FACULTY OF SCIENCES

SYLLABUS

FOR

B.Sc. (Hons.) Chemistry

(Semester I-VI)
Session: 2017-18

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

		SEMESTER–I		
S. No.	**Course No.**	**Course Title**	**Max. Marks**	**Hrs**
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) 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
TOTAL			**450**	**405**

SEMESTER–II				
S. No.	**Course No.**	**Course Title**	**Max. Marks**	**Hrs**
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) 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
TOTAL			**450**	**405**

Semester-III				
S. No.	**Course No.**	**Course Title**	**Max. marks**	**Hrs.**
1.	CHEM -201	Physical Chemistry-III	50	45
2.	CHEM -202	Inorganic Chemistry-III	50	45
3.	CHEM -203	Organic Chemistry-III	50	45
4.	CHEM -204	Inter Disciplinary Course-I (Geography)	50	45
5.	CHEM -205	Mathematics-III	50	45
6.	CHEM -206	Physics-III	50	45
7.	CHEM -207	Physics Lab-III	50	45
8.	CHEM -208	Physical Chemistry Lab-I	50	45
9	CHEM -209	*Environment Science-I	Non-Evaluative	30
TOTAL			**400**	**390**

Semester-IV				
S. No.	**Course No.**	**Course Title**	**Max. marks**	**Hrs.**
1.	CHEM -210	Physical Chemistry-IV	50	45
2.	CHEM -211	Inorganic Chemistry-IV	50	45
3.	CHEM -212	Organic Chemistry-IV	50	45
4.	CHEM -213	Mathematics-IV	50	45
5.	CHEM -214	Physics –IV	50	45
6.	CHEM -215	Inter Disciplinary Course-II	50	45
7.	CHEM -216	Organic Chemistry Lab-II	50	45
8.	CHEM -217	Physics Lab-IV	50	45
9.	CHEM -218	*Environmental Science-II	Non-Evaluative	30
TOTAL			**400**	**390**

Semester-V				
S. No.	**Course No.**	**Course Title**	**Max. marks**	**Hrs.**
1.	CHEM -301	Physical Chemistry-V	50	45
2.	CHEM -302	Inorganic Chemistry-V	50	45
3.	CHEM -303	Organic Chemistry-V	50	45
4.	CHEM -304	Organic Chemistry-VI	50	45
5.	CHEM -305	Analytical Chemistry	50	45
6.	CHEM -306	Inorganic Lab II	50	45
7.	CHEM -307	Organic Lab III	50	45
8	CHEM -308	Physical Chemistry Lab III	50	45
Student PowerPoint Presentation/Seminar on a Subject Topic				
TOTAL			**400**	**360**

Semester-VI				
S. No.	**Course No.**	**Course Title**	**Max. marks**	**Hrs.**
1.	CHEM -309	Physical Chemistry-VI	50	45
2.	CHEM -310	Inorganic Chemistry-VI	50	45
3.	CHEM -311	Organic Chemistry-VII	50	45
4.	CHEM -312	Advanced Physical Chemistry	50	45
5.	CHEM -313	Advanced Chemistry	50	45
6.	CHEM -314	Inorganic Lab III	50	45
7.	CHEM -315	Physical Lab III	50	45
TOTAL			**350**	**315**

SNo	**Semester**	**Maximum marks**	**Hours Allocated**
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
Total		**2400**	**2265**

B.Sc. (Hons) Chemistry

Semester-I

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

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(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 eight 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 8 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 enthalphy (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 &Moungi G. Bawendi, 4th Ed., New York: John Wiley, 2005.

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

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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 Ψ and Ψ^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, Recaptulation 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 2nd 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, 4th edition, Pubs: ELBS,1991.
3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry : Principles of Structures and Reactivity; 4th Edition, Pubs: Harper Collins, 1993.
4. Greenwood N.N. and Earnshaw A., Chemistry of the Elements, 2nd edition., Pubs: Butterworth/Heinemann, 1997.

FURTHER READING:

1. Cotton F.A. and Wilkinson G., Murillo C.A., Bochmann M., Advanced Inorg. Chemistry, 6th Edition, Pubs: John Wiley & Sons. Inc., 1999.
2. Shriver D.F., Atkins F.W. and Langford C.M., Inorganic Chemistry; 3rd 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

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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, clatherates, 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 stereogeric 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, Markownikiff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$ 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. Machansim of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profie 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, 7th Edn., Pubs: Allyn and Bacon Inc., Boston, 2006
2. Mukerji S. M., Singh S. P. and Kapoor R. P., Organic Chemistry Second EditionVol. 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. Streitwisser A., Jr. and Heathcock C.H., Introduction to Organic Chemistry, 3rd Edn., Pubs: MacMillan Pub. Co., N.Y,1992.

B.Sc. (Hons) Chemistry Semester-I

CHEM -104: Physics-I

Optics

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(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 eight 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 8 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, Brewester 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-Liner 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: 40+10(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-I

2017-18
SEMESTER – I
COMMUNICATIVE ENGLISH
B.Sc. (Hons.) Physics, Chemistry, Zoology ,Botany, Mathematics

TIME : 3 Hrs

Max. Marks: 50
Theory: 40
Internal Assessment: 10

Course Contents:

1. 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.

2. Developing Vocabulary and using it in the Right Context:

The students will be required to master "Word List" and "Correct Usage of Commonly Used Words and Phrases" from the Chapter "Vocabulary" in the book *The Written Word*.

3. 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. A question on Letter Writing from *The Written Word* (6 marks)
5. Theoretical question(s) based on the two chapters from the book *The Written Word* (6 marks)

Sukhmeen Bedi
17/4/2017

B.Sc. (Hons) Chemistry Semester-I

CHEM -107(A): Punjabi-I

B.A. (Hons. – English), B.Sc. (Hons. – Physics, Chemistry), B.Com. (Hons.), B.Sc. Agri./Bio Tech./IT/FD/ Food Sc./ Food Sc. & QC/BCA, BJMC

SEMESTER-I
ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

ਸਮਾਂ : ੩ ਘੰਟੇ

ਥਿਊਰੀ ਅੰਕ : 40
ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ : 10
ਕੁਲ ਅੰਕ: ੫੦

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

1. **ਸਾਹਿਤ ਦੇ ਰੰਗ** (ਸੰਪਾ. ਡਾ. ਮਹਿਲ ਸਿੰਘ), ਭਾਗ ਪਹਿਲਾ (ਕਵਿਤਾ ਅਤੇ ਕਹਾਣੀ), ਚਰੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
2. **ਪੈਰ੍ਹਾ ਰਚਨਾ**
3. **ਪੈਰ੍ਹਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ।**
4. (ੳ) **ਪੰਜਾਬੀ ਧੁਨੀ ਵਿਉਂਤ :** ਉਚਾਰਨ ਅੰਗ, ਉਚਾਰਨ ਸਥਾਨ ਤੇ ਵਿਧੀਆਂ, ਸਵਰ, ਵਿਅੰਜਨ, ਮੁਰ।
(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) **8 ਅੰਕ**
2. ਕਿਸੇ ਕਹਾਣੀ ਦਾ ਸਾਰ, ਉਸਦਾ ਵਿਸ਼ਾ ਵਸਤੂ, ਕਹਾਣੀ ਕਲਾ ਜਾਂ ਪਾਤਰ ਉਸਾਰੀ (ਦੋ ਵਿਚੋਂ ਇੱਕ) **8 ਅੰਕ**
3. ਪੈਰ੍ਹਾ ਰਚਨਾ : ਤਿੰਨ ਵਿਸ਼ਿਆਂ ਵਿਚੋਂ ਕਿਸੇ ਇੱਕ ਉੱਤੇ ਪੈਰ੍ਹਾ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇ। **4 ਅੰਕ**
4. ਪੈਰ੍ਹਾ ਦੇ ਕੇ ਉਸ ਬਾਰੇ ਚਾਰ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ **4 ਅੰਕ**
5. ਨੰਬਰ 5 ਉੱਤੇ ਦਿੱਤੀ ਵਿਆਕਰਣ ਦੇ ਆਧਾਰ 'ਤੇ ਵਰਣਨਾਤਮਕ ਪ੍ਰਸ਼ਨ **8 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 ਅਸੈੱਸਮੈਂਟ 10 ਅੰਕਾਂ ਦੀ ਹੈ, ਜੋ ਕਾਲਜ ਵਲੋਂ ਨਿਰਧਾਰਿਤ ਦਿਸ਼ਾ ਨਿਰਦੇਸ਼ਾਂ ਅਨੁਸਾਰ ਇਨ੍ਹਾਂ ਅੰਕਾਂ ਤੋਂ ਵੱਖਰੀ ਹੋਵੇਗੀ। ਇਸ ਪੇਪਰ ਦੇ ਕੁਲ ਅੰਕ 40+10 = 50 ਹਨ।

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

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(Internal Assesment)

1. Calibration of Thermometer

80-82 ^{o}C (Naphthalene), 113-114^{o}C (acetanilide**).** 132-133 ^{o}C (Urea), 100^{o}C (distilled Water)

2. Determination of melting point

Naphthalene 80-82^{o}C, Benzoic acid 121.5-122^{o}C Urea, 132.5-133^{o}C, Succinic acid 184-185 ^{o}C, Cinnamic acid 133^{o}C, Salicylic acid 157-5-158^{o}C, Acetanilide 113-5-114^{o}C, m-Dinitrobenzene 90^{o}C, p-Dichlorobenzene 52^{o}C, Aspirin 135^{o}C.

3. Determination of boiling points

Ethanol 78^{o}C, Cyclohexane 81.4^{o}C, Toluene 110.6^{o}C, Benzene 80^{o}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,5th Edn.,Pubs: ELBS, 1989.
2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques,
   3rd 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); 7th edition, Pubs: Orient Longman, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman,1978.

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

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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 Kp, Kc, Ka 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, 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, (NaCl-H_2O), $FeCl_3$-H_2O) and $CuSO_4$-H_2O) system, Freezing mixtures: acetone-dry ice, Liquid-liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law, Non-ideal system: azeotropes-HCl-H_2O and ethanol-water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consulate 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 Ka 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)

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight short questions carrying 1 Mark each.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions 8 in total having TWO questions from each unit of the syllabus and each question carry 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 $Be_4O(CH_3\ COO)_6$, beryllium oxalate complexes $Be(ox)_2$, 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.

Clatharate 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 co-ordination 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. Wilinson, 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

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(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 eight 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 8 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 [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

Trihydirc 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 Reimen-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 nuclephilic substitution reactions of alkyl halides, SN_2 and SN_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, $LiAlH_4$ and $NaBH_4$ reductions. Halogenatin of enolizable ketones.

An introduction to α, β-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 Chemsitry, 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 ChemistryVol. 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, Macmilan.

B.Sc. (Hons) Chemistry Semester-II

CHEM -113: Physics-II

Modern Physics

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(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 eight 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 8 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 Brogile'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 α, β and γ 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: 40+10(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^{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- II

2017-18
SEMESTER – II
COMMUNICATIVE ENGLISH
B.Sc. (Hons.) Physics, Chemistry, Zoology ,Botany, Mathematics

TIME : 3 Hrs

Max. Marks: 50
Theory: 40
Internal Assessment: 10

Course Contents:

1. 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.

