SCHEME

&

SYLLABUS

FOR

M.Sc. Chemistry

Regular

(Semester I-IV)

Session: 2023-24

BADDI UNIVERSITY OF EMERGING SCIENCES & TECHNOLOGY

M.Sc. (Chemistry Regular) (Semester I-IV)

Scheme of Courses of M.Sc. (Chemistry Regular) Semester System

Semester I					
Subject Code	**Subject**	**L**	**T**	**P**	**Credits**
PCH-111	Inorganic Chemistry – I	4	0	0	4
PCH-112	Organic Chemistry –I	4	0	0	4
PCH-113	Physical Chemistry-I	4	0	0	4
PCH-114 PCH-115	Mathematics in Chemistry OR Biology in Chemistry	4 4	0 0	0 0	4 4
PCH-116	Inorganic Chemistry Practical (Session I)	0	0	6	3
PCH-117	Organic Chemistry Practical(Session I)	0	0	6	3
PCH-118	Physical Chemistry Practical(Session I)	0	0	6	3
Total		**16**	**0**	**18**	**25**
				Total Hours:	***34***
Semester II					
Subject Code	**Subject**	**L**	**T**	**P**	**credits**
PCH-161	Inorganic Chemistry - II	4	0	0	4
PCH-162	Organic Chemistry -II	4	0	0	4
PCH-163	Physical Chemistry-II	4	0	0	4
PCH-164	Chemistry of advanced Materials	4	0	0	4
PCH-165	Inorganic Chemistry Practical (Session II)	0	0	6	3
PCH-166	Organic Chemistry Practical(Session II)	0	0	6	3
PCH-167	Physical Chemistry Practical(Session II)	0	0	6	3
Total		**16**	**0**	**18**	**25**
	Total Hours:	**34**			

SEMESTER III					
Subject Code	**Subject**	**L**	**T**	**P**	**Credits**
PCH-211	Application of Spectroscopic techniques	5	0	0	5
PCH-212	Analytical Chemistry	5	0	0	5
PCH-213 PCH-214 PCH-215	Inorganic Chemistry Special-I OR Organic Chemistry Special-I OR Physical Chemistry Special-I	5	0	0	5
PCH-216 PCH-217 PCH-218	Inorganic Chemistry Practicals Special (3 Sessions) OR Organic Chemistry Practicals Special (3 Sessions) OR Physical Chemistry Practicals Special (3 Sessions)	0	0	6	3
PCH-269	Project (Synopsis)	0	0	3	3
Total		**15**	**0**	**9**	**21**
	Total Hours:	**24**			

Semester – IV					
Subject Code	**Subject**	**L**	**T**		**Credits**
PCH-261	Bio Inorganic and Environmental Chemistry	5	0		5
PCH-262	Organic Synthesis	5	0		5
PCH-263 PCH-264 PCH-265	Inorganic Chemistry Special-II OR Organic Chemistry Special-II OR Physical Chemistry Special-II	5	0		5
PCH-269	Project (Experimental work)	0	6		3
Total		**15**	**6**		**18**
	Total Hours:	**21**			

Course Code	Course Title	L	T	P	Credit
PCH-111	INORGANIC CHEMISTRY –I	4	0	0	4

1st Semester

Prerequisites: Nil

Objective:

1. To apply the knowledge of inorganic chemistry in industrial sectors.
2. To use concepts of chemistry for solving various types of problems.
3. To provide broad understanding of Lanthanides and Actinides

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Bonding and Stereochemistry in Main Group Compounds

VSEPR Theory, Walsh diagrams (tri and tetra-molecules), d π-p π bonds, Bent rule and energetics of hybridization,

Crystal Defects: Types of defects, thermodynamics of Schottky and Frenkel defect formation,

F center, Kroger-Vink notation for crystal defects

UNIT-II

Metal Ligand Bonding and Spectra

Molecular orbital theory, octahedral, tetrahedral and square planar complexes, π bonding and molecular orbital theory. Correlation Diagrams, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), charge transfer spectra,

UNIT-III

Inorganic Polymers

Chemistry of inorganic rings, cages, borazines, phosphazene.

Silicates, Aluminosilicates, & Silicones: classification, structure, properties, and application and naturally occurring silicates, alumino silicates and silicones.

UNIT-IV

Lanthanides and Actinides:

Position in the periodic tables, electronic structure, oxidation states, magnetic properties, lanthanide contraction, colour and spectra, separation by different techniques.

Course Outcome:

1. Know the Metal Ligand Bonding and Spectra.
2. Discuss the problem based on d-π and p-π bonds.
3. Difference between borazines and phosphazene.
4. Discuss the periodic properties of lanthanides and actinides

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks) –20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1. F.A. Cotton, Chemical Application of Group Theory, Wiley Eastern.
2. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, 3rd edition, Pearson Education.
3. B.N. Figgis, Introduction to Ligand Field, Wiley Eastern.
4. A.B.P. Lever, Inorganic Electronic Spectroscopy, Elsevier.

Course Code	Course Title	L	T	P	Credit
PCH-112	**ORGANIC CHEMISTRY–I**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Objective:

4. To provide the deep understanding of organic chemistry.
5. To explore the organic chemistry for solving various types of problems.

Web Resources:

5. A. Earnshaw, Introduction to Magnetochemistry, Academic Press.
6. J.E. Huheey, Inorganic Chemistry Principles of Structure and Reactivity, Harper
7. Interscience.

The question paper will consist of 8 questions. Student has to attempt total five questions at least one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Study & Description of Organic Reaction Mechanism: Kinetic and thermodynamic requirements of reactions, potential energy diagram, transition states and intermediates. methods of determining reaction mechanisms

Supramolecular chemistry:

Introduction, Bonding other than covalent bond. Crown ether complexes
and Cryptands, Inclusion compounds, Cyclodextrins, Catenanes their applications.

UNIT-II

Aliphatic Nucleophilic Substitution: The SN2, SN1, mixed SN1 and SN2, SET mechanisms & SNi mechanism. The neighboring group mechanism, neighboring group participation by π and σ bonds, anchimeric assistance. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Esterification of carboxylic acid, transesterification, transetherification. Phase-transfer catalysis, and ambident nucleophile, regioselectivity.

Aliphatic Electrophilic Substitution: Bimolecular mechanisms- SE2 and SE1. The SE1 mechanism, electrophilic substitution accompanied by double bond shifts, Aliphatic diazonium coupling.

UNIT-III

Free Radical Reactions

Type of free radical reactions, free radical substitution mechanism at an aromatic substrate, neighbouring group assistance. Reactivity 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-IV

Addition to Carbon-Carbon Multiple Bonds

Mechanistic and stereochemical aspects of addition reaction 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 ring. Hydroboration. Michael reaction.

Addition To Carbon-Heteroatom Multiple Bonds

Addition of grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Wittig reaction. Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides.

