Books), New Delhi, 1996
6. Laser and Non-Linear Optics, B.B. Laud (New Age Pub.) 2002
7. Optics, Born and Wolf, (Pergamon Press) 3rd edition, 1965
8. Laser, Svelto, (Plenum Pres) 3rd edition, New York

*B.Sc. (Hons) Chemistry Semester-I*  
**CHEM -105: Mathematics-I**

**4 Hrs./Week**

**45 hrs.**

**Max. Marks: 37+13 (Internal Assessment)**

**Instructions for paper setters and candidates**

- I. Examiner will make four sections of paper namely Section-I, II, III, IV
- II. Examiner will set total of SIXTEEN questions, FOUR questions for each section from each unit and carrying FIVE marks each.
- III. The students are required to attempt EIGHT questions in all, with TWO questions from each section.

**UNIT-I**

**1. Trigonometry**

**9 Hrs**

T- ratios, addition and subtraction formulae, multiple angles, sub-multiple angles, trigonometric equations, inverse trigonometrical functions (proofs of articles are not required).

**2. Algebra**

**3 Hrs**

Fundamental principle of counting, Permutation and Combination with simple applications. Principle of mathematical induction, statement of Binomial Theorem and its applications.

**UNIT-II**

**3. Determinants and Matrices**

**11 Hrs**

Introduction to matrix, Different kinds of matrices, Addition, Multiplication, Symmetric and Skew symmetric matrix, Transpose of matrix. Determinant of matrix, properties of determinant, product of two determinant of third order.

Adjoint and Inverse of matrix, Rank of matrices, Condition of Consistency of system of linear equations, Eigen vectors and Eigen values using proof).

**UNIT-III**

**4. Co-ordinate Geometry**

**11 Hrs**

Polar & Cartesian co-ordinates in plane, different forms of straight lines, Angle between two straight lines. Conditions of parallelism and perpendicularity. Standard equations of circle, parabola, ellipse and hyperbola(without proof) and simple problems.

**UNIT-IV**

**5. Solid Geometry**

**11 Hrs**

**Sphere:** Standard form, Central form, General form, Diameter form, four point form

**Cone:** Eq. of cone whose vertex is origin, Right circular cone, standard cone

**Cylinder:** Quadratic cylinder, Right circular cylinder, Base-conic cylinders, Parabolic cylinder, Hyperbolic cylinder, elliptic cylinder

(Articles without proof)

**Books :**

1. A Text book of Matrices-Shati Narayan
2. Elementary Engineering Mathematics- B.S.Grewal
3. Mathematical Te
4. A text book of Engineering Mathematics- B. L. Moncha and H.R. Choudhary

*B.Sc. (Hons) Chemistry Semester-I*  
**CHEM -106: COMMUNICATIVE ENGLISH**  
**B.Sc. ( Hons.) Physics and Chemistry**

**TIME : 3 Hrs**

**Max. Marks: 50**

**Theory: 37**

**Internal Assessment: 13**

**Course Contents:**

**T.. Reading and Comprehension Skills:**

Students will be required to read and comprehend the essays in Unit 1 and 2 of the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition. They will be required to answer the questions given after each essay.

**T.. Developing Vocabulary and using it in the Right Context:**

The students will be required to master “Word List” from the Chapter “Vocabulary” in the book *The Written Word*. The question will be set from the following words :

Acute, Arrogant, Apathy, Bliss, Brevity, Cease, Chronic, Dearth, Discontent, Effigy, Fastidious, Giddy, Hamper, Guile, Inauspicious, Juxtapose, Kinetic, Laudable, Meticulous, Mundane, Naive, Opaque, Peevish, Proficient, Prolific, Remedial, Strife, Verbose, Woe, Zenith.

**T.. Writing Skills**

Students will be required to write Paragraph Writing and Letter Writing as in the book *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.