2. 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. Question on note making from *The Written Word* (6 marks)
5. Theoretical question(s) based on the two chapters from the book *The Written Word* (6 marks)

Sukhmeen Bedi
17/4/2017

B.Sc. (Hons) Chemistry Semester-II

CHEM -116(A): Punjabi- II

B.A. (Hons. – English), B.Sc. (Hons. – Physics, Chemistry), B.Com. (Hons.), B.Sc. Agri./Bio Tech./IT/FD/ Food Sc./ Food Sc. & QC/BCA, BJMC

SEMESTER-II

ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

ਸਮਾਂ : 3 ਘੰਟੇ

ਥਿਊਰੀ ਅੰਕ : 40
ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ : 10
ਕੁਲ ਅੰਕ : 50

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

1. ਸਾਹਿਤ ਦੇ ਰੰਗ (ਸੰਪਾ. ਡਾ. ਮਹਿਲ ਸਿੰਘ), ਭਾਗ ਦੂਜਾ (ਵਾਰਤਕ ਅਤੇ ਰੇਖਾ-ਚਿੱਤਰ), ਚਰੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
2. ਸ਼ਬਦ-ਸਰੂਪ 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) (8 ਅੰਕ)
2. ਰੇਖਾ ਚਿਤਰ : ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਸ਼ਖਸੀਅਤ ਦੇ ਗੁਣ (8 ਅੰਕ)
3. ਯੂਨਿਟ 3-4 ਨੰਬਰ ਉੱਤੇ ਦਿੱਤੀ ਵਿਆਕਰਣ ਦੇ ਆਧਾਰ ਤੇ ਵਰਣਨਾਤਮਕ ਪ੍ਰਸ਼ਨ (8 ਅੰਕ)
4. ਪੈਰ੍ਹਾ ਰਚਨਾ : ਤਿੰਨ ਵਿਸ਼ਿਆਂ ਵਿਚੋਂ ਕਿਸੇ ਇੱਕ ਉੱਤੇ ਪੈਰ੍ਹਾ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇ । (4 ਅੰਕ)
5. ਪੈਰ੍ਹਾ ਦੇ ਕੇ ਉਸ ਨਾਲ 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 ਅਸੈੱਸਮੈਂਟ 10 ਅੰਕਾਂ ਦੀ ਹੈ, ਜੋ ਕਾਲਜ ਵਲੋਂ ਨਿਰਧਾਰਿਤ ਵਿਸ਼ਾ ਨਿਰਦੇਸ਼ਾਂ ਅਨੁਸਾਰ ਵਿਦਿਆਂ ਅੰਕਾਂ ਤੋਂ ਵੱਖਰੀ ਹੋਵੇਗੀ। ਇਸ ਪੇਪਰ ਦੇ ਕੁਲ ਅੰਕ 40+10 = 50 ਹਨ।

B.Sc. (Hons) Chemistry Semester-II

CHEM -117: Inorganic Chemistry Lab-I

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(Internal Assessment)

Identification of cations and anions in a mixture which may contain combinations of acid ions. These must contain interferring 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: 40+10(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.

B.Sc. (Hons) Chemistry

Semester-III

B.Sc. (Hons) Chemistry Semester-III

CHEM-201: Physical Chemistry-III

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(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 eight 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 8 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. Partial Molar Properties and Fugacity **(5 Hrs.)**

Partial molar properties. Chemical potential of a perfect gas, dependence of chemical potential on temperature and pressure, Gibbs- Duhem equation, real gases, fugacity, its importance and determination, standard state for gases.

2. Thermodynamics of Simple Mixtures **(6 Hrs.)**

Ideal and Non-ideal solutions, Chemical potential of liquids. Raoult's law, Henry's law. Thermodynamic functions for mixing of liquids (ideal solutions only). Mixtures of volatile liquids, vapour pressure diagrams. Lever's rule, distillation diagrams. Real solutions and activities, standard states for solvent and solute.

UNIT-II

3. Surface Chemistry **(11 Hrs.)**

Bulk phases and interfacial region, types of interfaces; Surface tension and interfacial tension. Thermodynamics of surfaces, plane interface, curved interface, Laplace and Kelvin equations, the contact angle, capillary rise and surface tension. Surface tension of solutions, Gibbs adsorption equation and its derivation from thermodynamic considerations. Surfactants, Surface films on liquids. criteria for spreading in liquid-liquid systems. (Wetting as contact angle and capitulary action Phenomenon solid-liquid systems).

UNIT- III

4. Thermodynamics of Electrolytic Solutions **(4 Hrs.)**

Activities of ions in solutions, a model of ions in a solution, qualitative idea of Debye-Huckel theory, ionic strength, mean ionic activity coefficient and the Debye-Huckel limiting law for activity coefficients.

5. Electrochemistry- II **(8 Hrs.)**

Interfacial potential difference, the electrodes, potential at interfaces, electrode potentials, galvanic cells, emf, direction of spontaneous reactions. Concentration dependence of emf, equilibrium Constant from electrode potential, standard electrode potentials and their determination. Measuring activity co-efficient, thermodynamic data from cell emf. The temperature dependence of emf. Applications of emf. Measurements – solubility product, potentiometric titrations, pK and pH measurements of pK and pH. Acid-base titrations. Concentration cells with & without transference

UNIT-IV

6. Colligative Properties **(4 Hrs.)**

Solutions of non-volatile solutes: colligative properties, elevation in boiling point, depression in freezing point, osmosis and osmotic pressure

7. Chemical Kinetics **(7 Hrs.)**

Rate of reaction, rate constant and rate laws, the order of reaction, first, second & third and zero order reactions, half-lives; determination of reaction order. Temperature dependence of reaction rates, reaction mechanism, rate-determining step approximation, steady-state approximation. From rate-law to mechanism, unimolecular reactions, bimolecular reactions.Kinetics of Complex reactions : Reversible first order reactions, consecutive first order reactions, parallel first order reactions, Chain reactions, Explosive/branched chain reactions, catalysis, homogeneous catalysis, autocatalysis, oscillation reactions, bistability. Enzyme catalysis, heterogeneous catalysis.

Suggested Books

ESSENTIAL:

1. Atkins P.W., Physical Chemistry, 7th Edition, Pubs: Oxford University Press (2002).
2. Lavine I. N., Physical Chemistry, 3rd Edition, Pubs: Pearson Eductaion (1988).
3. Adamson A.W., Physical Chemistry of Surfaces, Pubs: John Wiley & Sons (1982)

FURTHER READING:

1. Castellan G.W., Physical Chemistry, 3rd Edn., Pubs: Addison Wisley/Narosa (1985) (Indian Print).
2. Barrow G. M., Physical Chemistry, 6th Edn., Pubs: McGraw Hill, New York (1996).

B.Sc. (Hons) Chemistry Semester-III

CHEM-202: Inorganic Chemistry-III

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(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 eight 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 8 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. Chemistry of d-Block Elements: **(2 Hrs.)**

Position in periodic Table, electronic configuration, variation in size, ionization energy, magnetic behavior and Complex formation.

2. General Chemistry of 1st row d-block elements: **(10 Hrs.)**

The Chemistry of Ti and V complexes: Solution Chemistry and complexes of Ti(III), Chemistry of vanadium (V) with emphasis on structure and formation of vanadates. Chemistry of vanadium(IV).

Cr and Mn: Oxidation states and complexes:Isolation of Cr from its chromite ore. Chemistry of Chromium(II); binuclear compounds, Chemistry of Cr(III) complexes; The Chemistry of Cr(VI) chromates, dichromates and peroxo complexes of Cr(IV), Cr(V). Chemistry of Mn(II) and Mn(III) complexes.

Fe and Co, chemistry and complexes: Aqueous and coordination chemistry of Fe(III). Mixed valence compounds of iron. Chemistry of complexes of Co(II) and Co(III). Oxidation of Co(II) by molecular oxygen.

Ni and Cu complexes: Stereochemistry of Ni (II) tetrahedral, square planar, octahedral and five coordinated derivatives. Anomalous structural properties of Ni(II) complexes. Chemistry of Cu(I) compounds and complexes. Stereochemistry of Cu(II) complexes.

UNIT-II

3. Chemistry of 2nd and 3rd row d-block elements: (6 Hrs.)

Comparison of the chemistry of elements of second and third row series with that of elements of the first transition series. Aqueous chemistry of Zr(IV). Zirconium clusters, Chemistry of Nb(V), Dinitrogen complexes of Molybdenun. Mo-Mo and Re-Re quadrupole bonds. Chemistry of complexes of Rh(III), Pt(II) and Pd(II).

4. Non-aqueous Solvents 5 Hrs.

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

UNIT-III

5. Chemistry of f-block elements: (11 Hrs.)

Chemistry of Lanthanide Elements, Electronic structure, oxidation states and ionic radii and lanthanide contraction. Electronic absorption and magnetic properties of lanthanides, comparison with transition elements, Chemistry of Thorium and Uranium, their separation from one another, Lanthanide chelates.

Chemistry of Actinides General features and chemistry of actinides, similarities between the later actinides and the later lanthanides. Electronic and magnetic properties of actinides and their general comparison with the lanthanide elements

UNIT-IV

6. Basic Coordination Chemistry (11 Hrs.)

Werner's theory, nomenclature of coordination complexes, chelating agents, metal chelates and chelate effect, names and abbreviations of important ligands, polydentate ligands, polypyrazolyborates , macrocyclic ligands, macrocyclic effect, ketoenolates, tripod ligands, conformation of chelate rings, streochemistry of coordination numbers 2 –12, factors determining kinetic and thermodynamic stability.

Books Recommended

J.E. Huheey, E.A. Keiter, R.L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education, Singapore, 1999.

J.D.Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.

Cotton F. A.,Wilkinson G., Murillo C. A., Bochmann M., Advanced Inorg. Chemistry, 6th edn., Pubs: John Wiley India. (2003).

Shriver D. F., Atkins F. W. and Langford C. M., Inorganic Chemistry, 3rd edn., Pubs: Oxford University Press, 1999.

Huheey J. E., Keiter E. A., Keiter R. L., Inorganic Chemistry : Principles of Structure and Reactivity; 4th edn, Pubs: Harper Collins, 1993.

B.Sc. (Hons) Chemistry Semester-III

CHEM-203: Organic Chemistry-III

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(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 eight 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 8 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. Organic Compounds of Nitrogen **(8Hrs)**

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.

Halonitroarene: reactivity. Structure and nomenclature of amines, physical properties. Stereochemistry of amines.Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds nitriles), reductive amination of aldehydic and ketonic compounds. Gabricl-phthalimide reaction, Hoffmann bromamide reaction.

2. Organosulphur Compounds **(4 Hrs.)**

Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

UNIT-II

3. Carbohydrates **(11 Hrs.)**

Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threodiastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters.Determination of ring size of monosaccharides. Cyclic structure of D(+)-glucose. Mechanism of mutarotation.Structures of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

UNIT-III

4. Amino Acids, Peptides, Proteins and Nucleic Acids (11 Hrs.)

Classification, structure and stereochemistry of amino acids. Acid-base behavior, isoelectric point and electrophoresis. Preparation and reactions of ά-amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation.
Nucleic acids : Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT-IV

5. Fats, Oils and Detergents (4 Hrs.)
Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

6. Synthetic Dyes (3 Hrs.)
Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo.

7. Synthetic Polymers (4 Hrs)
Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

Suggested Books

ESSENTIAL :

1. Morrison R.T. and Boyd P.S., Organic Chemistry, 5thEdn., Pubs: Allyn and Bacon Inc., Boston, 1992.
2. Mukerji S. M., Singh S. P. and Kapoor R. P., Organic Chemistry Vol. I/II, Pubs: Wiley Eastern Ltd., New Delhi, 1985.