Course Outcomes:

1. Know the Supramolecular chemistry.
2. Difference between Aliphatic Electrophilic and Aliphatic Nucleophilic Substitution types reaction.
3. Difference between SN2 and SN1 reaction.
4. Discuss the problem based on Free Radical Reactions.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks

Course Code	Course Title	L	T	P	Credit
	• Average of TWO Mid-Terms (50 Marks) –20 Marks • Attendance 5 Marks • End Term (100 Marks) – 50 marks • Total Assessment (Out of 100 Marks)				
PCH-113	**PHYSICAL CHEMISTRY-I**	**4**	**0**	**0**	**4**
Prerequisites: Nil					
Objective: 1. To provide the deep understanding of Classical and Statistical Thermodynamics. 2. To explore the problems based on the non-Equilibrium Thermodynamics.					
Preferred Reading: 1. Reaction Mechanism in Organic Chemistry, S. M. Mukherjee and S. P. Singh, McMillan Publication. 2. Stereochemistry – Eliel 3. Advanced Organic Chemistry – Jerry March. 4. Advanced Organic Chemistry, F. A. Carey, R. J. Sundberg, Volume I and II 5. Highlights of Organic Chemistry, W.J. L. Nobel; An Advanced Text Book.					
Web Resources:					

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Classical Thermodynamics

Chemical potential, partial molar properties, partial molar free energy, partial molar volume and partial molar heat content and their significances. Determination of these quantities. Concept of fugacity and determination of fugacity.

Non-ideal systems: Excess functions for non-ideal solutions. Activity, activity coefficients, Debye-Huckel theory for activity coefficient of electrolytic solutions, determination of activity and activity coefficients, ionic strength. Application of phase rule to three component system, second order phase transitions.

Statistical Thermodynamics: BASIC

Concept of distribution, thermodynamic probability & most probable distribution, ensemble averaging, postulates of ensemble averaging, canonical, grand canonical & micro canonical ensembles

UNIT-II

Statistical Thermodynamics:

Corresponding distribution laws (using Lagrange's method of undetermined multipliers) Partition functions: Translational, Rotational, Vibrational, Electronic partitions functions. Calculation of Thermodynamic properties in terms of partition functions. Heat capacity, behaviour of solids chemical equilibria and equilibrium constant in terms of partition function, F.D. statistics, distribution law and application to metals. Bose Einsteins statistics. Distribution law & application to Helium**.**

UNIT-III

Surface Chemistry

Adsorption: Surface tension, capillary action, pressure difference across curved surface (Laplace eqn), vapour pressure of droplets, (Kelvin eqn), Gibb's adsorption isotherm, estimation of surface area (BET eqn), surface films on liquids (electro kinetic phenomenon), catalytic activity at surfaces.

Micelles: Surface active agents, classification of surface active agents, micellisation, hydrophobic interactions, critical micellar comentration, factors affecting CMC of surfactants, counter ions binding to micelles, thermodynamics of micellization-phase separation & mass action models, solubilization, microemulsion, reverse micelles.

UNIT-IV

Electrochemistry:

Electrochemistry of solutions, Debye-Huckel treatment, and its extension, ion solvent interaction, Debye-Huckel-Jerrum model, Thermodynamics of electrified interface equations, derivation of electrocapillarity, Lippmann equations, Methods of determining structures of electrified interfaces, Guoy-Chapman, Stern. Over potentials, exchange current density, derivation of Butler-volmer equation. Tafel plots. Quantum aspects of charge transfer at electrode solution interfaces, quantization of charge transfer, tunnelling Semiconductor interfaces- theory of double layer interfaces, effects of light at semiconductor solution interface. Influence of various parameters, H-electrode, polarography, theory Ilkovic eqn, (excluding derivation), Half wave potential & its significance, electrocardiography, introduction to corrosion, homogeneous, theory, forms of corrosion, corrosion monitoring.

Course Code	Course Title	L	T	P	Credit
PCH-114	**Mathematics in Chemistry**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Outcomes:

1. Know the use of simple models for predictive understanding of physical phenomena associated to chemical thermodynamics and kinetics
2. Able to discuss the Debye – Huckel Limiting Law.
3. Difference between F.D. statistics and Bose Einstein's statistics

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks) –20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1. I F Nash: Elements of classical and statistical thermodynamics
2. Pitts: Non equilibrium thermodynamics
3. I Prigogine: Introduction to thermodynamics of irreversible processes
4. T L Hill: Introduction to statistical thermodynamics

Web Resources:

Objective:

1. The intent of the course is to build upon basic understanding of mathematics.
2. The course develops an insight to apply the knowledge of mathematics for better understanding of various derivations in their subject

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Trigonometry

Definition of sin, cos, tan, cot, sec, cosec functions with the help of unit circle, values of sin x, cosx, for x = 0, /6, π/3, π/2. Meaning of a trigonometric identity. The following identities (no need of derivation and proof. However, application has to be emphasized).

$\cos^2 x + \sin^2 x = 1$, $\sec^2 x - \tan^2 x = 1$, $\operatorname{cosec}^2 x - \cot^2 x = 1$
$\sin(2\Pi - x) = -\sin x$, $\cos(2\Pi - x) = \cos x$
$\sin(\pi/2 - x) = \cos x$, $\cos(\pi/2 - x) = \sin x$
$\cos(-x) = \cos x$; $\sin(-x) = -\sin x$, $\tan(-x) = -\tan x$
$\sin(\pi - x) = \sin x$; $\cos(\pi - x) = -\cos x$, $\sin(\pi + x) = \sin x$; $\cos(\pi + x) = \cos x$,
$\sin 2x = 2 \sin x \cos x$
$\cos 2x = 2\cos^2 x - 1 = 1 - 2\sin^2 x$
$\tan(\pi/2 - x) = \cot x$, $\tan(\pi - x) = -\tan x$, $\tan(2\pi - x) = -\tan x$, $\tan(\pi + x) = \tan x$
$\tan 2x = 2\tan x/(1 - \tan^2 x)$

UNIT-II

Determinants and Matrices

Introduction to various terms Matrix, row, column, diagonal, unit. Sub, square, equal matrices, null, symmetric, order of matrix, character of matrix, transpose of matrix, Adjoint of matrix, inverse of matrix. Addition multiplication, diagonalization, similarity transformation of matrices, characteristic equation statement of Cayley Hamilton theorem. Rank of matrix, condition of consistency of a system of linear equations. Eigen vectors and Eigen values using matrices. Definition and properties of determinants, product of two determinants of 3^{rd} order.

UNIT-III

Differential Calculus: Differentiation of standard functions, theorems relating to the derivative of the sum, difference, product and quotient of functions, derivative of trigonometric functions, inverse trigonometric functions, logarithmic functions and exponential functions, differentiation of implict functions, logarithmic differentiation.

Integral Calculus: Integration as an inverse ofdifferentiation summation, area under a curve, indefinite integrals of standard forms, method of substitution, method of partial fractions, integration by parts, definite integrals, reduction formulae, definite integrals of limit of a sum and geometrical interpretation.

UNIT-IV

Vectors: Vector, dot, cross and triple products etc. The gradient, divergence and curl. Vector calculus, Gauss theorem, divergence theorem etc.

Matrix Algebra: Addition and multiplication; inverse, adjoint and transpose of matrices, special

matrices (Symmetric, skew-symmetric, Hermitian, unit, diagonal, unitary, etc.) and their properties. Matrix equation: Homogeneous, non-homogenous linear and conditions for the solution, linear dependence and independence. Introduction to vector spaces, matrix eigen values and eigen vectors, diagonalization, determinants (examples from Huckel theory).