**Suggested paper pattern:-**

1. Practical Question on Paragraph Writing with internal choice as prescribed in *The Written Word* ( 8 marks)
2. Short answer type questions from Unit 1 and 2 of *Making Connections : A Strategic Approach To Academic Reading* (12 marks)
3. Essay type question with internal choice from Unit 1 and 2 of *Making Connections: A strategic Approach to Academic Reading* ( 8 marks)
4. Practical question on Letter Writing from *The Written Word* ( 5 marks)
5. The question will carry 08 words out of 30 prescribed words from the “Word List” in *The Written Word*. The student will attempt any four (4) out of the eight (08). (4X1= 4 marks)



B.Sc. (Hons) Chemistry Semester-I

CHEM -107(A): Punjabi-I

B.Sc. (Hons. – Botany, Chemistry, Mathematics, Physics, Zoology), B.Sc. Agri./Bio Tech./IT/FD/ Food Sc./BCA, BJMC  
B. Com. Ac. & Finance, B. Internet & Mob. Tech., B. Multimedia

SEMESTER-I  
ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

ਸਮਾਂ : 3 ਘੰਟੇ

ਬਿਊਰੀ ਅੰਕ : 37  
ਇੰਟਰਨਲ ਅਸੈਸਮੈਂਟ : 13  
ਕੁਲ ਅੰਕ: 50

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

1. ਸਾਹਿਤ ਦੇ ਰੰਗ (ਸੰਪਾ. ਡਾ. ਮਹਿਲ ਸਿੰਘ), ਭਾਗ ਪਹਿਲਾ (ਕਵਿਤਾ ਅਤੇ ਕਹਾਣੀ), ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
2. ਪੈਰੂਾ ਰਚਨਾ
3. ਪੈਰੂਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ।
4. (ੳ) ਪੰਜਾਬੀ ਧੁਨੀ ਵਿਉਤ : ਉਚਾਰਨ ਅੰਗ, ਉਚਾਰਨ ਸਥਾਨ ਤੇ ਵਿਧੀਆਂ, ਸਵਰ, ਵਿਅੰਜਨ, ਸੁਰ।  
(ਅ) ਭਾਸ਼ਾ ਵੰਨਗੀਆਂ : ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਅਤੇ ਉਪ-ਭਾਸ਼ਾ ਦਾ ਅੰਤਰ, ਪੰਜਾਬੀ ਉਪਭਾਸ਼ਾਵਾਂ ਦੇ ਪਛਾਣ-ਚਿੰਨ੍ਹ।
5. ਮਾਤ ਭਾਸ਼ਾ ਦਾ ਅਧਿਆਪਨ  
(ੳ) ਪਹਿਲੀ ਭਾਸ਼ਾ ਦੇ ਤੌਰ ਉੱਤੇ  
(ਅ) ਦੂਜੀ ਭਾਸ਼ਾ ਦੇ ਤੌਰ ਉੱਤੇ

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਕਿਸੇ ਕਵਿਤਾ ਦਾ ਸਾਰ ਜਾਂ ਉਸਦਾ ਵਿਸ਼ਾ ਵਸਤੂ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 7 ਅੰਕ
2. ਕਿਸੇ ਕਹਾਣੀ ਦਾ ਸਾਰ, ਉਸਦਾ ਵਿਸ਼ਾ ਵਸਤੂ, ਕਹਾਣੀ ਕਲਾ ਜਾਂ ਪਾਤਰ ਉਸਾਰੀ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 7 ਅੰਕ
3. ਪੈਰੂਾ ਰਚਨਾ : ਤਿੰਨ ਵਿਸ਼ਿਆਂ ਵਿਚੋਂ ਕਿਸੇ ਇੱਕ ਉੱਤੇ ਪੈਰੂਾ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇ। 4 ਅੰਕ
4. ਪੈਰੂਾ ਦੇ ਕੇ ਉਸ ਬਾਰੇ ਚਾਰ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ 4 ਅੰਕ
5. ਨੰਬਰ 5 ਉੱਤੇ ਦਿੱਤੀ ਵਿਆਕਰਣ ਦੇ ਆਧਾਰ 'ਤੇ ਵਰਣਨਾਤਮਕ ਪ੍ਰਸ਼ਨ 7 ਅੰਕ
6. ਨੰਬਰ 6 ਵਿਚ ਮਾਤ ਭਾਸ਼ਾ ਦੇ ਪਹਿਲੀ ਭਾਸ਼ਾ ਅਤੇ ਦੂਜੀ ਭਾਸ਼ਾ ਵਜੋਂ ਅਧਿਆਪਨ, ਮਹੱਤਵ ਅਤੇ ਸਮੱਸਿਆਵਾਂ ਬਾਰੇ ਚਾਰ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਦੋ ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ।