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.
Streitwisser A., Jr. and Heathcock C.H., Introduction to Organic Chemistry, 3rd Edn., Pubs: MacMillan Pub. Co., N.Y,1992.

B.Sc. (Hons) Chemistry Semester-III

CHEM-204: Interdisciplinary Course-I (Geography)

Time:- 4 Hours **Max. Marks: 50**

Theory: 30 Marks

Internal Assessment: 10 Marks

Practical: 10 Marks

Section A: - It will consist of 10 questions from the entire syllabus. All questions are compulsory. Each question will carry one mark; the total weightage being 10 marks. **(10x1=10 Marks)**

Section B: - It will consist of 8 short answer questions upto100 words in length. The students will be required to attempt any 5 questions. Each question will carry 4 marks; the total weightage being 20 marks. **(5x4=20 Marks)**

Section C: - There will be a Practical file work.

Part A: Physical Geography

1. **Exploring the Earth:** The shape of the Earth, The Earth's movements, Day and Night, The Earth's Revolution, Dawn and Twilight, Latitude and Longitude, Longitude and Time, Standard Time and Time Zones, The International Date line.
2. **The Earth's Crust:** The Structure of the Earth, Classification of Rocks, (Igneous, Sedimentary and Metamorphic), Types of Mountains, Types of Plateau, Types of Plains.
3. **The Oceans :** The movements of Ocean currents, The Indian Ocean circulation

Part B: Weather, Climate and Vegetation

1. **Weather:** The Difference between Climate and Weather, The Elements of Weather and Climate, Rainfall, Pressure, Temperature and Humidity, Winds, Sunshine.
2. **Climate:** The Atmosphere, Insulation, Elements of Climate and Factors affecting them, Temperature, Factors affecting temperature, Precipitation, Rainfall, Monsoon.
3. **Vegetation:** Climatic Types and Natural vegetation, World Climatic Types.

Part C: Practical Work

1. **Maps:** Physical (India & World), Types of soil (India), Monsoon.
2. **Maps:** Vegetation (India), Rainfall (World & India), Natural calamities (last 6 months) viz. Earthquake, Flood, Cyclone, Tsunami, Land slide.

Prescribed Text:

a. Certificate Physical & Human Geography by G.C. Leong
b. Oxford India Atlas (Latest Edition)
a. Spectrum- Geography & India

B.Sc. (Hons) Chemistry Semester-III

CHEM-205: Mathematics-III

Time: 4 Hours Max.Marks:40+10(Internal assessment)

Instructions for paper setters and candidates

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

UNIT-I

Integral calculus: (8 Hrs)

Double, triple integrals, determination of C.G. using double and triple integrals. Integration by Trapezoidal and Simpson's rule.

UNIT-II

Differential Equations: (15 Hrs)

Ordinary differential equations. Formation of differential equation, solution of linear differential equation of the first order and the first degree. Solution of homogeneous and non homogeneous differential equations with constant coefficient. The chemical application of the first order differential equations.

Series solution of the Legendre differential equations and Legendre Polynomials. Recurrence and orthognality relation, Rodrigue's Formula.

UNIT-III

Partial differential Equations: (7 Hrs)

Formation of Partial differential equations. Solution by Charpit's Method. Solution of homogeneous partial differential equations with constant coefficients.

UNIT-IV

Complex Analysis: (15 Hrs)

De-Moivre's Theorem and its simple applications, Analytic functions, Cauchy-Riemann Equations, Complex Integration, statements of Cauchy's theorem, Cauchy's Integral formula, Morera's theorem, Taylor's Theorem, Laurent's Theorem, Cauchy's residue Theorem and their simple applications.

Books Recommended:

1. B.S. Grewal- Higher Engineering Mathematics
2. Erwin Kreyszig - Higher Engineering Mathematics
3. Joseph B, Dence- Mathematical techniques in Chemistry
4. B.L. Manocha and H.R. Choudhary- A text book of Engineering Mathematics
5. Margenau Murphy- Mathematics for physicists and Chemists

B.Sc. (Hons) Chemistry Semester-III

CHEM-206: Physics-III

ELECTRICITY AND MAGNETISM

Time: 4 Hours **Total Marks:50**

(Max. Marks: 40+Internal Assessment: 10)

Total Lectures: 60 **Pass Marks: 35%**

Instructions for the Paper Setters:

There will be five sections. Section A will consist of Eight Short Answer Type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each Section. All questions carry equal marks.

UNIT-I

Basic Ideas of Vector Calculus, Introduction to gradient, divergence & curl; their physical significance, Gauss's Divergence and Stoke's theorems (Statement only), Electric charge and its properties, Coulomb's law. Principle of superposition. The electric field due to a point charge and continuous charge distributions, Electric field due to finite and infinite lines of charges. Field due to electric dipole, Field lines, flux, Gauss's law and its applications. Curl of electric field. Relation between potential and electric field. Poisson's and Laplace's equations. Electric potential due to different charge distribution: Wire, Ring etc.

UNIT-II

Electric Currents and Fields of Moving Charges Conductors in the electrostatic field, Capacitors, Current and current density, drift velocity, expression for current density vector, Equation of continuity. Ohm's Law and expression for electrical conductivity, limitations of Ohm's law, Dielectrics, Non Polar and Polar Molecules, Polarisation of Dielectric, Polarization Vector 'P', Atomic polarizability, Dielectric Constant

UNIT-III

Magnetic Effect of Electric Current, Direction of Field Lines due to current Flowing in a straight Conductor, Magnetic Field Density, Magnitude of Magnetic Flux, Magnetic and Lorentz Forces, Biot-Savart's Law, Magnetic Field Due to along Straight Conductor, Magnetic Field Intensity at point on the axis of a current loop. Variation of Field along the axis of the coil, Magnetic Field intensity inside a long Solenoid, Ampere's Circuital Law: Line Integral of Magnetic Field,

UNIT-IV

Some Important Terms associated with Magnetic Materials, Torque on current Loop, Magnetic Dipole in a Magnetic Field , Potential Energy of Magnetic Dipole, Force on Magnetic Dipole In Non-Uniform Magnetic Field, Magnetic Dipole Moment of an Atom, Expression of orbital

Magnetic dipole moment of Electron, Electron Spin Magnetic Moment , Diamagnetism , Langevin's theory of diamagnetic behaviour, Paramagnetism and Langevin's Theory of Paramagnetic Susceptibility, Ferromagnetism, Domain theory of Magnetism,

Reference Books:

1. Electricity & Magnetism-T.S. Bhatia and Gurpreet Singh, Vishal Publishing Co.
2. Introduction to Electrodynamics -D.J. Griffiths, Pearson Prentice Hall, New Delhi.
3. Berkeley Physics Course Vol. II (Electricity & Magnetism)-E.M.Purcell, Mc Graw hill, New York.

B.Sc. (Hons) Chemistry Semester-III

CHEM-207: Physics Lab-III

Time: 4 Hours **Total Marks:50**

General Guidelines for Practical Examination

I. The distribution of marks is as follows: **Marks: 40; Internal Assessment: 10**

i) One experiment **20 Marks**

ii) Brief Theory **5 Marks**

iii) Viva–Voce **10Marks**

iv) Record (Practical file) **5 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session and will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

1. To determine low resistance with Carey-Foster's Bridge after calibrating the bridge wire.
2. To determine low resistance with Carey-Foster's Bridge without calibrating the bridge wire.
3. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.
4. To study the induced e.m.f. as a function of the velocity of the magnet.
5. To determine unknown Capacitance by flashing and quenching of a neon lamp.
6. Determination of permittivity of a air and relative permittivity by measuring capacitance using de–Sauty's bridge.
7. To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.
8. To study the working of household energy meter.
9. To determine the heating efficiency of an electric kettle with varying input voltages.

10. To study the resonance in series LCR circuit for different R values and calculate Q value.

11. To determine the magnetic dipole moment of a bar magnet and horizontal intensity of earth's magnetic field using a deflection magnetometer.

12. To measure the charge sensitivity of a moving coil Ballistic galvanometer using a known capacitor.

13. To measure the magnitude and direction of earth's magnetic field using earth inductor.

14. To study the variation of resistance of a filament of a bulb with temperature.

Reference Books :

3. Practical Physics, Volume-I, T.S. Bhatia, Gursharan Kaur, Iqbal Singh, Vishal Publications

4. Practical Physics, C. L. Arora, S. Chand & Co.

B.Sc. (Hons) Chemistry Semester-III

CHEM-208: PHYSICAL CHEMISTRY Lab-I

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(Internal Assessment)

1. Liquids and Solutions

(i) To determine relative viscosities of aqueous solutions of glycerol at different concentrations. Calculate partial molar volume of glycerol at infinite dilution from density measurement.

(ii) To determine viscosity-average molecular weight, number-average molecular weight and mean diameter of polyvinyl alcohol molecule from intrinsic viscosity data.

2. Thermochemistry

(i) To determine heat capacity of a calorimeter and heat of solution of a given solid compound.

(ii) To determine heat of solution of Solid calcium chloride and calculate lattice energy of calcium chloride using Born-Haber cycle.

(iii) To determine heat of hydration of copper sulphate.

3. Distribution Law

To determine distribution (i.e. partition) coefficient of a solute between water and a non-aqueous solvent.

4. Surface Phenomena

To study the adsorption of acetic acid/oxalic acid from aqueous solution on charcoal. Verify Freundlich and langmuir adsorption isotherms.

5. Colorimetery

To verify Lambert-Beer law.

Suggested Books

1. Levitt, B.P., Findlay A Practical Physical Chemistry; 9th edition, Pubs: Longman Group Ltd., London & New York (1978).
2. Khosla, B.D., Garg, V.C., Gulati, A., Senior Practical Physical Chemistry; 11th edition, Pubs: R.Chand & Co., New Delhi (2002).
3. Das, R.C., Behra, B., Experimental Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd. (1983).
4. Vogel's Textbook of Quantitative Chemical Analysis (revised by Jeffery, Bassett, Mendham and Denney), 5th Edn., Pubs: ELBS (1989).
5. Svehla G.,Vogel's Qualitative Inorganic Analysis (revise), 6th Edn., Pubs: Orient Longman, New Delhi (1987).
6. Christian G.D., Analytical Chemistry, Pubs: John Wiley & Sons Inc., New York (1994).
7. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edn., Blackwell Science (2000).

B.Sc. (Hons) Chemistry Semester-III

CHEM-209/ESL-221
ENVIRONMENTAL STUDIES–I (COMPULSORY)

Theory Lectures: 1½ Hours/ Week

Section–A: (12 Marks): It will consist of five short answer type questions. Candidates will berequired to attempt three questions, each question carrying four marks. Answer to any of thequestions should not exceed two pages.

Section–B: (16 Marks): It will consist of four essay type questions. Candidates will be requiredto attempt two questions, each question carrying eight marks. Answer to any of the questionsshould not exceed four pages.

Section–C: (12 Marks): It will consist of two questions. Candidate will be required to attemptone question only. Answer to the question should not exceed 5 pages.

1. The Multidisciplinary Nature of Environmental Studies:

- Definition, scope & its importance.
- Need for public awareness.

2. Natural Resources:

- Natural resources and associated problems:

a) Forest Resources: Use of over exploitation, deforestation, case studies. Timber extraction, Mining, dams and their effects on forests and tribal people.

b) Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food Resources: World food problems, change caused by agriculture and overgrazing, effects or modern agriculture, fertilizer-pesticide problem, salinity, case studies.

e) Energy Resources: Growing of energy needs, renewable and non-renewable energy resources, use of alternate energy sources, case studies.

f) Land Recourses: Land as a resource, land degradation, soil erosion and desertification.