Elementary Differential Equations: Variables-separable and exact, first-order differentia equations, homogenous, exact and linear equations. Applications to chemical kinetics, secular equilibria, quantum chemistry, etc. Solutions of differential equations by the power series method, Fourier series, spherical harmonics, second order differential equations and their solutions.

Course Outcomes:

1. Better understanding of mathematical results in Physical Chemistry.
2. Organizing the data for analysis in their experiments.
3. Selecting the most logical method/procedure for the observed data in chemistry practicals.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks) –20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Shanti Narayan – Differential Calculus.
2. Shanti Narayan - Integral Calculus.
3. B.S. Grewal – Higher Engineering Mathematics.
4. Joseph B. Dence – Mathematical Techniques in Chemistry

Web Resources:

Course Code	Course Title	L	T	P	Cr.
PCH-115	**BIOLOGY IN CHEMISTRY**	**4**	**0**	**0**	**4**

Prerequisites: B.Sc

Objective:

1. These courses provide a unique opportunity to develop an insight into research at the interface between Chemistry and Biochemistry.
2. They are designed to introduce students to the techniques required for chemical research at a University with an international reputation for Biological Chemistry.

UNIT-I

The Organisation of Life: The life of cells – The cell theory, general characteristics of cells, difference between prokaryotic and eukaryotic cells, difference between plant and animal cells, cell organelles.

UNIT-II

Genetics: The basic principle of heredity: Mendel's law, monohybrid cross, dihybrid cross.
DNA – Double helix structure and replication.
Gene expression: Transcription and translation, genetic code.

UNIT-III

Carbohydrates: Conformation of monosaccharides, disaccharides and polysaccharides. Structure and biological functions of glucosaminoglycans or muco-polysaccharides. Carbohydrates of glycoproteins and glycolipids. Blood group substances.

Carbohydrate metabolism- kreb's cycle, glycolsis, glycognesis and glycogenolysis, gluconeogenenis, pentose phosphate pathway

UNIT-IV

Proteins: Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of proteins forces responsible for holding of secondary structures. Alpha helix, Beta sheets, secondary structure, triple helix structure of collagen. Tertiary structure of protein-folding and domain structure. Quaternary structure.

Vitamins: A general study, detailed study of chemistry of thiamine (Vitamin B1), Ascorbic acid (Vitamin C), Pantothenic acid, biotin (Vitamin H), α-tocopherol (Vitamin E), Biological importance of vitamins

Learning Outcomes:

- Demonstrate knowledge of the principal types of enzymic catalysis, including methods for probing the structure and function of biomacromolecules.
- Use scientific skills in a research project on biological chemistry.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks) –20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Cord Biology - South Western Educational Publications, Texas, 2000.
2. Lehninger. A.L. Principles of Biochemistry, Worth publishers.

Course Code	Course Title	L	T	P	Cr.
PCH-116 & PCH-165	**INORGANIC CHEMISTRY PRACTICALS**	**0**	**0**	**6**	**3**

Prerequisites: B.Sc

Objective:

This course equips the students with various types of skills used in industry.

Student has to attempt any 10 practicals

Qualitative Analysis

Total five radicals to be given containing two less common metal ions, one insoluble and 2 acid radicals

Less common metal ions ---- W, Tl, Mo, Se, Ti, Zr, Th, V, U, Ce, Be
Insolubles ---- Halides (AgCl, AgBr, AgI); Sulphates ($PbSO_4$, $BaSO_4$) and Oxides (Al_2O_3, Cr_2O_3, SnO_2, TiO_2, SiO_2)

Quantitative Analysis

Determination of metal ions using volumetric and/or gravimetric methods
Mg, Cr, Ni, Cu, Ca, Fe, Ba, Zn, Al

Preparations

Hg $[Co(SCN)_4]$
$Ni(dmg)_2$
$[Cu(NH_3)_4]SO_4.H_2O$
Prussian Blue and Turnbull,s blue
$Mn(acac)_3$
$[Ni(NH3)_6]Cl_2$
$VO(acac)_2$

Learning Outcomes:

1. Perform the Qualitative Analysis of inorganic compound
2. Difference between Quantitative and Qualitative Analysis
3. Able to synthesize the Hg [Co(SCN)4], Prussian Blue and Turnbull,s blue, [Ni(NH3)6]Cl2 compounds.

Assessment Model:

- Total Assessment Out of 30 Mark

Preferred Reading:

1. A text book of macro and semi micro quantitative analysis ,A.I.Vogel,
2. A vogel's Text Book of Quantitive Inorganic Analysis, J.Bassett, R.C.Denney, G.B. Jaffrey and J. Menaham, Longman , London
3. Synthesis and Characterisation of Inorganic compounds, W.B.Jolly, Prentice Hall,

Englewood
4. Synthesis and Physical studies of inorganic compounds, C.F.Bell, Pergamon Press
5. Inorganic Preparations, W.G.Palmer

Course Code	Course Title	L	T	P	Cr.
PCH-117 & PCH-164	**ORGANIC CHEMISTRY PRACTICALS**	**0**	**0**	**6**	**3**

Prerequisites: B.Sc					
Objective: 1. This course equips students to understand good laboratory practices and safety. 2. Create laboratory skills to link chemical structure to spectroscopic phenomena. 3. To carry out the separation organic compounds from binary mixture and to prepare their derivatives.					
Student has to attempt any 10 Practicals': 1. Purification of organic compounds involving fractional crystallization fractional distillation, steam distillation, sublimation and extraction. 2. Systematic identification of pure organic compounds: Separation and identification of simple binary mixtures having acidic, basic and neutral components, Preparations of their derivatives 3. Preparation of organic compounds involving two stages 4. Estimation of phenol and aniline. 5. Determination of the molecular weight of acid by titration and by the silver salt method					
Assessment Model: ▪ Total Assessment Out of 30 Mark					
Preferred Reading: 1. Vogel's Text book of practical organic chemistry, 5th Edition 2. Experiment organic Chemistry by H.Dupont Durst, George W. Gokel, McGraw Hill					

Course Code	Course Title	L	T	P	Cr.
PCH-118 & PCH-167	**Physical CHEMISTRY PRACTICALS**	**0**	**0**	**6**	**3**

Prerequisites: B.Sc

Objective:

1. This course equips the students to learn the physical chemistry practicals.
2. Create laboratory skills.
3. To carry out the handling of Conductometry, Potentiometry, Refractometry instrument etc and also to know their applications.