(4×2)=8 ਅੰਕ

ਨੋਟ: ਇੰਟਰਨਲ ਅਸੈਸਮੈਂਟ 13 ਅੰਕਾਂ ਦੀ ਹੈ, ਜੋ ਕਾਲਜ ਵਲੋਂ ਨਿਰਧਾਰਿਤ ਦਿਸ਼ਾ ਨਿਰਦੇਸ਼ਾਂ ਅਨੁਸਾਰ ਇਨ੍ਹਾਂ ਅੰਕਾਂ ਤੋਂ ਵੱਖਰੀ ਹੋਵੇਗੀ। ਇਸ ਪੇਪਰ ਦੇ ਕੁਲ ਅੰਕ 37+13 = 50 ਹਨ।

*B.Sc. (Hons) Chemistry Semester-I*  
**CHEM -108: Organic Chemistry Lab-I**

4 Hrs./Week

45 hrs.

Max. Marks: 37+13 (Internal Assessment)

- 1. Calibration of Thermometer**  
80-82 °C (Naphthalene), 113-114°C (acetanilide). 132-133 °C (Urea), 100°C (distilled Water)
- 2. Determination of melting point**  
Naphthalene 80-82°C, Benzoic acid 121.5-122°C Urea, 132.5-133°C, Succinic acid 184-185 °C, Cinnamic acid 133°C, Salicylic acid 157-5-158°C, Acetanilide 113-5-114°C, m-Dinitrobenzene 90°C, p-Dichlorobenzene 52°C, Aspirin 135°C.
- 3. Determination of boiling points**  
Ethanol 78°C, Cyclohexane 81.4°C, Toluene 110.6°C, Benzene 80°C.
- 4. Mixed melting point determination**  
Urea-Cinnamic acid mixture of various compositions (1:4,1:1,4:1)
- 5. Distillation**  
Simple distillation of ethanol-water mixture using water condenser  
Distillation of nitrobenzene and Aniline using air condenser.
- 6. Crystallization**  
Concept of induction of crystallization  
Phthalic acid from hot water (using fluted filter paper and stemless funnel)  
Acetanilide from boiling water  
Naphthalene from ethanol  
Benzoic acid from water.
- 7. Decolorisation and crystallization using charcoal**  
Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration.  
Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorising carbon) from ethanol.
- 8. Sublimation (Simple and Vacuum)**  
Camphor, Naphthalene, Phthalic acid and Succinic acid.

9. **Extraction: The separatory funnel, drying agent:**  
Isolation of caffeine from tea leaves
10. **Steam distillation**  
Purification of aniline/nitrobenzene by steam distillation.

#### Suggested Books

1. Vogel A. I., Tatchell A.R., Furnis B.S., Hannaford A.J., Smith P.W.G., Vogel's Text Book of Practical Organic Chemistry, 5<sup>th</sup> Edn., Pubs: ELBS, 1989.
2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques, 3<sup>rd</sup> Edn., Pubs: Thomson Brooks/Cole, 2005.
3. Mann F.G., Saunders. P.C., Practical Organic Chemistry, Pubs: Green & Co. Ltd., London, 1978.
4. Svehla, G., Vogel's Qualitative Inorganic Analysis (revised); 7<sup>th</sup> edition, Pubs: Orient Longman, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4<sup>th</sup> edition, Pubs: Orient Longman, 1978.

*B.Sc. (Hons) Chemistry Semester-I*  
**CHEM -109: Physics Lab-I**

**4 Hrs./Week**

**45 hrs.**

**Max. Marks: 37+13 (Internal Assessment)**

1. To find the angle of prism by rotating telescope.
2. To find the refractive index of the glass prism using a spectrometer.
3. To find the refractive index of a transparent liquid using a hollow glass prism and spectrometer for given wavelength.
4. To study the variation of refractive index with wavelength of spectral line of mercury source and hence find the values of Cauchy's constant.
5. To measure the wavelength of sodium light by using Newton's rings apparatus.
6. To determine the wavelength of spectral line of mercury using diffraction grating.
7. To determine the wavelength of sodium light using plane diffraction grating.
8. To determine the resolving power of plane diffraction grating.
9. To measure an accessible distance between two points using a sextant.
10. To measure an inaccessible distance between two points using a sextant.
11. To determine the wavelength of He-Ne laser using plane diffraction grating.
12. To find the specific rotation of sugar solution by Laurentz half shade polarimeter

*B.Sc. (Hons)*  
*Chemistry*

*Semester-II*

*B.Sc. (Hons) Chemistry Semester-II*  
**CHEM-110: Physical Chemistry-II**

**45 Hrs.**

**Time: 4 Hrs/week.**

**Max. Marks: 37+13 (Internal Assessment)**

**Instructions for paper setters and candidates**

- I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
- II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
- III. Section-I will consist of nine short questions carrying 1 Mark each.
- IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
- V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

**UNIT-I**

**1. Chemical Equilibrium**

**(4 Hrs)**

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action. Determination of  $K_p$ ,  $K_c$ ,  $K_a$  and their relationship, Clausius-Clapeyron equation, applications.