□□Role of an individual in conservation of natural resources.

□□Equitable use of resources for sustainable lifestyles.

3. Ecosystem:

□□Concept of an ecosystem.

□□Structure and function of an ecosystem.

□□Producers, consumers and decomposers.

□□Energy flow in the ecosystem.

□□Ecological succession.

□□Food chains, food webs and ecological pyramids.

□□Introduction, types, characteristic features, structure and function of the following ecosystems:

a. Forest ecosystem

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4. Social Issues and Environment:

□□From unsustainable to sustainable development.

□□Urban problems related to energy.

□□Water conservation, rain water harvesting, watershed management.

□□Resettlement and rehabilitation of people; its problems and concerns.Case studies.

□□Environmental ethics: Issues and possible solutions.

□□Climate change, global warning, acid rain, ozone layer depletion, nuclear accidents and holocause. Case studies.

□□Wasteland reclamation.

□□Consumerism and waste products.

Environmental Protection Act:

- Air (prevention and Control of Pollution) Act.
- Water (prevention and Control of Pollution) Act.
- Wildlife Protection Act.
- Forest Conservation Act.

Issues involved in enforcement of environmental legislation.

Public awareness.

5. National Service Scheme

- **Introduction and Basic Concepts of NSS:** History, philosophy, aims & objectives of NSS; Emblem, flag, motto, song, badge etc.; Organizational structure, roles and responsibilities of various NSS functionaries.
- **Health, Hygiene & Sanitation:** Definition, needs and scope of health education; Food and Nutrition; Safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan); National Health Programme; Reproductive health.

References/Books:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.

2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.

3. Down to Earth, Centre for Science and Environment, New Delhi.

4. Jadhav, H. &Bhosale, V. M. 1995. Environmental Protection and Laws.Himalaya Pub.

5. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson

Education (Singapore) Pte. Ltd., Delhi.

6. Kaushik, A. &Kaushik, C. P. 2004. Perspective in Environmental Studies,

New Age International (P) Ltd, New Delhi.

7. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.

8. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.

9. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex,

Amritsar

10. Kanta, S., 2012. Essentials of Environmental Studies, ABS Publications, Jalandhar.

B.Sc. (Hons) Chemistry

Semester-IV

B.Sc. (Hons) Chemistry Semester-IV

CHEM-210: Physical Chemistry-IV

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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 features of Spectroscopy (5 hrs.)

Units and conversion factors, Introduction to spectroscopy, Nature of radiation, Energies corresponding to various kinds of radiation, Intensities of spectral lines, selection rules and transition moments, Line widths, Broadening (Book 1)

2. X-ray diffraction (6 Hrs.)

Definition of space lattice, unit cell. Miller indices, Symmetry elements in crystals – X ray diffraction by crystals. Bragg equation. Dimension and contents of unit cell. Structural information from the physical properties of crystals. Neutron and electron diffraction and their applications.

UNIT-II

3. Pure Rotational Spectra (6 Hrs.)

Classification of molecules according to their moment of inertia. Rotational energy levels of hydrogen chloride. Determination of molecular geometry by rotational spectrum, isotopic substitution effects. Stark effect, Estimation of molecular dipole moments, Selection rules, Rotational Raaman Spectra, anisotropic polarizability, specific selection rule in Raman Spectra, Stokes and anti –Stokes lines.

4. Vibrational Spectra (5 Hrs.) **(5 Hrs.)**

Diatomic molecules, Force constants, Fundamental vibration frequencies, anharmonicity of molecular vibrations and its effect on vibrational frequencies, Frequencies of the vibrational transitions of HCl. Vibrational rotation spectra of CO, P,Q and R branches.

UNIT-III

5. Infrared and Raman Spectra (11 Hrs.)

Vibrations of polyatomic molecules. Examples of CO_2, H_2O. Mechanics of measurement of infrared and Raman spectra, absorption of common functional groups, their dependence on chemical environment (bond order, conjugation, H –bonding), Use of group theory to determine the number of active infrared and Raman active lines. Fermi resonance, combination bands and overtones, complications due to interactions of vibrations of similar frequency. Application of IR in structure elucidation, C-H, N-H, O-H vibrations and H-bonding, Far IR region, Metal ligand

vibrations, Group frequencies of complex ligands – CN stretching and effect of co-ordination on it. Nitro-nitrito- and C=O ligands and the effect of their co-ordination with metal ions and IR spectra.

UNIT-IV

6. UV and Visible Spectroscopy (12 Hrs.)

Measurement technique, Beer –Lambert's Law, molar extinction coefficient, and intensity of the electronic transition, Frank Condon Principle, Ground and first excited electronic states of diatomic molecules, relationship of potential energy curves to electronic spectra.

Chromophores, auxochromes, electronic spectra of polyatomic molecules, Woodward rules for conjugated dienes and α, β- unsaturated carbonyl groups, extended conjugated and aromatic sterically hindered systems, red shift, blue shift, hypo and hyperchromic effect.

ESSENTIAL:

1. Atkins P.W., Physical Chemistry, 7th Edition., Pubs: Oxford University Press (2002).
2. Levine I. N., Physical Chemistry, 3rd Edition, Pubs: Pearson Eductaion (1988).
3. Chatwal G. R., anand S.K., Spectroscopy, Himalaya Publishing House (2015)

FURTHER READING

1. Castellan G.W., Physical Chemistry, 3rd Edn., Pubs: Addison Wisley/Narosa (1985) (Indian Print).
2. Barrow G. M., Physical Chemistry, 6th Edn., Pubs: McGraw Hill, New York (1996).

B.Sc. (Hons) Chemistry Semester-IV

CHEM-211: Inorganic Chemistry-IV

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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. Coordination Chemistry: Reactions, Kinetics, and Mechanisms (11 Hrs.)

Substitution in square planar complexes. Rate law for Nucleophillic substitution in a square planar complexes, The trans-effect, its synthetic application, I.D. theories of trans effects, Mechanism for Nucleophillic substitution in a square planar complexes, Themodynamic and Kinetic stability, Kinetics and Mechanism of octahedral substitution, Mechanisms of Redox reactions., electron transfer reactions, mechanism of one electron transfer reactions, outer-sphere type reactions, inner sphere type reactions.

UNIT- II

2. Metal- Ligand Bonding in Transition Metal complexes (5 Hrs.)

Valence bond theory for bonding in coordination compounds; concept of multiple bonding and back bonding, inner and outer orbital complexes, strength and weaknesses of valence bond approach.

3. Magnetic Properties of Transition Metal Complexes (7 Hrs.)

Types of magnetic behavior, methods of determining magnetic susceptibility (Gouy's method and Faraday method), spin-only formula, relationship between magnetic susceptibility and magnetic moment, L-S coupling, correlation of μs and μ_{eff} values, Importance of magnetic susceptibility measurements in structure determination of transition metal compounds, Magnetic exchange coupling and spin crossover. variation of magnetic susceptibility with temperature, temperature independent paramagnetism (TIP).

UNIT-III

4. Symmetry and group theory (Part I) (11 Hrs.)

Symmetry elements and symmetry operations, point groups, definitions of group, subgroup relation between orders of a finite group and its subgroup; group multiplication tables, conjugacy relation and classes. Schoenflies symbols, Representation of groups, character of a representation.

UNIT-IV

5. Symmetry and group theory (Part II) (11 Hrs.)

Properties of irreducible representations, the great orthogonality theorem (without proof) and its importance. Character Tables, Symmetry criteria for optical activity, Symmetry restrictions on dipole moment, Hybridization schemes of orbitals.

Books Recommended

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, 4th edition, Pubs: ELBS,1991.
3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry : Principles of Structures and Reactivity; 4th Edition, Pubs: Harper Collins, 1993.
4. F.A. Cotton, Chemical Application of Group Theory, Wiley Eastern.

B.Sc. (Hons) Chemistry Semester-IV

CHEM-212: Organic Chemistry-IV
Heterocyclic Chemistry

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(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 eight 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 8 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. Nomenclature of Heterocycles **(5 Hrs)**

Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic, fused and bridged heterocycles.

2. Aromatic Heterocycles **(6 Hrs)**

Aromatic resonance energy, structure of six-membered heteroaromatic systems (pyridine, diazines, pyridones and pyrones), structure of five-membered heteroaromatic systems (pyrrole, thiophene, furan, azoles), bicyclic heteroaromatic compounds. Heteroaromatic reactivity and tautomerism in aromatic heterocycles

UNIT-II

3. Non-aromatic Heterocycles **(7 Hrs)**

Strain bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction.

Stereo-electronic effect, anomeric and related effects. Attractive interactions –hydrogen bonding and intermolecular nucleophilic-electrophilic interactions

4. Heterocyclic Synthesis **(4 Hrs)**

Principles of heterocyclic synthesis involving cyclization and cycloaddition reactions

UNIT-III

5. Small Ring Heterocycles **(4 Hrs)**

Three-membered and four-membered heterocycles-synthesis and reactions of aziridines oxiranes, thiiranes, azetidines, oxetanes and thietanes

6. Benzo-Fused Five-Membered Heterocycles **(3 Hrs)**

Synthesis and reactions including medicinal applications of benzopyrroles, Benzofurans and benzothiophenes

7. Meso-ionic Heterocycles **(4 Hrs)**

General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications.

UNIT-IV

8. Six-Membered Heterocycleswith One Heteroatom **(5 Hrs)**

Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium & thiopyrylium salts and pyridones.

Synthesis and reactions of quinolizinium and benzopyrylium salts, coumarins and chromones.

9. Six-Membered Heterocycles with Two or More Heteroatoms **(3 Hrs)**

Synthesis and reactions of diazines, triazines, oxadiazoles and thiadiazoles

10. Purines: Synthesis and Reactions **(4 Hrs)**

Approaches for the construction of purine ring, reactions of purines with electrophilic reagents, with nucleophilic reagents, reactions with bases, reactions of C-metallated purines

Books Suggested:

1. Heterocyclic Chemistry, J.A. Joule, K. Mills and G.F. Smith, 3rd edition, Indian reprint, 2004. Chennai Microprint Pvt. Ltd.
2. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical
3. Contemporary Heterocyclic Chemistry, G.R. Newkome and W.W. Paudler, Wiley-Inter Science.
4. An Introduction to Heterocyclic Compounds, R.M. Acheson, John Wiley
5. Comprehensive Heterocyclic Chemistry, A.R. Katritzky and C.W. Rees, eds. Pergamon Press.
6. Heterocyclic Chemistry, A. Paquett

B.Sc. (Hons) Chemistry Semester-IV

CHEM-213 Mathematics-IV

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(Internal Assessment)

Instructions for paper setters and candidates

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

UNIT-I

Vectors Algebra: (9 Hrs)

Definition of vector and scalar, Scalar and vector product of two vectors, Scalar triple product and vector triple product and their applications, Work done by a force, moment of a force about a point.

UNIT-II

Vector calculus: (12 Hrs)

Vector differentiation and integration of vectors, Vectors operators, Gradient, Divergence and curl. Gauss, Stoke and Green's theorem (statements only) and their applications.

UNIT-III

Laplace Transform: (12 Hrs)

Definition of elementary transforms, transforms of integrals and derivatives. Laplace transforms of periodic functions, Inverse Laplace Transform of elementary functions (Linearity property, Method of partial fractions, First Shifting Property). Solutions of ordinary differential equations with constant coefficients and Simultaneous differential equations using Laplace transforms.