Student has to attempt any 10 practicals':

1. Determination of mol.wt. of high polymer by viscosity measurements
2. To determine the critical micelle concentration of a soap by surface tension measurements
3. To determine the equilibrium constant of the reaction $KI + I_2$ ---- KI_3 by distribution method
4. To investigate the adsorption of any acid from aqueous solutions by activated carbon
5. To construct the Phase diagrams of system of two components and three component system

Conductometry

6. Comparison of strengths of acetic acid and monochloroacetic acids
7. Determination of solubility of lead sulphate
8. Determination of degree of hydrolysis of NH_4Cl and CH_3COONa.
9. To study the kinetics of saponification of ethyl acetate by NaOH conductometrically
10. Conductometric titration involving precipitation

Chemical Kinetics

11. To study the kinetics of reaction between $K_2S_2O_8$ and KI. Determine the rate constant and order of reaction. Study the influence of ionic strength on the rate constant.
12. To study the kinetics of iodine clock reaction

Potentiometry

13. To set up galvanic cells and to measure their potentials
14. To determine potentiometrically heat of reaction, equilibrium constant and other thermodynamic functions of reaction : $Zn + Pb^{2+}$ ----- $Zn^{2+} + Pb$
15. Titration of oxalic acid, malonic acid and tartaric acid

pH metry:

16. Prepartion of buffer solution of various pH and determination of their pH values
17. Acid base titration

Polarimetry:

18. Determination of specific and molecular rotations
19. To study inversion of sugar/sucrose
20. Determination of percentages of two active substances in a solution by optical rotation method

Refractometry

21. Determination of refractive indices and specific refractions
22. Determination of concentration of a mixture of liquids refractometrically

Thermo chemical Measurements

23. Determination of heat of neutralization of HCl and NaOH
24. Determination of heat of solution of KNO_3 in water.
25. Determination of heat of hydration of sodium sulphate.

Assessment Model:

- Total Assessment Out of 30 Mark

Preferred Reading:

BD Khosla Text book of practical physical chemistry, 5th Edition.

SEMESTER –II

Course Code	Course Title	L	T	P	Cr.
PCH-161	**INORGANIC CHEMISTRY –II**	4	0	0	4

Prerequisites: B.Sc in Inorganic Chemistry

Objective: .

1. To enable the student to acquire a knowledge of the fundamentals of electrochemistry and extend their knowledge of inorganic chemistry.
2. This course provide the deep understanding of transition metal complexes

UNIT-I

Symmetry and Group Theory

Symmetry elements, point group determination, determination of reducible and irreducible representations, character tables, construction of character tables for C2v, C3v and D_{2h}, use of character table, Molecular asymmetry, dissymmetry and optical activity

UNIT-II

Reaction Mechanism of Transition Metal Complexes

Inert and labile complexes, kinetics of octahedral substitution. Acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, reactions without metal-ligand bond cleavage. mechanism of substitution reaction, Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus Hush Theory, inner sphere type reactions

UNIT-III

Metal Π–Complexes

Metal carbonyls, structure and bonding, important reaction of metal carbonyls. Preparation, bonding structure and important reactions of transition metal nitrosyl, di nitrogen and di oxygen complexes, tertiary phosphine as ligand

UNIT-IV

Nuclear and Radiochemistry

Radioactive elements, nuclear structure and nuclear stability, binding energy and stability of nuclei, nuclear models. Neutron activation analysis, Nuclear reactions: fission and fusion reactions, Q-value, Radioactivity, detectors and their principles. Radioactive tracer technique and their applications (in medical, agriculture and industry). Rock and carbon dating.

Learning Outcomes: On completion of this module, students are expected to be able to:

1. Demonstrate a knowledge and understanding of the underlying concepts of Inorganic Chemistry.
2. Apply the concepts of Inorganic Chemistry to solve a range of different chemical problems.
3. Demonstrate practical laboratory skills appropriate to the area of Inorganic Chemistry, working safely and carefully. Handle experimental data in a manner which demonstrates understanding of its significance.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks) –20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1. F.A. Cotton, Chemical Application of Group Theory, Wiley Eastern.

2. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, 3rd edition, Pearson Education.
3. B.N. Figgis, Introduction to Ligand Field, Wiley Eastern.
4. A.B.P. Lever, Inorganic Electronic Spectroscopy, Elsevier.
5. Earnshaw, Introduction to Magnetochemistry, Academic Press.
6. J.E. Huheey, Inorganic Chemistry Principles of Structure and Reactivity, Harper
7. Interscience.
8. R.S. Drago, Physical Method in Chemistry, W.B. Saunders Company.
9. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Inter- science.

Course Code	Course Title	L	T	P	Cr.
PCH-162	Organic chemistry-II	4	0	0	4

Prerequisites: B.Sc organic chemistry

Objective:

1. Organic chemistry plays an essential role in a large number of chemical industries.
2. The objectives of this program is to provide students with an advanced knowledge of areas of organic chemistry including industries based on natural products, pharmaceuticals, food & beverages, cosmetics, plastics and rubber etc., in order to improve productivity and enhance developments in Industry.

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Aromatic Electrophilic Substitution: Arenium ion mechanism, orientation and reactivity, energy profile diagrams, The ortho/para ratio, ipso attack, orientation in other ring systems. Diazonium coupling, Vilsmeir reaction, Scholl reaction, Amination reaction, Fries rearrangement,

Aromatic Nucleophilic Substitution: SNAr, SN1, benzyne and SRN1 mechanism. Reactivity, effect of substrate structure, leaving group and attacking nucleophile, Von Richter, Sommelet- Hauser, and Smiles rearrangements, Ullman reaction, Schiemann reaction.

UNIT-II

Stereochemistry

Stereochemistry: Basic concept in stereochemistry**,** Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity in acylic and cyclohexane systems. Steric strain due to unavoidable crowding. Enantiomer, diastereomers, Elements of symmetry: chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity, Optical activity due to chiral planes, Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), Asymmetric Synthesis: Principle and categories with specific examples of asymmetric synthesis including newer methods involving enzymatic and catalytic reactions,

UNIT-III

Oxidation: Different oxidative Processes Hydrocarbon-alkenes, aromatic rings, saturated C-H groups Alcohols, diols, aldehybes, ketones, ketals and carboxylic acids, amines, hydrazines, and sulphides.

Reduction: Different reductive processes Hydrocarbons-alkanes, alkenes, alkynes and aromatic rings carbonyl compounds-aldehyde, ketones, acids and their derivatives. epoxides. nitro, nitroso, azo and oxime groups. Hydrogenolysis.

UNIT IV

Rearrangements

A detailed Study of the following rearrangements, Benzil- Benzilic Acid, Favorskii, Arndt' Eistert synthesis, Neber, Beckmann, Curtius, Schmidt, Baeyer- Villiger, Shapiro reaction. Wagner-Meerwein, Pinacol-Pinacolone and Demjanov ring expansion and ring contraction

Learning Outcomes:

Upon successful completion of Organic Chemistry I, students will understand principles of organic compounds including, nomenclature, structure, functional groups, reactions, reaction mechanisms, and synthesis of organic molecules.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks) –20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Reaction mechanism in organic chemistry, S.M. Mukherji, S. P. Singh, MacMillion India, New Delhi.
2. Principles of Organic Synthesis – Norman and Coxon
3. Advanced Organic Chemistry – Jerry March.
4. Advanced Organic Chemistry, F.A . Carey, R.J. Sunberg.
5. Highlights of Organic Chemistry, W, J.L. Nobel; An Advanced Text Book.
6. Hand Book of Reagents for Organic Synthesis - Oxidizing and Reducing Reagents. S. D. Burke and R. L. Danheiser (John Wiley and Sons)
7. Organic Synthetic reactions by William Carruther

Web Resources:

Google, Journal of American chemical society, Journal of royal chemical society

Course Code	Course Title	L	T	P	Cr.
PCH-163	PHYSICAL CHEMISTRY-II	4	0	0	4

Prerequisites: B.Sc in Physical Chemistry

Objective:

1. Apply the basic concepts of calculus to concepts in chemistry.
2. Discuss the Three Laws of Thermodynamics and their development.
3. Use the Maxwell equations and other thermodynamic relations to compute thermodynamic quantities from thermodynamic data tables.
4. Be able to derive relationships between thermodynamic quantities.
5. Interpret phase diagrams and discuss phase equilibria in terms of chemical potentials.