**2. Introduction to Phase Equilibrium**

**(8 Hrs)**

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water,  $\text{CO}_2$  and S systems, Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic; Bi-Cd, Pb-Ag systems, desilverisation of lead, Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ( $\text{NaCl-H}_2\text{O}$ ), ( $\text{FeCl}_3\text{-H}_2\text{O}$ ) and ( $\text{CuSO}_4\text{-H}_2\text{O}$ ) system, Freezing mixtures: acetone-dry ice, Liquid-liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law, Non-ideal system: azeotropes-HCl- $\text{H}_2\text{O}$  and ethanol-water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consolute temperature.

**UNIT-II**

**3. Solid State:**

**(11 Hrs)**

Definition of space lattice, unit cell.

Laws of crystallography - (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals X-ray diffraction by crystals. Derivation of Bragg equation, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method). Defects in Solids- Point defects, Line defects, screw defects Properties of Solids- Electrical, magnetic and dielectric properties.

**UNIT-III**

**4. Colloidal State:**

**(6Hrs)**

Definition of colloids, classification of colloids.

Solids in liquids (sols): properties - kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, Gold Number.

Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier.

Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

**5. Physical Properties and Molecular Structure: (5Hrs)**

Optical activity, polarization - (Clausius - Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment temperature method, dipole moment and structure of molecules

**UNIT-IV**

**6. Electrochemistry-I (11 Hrs)**

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

**Books Suggested:**

1. Principles of physical chemistry, S. H. Maron & C. F. Prutton.
2. Physical Chemistry, K. J. Laidler.
3. Physical Chemistry Vol-1, K. L. Kapoor.
4. Physical chemistry, W. J. Moore.

*B.Sc. (Hons) Chemistry Semester-II*  
**CHEM -111: Inorganic Chemistry-II**  
**(Chemistry of representative elements)**

**45 Hrs.**

**Time: 4 Hrs/week.**

**Max. Marks: 37+13 (Internal Assessment)**

**Instructions for paper setters and candidates**

- I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
- II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
- III. Section-I will consist of nine short questions carrying 1 Mark each.
- IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
- V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

**UNIT-I**

**1. General properties of representative elements**

**7 Hrs.**

General remarks about each group, trends in electronic configuration, structure of elements, atomic and ionic radii, ionization potential, electron affinity, electronegativity, oxidation states, inert pair effect, catenation and heterocatenation, first and second row anomalies, the use of d orbitals by non-metals, the use of p-orbitals in bonding . Important classes of compounds of s and p block elements.

**2. Alkali Metals**

**4 Hrs.**

Oxides, hydroxides, peroxides and super oxides, halides, hydrides, solutions of metals in liquid ammonia, complexes crowns and cryptands and podands.

**UNIT-II**

**3. Alkaline Earth Metals**

**4 Hrs.**

Solutions of the metals in liquid ammonia, hydroxides, oxides, sulfates, hydrides, halides, carbides, structures of calcium carbide, structures of basic beryllium acetate  $\text{Be}_4\text{O}(\text{CH}_3\text{COO})_6$ , beryllium oxalate complexes  $\text{Be}(\text{ox})_2$ , Structure of chlorophyll 'a'.

**4. Group III (Boron Group)**

**4 Hrs.**

Oxides, halides and hydrides of group III elements, boron sesquioxide and borates structure of borates, trihalides and lower halides of boron, preparation of boron hydrides reactions and structures of boranes.

**5. Group IV (Carbon Group)**

**4 Hrs.**

Structure and allotropy of the elements, types and structure of carbides, oxides of carbon and silicon, types and structures of silicates, Organo-silicon compounds and the silicones, halides of IV group elements.

**UNIT-III**

**6. Group V (Nitrogen Group)**

**4 Hrs.**



Hydrides, properties and structure of ammonia, hydrazine, hydroxylamine, trihalides and Pentahalides of V groups elements, oxides of nitrogen, structure of  $N_2O$ ,  $NO$ ,  $N_2O_3$ ,  $N_2O_4$  and  $N_2O_5$ , oxo acids of nitrogen and phosphorous, phosphazenes and cyclophosphazenes.