UNIT-IV

Fourier series: (12 Hrs)

Periodic functions, Dirichlet Conditions, Fourier Series and Fourier Coefficient, functions having arbitrary period, Sine and Cosine Series, half range expansions, Fourier integral(definitions), Harmonic Analysis.

Books Recommended:

1. B.S. Grewal – Higher Engineering Mathematics.
2. Erwin Kreyszig - Higher Engineering Mathematics.
3. Joseph B, Dence – Mathematical Techniques in Chemistry.
4. B.L. Manocha and H.R. Choudhary- A Text Book of Engineering Mathematics.
5. Margenau Murphy – Mathematics for Physicists and Chemists.\

B.Sc. (Hons) Chemistry Semester-IV

CHEM-214 Physics-IV

Time: 3 Hours
Max. Marks: 40+10(Internal Assessment)
Total Lectures: 60 **Pass Marks: 35%**
Instructions for the Paper Setters:

There will be five sections. Section A will consist of Eight short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

Classification of Solids, Space lattice and translation vectors, basis and Crystal structure, Unit cell, Symmetry operations, Two and Three dimensional Bravais lattices, Structure and Characteristics of Cubic Cells, Lattice planes and Miller indices, Density of atoms in a crystal plane, Diamond and NaCl structures.

UNIT–II

Crystal Diffraction: Bragg's law, Experimental methods for crystal structure studies, Laue equations, Reciprocal lattices of SC, BCC and FCC, Brag's law in reciprocal lattice, Brillouin zones and its construction in two and three dimensions, Structure factor and atomic form factor.

UNIT–III

Lattice vibrations, Monoatomic linear chains, Density of modes, Concept of phonons, Scattering of photons by phonons, Specific heat in solids, Einstein and Debye models of specific heat.

UNIT–IV

Free electron model of metals (Drude Lorentz Classical theory), Sommerfeld quantum theory, Fermi energy, Total and Average energy, Density of states, Three dimensional potential well, Fermi Dirac distribution function, Qualitative discussion of the following: Conductivity and its variation with temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, band gap in semiconductors, pn junction diode and light emitting diode, zener diode as voltage stablizer.

Books Suggested:

1.Condensed Matter Physics by T.S. Bhatia (Vishal Publishing Co.)
2. Condensed Matter Physics by T.S. Bhatia and V.K. Sharma (S.Vikas and Co.))
3. Introduction to Solid State Physics by C. Kittel (Wiley Eastern)
4. Elements of Modern Physics by S.H. Patil (TMGH, 1985).
5. Solid State Physics by R.K. Puri and V. K. Babbar (S.Chand)

B.Sc. (Hons) Chemistry Semester-IV

CHEM-215 (Inter-disciplinary course-II)

Psychology

Time: 4 Hours
Max. Marks: 50
Max. Marks: 40+10(Internal Assessment)

Section A: - Ten Questions will be set in Section A .Students are required to Attempt all the questions in about 50 words. Each question carries 2 marks. **10x2=20 Marks**

Section B: - Eight questions will be set. Students are required to attempt any five out of the eight questions in about 100 words. Each question carries 4 marks. **5x4=20 Marks**

UNIT-I

Personality

a. Knowledge of theories of personality(Eysenck, Freud, Erickson and Big Five)
b. Personality tests

Attitudes

a. Knowledge of the nature of attitudes
b. Identify the components of attitudes (cognitive, affective and behavioral)

Motivation

a. Theories of motivation (Maslow and Herzberg)
b. Differentiate between primary and secondary motivation.

UNIT-II

Goal Setting

a. Understanding Goal Setting (Locke's theory)
b. Goal-Setting Principles

Mental Imagery:

a. Understanding the use Working, Impact, Contribution, Structuring of Mental Imagery in Sport
b. Maximizing the value of Mental Imagery

UNIT- III

Confidence

a. Defining confidence (Vealey)
b. Defining and Developing optimistic mind-set
c. Knowledge of self-efficacy (Bandura)

23

Concentration

a. Understanding concentration
b. Components, Strategies of concentration

References:-

1. Human motivation by David C. McClelland, Cambridge University Press
2. Psychology of Motivation by Denis Waitley, Nova Publishers.
3. Theories of Personality by Jess Feist, Gregory J Feist, Irwin/McGraw-Hill.
4. Attitudes and attitude change by William D. Crano, RadmilaPrislin, Psychology Press.
5. Attitudes amd attitude change by William D. Crano, RadmilaPrish, Psychology Prsess.
6. Morgan and King: Introduction to Psychology - Tata McGraw Hill.
7. Social Psychology in Sport by Sophia Jowett, David Lavallee, Human Kinetics.

B. Sc. (Hons) Chemistry Semester-IV

CHEM-216: ORGANIC CHEMISTRY Lab-II

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(Internal Assessment)

A. Thin Layer and Column Chromatography

I. Determination of R_f value and purity of organic compounds by use of thin layer chromatography.
II. To analyse the analgesic drug APC by thin layer chromatography.
III. Separation of mixture of *o*-nitroaniline and *p*-nitroaniline by column chromatography.

B. Qualitative Analysis

To perform qualitative analysis of single organic compound (hydrocarbons, aldehydes, ketones, phenols, carboxylic acids/(derivative), amines, amides, nitro compounds and carbohydrates).

I. Test for elements (other than C, H, O).
II. Functional group determination.
III. Melting point, derivative preparation and R_f value determination.

C. Estimation of organic compounds

I. To estimate the strength of given glucose solution (Fehling method).
II. To estimate acid value, iodine value and soaponification value of a given oil.
III. To estimate percentage of sulphur in given organic compound by Messenger's method.

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,5th Edn.,Pubs: ELBS, 1989.
2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques, 3rd Edn., Pubs: Thomson Brooks/Cole,2005.
3. Mann F.G., Saunders. P.C.,Practical Organic Chemistry,Pubs:Green & Co. Ltd., London, 1978.
4. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Chemical Analysis (revised); 5th edition, Pubs: Longman Scientific and Technical,1989.

B.Sc. (Hons) Chemistry Semester-IV

CHEM-217: PHYSICS LAB-IV

Time: 4 Hours **Total Marks:50**

General Guidelines for Practical Examination

I. The distribution of marks is as follows: **Marks: 40; Internal Assessment: 10**
i) One experiment **20 Marks**
ii) Brief Theory **5 Marks**
iii) Viva–Voce **10Marks**
iv) Record (Practical file) **5 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session and will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

1. Determination of Resistivity and Band Gap of Semiconductors by Four Probe Method at different temperatures.
2. Finding the energy band gap of semiconductor material of a P-N junction of diode.
3. Study of Characteristics of Silicon and Germanium diode.
4. Study of characteristics of Zener diode.
5. Study of characteristics of light emitting diode.
6. To study the stabilization of output voltage of a power supply with Zener diode with variable input voltage and with variable load resistance.
7. To show the variation of resistance of a thermistor with temperature.
8. To trace the B-H curves for different materials using CRO and find the magnetic parameters from these.
9. To determine Hall coefficient by Hall Effect.
10. To determine Stefan's constant using Boltzmann's Law.
11. To study the dielectric constant of various liquids using dipole meter.

Reference Books :

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

B.Sc. (Hons) Chemistry Semester-IV

CHEM-218/ESL-222 ENVIRONMENTAL STUDIES–II (COMPULSORY)

Theory Lectures: 1½ Hours/ Week

Section–A: (12 Marks): It will consist of five short answer type questions. Candidates will berequired to attempt three questions, each question carrying four marks. Answer to any of thequestions should not exceed two pages.

Section–B: (16 Marks): It will consist of four essay type questions. Candidates will be requiredto attempt two questions, each question carrying eight marks. Answer to any of the questionsshould not exceed four pages.

Section–C: (12 Marks): It will consist of two questions. Candidate will be required to attemptone question only. Answer to the question should not exceed 5 pages.

1. Biodiversity and its Conservation:

- Definition: Genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and option
- values.
- Biodiversity of global, National and local levels.
- India as mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity.

2. Environmental Pollution:

□□Definition, causes, effects and control measures of:

a) Air Pollution
b) Water Pollution
c) Soil Pollution
d) Marine Pollution
e) Noise Pollution
f) Thermal Pollution
g) Nuclear Hazards
h) Electronic Waste

□□Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

□□Role of an individual in prevention of pollution.

□□Pollution case studies.
□□Disaster Management: Floods, Earthquake, Cyclone and Landslides.

3. Human Population and the Environment

□□Population growth, variation among nations.
□□Population explosion-Family welfare programme.
□□Environment and human health.
□□Human rights.
□□Value education.
□□HIV/AIDS.
□□Women and child welfare.
□□Role of information technology in environment and human health.
□□Case studies.
□□Road Safety Rules & Regulations**:** Use of Safety Devices while Driving, Do's and Don'ts while Driving, Role of Citizens or Public Participation, Responsibilities of Public under Motor Vehicle Act, 1988, General Traffic Signs.
□□Accident & First Aid**:** First Aid to Road Accident Victims, Calling Patrolling Police & Ambulance.

4. National Service Scheme:

- **Entrepreneurship Development:** Definition & Meaning; Qualities of good entrepreneur; Steps/ ways in opening an enterprise; Role of financial and support service Institutions.
- **Civil/Self Defense:** Civil defense services, aims and objectives of civil defense; Needs for self-defense training.

5. Field Visits:

- Visit to a local area to document environmental assets–river/forest/grassland/hill/mountain.
- Visit to a local polluted site–Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems–pond, river, hill slopes etc.
- Contribution of the student to NSS/any other social cause for service of society.

Note: In this section the students will be required to visit and write on the environment of an area/ ecosystem/vi1lage industry/disaster/mine/dam/agriculture field/waste management/hospital etc. with its salient features, limitations, their implications and suggestion for improvement.

References/Books:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Down to Earth, Centre for Science and Environment, New Delhi.
4. Jadhav, H. &Bhosale, V. M. 1995. Environmental Protection and Laws.Himalaya Pub.
5. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.

6. Kaushik, A. &Kaushik, C. P. 2004. Perspective in Environmental Studies,
New Age International (P) Ltd, New Delhi.
7. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
8. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
9. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex,
Amritsar
10. Kanta, S., 2012. Essentials of Environmental Studies, ABS Publications, Jalandhar.

B.Sc. (Hons) Chemistry

Semester-V

B.Sc. (Hons) Chemistry Semester-V

CHEM-301: Physical Chemistry-V

3 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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. Equilibrium Thermodynamics: (11 Hrs.)

Revision of zeroth, 1st, 2nd and 3rd Laws of thermodynamics. The work function and free energy relationships, the Gibbs Helmhotz equation, conditions of equilibrium, partial molar properties, physical significance of partial molar property, chemical potential, Gibb's Duhem equation, Duhem-Margles equation, variation of chemical potential with temperature and pressure, fugacity, determination by graphical method, use of equation of state, generalized method for determination of fugacity. Variation of fugacity with temperature and pressure, fugacity of solids and liquids, Numericals.

UNIT II

2. Non-Equilibrium Thermodynamics (11 Hrs.)

Thermodynamic criteria for non-equilibrium states, entropy production for heat flow, matter flow and electric current flows. Rate of entropy production, phenomenological equations, flows and fluxes, Onsager reciprocity relations, Principles of microscopic reversibility, Principle of minimum entropy production, electrokinetic effects, diffusion, electric conduction. Applications of irreversible thermodynamics to biological systems.