UNIT-I

Quantum Chemistry

Postulates of quantum mechanics. Application of Schrodinger wave equation to particle in a box, simple harmonic oscillator and rigid rotator.

Approximate Methods: The variation theorem, Linear variation Principle, perturbation theory (first order, second order and Non degenerate), Applications of variation method and perturbation theory to the Helium atom. Self-Consistent-Field theory.

UNIT-II

Angular Momentum and MOT

Ordinary ang. momentum, generalized angular momentum,eigen functions for angular momentum, eigcuvalues of angular momentum, operator using ladder operators, addition of angular-momenta, spin, anti symmetry and Pauli exclusion principle.

Huckel theory of conjugated systems, bond order and charge density calculations, application to ethylene, allyl, butadiene, cyclopropenyl system, cylobutadiene etc.

UNIT-III

Chemical Thermodynamic-II

Gibb's and Helmholtz equation and its utility in thermodynamics of cell reaction. Chemical potential in case of ideal gases. Chemical equilibrium constant and its temperature dependence. Law of chemical equilibrium and its application. Clausius and Clapeyron equation and its application thermodynamic derivation of phase rule and its application to two component systems. Distribution law, its thermodynamic derivation and application

UNIT-IV

Theories of reaction rates: The kinetic theory of collisions, transition state theory, steric factor, transmission –coefficient, steady – state hypothesis / transient phase theory, Lindmans theory of unimolecular reaction, the thermodynamic formulation of reaction rates.

Learning Outcomes:

The student shall acquire increased knowledge of central fields in physical chemistry and be able to use this in practical work with chemical systems.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)
Preferred Reading: 1. Physical Chemistry, A Molecular Approach by MacQuarrie and Simon. 2. Quantum Chemistry, Ira N. Levine, Prentice Hall. 3. Quantum Chemistry, H. Eyring, Kimball and Walter. 4. Quantum Chemistry, Atkin. .

Course Code	Course Title	L	T	P	Cr.
PCH-164	CHEMISTRY OF ADVANCED MATERIALS	4	0	0	4

Prerequisites: Nil

Objective: To study the unique properties and applications of advanced Materials.

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Glasses and Composites

Glassy state, glass formers, and glass modifiers, application. composite, Nanocrystalline phase, preparation procedure, special properties, applications.

Liquid Crystals

Mesomorphic behaviour, thermotropic liquid crystal, positional order, bond orientational order, nematic and smectic mesophases, planar and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic C phases,

UNIT-II

PTC and Polymer supported reagents

PTC:- Introduction, mechanism of PTC, preparation of PTC (Macrocyclic ether, quaternary salts, Tetrahexyl ammonium bromide,hexadecyl tributyl phosphonium bromide) and application of PTC in synthesis.

Polymer Supported Reagent:-Introduction, determination of functionalization in polymer support, Applications,

UNIT-III

Nanomaterials

Introduction, Definition and Terminology, Synthesis and Characterisation technique, Consequences of the Nanoscale, One dimensional nanomaterials Two dimensional nanomaterials,Three dimensional nanomaterials, Grahhene, Carbon dot. Application of nanomaterials

UNIT-IV

High Tc Materials

Defect perovskites, high T_c superconductivity in Cuperates, preparation and characterization of 1-2-3 and 2-1-4 materials;

Supramolecular

Introduction, cryptands, cyclophanes, crown ethers, calixaerenes, cyclodextrines, spherands, siderophores, helicates, catenanes and rotaxanes.

Learning Outcomes:

The students will:

1. Have a consolidated knowledge of metallic elements and main groups, correlating atomic and molecular properties with the structural characteristics of their compounds, based on their use as functional materials in different applicative sectors.
2. Be able to determine and understand the static structure and dynamic nature of molecular interactions between superconductors, polymers, advanced ceramic materials, compound materials applied in the industrial and medical sector;

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

Solid State Physics, N.W. Ashcrofy and N.D. Mermin, Saunders college.
Material Science and Engineering, An introduction, W.D. Callister, Willey.
Principle of the Solid State, H.V. Keer, Willey Eastern.
Material Science, J.C. Anderson, K.D. Leaver, J.M. Alexander and R.D.Rawlings, ELBS
Thermotropic Liquid Crystals, Ed., G.W. Gray, John Willey.

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SEMESTER –III

Course Code	Course Title	L	T	P	Cr.
PCH-211	**Spectroscopic Techniques**	**5**	**0**	**0**	**5**

Prerequisites: B.Sc

Objective:

1. In Organic Chemistry, we use spectroscopy for structure elucidation of organic molecules.
2. Will be study Ultraviolet (UV) Spectroscopy and its applications.
3. To study about NMR instrument.

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Ultraviolet and Visible Spectroscopy

Principal, Instrumentation, Electronic transitions, Beer-Lambert law, effect of solvent on electronic transition, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Fieser- Woodwared rules for conjugated dienes and carbonyl, ultraviolet spectra of aromatic and heterocyclic compounds.

UNIT-II

Nuclear Magnetic Resonance (NMR) Spectroscopy: General introduction, Principal, theory of ^{1}H NMR spectroscopy, chemical shift and its factors, Hydrogen bonded to hetero-atom, chemical exchange, spin-spin coupling, n+1 rule, pascal triangle, double resonance, Interpretation of ^{1}H NMR spectra, ^{13}C NMR spectroscopy, no of signals in carbonyl carbon, aromatic carbon, olefinic carbon, acetylenic carbon, aliphatic carbon, 2D NMR, COSY, NOESY, DEPT, APT and INADEQUATE. Problems using IR and NMR data.

UNIT-III

Infrared and Raman Spectroscopy

Instrumentation and sample handling. Stretching, bending, Hook law, hydrogen region, triple bonded region, double bond region, vibrational frequencies of anhydrides, acid halides, esters, cyclic ester, aldehydes lactones, carboxylic acid, amides, hydrogen bond, conjugation, Effect of hydrogrn bonding, solvent effect on vibrational frequencies, Interpretation of IR spectra of organic compound.

Raman Spectra: Raman effect, Principle, Rotational Raman Spectra, Rule of mutual exclusion

UNIT-IV

Electron Spin Spectroscopy

Principal, Instrumentation, Hyperfine splitting constant, comparison to proton NMR, calculation of number of EPR lines and intensity ratio, Drago rule, g value, Kramer degeneracy, Calculation of ESR spectra of metal complexes.