**7. Group VI (Oxygen Group)**

**4 Hrs.**

Structure and allotropy of the elements. Oxides of sulfur (structure of  $SO_2$  and  $SO_3$ ) oxoacids of sulfur halides of sulfur, selenium and tellurium, compounds of Sulfur and nitrogen ( $S_4N_4$ ).

**8. Group VII (Halogen Group)**

**3 Hrs.**

Oxides of halogens ( $OF_2$ ,  $O_2F_2$ ,  $Cl_2O$ ,  $ClO_2$ ,  $Cl_2O_6$ ,  $BrO_2$ ,  $I_2O_5$ ) (structures), Preparation, reaction and structure inter-halogen compounds. ( $ClF_3$ ,  $BrF_3$ ,  $ICl_5$ ,  $IF_5$ ,  $IF_7$ ) Polyhalides, basic properties of halogens.

**UNIT-IV**

**9. Zero Group (Noble Gases)**

**4 Hrs.**

Clathrate compounds, preparation, structure and bonding of noble gas compounds ( $XeF_2$ ,  $XeF_4$ ,  $XeF_6$ ,  $XeO_3$ ,  $XeO_2F_2$ ,  $XeO_4$ ).

**10. Elementary Coordination Chemistry**

**7 Hrs.**

Werner's theory, nomenclature of coordination complexes, isomerism in coordination complexes, stereochemistry of coordination numbers 2-12, Valence Bond Theory of coordination compounds and its application.

**Books Recommended:**

1. J.D. Lee, Concise Inorganic Chemistry, 4th Ed.
2. J.E. Huheey, Inorganic Chemistry, Harper & Row.
3. F.A.Cotton and G. Wilinon, Advanced Inorganic Chemistry, Interscience Publishers.
4. N.N. Greenwood and A. Earnshaw, Chemistry of Elements, Pergamon Press.

*B.Sc. (Hons) Chemistry Semester-II*  
**CHEM -112: Organic Chemistry-II**

**45 Hrs.**

**Time: 4 Hrs/week.**

**Max. Marks: 37+13 (Internal Assessment)**

**Instructions for paper setters and candidates**

- I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
- II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
- III. Section-I will consist of nine short questions carrying 1 Mark each.
- IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
- V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

**UNIT-I**

**1. Alcohols**

**6Hrs**

Classification and nomenclature.

Monohydric alcohol - nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, Acidic nature. Reactions of alcohols.

Dihydric alcohols - nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [ $\text{Pb}(\text{OAc})_4$  and  $\text{HIO}_4$ ] and pinacol-pinacolone rearrangement.

Trihydric alcohols - nomenclature and methods of formation, chemical reactions of glycerol.

**2. Phenols**

**5 Hrs**

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols - electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Laderer-Manasse reaction and Reimer-Tiemann reaction.

**UNIT-II**

**3. Ethers and Epoxides**

**4 Hrs**

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions – cleavage and autoxidation, Ziesel's method.

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

**4. Alkyl and Aryl Halides**

**7 Hrs**

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides,  $\text{S}_{\text{N}}2$  and  $\text{S}_{\text{N}}1$  reactions with energy profile diagrams.

Polyhalogen compounds: chloroform, carbon tetrachloride.

Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

### UNIT-III

#### **5. Aldehydes and Ketones**

**11Hrs**

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties, of aldehydes and ketones

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner,  $\text{LiAlH}_4$  and  $\text{NaBH}_4$  reductions. Halogenation of enolizable ketones.

An introduction to  $\alpha$ ,  $\beta$ -unsaturated aldehydes and ketones.

### UNIT-IV

#### **5. Carboxylic Acids**

**7 Hrs**

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids.

Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

Methods of formation and chemical reactions of halo acids. Hydroxy acids: maleic, tartaric and citric acids.

Methods of formation and chemical reactions of unsaturated monocarboxylic acids.

Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

#### **6. Carboxylic Acid Derivatives**

**5 Hrs**

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, Preparation and interconversion of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

#### **Books Suggested:**

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Fundamentals of Organic Chemistry, Solomons, John Wiley.
3. Organic Chemistry, F.A. Carey, McGraw Hill, Inc.
4. Organic Chemistry, L.G. Wade Jr. Prentice Hall.
5. Organic Chemistry Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd (New Age International).
6. Introduction to organic chemistry, Stritwieser, Heathcock and Kosover, Macmillan.