UNIT III

3. Solutions and Their Properties: (12 Hrs.)

Factors affecting solubility, types of solutions, thermodynamic properties of solutions, the solution process, condition for equilibrium between phases, equilibrium between a solution and its vapor phase, Ideal solution, the vapor pressure of ideal solution, vapor pressure of actual

liquid pairs, boiling point diagrams of miscible binary mixtures, distillation of binary miscible solutions, Azeotropes, the fractionating column, ratio of distillate to residue, solubility of partially miscible liquid pairs; Maximum, minimum, maximum & minimum solution temperature type, type without critical solution temperature, vapor pressure and distillation diagrams of partially miscible liquid pairs, vapor pressure and distillation of immiscible liquids, solubility of gases in liquids, the Nernst distribution law, solutions of solids in liquids, chemical equilibria in solutions.

Dilute Solutions: Henrys Law, Freezing points of dilute solutions, determination of M. Wts, the B. Pts of solutions, temperature and solubility in dil. solutions.

UNIT IV

4. Nanochemistry (11 Hrs.)

Introduction, Self assembling of materials, material self assembling, Molecular vs material self assembling, Two diemsional assemblies, Mesoscale assemblies, coercing colloids, nanocrystals, supramolecular structures, nanoscale materials, carbon nanotubes, nanowires, fullerenes, Applications of nonomaterials, Future perspectives

Books Recommended:

1. Principles of Physical Chemistry, C.F. Prutton and S.H. Maron.
2. Physical Chemistry by G.W. Castellan.
3. Thermodynamics for Chemists, S.Glasstone.
4. Physical Chemistry, P.W. Attkins, 6th edn. Oxford.
5. The Thermodynamics of Biological Processes, D.Jou and J.E. Llebot.
6. Physical Chemistry, W.J. Moore.
7. Physical Chemistry: A Molecular Approach, D.A. MCMarrie & J. D. Simon.
8. L. E. Foster, Nanotechnology, Science Innovation and Opportunity, Pearson Edu., 2007

B.Sc. (Hons) Chemistry Semester-V

CHEM-302: Inorganic Chemistry-V

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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 Bonding-III (Ionic bond) **(11 Hrs.)**

Factors affecting the stability of ionic compounds. Lattice energy, Born Lande equation and its applications, Madelung constant, Born-Haber cycle, applications of lattice energy, covalent character in ionic compounds, polarizing power and polarizability, Fazan's rules, Ionic radii, Factors affecting the radii of ions, Radii of polyatomic ions, Efficiency of packing and crystal lattices, Radius ratio rule, calculation of some limiting radius ratio values for different coordination members, Structure of crystal lattices, NaCl, CaCl, ZnS (Zinc blende and Wurzite), fluorite, rutile and cadmium iodide. Predictive power of thermochemical calculations on ionic compounds.

UNIT-II

2. Perfect and imperfect crystals: **(11 Hrs.)**

Intrinsic and extrinsic defects, point defects, line and plane defects, vacancies-Schottky and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects. Metals, insulators and semiconductors, Band theory, Band structure of metals, intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, High temperature super conductors.

UNIT-III

3. Crystal field theory **(12 Hrs.)**

The splitting of d-orbitals in different fields (octahedral, tetrahedral, tetragonally distorted octahedral, square planar, trigonal bipyramidal), Consequences and applications of orbital splitting, crystal field stabilization energy, magnetic properties, Factors affecting extent of

splitting and spectrochemical series, colour of transition metal complexes. Structural effect of crystal field splitting; ionic radii, Jahn-Teller effect in octahedral and tetrahedral complexes. Thermodynamic effects of crystal field splitting, enthalpies of hydration of M^{2+} ions, lattice energies of MCl_2 compounds, etc. Evidence of covalence and adjusted crystal field theory. Molecular orbital treatment of octahedral complexes and bonding; complexes with no bonding and complexes with bonding. Molecular orbital diagrams for tetrahedral and square planar complexes.

UNIT-IV

4. Electronic Spectra of Transition Metal Complexes: (11 Hrs.)

Basis of electron absorption spectroscopy, Term Symbols, Spin-spin, orbital-orbital and spin orbital coupling, L.S. and jj coupling schemes, Russell-Saunders coupling scheme, determination of all the spectroscopic terms of p^n, d^n ions, determination of ground state terms for p^n, d^n, f^n ions using L.S. scheme, determination of total degeneracy of terms, order of interelectronic repulsions and crystal field strength in various fields, two type of electron repulsion parameters. spin orbit coupling parameters energy separation between different j states. Orgel diagrams; weak field splitting, Intermediate and strong field splitting. Tanabe and Sugano diagrams. Electronic spectra of d^1-d^9 metal complexes and f type compounds. Calculation of D_q, of d^1, d^2 & d^8 configurations.

Books Recommended

1. Cotton F. A.,Wilkinson G., Murillo C. A., Bochmann M., Advanced Inorg. Chemistry, 6th edn., Pubs: John Wiley India. (2003).
2. Shriver D. F., Atkins F. W. and Langford C. M., Inorganic Chemistry, 3rd edn., Pubs: Oxford University Press, 1999.
3. Huheey J. E., Keiter E. A., Keiter R. L., Inorganic Chemistry : Principles of Structure and Reactivity; 4th edn, Pubs: Harper Collins, 1993.

B.Sc. (Hons) Chemistry Semester-V

CHEM-303: Organic Chemistry-V
Organic Aspects of Spectroscopy

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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. Electromagnetic Spectrum: Absorption Spectra (11 Hrs)

Ultraviolet (UV) absorption spectroscopy – absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

Infrared (IR) absorption spectroscopy – molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

UNIT-II

2. NMR Spectroscopy (12 Hrs)

Introduction. The nuclear spin, presessional motion. Larmor frequency, the NMR isotopes, population of nuclear spin levels, spin –spin and spin –lattice relaxation, measurement techniques (CW and FT methods). Solvent used, Chemical Shift, shielding constant, range of typical chemical shifts simple applications of chemical shift ring currents and aromaticity, shifts of ^{1}H and ^{13}C, inductive effect, ring current effect and anisotropy chemical bonds, intermolecular forces effecting the chemical shifts. Spin –spin interactions, low and high resolution NMR with various examples. Correlation for H bonded to Carbon. 1H bond to other nuclei such as nitrogen, oxygen and sulphur. Complex spin –spin interaction. Interaction

between two or more nuclei, splitting due to vicinal and geminal protons, long range coupling. ABX and ABC systems with their coupling constants, shifts reagents. Effects of chemical exchange, fluxional molecules, Hindered rotation on NMR spectrum, Karplus relationship. Nuclear magnetic double resonance, spin decoupling, Nuclear overhauser Effect (NOE). ^{13}C ^{1}H coupling, ^{13}C spectra, Differences from ^{1}H nmr, DEPT, Intensities of lines in ^{13}C.

UNIT-III

3. Mass Spectroscopy (11 Hrs)

Basic Principles. Methods of ionization E1 & C1, Laser desorption, Fast Atom Bombardment (FAB). Molecular ions, isotope ions, fragment ions of odd and even electron types, Nitrogen rule, Factors affecting cleavage patterns, simple cleavage, cleavages at a hetero atom, multicentre fragmentations, rearrangements, Diels–Alder fragmentation, Mc Lafferty rearrangement. Cleavage associated with common functional groups, Aldehydes, ketones cyclic and acyclic esters, alcohols, olefins, aromatic compounds amine.

UNIT-IV

4. Application of UV, IR, NMR and Mass Spectroscopy (11 Hrs)

Structure elucidation by combined application of UV, IR, NMR and mass spectra.

Books:

1. W. Kemp, "Organic Spectroscopy".
2. D.L. Pavia, G.M. Lampan, G.S. Kriz, Introduction to Spectroscopy
3. D.H. Williams, I. Fleming, "Spectroscopic Methods in Organic Chemistry
4. R. S. Drago, "Physical Methods in Chemistry"
5. R.M. Silverstein, G.C. Bassler, T.C. Morr. Spectrometric Introduction of Organic Compounds".
6. R.C. Banks, E.R. Matjeka, G. Mercer, "Introductory Problems in Spectroscopy".
7. C.N. Banwell "Fundamentals of Molecular Spectroscopy".

B.Sc. (Hons) Chemistry Semester-V

CHEM-304: Organic Chemistry-VI
(Reaction Mechanisms)

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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.
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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. Aliphatic Nucleophilic Substitution **(11 Hrs)**

The S_N^1, S_N^2, mixed S_N^1 and S_N^2 and SET mechanisms.
The neighbouring group mechanism, neighbouring group participation by πand σ bonds, anchimeric assistance. Nucleophilicity and S_N^2 reactivity based on curve cross model.

Classical and nonclassical carbocations, phenonium ions, norbornyl system, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations. Relationship between poar and electron transfer reactions.
The S_N^1 mechanism.
Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.

UNIT-II

2. Aromatic Nucleophilic Substitution **(6 Hrs)**

The SNAr, SN1, benzyne an SRN1 mechanisms, Reactivity –effect of substrate structure, leaving group and attacking nucleophile. The von Richter, Sommelet-Hauser, and Smiles rearrangements.

3. Free Radical Substitution **(6 Hrs)**

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactvity in the attacking radicals. The effect of solvents on reactivity.

Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free radical rearrangement, Hunsdiecker reaction.

UNIT-III

4. Aliphatic Electrophilic Substitution (**5 Hrs)**

Bimolecular mechanisms- SE2 and SEi. The SE1 mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity.

5. Aromatic Electrophilic Substitution (**6 Hrs)**

Arenium ion mechanism The SE1 mechanism, orientation and ortho/para ratio, Ipso attack, Mechanism of nitration, Amination, halogenation, sulponation, mercuration,Vilsmeir-Haac reaction and Friedel-Crafts reaction. Energy profie diagrams. Activating and deactivating substituents.

UNIT-IV

6. Addition to Carbon-Carbon Multiple Bonds **(6 Hrs)**

Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio- and chemoselectivity,orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Hydroboration. Michael reaction. Sharpless asymmetric epoxixation.

7. Addition to Carbon-Hetero Multiple Bonds **(5 Hrs)**

Addition of water, H_2S, alcohol, amines and grignard reagent to carbonyl compounds, imine, isocyanate, nitriles, carbon disulfide, Mannich reaction, Reformatsky reaction.

Books Suggested:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. sundberg, Plenum.
3. Modern Physical organic chemistry Eric V. Anslyn /Deniis A.Doughutes. P 637-655 (2004) University, Science Books.
4. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
5. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
6. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice Hall
7. Modern Organic Reactions, H.O. House, Benjamin.
8. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional.
9. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.

B.Sc. (Hons) Chemistry Semester-V

CHEM-305: Analytical Chemistry

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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.
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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 8 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. Electro Analytical Methods: **(11 hrs.)**

Electrolytic and galvanic cell, Cell components, D.C. & A.C. current in a cell, Reversible and irreversible cells. Nature of electrodes potentials. Description of standard hydrogen electrode. Measurement of potentials. Sign conventions. E^{o} values and their calculations. Effect of concentration on cell potentials. Concept of Liquid Junction potential. Ohmic potential (IR drop). Polarization (overvoltage) phenomenon and its theories. Limitation of the use of standard electrode potentials.

UNIT-II

2. Potentiometric Methods: **(7 Hrs.)**

Reference electrodes (Calomel, Ag/AgCl, TI/TICI) Metallic indicator electrodes (first, second and third type). Metallic Redox indicator electrode: Membrance and ion –selective Electrodes: Principle and design: Glass electrode. Gas sensing probes. Enzyme electrode: Ion Sensitive Field Effect Transistors (ISFETS) Principal and

Potentiometer methods.