Mass spectroscopy

Introduction, molecular ions peak, mass to charge ratio, nitrogen rule, nature abundance of common isotopes, alpha cleavage, Mclafferty rearrangement, fragmentation of organic compounds, Various techniques and instrumentation such as EI, CI, ESI, APEI, high resolution mass spectrophotometry, structural elucidation of organic compounds based on IR, NMR, UV and mass spectra.

Learning Outcomes:

1. Discuss similarities and differences between spectrometry and spectroscopy.
2. Identify the basic components of spectroscopic instrumentation.
3. Demonstrate a working knowledge of mass spectroscopy (MS), ultraviolet-visible (UV-Vis) spectroscopy, infrared (IR) spectroscopy, and nuclear magnetic resonance (NMR) spectroscopy.
4. Describe how a mass spectrometer produces its spectral patterns.
5. Explain the information obtained from a UV-Vis spectrophotometer and how it can be used for analysis.
6. Illustrate the mechanisms that give rise to the infrared absorption bands and identify to which functional groups each correspond.
7. Demonstrate an understanding of the processes responsible for NMR chemical shifts and splitting patterns.
8. Elucidate the structures of organic molecules from spectral data.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

W. Kemp. Organic Spectroscopy.
D.H. Williams and I. Fleming. Spectroscopic Methods in Organic Chemistry.
R.M. Silverstein & G.C. Bassler, Spectrometric Identification of Organic Compounds.
R.C. Banks, E.R. Matjeha and G. Mercer, Introductory Problems in Spectroscopy.
Introduction to Spectroscopy – Pavia
E.A.V Ebsworth; W.H Renkin; Cradock, Structure Methods in Inorganic Chemistry.
R.S Drago, Physical Methods for Chemists (Ist and IInd Edition).
C.N Banwell, Fundamentals of Molecular Spectroscopy.
. S. Walker and H. Straugh an Spectroscopy, Vol.I.
J.E. Wertz & J.R. Bolton, Electron Spin Resonance (p.49-65).
N.N. Greenwood & T.C Tibb, Mossbauer Spectroscopy.
K. Nakamoto, Infrared Spectra of Inorganic and co-ordination Compounds

Web Resources:

Google, Journal of American chemical society, Journal of royal chemical society

Course Code	Course Title	L	T	P	Cr.
PCH-212	**ANALYTICAL CHEMISTRY**	**5**	**0**	**0**	**5**

Prerequisites:Nil

Objective:

1. Common understanding of analytical methodology available for contaminated land investigations.
2. Industry standards for laboratory service and data deliverables.
3. Industry standards for performing data validation and interpretation.

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Electroanalytical methods of analysis

Electrogravimetry: current voltage relationship during an electrolysis, decomposition potential, constant current electrolysis, apparatus, electrodes, mercury cathode, applications, physical properties of electrolytic precipitates.

Cyclic voltammetry

Polarography: general principles, diffusion controlled current, half wave potentials, over potential, theories of hydrogen overvoltage

UNIT-II

Photometric methods

Atomic absorption spectroscopy

General principles, resonance line, its natural width, Doppler's effect, broadening due to pressure, hollow cathode lamp.

Flame Photometry

Theory of flame photometry, flame temperature, emission flame photometry, intensity of spectral lines, selection of optimum working conditions.

UNIT-III

Inorganic Photochemistry

Photochemistry and its relevance. Introduction to photophysical laws. Quantum yield. Photophysical processes in electronically excited molecules. Photochemical processes. Ligand field photochemistry of Cr, Co and Ru complexes. Quenching and stabilization processes of coordination compounds.

UNIT-IV

Chemistry of Main Group Elements

Zintl cations and anions, their structure, Interhalogen compounds and their utility as synthetic precursers. Pseudohalides. Recent development in the chemistry of noble gas compounds. Chemistry of polycations of chalcogens and halogens (preparation, structure and bonding).

Learning Outcomes*: At the end of this course, students should be able to:*

1. Understand the principle of analytical chemistry.
2. Understand the procedures and applications of the analytical techniques.
3. Use statistical method for evaluating and interpreting data.
4. Understand the principles of chromatographic methods.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. A text book of quantitative inorganic analysis, A.I. Vogel. ELBS, London
2. Fundamentals of analytical chemistry, D.A.Skoog, O.M.West and F.J.Holler, W.B.Saunders
3. Instrumental Methods of analysis, L.L.Merrit, R.H. Willard and J.A. Dean, Van Nostrand-Reinhold
4. Relaxation methods, H.Strehlow and W. Knowkhe, Springer-Verlag
5. Chemical Kinetics Methods-Principles of relaxation techniques and applications, C.Kalidas,New age international,
6. Modern Optical methods of analysis, E.D.Olgen, McGraw Hill

Course Code	Course Title	L	T	P	Cr.
PCH-213	INORGANIC CHEMISTRY SPECIAL-I	5	0	0	5

Prerequisites:
- General chemistry, - Inorganic Chemistry or similar courses

Objective:

1. To provide a well-integrated advanced level inorganic course, using chemical compounds to illustrate new experimental techniques for structure and mechanism elucidation.
2. To extend the descriptive chemistry of d- and f-block elements.
3. To improve the student's ability to critically assess the current literature.
4. To consolidate a knowledge of solid state chemistry.
5. To expand the awareness of the applications of modern instrumental techniques to the study of inorganic and organometallic compounds.
6. To introduce the student to topics of current importance in inorganic chemistry.
7. To introduce the student to the synthesis and applications of inorganic polymers

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-ICompounds of Transition Metal-Carbon Multiple Bonds

Alkylidenes, alkylidynes, low valent Carbenes and carbynes-Synthesis, nature of bond, Structural Characteristics, nucleophilic and Electrophilic reaction on the ligands, role in organic synthesis

Transition Metal Compounds with Bonds to Hydrogen

Transition metal Compounds with bonds to hydrogen

UNIT-II

Transition Metal Complexes

Transition Metal Complexes with unsaturated Organic molecules, alkenes, alkynes, Allyl, diene, dienyl, arene and trienyl complexes, preparations, properties, nature of bonding and structural features importantreactions relating to nucleophilic and electrophilic attack on ligands and to organic synthesis.

UNIT-III

Alkyls and Aryls of Transition Metals

Types, routes of synthesis, Stability and decomposition Pathways, organocopper in Organic Synthesis

Fluxional organometallic compounds

Fluxionality and dynamic equilibria in compounds such as η^2 olefin, η^2 Allyl and dienyl Complexes

UNIT-IV

Homogeneous Catalysis

Stoichiometric reaction for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerization of olefins, catalytic reations involving carbon monoxide such as hydrocarbonylation of olefins (oxo reaction) oxopalladation reactions, activation of C-H bond.

Learning Outcomes: On successful completion of this course, the students:

1. Will have a broad knowledge of the principles and concepts of contemporary inorganic

chemistry.