*B.Sc. (Hons) Chemistry Semester-II*  
**CHEM -113: Physics-II**  
*Modern Physics*

45 Hrs.

Time: 4 Hrs/week.

Max. Marks: 37+13 (Internal Assessment)

**Instructions for paper setters and candidates**

- I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
- II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
- III. Section-I will consist of nine short questions carrying 1 Mark each.
- IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
- V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

**UNIT-I**

**12Hrs**

**1. Dual Nature of Matter and Radiation:** De Broglie's hypothesis, photoelectric effect, Compton effect, electron diffraction experiments of Davission and Germer, Wave group and particle velocities, Heisenberg's uncertainty principle, principle of the electron microscope, Diffraction of X-rays from crystals, Planck's quantum hypothesis, Bragg's law of determination of structure of simple crystals.

**UNIT-II**

**11Hrs**

**2. Radioisotopes and their Application:** Radioactive decay laws, Uranium and Carbon dating, introduction to  $\alpha$ ,  $\beta$  and  $\gamma$  decays, Radioisotopes and their production, mass spectrograph, uses of radioisotopes in medicine, agriculture and geology Radiation doses and their units, Biological effects of radiation.

**UNIT-III**

**11Hrs**

**3. Particle detectors:** Uses of ionization chamber, Proportional counter, GM Counter, Scintillation counter and photographic emulsions as detectors.

**UNIT-IV**

**11Hrs**

**4. Elementary Particles:** Types of interaction, Classification of elementary particles and their properties, Quantum numbers and conservation laws, isospin, charge conjugation, Antiparticles, Introduction to Quarks. Origin and general characterization of cosmic rays (Primary and Secondary)

**Reference Books:**

1. Concepts of Modern Physics: A. Beiser.
2. Essentials of Modern Physics: V. Acota and C. L. Grown
3. Fundamentals of Modern Physics: B. D. Duggal and C. L. Chhabra

*B.Sc. (Hons) Chemistry Semester-II*  
**CHEM -114: MATHEMATICS - II**

4 Hrs./Week

45 hrs.

Max. Marks: 37+13 (Internal Assessment)

**Instructions for paper setters and candidates**

- I. Examiner will make four sections of paper namely Section-I, II, III, IV
- II. Examiner will set total of SIXTEEN questions, FOUR questions for each section from each unit and carrying FIVE marks each.
- III. The students are required to attempt EIGHT questions in all, with TWO questions from each section.

**UNIT-I**

**(11 Hrs)**

**1. Function, Limit and Continuity:**

Functions and graphs of standard T-ratio, Domain and Co-Domain, range, Inverse Functions, Exponential and Logarithmic Functions, limit of Functions, Algebraic Computations of limits, Continuity of Functions at a point.

**UNIT-II**

**(12 Hrs)**

**2. Differential Calculus I**

An Introduction to the Derivative, Differentiation of standard Functions, Formulae on derivative of sum, difference, product and quotient of functions, chain rule, derivative of Trigonometric functions, Inverse Trigonometric functions, Exponential and Logarithmic Functions.

**3. Differential Calculus II**

Differentiation of implicit functions, Derivative of functions expressed in parametric form, derivative of higher order excluding  $n^{\text{th}}$  order derivative, Increasing and decreasing functions, Sign of derivative, Maxima and Minima of a single variable. Introduction to Partial differentiation.

**UNIT-III**

**(11 Hrs)**

**4. Differential Calculus III**

Rolle 's, Lagrange and Cauchy mean values theorems and their applications, Taylor theorem and Maclaurian's theorem with Lagrange's form of remainder and applications of formal expansions of functions. (Proofs of theorems are not required).