3. Electrogravimetry and Coulmetry: **(5 Hrs.)**

Current voltage relationship, electrolysis at constant applied voltage, constant current

electrolysis, coulometric methods of Analysis, potentiostatic coulmetry, Amperostatic Coulmetry, application of coulmetric titrations.

UNIT-III

4. **Voltammetry and Polarography** **(11 Hrs.)**

General introduction, theoretical consideration of classical polarography, polarographic currents, effect of capillary characteristics on diffusion current, residual current, half wave potential. Effect of complex formation on polarographic waves and mixed anodic cathodic waves, oxygen waves, instrumentation, cell, electrodes and their modifications. Application of polarography. Modified voltametric methods, viz.; current sampled polarography, (TAST), pulse polarography square wave, Fast linear sweep, Cyclic voltammetry, Hydrodynamic Voltametric, stripping methods, amperometric titrations and their applications.

UNIT-IV

5. Conductometric Methods: **(7 Hrs.)**

Electrolytic conductance, relationships used in conductometry, variation of equivalent conductance with concentration, measurement of conductance, conductometric titrations, Applications to various types of titrations for detection of end points.

6. Turbidimetry and Nephelometery: **(4Hrs.)**

Theory of Nephelometry and Turbidimetry, Instrumentation, applications.

Books:

1. D.A. Skoog and D.M. West: Prinicples of Instrumental Methods of Analysis.
2. D.A.Skoog and D.M. West, F.J.Hollar: Fundamentals of Analysis Chemistry.
3. G.W.Ewing: Instrumental Methods of Analysis.
4. H.H. Willard, L.L. Marritt & J.A. Dean: Instrumental Methods of Analysis.

Recommended for Further Readings:

1. B.H. Vassos and G.W.Ewing: Electro Analytical Chemistry.
2. J.A. Plamberk: Electro Analytical Chemistry.

H.A. Flaschka, A.J. Barnard and P.E. Strurrock, Analytical Chemistry.

B.Sc. (Hons) Chemistry Semester-V

CHEM-306: Inorganic Lab-II

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(Internal Assessment)

Quantitative Analysis

1. Volumetric Analysis

a. Determination of acetic acid in commercial vinegar using NaOH.

b. Determination of alkali content-antacid tablet using HCI.

c. Estimation of calcium content in chalk as calcium oxalate by permanganometry.

d. Estimation of hardness of water by EDTA.

e. Estimation of ferrous and ferric by dichromate method.

f. Estimation of copper using sodiumthiosulphate.

2. Synthesis and Analysis

(a) Preparation of Sodium trioxalatoferrate (III)
(b) Preparation of Ni-DMG Complex
(c) Preparation of Copper tetrammine complex
(d) Preparation of cis-bisoxalatodiaquachromate (III) ion
(e) Preparation of bisethylenediammine cobalt (III) chloride
(f) Preparation of trans-bisoxalatodiaquachromate (III) ion

Book:

1. Synthesis and techniques in inorganic chemistry. R. J. Angelici, Pubs: SGS series London, (1977).
2. Vogel's Inorganic Quantitative book on Analysis.

B.Sc. (Hons) Chemistry Semester-V

CHEM-307: Organic Chemistry Lab-III

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(Internal Assessment)

1. Synthesis of adipic acid starting from cyclohexanol.
2. Synthesis of p-nitroacetanilide from acetanilide.
3. Synthesis of p-bromoaniline by bromination of acetanilide and subsequent hydrolysis.
4. Isolation of caffeine from tea leaves.
5. Synthesis of aniline from nitrobenzene.
6. Synthesis of 2-phenylindole by Fischer indole synthesis approach.
7. Synthesis of diethylbarbituric acid from diethyl malonate.
8. Synthesis of Fluorescein.
9. Cannizzaro reaction of 4-chlorobenzoic acid.
10. Synthesis of ethyl benzoate from benzoic acid.
11. Dihydroxylation of cyclohexene with peracids and $KMnO_4$ –Product distribution by TLC *J. Chem Edu*., **2008**, 85, p959.
12. Prepare a sample of Ibuprofen and record its ^{1}H, ^{13}C NMR spectra
13. Reduction of 3-nitroacetophenone using i) $NaBH_4$ ii) using Sn and HCl. Identification of the products with NMR, UV, IR spectra
14. Preparation of oil of Wintergreen from commercial aspirin tablets *J. Chem Edu*., **2009**, 86, p475

B.Sc. (Hons) Chemistry Semester-IV
CHEM-308: PHYSICAL CHEMISTRY Lab-II

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(Internal Assessment)

Conductometry

1. Determination of strength of given strong acid (HCl).
2. To determine strength of given weak acid
3. To determine strength of given mixture of strong acid and weak acid.
4. Determine the equivalent conductance of a weak electrolyte at infinite solution by Kohlrausch's law and determine the degree the electrolyte.

Potentiometry

5. Titration of strong acid solution (HCl) with NaOH solution using quinhydrone electrode.
6. Titration of a mixture of strong and weak acids (HCl + CH_3COOH) and hence the composition of the mixture.

Refractometry

7. To determine molar refractivity of given liquids.

Colorimetry

8. To test the validity of Beer Lambert law.

Polarimetry

9. To determine specific and molecular rotation of an optically active substance (Say cane sugar).

Phase Equilibrium

10. To study the distribution of iodine in $CCl_4 - H_2O$ system.

Books Recommended:

1. Findlay's Practical Physical Chemistry.
2. Advanced Practical Physical Chemistry by J. B. Jadav.
3. Quantitative Inorganic analysis by Vogel.

B.Sc. (Hons) Chemistry

Semester-VI

B.Sc. (Hons) Chemistry Semester-VI
CHEM-309: Physical Chemistry-VI

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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.
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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 8 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. Thermodynamics of diffusion: **(11Hrs.)**

Thermodynamic view of diffusion, Relation between transport properties. Einstein relation, Nernst-Einstein relation, stoke's Einstein relation. Diffusion in non-steady state. Fick's second law of diffusion. Theory of diffusion in liquids.

UNIT II

2. Photochemistry **(11 Hrs.)**

Interaction of radiation with matters, difference between thermal and photochemical processes, Lamber's law, Lambert-beer law, laws of photochemistry: Grothus-Drapper law, Stark-Einstien law, jablonski diagram, qualitative description of fluorescence and phosphorescence and non-radiative processes, Stern-Volmer equation, quantum yield and its determination, photosensitized reaction, energy transfer processes, Flash photolysis.

UNIT III

3. Solid State **(12 Hrs.)**

Classification of solids: Crystalline and amorphous, covalent, ionic, metallic and molecular solids, Unit cell and space lattice, Crystallographic system, braivais lattices, laws of crystallography, symmetry elements in crystals, X-ray diffraction by crystals, derivation of Bragg's law, determination of crystal structure of NaCl, KCl by use of powder method; Laue's method.

UNIT IV

4. Nuclear Chemistry **(11 Hrs.)**

Introduction, Theories of radioactive decay, modes of decay, group displacement laws, Kinetics of radioactive decay, radioactive equilibrium, radioactive disintegration series, artificial radioactivity, artificial transmutation, Nuclear models, nuclear fission and nuclear fusion, radioactive detection: GM counter, Scintillation counter, applications of radioactivity. Tracer techniques,

Books Recommended:

1. Principles of Physical Chemistry, C.F. Prutton and S.H. Maron.
2. Physical Chemistry by G.W. Castellan.
3. Thermodynamics for Chemists, S.Glasstone.
4. Physical Chemistry, P.W. Attkins, 6th edn. Oxford.
5. Physical Chemistry, W.J. Moore.
6. Physical Chemistry: A Molecular Approach, D.A. MCMarrie & J. D. Simon.
4. Friedlander G., Kennedy J.W., Macias E.S. and Miller J.M., Nuclear and Radiochemistry, 3rd Edition, Pubs: John Wiley and Sons (1981).
5. Arnikar H.J., Essentials of Nuclear Chemistry, 2nd Edition, Pubs: Wiley Eastern Limited (1987),

B.Sc. (Hons) Chemistry Semester-VI

CHEM-310: Inorganic Chemistry-VI

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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.
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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 8 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. Organometallics: **(12 Hrs.)**

Importance of organometallic chemistry in modern times: Definition and terminologies. 18-electron rule, Preparation of metal carbonyls, binary carbonyls, mixed metal polynuclear carbonyls, chemical reactions of metal carbonyls, nitrosyl compounds, Dinitrogen and dioxygen complexes, Metal Alkyls, Carbenes, Carbynes and Carbides,

2. Catalysis by Organometallic compounds:

Alekene Hydrogenation, Tolman Catalytic loop, Hydroformylation, Monsanto Acetic Acid Process, The Wacker Process, Ziegler-Natta catalysis

UNIT-II **(11 hrs)**

3. Alkali metal and alkaline earth metal chelators: Macrocyclic ligands, macrocyclic effect, crown ethers and podands, coronands, cryptands, structure of 18 crown-6 complex with KNCS, ion cavity complex, effect of anion and cation type on complex structure, simultaneous complexation of metal ion and water or of two metal ions, sandwich formation, cryptands and their cation complexes, podands with aromatic donors and groups.

UNIT-III

4. Molecular Orbital Theory: **(10 Hrs)**

Evidence for covalent character in Bonding, MOEL diagram for octahedral and tetrahedral complexes involving bonding, charge transfer transitions.

5. πAcid Ligands: Definition Carbon monoxide complexes, bonding in linear MCO groups,

polynuclear metal carbonyls, vibrational spectra, Reactions, carbonyl hydrides and halides. Metal-metal bonding metal-metal multiple bonding,

UNIT-IV

6. Bioinorganic Chemistry **12 Hrs.**

Essential and trace elements in biological processes, Metal storage and transport: Fe, Cu, Zn and V, metalloporphyrins and special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}, Metallothioneins: transporting some toxic metals, Biological redox processes

Books:

1. Cotton F. A.,Wilkinson G., Murillo C. A., Bochmann M., Advanced Inorg. Chemistry, 6th edn., Pubs: John Wiley India. (2003).
2. Gupta B. D. and Elias A. J.Basic Organometallic Chemistry.Pubs: University Press (2010)
3. Huheey J. E., Keiter E. A., Keiter R. L., Inorganic Chemistry : Principles of Structure and Reactivity; 4th edn, Pubs: Harper Collins, 1993.
4. B.E. Douglas and D.H. McDaniel, Concepts and Models of Inorganic Chemistry.
5. R. Hilgenfeld and W. Saengar, Topics in current chemistry Vol-II.
6. Elschenbroich C., Organometallics. Pubs: Wiely VCH Verlag GmbH.

B.Sc. (Hons) Chemistry Semester-VI

CHEM-311: Organic Chemistry-VII
Organic Synthesis

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(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.
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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 8 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. Stereochemical Principles; conformation, steric and stereoelectronic effects (11 Hrs)

Enantiomeric relationships, Diastereomeric relationships, Dynamic stereochemistry, Prochiral relationships, Conformations of Acyclic molecules, cyclohexane derivatives, Rings other than six membered, Conformational effects on reactivity, angle strain and its effects on reactivity, Relationship between ring size and facility of ring closure. Torsional strain and related stereo electronic effects. Asymmetric synthesis. optical activity in absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

UNIT-II

2. Reactive Intermediates: Structure and Reactivity (6 Hrs)

Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes.