2. Can discuss and define the chemical properties of main group compounds.
3. Can elucidate the electronic structure of a variety of metal complexes.
4. Can describe the various instrumental techniques.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. J.E. Huheey : Inorganic Chemistry III & IV Ed. Pearson Education Asia – (2002).
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 5^{th} Edition.
3. Progress in Inorganic Chemistry, Vols 18 and 38 Ed. J. J. Lippard, Wiley.
4. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, 3^{rd} edition, Pearson Education.

Course Code	Course Title	L	T	P	Cr.

PCH-214	**ORGANIC CHEMISTRY SPECIAL-I**	**5**	**0**	**0**	**5**

Objective:

1. Natural Product chemistry is a course which is intended to provide students with the nature and classes of natural products.
2. Natural products have been a fertile area of chemical investigation for many years, driving the development of both analytical chemistry and of new synthetic reactions and methodologies. Many of the most important synthetic reactions in chemistry have been developed in the quest to characterise and synthesise these materials.

The question paper will consist of 8 questions. Student has to attempt total five questions at least one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT I

Natural Product: Classification, general method of isolation and structure determination

Alkaloids: Chemistry and synthesis of Atropine, Morphine, Nicotine, Quinine and ephedrine.

UNIT II

Terpenoids and Carotenoids: Structure determination and synthesis of citral, geraniol, camphor, farsenol,santonin.

Steroids: Isolation, structure determination and synthesis of Cholesterol, testosterone, progesterone.

UNIT III

Drug Design: Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structure-activity relationship (SAR), factors affecting bioactivity, resonance, inductive effect. Theories of drug activity: occupancy theory, rate theory, induced fit theory.

Central Nervous system: Anaesthetic (Local & general), Analgesics, Sedative & hypnotic Tranquilizers (Major & Minor), Antiepileptics, Anticonvulsants, CNS stimulants & activators

UNIT IV

Antibiotics and Antiinfective Drugs: penicillin: penicillin G, penicillin V, ampicillin, amoxicillin,chloramphenicol, cephalosporin, tetracycline and streptomycin.

Sufonanmides: sulfonamide inhibition and probable mechanisms of bacterial resistance to sulfonamides.

Diuretics: Mercurial diuretic, Non mercurial diuretics (Thiazides, carbonic-anhydrase inhibitors, xanthine derivatives, pyrimidine diuretics and osmotic diuretics

Learning Outcomes:

Upon completion of this course, students will be highly equipped to answer questions below and related ones:

1. What do natural products represent?
2. What are the different type, chemical nature and features of natural products?
3. Know different classification of natural products
4. Identify the examples of terpenes, steroids and alkaloids.
5. Discuss the application of terpenes, steroids and alkaloids.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks

- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Natural products: Chemistry and Biological significance – J. Madd, R. S. Davidson, J. B. Hobbs, D.V. Banthrope.
2. Organic chemistry, Vol 2., - I..L. Finar.
3. Stereoselective synthesis: A practical approach - M. Nogradi.
4. Chemistry, Biological and Pharmacacological properties of medicinal plants from the Americas - Ed. Kurt, M. P. Gupta and A. Marston.
5. New trends in Natural product chemistry – Alta – Ur- Rahman and M.I. Choudhary.

Web Resources:

Google, Journal of American chemical society, Journal of royal chemical society

Course Code	Course Title	L	T	P	Cr.
PCH-215	**PHYSICAL CHEMISTRY SPECIAL-I**	5	0	0	5

Prerequisites: B.Sc Chemistry

Objective:

1. Distinguish between: metallic conduction and electrolytic (ionic) conduction; oxidation and reduction; electrolytic cells and voltaic cells; anode and cathode.
2. Understand the general concepts of electrolysis.
3. Given the components of the electrodes and observations of what happens at the electrodes when an electrolytic cell is in operation, be able to do the following: Describe the operation of the cell; write balanced oxidation and reduction half-reactions; write balanced chemical equations for the overall reaction; construct a simplified diagram of the cell, including designation of anode and cathode, positive and negative electrode, direction of electron flow in the external circuit, and direction of migration of ions within the cell.
4. Understand Faraday's Law of Electrolysis; perform calculations to relate the amount of electricity passing through an electrolytic cell to the amount (mass or gas volume) of a specified reactant consumed or product formed in the cell. Relate this information to the charge or atomic weight of an ion consumed or produced.
5. Describe the process of electrolytic refining of impure metals.

UNIT-I

Symmetry and group theory:

Symmetry elements & symmetry operation, definitions of group, subgroup, relation between orders of a finite group & its sub groups. Point group symmetry. Representations of groups by matrices (representation for the Cn, Cnv, Cnn, Dnn etc. group) character of a representation. The great orthogonality theorem and its importance character tables and there use-in spectroscopy.

UNIT-II

Electronic properties and Band Theory: Metals, insulators and semiconductors, electronic structure of solids-band theory of metals, insulators and semiconductor. doping semiconductors, p-n junctions, superconductors. Optical properties-Optical reflectance, photoconduction-photoelectric effects. Magnetic properties-Classification of materials: Quantum theory of paramagnetics- cooperative phenomena-magnetic domains, hysteresis.

UNIT-III

Polymers: Macromolecular Concepts, Importance of polymers, Chemical and geometrical structure of polymers, Polymerization: Chain polymerization, step growth polymerization, electrochemical, met, Concept of copolymerization, , Kinetics of chain and step growth polymerization. sedimentation velocity, sedimetation equilibrium and viscosity. Light scattering and small angle X-ray scattering.

UNIT-IV

Molecular Photochemistry

An overview: transition between states (chemical, classical and quantum dynamics, vibronic states),potential enrgy surfaces, transition between potential energy surfaces, The Franck Codon Principle and radiative transitions, A classical model of radiative transitions. The absorption and emission of light-state mixing, Spin orbital coupling, Spin forbidden radiative transitions, absorption complexes, delayed fluorescence and phosphorescence.

Photophysical Radiationless Transitions: Wave mechanical interpretation of radiationless transition

b/w state factor that influences the rate of vibrational relaxation.Theory of radiationless

Learning Outcomes:

1. Highlighting the use of electrochemical techniques to obtain mechanistic and kinetic information.
2. Illustrating the practical importance of electrochemistry for solving challenges such as improving the environment and the monitoring of biologically important substrates.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

Chemical kinetics, K. J. Laidler, Macgraw-Hill.
Kinetics and Mechanisms of chemical transformation, J. Rajaraman and J. Kuriacose, McMilan.
Modern electrochemistry Vol. 1 and Vol. 2, J. O. M. Bockris and A. K. N. Reddy, Plenum
Fundamentals of electro analytical chemistry, P. Monk.

Course Code	Course Title	L	T	P	Cr.
PCH-216	INORGANIC CHEMISTRY PRACTICALS	0	0	6	3

Prerequisites: B.Sc

Objectives:

This course equips the students with analytical chemistry practical's and spectroscopic instrumentation.