**UNIT-IV**

**(11 Hrs)**

**5. Integral Calculus**

Integration as inverse of differentiation, Indefinite Integral of standard forms, Methods of substitution, Methods of fractions, Integration by parts, Definite Integral: Seven general theorems on Definite integral and their simple application, Tropezoidal Rule, Prismoidal rule, Simpson rule (without proof and simple problems)

**Books Recommended :**

1. Differential Calculus- Shanti Narayan

2. Integral Calculus- Shanti Narayan
3. Elementary Engineering Mathematics- B.S.Grewal
4. Mathematical Techniques in Chemistry- Joseph B. Dence
5. A text book of Engineering Mathematics- B. L. Moncha and H.R. Choudhary

*B.Sc. (Hons) Chemistry (Semester-II)*

**CHEM -115 COMMUNICATIVE ENGLISH**  
**B.Sc. ( Hons.) Physics and Chemistry**

**TIME : 3 Hrs**

**Max. Marks: 50**

**Theory: 37**

**Internal Assessment: 13**

**Course Contents:**

**T.. Reading and Comprehension Skills:**

Students will be required to read and comprehend the essays in Unit 3 and 4 of the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition. They will be required to answer the questions given after each essay.

**T.. Developing Vocabulary and using it in the right context :**

Students will be required to study ‘prefix’ and ‘suffix’ from the chapter “vocabulary” in the book *The Written Word*. The question will be set from the following words :

Prefixes :- a-, anti-, auto-, bi-, dia-, di-, dis-, homo-, Hyper-, hypo-, mis-, non-, semi-, un-, pre-

Suffixes :- -able, -al, -cy, -dom, -fy, -hood, -ious, -ist, -ment, -ness, -ship, -some, -y, -logy.

**T.. Writing Skills**

Students will be required to learn Essay writing, Report Writing and Letter Writing as in the book *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.

**Suggested paper pattern:-**

1. Practical Question on Essay Writing with internal choice as prescribed in *The Written Word*. ( 8 marks)
2. Short answer type questions from Unit 3 and 4 of *Making Connections : A Strategic Approach To Academic Reading* (12 marks)
3. Essay type question with internal choice from Unit 3 and 4 of *Making Connections: A strategic Approach to Academic Reading* ( 8 marks)
4. Practical Question on Report Writing from *The Written Word* ( 5 marks)
5. The question will carry 4 Prefixes and 4 Suffixes (from the list given above) from the book *The Written Word*. The students will attempt any four (4) out of eight (8) (4 marks)

**CHEM -116(A): Punjabi- II**  
**B.Sc. (Hons. – Botany, Chemistry, Mathematics, Physics, Zoology), B.Sc.**  
**Agri./Bio Tech./IT/FD/ Food Sc./BCA, BJMC**  
**B. Com. Ac. & Finance, B. Internet & Mob. Tech., B. Multimedia**

**SEMESTER-II**  
**ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)**

ਸਮਾਂ : 3 ਘੰਟੇ

ਥਿਊਰੀ ਅੰਕ : 37  
ਇੰਟਰਨਲ ਅਸੈਸਮੈਂਟ : 13  
ਕੁਲ ਅੰਕ : 50

**ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ**

1. ਸਾਹਿਤ ਦੇ ਰੰਗ (ਸੰਪਾ. ਡਾ. ਮਹਿਲ ਸਿੰਘ), ਭਾਗ ਦੂਜਾ (ਵਾਰਤਕ ਅਤੇ ਰੇਖਾ-ਚਿੱਤਰ), ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
2. ਸ਼ਬਦ-ਬਣਤਰ ਅਤੇ ਸ਼ਬਦ ਰਚਨਾ : ਪਰਿਭਾਸ਼ਾ, ਮੁਢਲੇ ਸੰਕਲਪ।
3. ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ
4. ਪੈਰ੍ਹਾ ਰਚਨਾ
5. ਪੈਰ੍ਹਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ
6. ਮੁਹਾਵਰੇ ਅਤੇ ਅਖਾਣ

**ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ**

1. ਕਿਸੇ ਲੇਖ/ਨਿਬੰਧ ਦਾ ਸਾਰ ਜਾਂ ਉਸਦਾ ਵਿਸ਼ਾ ਵਸਤੂ (ਦੋ ਵਿਚੋਂ ਇੱਕ) (7 ਅੰਕ)
2. ਰੇਖਾ ਚਿੱਤਰ : ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਸ਼ਖ਼ਸੀਅਤ ਦੇ ਗੁਣ (7 ਅੰਕ)
3. ਯੂਨਿਟ 3-4 ਨੰਬਰ ਉੱਤੇ ਦਿੱਤੀ ਵਿਆਕਰਣ ਦੇ ਆਧਾਰ ਤੇ ਵਰਣਨਾਤਮਕ ਪ੍ਰਸ਼ਨ (7 ਅੰਕ)
5. ਪੈਰ੍ਹਾ ਰਚਨਾ : ਤਿੰਨ ਵਿਸ਼ਿਆਂ ਵਿਚੋਂ ਕਿਸੇ ਇੱਕ ਉੱਤੇ ਪੈਰ੍ਹਾ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇ। (4 ਅੰਕ)
6. ਪੈਰ੍ਹਾ ਦੇ ਕੇ ਉਸ ਬਾਰੇ ਚਾਰ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ (4 ਅੰਕ)
7. ਨੰਬਰ 7 ਵਿਚ ਅੱਠ ਅਖਾਣ ਅਤੇ ਅੱਠ ਮੁਹਾਵਰੇ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਚਾਰ-ਚਾਰ ਨੂੰ ਵਾਕਾਂ ਵਿਚ ਵਰਤ ਕੇ ਅਰਥ ਸਪੱਸ਼ਟ ਕਰਨੇ ਹੋਣਗੇ। (4+4 = 8 ਅੰਕ)