Reaction of electron-deficient intermediates

Carbenes: Addition, insertion, rearrangement reactions; Wolff rearrangement and Arndt-Eistert synthesis.

Nitrines: generation of carboalkoxynitrenes from alkazidoformates.

3. Rearrangement reactions (5 Hrs)

Rearrangement of electron-deficient nitrogen compounds: Beckmann, curtius, Hofmann, Schmidt rearrangements (Bayer-villiger rearrangement)

Rearrangement of Carbocations: Pinacoles, Tiffeneau-Demjanov rearrangement, Carbon-carbon bond formation involving carbocations, Polyolefin cyclisation, Fragmentation reactions.

UNIT-III

4. Oxidation Reactions (6Hrs)

Oxidation of alcohols to aldehydes, ketones or carboxylic acids Transition metal oxidants: Cr(VI) Oxidants, MnO_2 and ruthenium tetraoxide. Other oxidants: DMSO-DCC, DMSO/Ac_2O, Dimethyl sulphide/ N-chloro succinimide, DMSO/Cl_2. Addition of oxygen at carbon-carbon double bonds. Transition metal oxidants. $KMnO_4$, OsO_4. Cleavage of carbon-carbon double bonds by transition metal oxidants; $KMnO_4$, $Na_2Cr_2O_7/Ac_2O$, CrO_3/AcOH.

5. Reduction Reactions (6 Hrs)

Reduction of Carbonyl group Addition of hydrogen. Catalytic hydrogenation, Group III hydride-transfer rearrangements. Reduction of carbonyl groups, halides, sulphonates, expoxides, acetylenes; Group IV hydride donors: Reduction of alcohols, aromatic ketones, Carboxylic acids and esters with silanes, Cannizzaro reaction. Hydrogen atom donors, reductive dehydrogenation of alkyl halides and acid chlorides and deoxygenation of alcohols with tributyl tin hydride. Dissolving metal reduction: addition of hydrogen, reductive deoxygenation of carbonyl groups, Clemmensen reduction, Wolff-Kishner reduction. Tosylhydrazone reduction, thioketal desulphurization.

UNIT-IV

6. Organic Synthesis *via* Enolates (6 Hrs)

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethylacetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.

7. Coupling Reactions (5 Hrs)

Reaction and mechanism of Diazo coupling, Glaser coupling, Heck reaction, Mcmurry reaction, Stille coupling, Suzuki coupling, Sonogashira reaction. Negishi and Hiyama coupling.

Suggested Books

1. Carey F.A. and Sundoerg R.J., Advance Organic Chemistry, part A and part B, 2nd Edn.,Pubs: Plenum Press, New York, 1984.
2. Morrison R.T. and Boyd P.S., Organic Chemistry, 5th Edn., Pubs: Allyn and Bacon Inc., Boston (1992).
3. March J., Advanced Organic Chemistry, 3rd Edn.,Pubs: Wiely Interscience ,1985.
4. Streitwisser A., Jr. and Heathcock C.H., Introduction to Organic Chemistry 3rd Edn., Pubs: MacMillan Pub. Co., N.Y, 1992.
5. Isaccs N.S., Physical Organic Chemistry, Pubs:Longman Scientific & Technical,1987.

B.Sc. (Hons) Chemistry Semester-VI

CHEM-312: Advance Physical Chemistry

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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. Molecular Interactions and other topics: (11 Hrs.)

Electrical properties: Polar and Non polar Crystals, Capacitance, Dielectric Properties, Dipole moment, polarization, polarizability and electrical susceptibility, Clausius Mossoti and Debye Equations.

Magnetic properties: magnetic susceptibility, permanent magnetic moment, induced magnetic moment. Liquid crystals, difference between liquid crystals solid and liquid, classification, structure of nematic and cholestric phases, movement in liquids, Ionic solids.

Molecular reaction dynamics: Collision theory, Diffusion controlled reactions Activated complex theory; reaction co-ordinates and transition state, formation and decay of the activated complex, Derivation and use of Eyring equation. Thermodynamic aspects; reactions between ions.

UNIT-II

2. Helium atom, Schrödinger Equation (11 Hrs.)

Approximate solutions, variation method and its application to ground state of hydrogen atom, Pauli exclusion principle, two electron spin functions, Slater determinants and Pauli principle,excited state of helium atom, Lithium atom.

UNIT-III

3. Periodic table, Atomic term symbols (11 Hrs.)

Spin-orbit coupling, vector model of atom, Hund's rules, atomic spectra and selection rules, j-j coupling.Molecular electronic structure, Born-Oppenheimer approximation, ionic and covalent bonding. The hydrogen molecule ion, Molecular orbital description of hydrogen molecule. Other homonuclear diatomic molecules, heteronuclear diatomic molecule; polyatomic molecules. Huckel molecular orbital theory, unsaturated molecules and aromatic hydrocarbons. Metals, insulators and semiconductors,

Valence bond theory.

UNIT-IV

4. Statistical Thermodynamics (12 Hrs.)

Molecular energy levels and the Boltzmann distribution: configurations and weights, most probable configuration; the molecular partition function, physical interpretation of the partition function. The canonical ensemble,canonical partition function and its relation to molecular partition function for independent particles. The statistical entropy; heat, work and entropy;entropy and partition function, entropy of a monoatomic gas. Factorization of partition function; calculation of translational, rotational vibrational and electronic contributions, the overall partition function.

Suggested Books

1. Physical Chemistry by P.W. Atkins 7th Edn. (1994).

2. Physical Chemistry by I.N. Levine 4h ed. (1993).

3. Physical Chemistry by Donald C. McQuarre(1983).

4. Introductory Quantum Chemistry by A.K. Chandra (1988).

5. Molecular Quantum Mechanis by P.W. Atkins and R. S. Friedman,Oxford University Press, 2004.

FURTHER READING:

1. Physical Chemistry by G.M.B. Barrow V. Edition (1985).

2. Physical Chemistry by Walter J. Moore V.Ed. (1976).

3. Physical Chemistry by Alberty and Silbey, Wiley (1992).

B.Sc. (Hons) Chemistry Semester-VI

CHEM-313: Advance Chemistry

4 Hrs./Week **45 hrs.**
Max. Marks: 40+10(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 eight 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 8 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. Elementary Quantum Chemistry: **(11Hrs.)**

Historical background, classical ideas of energy and particle trajectory. Blackbody radiation and Planck's hypothesis of quantization of energy,photoelectric effect. Line spectra of atoms, diffraction of electrons, wave-particle duality. De Broglie's relation Heisenberg's uncertainty principle.

Schrödinger-wave equation, concept of wave function (ψ)physical significance of ψ and ψ^2, normalization of ψ constraints on ψ. Free particle, particle in a one dimensional box, translational energy, energy levels, quantization of energy, wave functions for particle in a box,comparison with classical theory, concepts of orthogonality and orthonormality. Kronecker delta. Particle in a three dimensional box, cubical box and concept of degeneracy of energy levels.Operators, definitions, linear operators, eigenvalue operators, operators for various observables, concept of Hermitian operators, orthogonality.Postulates of quantum mechanics, time dependent Schrödinger equation, expectation values, applications of particle in a box model.

UNIT–II

(12 Hrs.)

2. Quantum Mechanics II. Vibrational motion, classical one-dimensional harmonic oscillator. Quantum mechanical harmonic oscillator, Energy and energy levels of simple harmonic oscillator (no derivation), wave functions for simple harmonic oscillator, tunnel effect. Hermite polynomials as even and odd functions, average kinetic energy and average potential energy of simple harmonic oscillator,virial theorem.

Rotational motion: two dimensional rotation (particle on a ring), energy levels, angular momentum and

position of particle on a ring. Rotation of a particle in three dimensions, Schrödinger equation and its elementary solution, spherical harmonics, applications to diatomic molecule (rigid rotator). Schrödinger equation for hydrogen-like atoms, elementary discussion of its solution, energy levels for hydrogen like atoms, wave functions for hydrogen atom, electron spin, concept of spin orbitals, spectral selection rules for one-electron atoms, spectrum of hydrogen atom.

UNIT III

3. Inorganic Polymers (11Hrs.)

Introduction, Types of inorganic polymers

Polyphosphazenes: Introduction, synthesis route, ring opening polymerization mechanism, molecular structure of phosphazene, nature of bonding in phosphazene, structure property relationship (crystalline vs. amorphous polymers, hydrophobic vs. hydrophilic, water stable vs. water erodible and material structure imposed by side group stacking) , advanced elastomers, polyphosphazene as biomedical material

UNIT-IV

4. Silicones and polysiloxanes (11 Hrs.)

Introduction, Nomenclature, Preparation of monomers, ring opening polymerization, copolymerization, structural features, formation of cross linked silicones, general properties, reactive homopolymers, random copolymers, block copolymers, silicones elastomers, silicones resins, applications.

Books Recommended

1. James E. Mark, Harry R. Allcock, Robbert West, Inorganic Polymers
2. Malcolm P.Stevens, Polymer Chemistry an Introduction, Third edition Oxford University Press
3. P.Ghosh, Polymer science and Technology of Plastics and Rubbers
4. Molecular Quantum Mechanics by P.W. Atkins and R. S. Friedman,Oxford University Press, 2004.
5. Introduction to Nuclear Chemistry by H.J.Arnikar, New Age Publishers (1981)

B.Sc. (Hons) Chemistry Semester-VI

CHEM-314: Inorganic Lab-III

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(Internal Assessment)

1. Determine nickel (II) in a given sample gravimetrically using dimethylglyoxime.
2. Determine copper (II) in a given sample gravimetrically using ammonium/sodium thiocyanate.
3. Estimate the iron as its ferric oxide from a given solution of ferrous ammonium sulfate gravimetrically.
4. Estimate chromium (III) as its lead chromate.
5. Estimate lead as its lead molybdate gravimetrically.
6. Estimate cobalt as mercury tetraisothiocyanatocobalt (II) $[HgCo(NCS)_4]n$.
7. Determine silver (I) as its chloride gravimetrically.
8. Determine barium (II) as its chromate gravimetrically.
9. Determine cadmium (II) as $[Cd(C_5H_5N)_2(SCN)_2]$ gravimetrically.

Book: Vogel's Quantitative Inorganic Analysis

B.Sc. (Hons) Chemistry Semester-VI

CHEM-315: Physical Lab III

4 Hrs./Week **45 hrs.**

Max. Marks: 40+10(Internal Assessment)

Conductometry

1. Determination of the solubility of a sparingly soluble substance.
2. Determination of the degree of hydrolysis of NH_4Cl and CH_3COONa.
3. To study the kinetics of saponification of ethyl acetate by sodium hydroxide.

Potentiometry

4. Potentiometric titrations of diabasic acid, oxalic acid and malonic acid with base.
5. To determine potentiometerically the solubility and solubility product of a sparingly soluble salt.
6. Determination of heat of reaction, equilibrium constant and other thermodynamic functions of the reaction.

$$Zn + Pb^{2+} \rightarrow \quad Zn^{2+} + Pb.$$

Polarimetry

7. To study the kinetics of inversion of cane sugar by means of polarimetry.

Chemical Kinetics

8. To determine activation energy of a reaction by studying its temperature dependence.
9. To study the reaction between potassium iodide and potassium peroxodisulphate. .

Determination of Molecular Masses by Cryoscopy

10. To determine molar depression constant (K_f) for a given solvent.
11. To determine cryoscopically the apparent degree of dissociation of KCl and Ca $(No_3)_2$ in water.

pH-metry:

12. To titrate a base against a strong acid and determine the ionization constant of the weak base