ਨੋਟ: ਇੰਟਰਨਲ ਅਸੈਸਮੈਂਟ 13 ਅੰਕਾਂ ਦੀ ਹੈ, ਜੋ ਕਾਲਜ ਵਲੋਂ ਨਿਰਧਾਰਿਤ ਦਿਸ਼ਾ ਨਿਰਦੇਸ਼ਾਂ ਅਨੁਸਾਰ ਇਨ੍ਹਾਂ ਅੰਕਾਂ ਤੋਂ ਵੱਖਰੀ ਹੋਵੇਗੀ। ਇਸ ਪੇਪਰ ਦੇ ਕੁਲ ਅੰਕ 37+13 = 50 ਹਨ।



*B.Sc. (Hons) Chemistry Semester-II*  
**CHEM -117: Inorganic Chemistry Lab-I**

4 Hrs./Week

45 hrs.

Max. Marks: 37+13 (Internal Assessment)

Identification of cations and anions in a mixture which may contain combinations of acid ions.

These must contain interfering acid anions and one, the insoluble.

**1. Special Tests for Mixture of Anions**

- (i) Carbonate in the presence of sulphite.
- (ii) Nitrate in the presence of nitrite
- (iii) Nitrate in the presence of bromide and iodide.
- (iv) Nitrate in the presence of chlorate.
- (v) Chloride in the presence of bromide and iodide.
- (vi) Chloride in the presence of bromide.
- (vii) Chloride in the presence of iodide.
- (viii) Bromide and iodide in the presence of each other and of chloride.
- (ix) Iodate and iodide in the presence of each other.
- (x) Phosphate, arsenate and arsenite in the presence of each other.
- (xi) Sulphide, sulphite, thiosulphate and sulphate in the presence of each other.
- (xii) Borate in the presence of copper and barium salts.
- (xiii) Oxalate in the presence of fluoride.
- (xiv) Oxalate, tartrate, acetate, citrate in the presence of each other.

**2. Separation and Identification of Cations in Mixtures**

- a. Separation of cations in groups.
- b. Separation and identification of Group I, Group II (Group IIA and IIB), Group III, Group IV, Group V and Group VI cations.

**3. Identification of Cations Including Less Familiar Elements by Spot Tests Assisted by Group Analysis (3 cations).**

**Book:** Vogel's book on Inorganic Qualitative Analysis

*B.Sc. (Hons) Chemistry Semester-II*  
**CHEM -118: Physics Lab-II**

**4 Hrs./Week**

**45 hrs.**

**Max. Marks: 37+13 (Internal Assessment)**

1. To study the gas discharge spectrum of hydrogen.
2. To study the absorption spectra of iodine vapours.
3. To determine the ionization potential of mercury.
4. To study the photoelectric effect and determine the value of Planck's constant.
5. To determine the ionization potential of mercury.
6. Study of variation of light intensity with distance using photovoltaic cell (Inverse Square Law).
7. To draw the plateau of a GM counter and find the operating voltage of GM tube.
8. To find the dead time of GM counter.
9. To study the absorption coefficient beta particles in aluminium using GM counter and find the absorption coefficients.
10. To study the statistical fluctuations and end point energy of beta particles using GM counter.
11. Measurement of reverse saturation current in pn junction diode at various temperatures and find the approximate value of the band gap.

**Reference Books :**

1. Practical Physics Vol.II, T.S. Bhatia, Gursharan Kaur, Iqbal Singh, Vishal Publications
2. Practical Physics, C.L. Arora, S. Chand & Co.