Student has to attempt any 10 practicals

Preparations

1. Chloropentaamminecobalt (III) chloride
2. Nitritopentaamminecobalt (III) chloride
3. Nitropentaamminecobalt (III) chloride
4. Hexaamminecobalt (III) chloride
5. Tristhiourea (I) sulphate
6. Trioxalato ferrate (III)
7. Chromousacetate dehydrate
8. Potassiumdioxalatocuprate (II) dehydrate
9. Tristhiourea-cuprous (I) sulphate
10. Ammonia tetrathiocyanatodiamine chromate (III)
11. Lead chromate
12. Potassiumtetrathiocyanatocobaltate
13. Sulphatopentaamminecobalt (III) bromide

Instrumentation

1. Spectrophotometric determinations
2. Conductometric titrations
3. Potentiometric titrations
4. pH analysis

Quantitative analysis

Quantitative analysis of elements or groups in the complexes, mixtures, ores, alloys etc. by available analytical techniques.

Assessment Model:

- Total Assessment Out of 30 Mark

Preferred Reading:

1. A vogel's Text Book of Quantitive Inorganic Analysis, J.Bassett, R.C.Denney, G.B. Jaffrey and J. Menaham, Longman , London
2. Synthesis and Characterisation of Inorganic compounds, W.B.Jolly, Prentice Hall, Englewood
3. Synthesis and Physical studies of inorganic compounds, C.F.Bell, Pergamon Press
4. Inorganic Preparations, W.G.Palmer

5. Synthesis and Physical studies of inorganic compounds, C.F.Bell, Pergamon Press
6. Inorganic Preparations, W.G.Palmer

Course Code	Course Title	L	T	P	Cr.
PCH-217	ORGANIC CHEMISTRY PRACTICALS	0	0	6	3

Prerequisites: B.Sc

Objectives:

1. This course equips the students with organic chemistry practical's.
2. Will be able to handle the colorimetrc technique.
3. Perform the qualitative Analysis.

Student has to attempt any 10 practicals

Qualitative Analysis

Separation of compounds of binary (liquid-liquid, liquid-solid or solid-solid) organic mixture using physical and chemical methods and characterization of the components with the help of chemical analysis and confirmation of their structures with help of IR and PMR spectral data (IR and PMR spectra to be provided)

Preparations of organic compounds

Preparation of organic compounds involving two or three stages*:* isolation and purification of natural products

Techniques of purification and separation*:* separation of mixtures using TLC, vacuum distillation and sublimation

Quantitative estimation of the following

Amino group, hydroxyl group, acetoxy group, carbonyl group, unsaturation, reducing and non-reducing sugars, saponification value and iodine value of fats and oils, formalin and glycine

Colorimetrc determination of the following

Carbohydrates, ascorbic acid, amino acids, proteins, cholesterol urea

Assessment Model:

- Total Assessment Out of 30 Mark

Preferred Reading:

1. A Textbook of vogel's practical organic chemistry by Longman Group, B.S.Furness et.al. ltd.
2. Experiments in organic chemistry, Louis Fieser, O.C.Heth and company Boston, 1955.
3. Ahandbook od organic analysis qualitative and quantitative , by H.T.Clarke and revised by B.Maynes, Edward Arnold (Pub.), Ltd. London, 1975
4. Systematic Qualitative organic analysis, by H.Middleton, Edward Arnold (Publishers) Ltd., London 1959
5. Practical organic chemistry by Mann and Saunders.

Course Code	Course Title	L	T	P	Cr.
PCH-218	PHYSICAL CHEMISTRY PRACTICALS	0	0	6	3

Prerequisites: B.Sc

Objectives:

1. Students Will be able to explore their laboratory skill with respect to industrial purpose.

Student has to attempt any 10 practical's

Potentiometry

1. Determination of activity coefficient of Ag^+ in a solution of silver nitrate and to study the effect of potassium nitrate on thr activity coefficient of silver nitrate.
2. Determination of the cell Pt, H_2\HCl, AgCl/Ag with various concentrations of HCl and to obtain the activity coefficient of HCl
3. Determination of solubility of silverh alides in water
4. Determination of first and second ionization constant of phosphoric acid
5. Study of silver-ammonia complex and determination of the stability constant
6. Determination of strength of ferrous ammonium sulphate using potassium dichromate or ceric sulphate and determination of redox potential
7. Determination of strength of HCl and CH_3COOH in a mixture using NaOH
8. Titration of waek/strong acid with strong base using quinhydrone and determination of dissociation constant of the acid
9. Titration of HCl and CH_3COOH, H_3PO_4 acid against NaOH and of aniline with acetic acid using hydrogen electrode
10. Study of equilibrium constant of the reaction $Fe^{3+} + Ag$ ------ $Fe^{2+} + Ag^+$
11. Determination of transport numbers and effect of concentration of copper, zinc and silver ions
12. Determine degree of hydrolysis of aniline hydrochloride
13. Titration of halides with AgNO3 individually and in the mixture of two halides
14. Determination of liquid junction potential

Chemical Kinetics

15. Determination of velocity constant of the reaction of ethyl acetate with NaOH and activation energy and temperature coefficient of the reaction.
16. Determination of the velocity constant and energy of activation of the reactions between H_2O_2 and HI.
17. Investigation of the reaction between acetone and iodine (with respect t H*, I_2 and acetone.
18. Determination of the velocity constants of the decomposition of benzene diazonium chloride at different temperatures.
19. Determine of the order and velocity of the reaction between potassium persulphate and potassium iodide.

Conductometry

1. Determination of the equivalent conductance of week solid (succinic, benzoic, maleic

and acetic acid) at several concentrations and the dissociation constant of the acid.

2. Determination of the equivalent conductance of strong electrolytes such as HCl, KCl, KNO_3, $AgNO_3$ and NaCl and the validity of Onsagar equation.
3. Determination of solubility of lead sulphte and silver halides.
4. Study of degree of hydrolysis of aniline hydrochloride.
5. Study the variation of conductivity of HBr and H_2SO_4 in glacial acetic acid.
6. Conductometric titration of ; (i) strong acid vs. strong base, (ii) strong acid vs. weak base, (iii) week acid vs. strong base, (iv) weak acid vs. weak base, (v) NH_4Cl vs. NaOH, (vi) CH_3COONa vs. HCl, (vii) $MgSO_4$ vs. $Ba(OH)_2$, (VIII) NH_4OH vs. CH_3COONa and (ix) $CH_3COOH + NH_4OH$) vs. NaOH.

pH-metry

7. Preparation of buffer solution of various pH and the determination of their pH their pH values.
8. pH-titratioins of: (i) acetic acid vs. BaOH, (II) hydrochloric acid vs. naOH, (III) acetic acid vs ammonium hydroxide and (iv) HCI vs. NH_4 OH.
9. Determination of the degree of hydrolysis of aniline hydrochloride.
10. To find dissocation constants of weak acids.

Colorimetry/Spectrophotometry

11. Verification of the Lambert-Beer's law using solutios such as I_2 in CCI_4, $K_2Cr_2O_7$, $CuSO_4$ and $KMnO_4$ in water.
12. Study of iron – tiron andiron-salicylic acid complexes.
13. Study of the formation of dichromate ion.
14. Study of the formation of complex between nickel and orthophenanthroline.
15. Determination of the composition of various mixtures spectrophotometrically: (i) crystal violet and aurine and (ii) Potassium dichromate and potassium permanganate.
16. Study of infrared absorption spectra of solution of para nitrotoluene in CS_2 and to test the validity of Lambert-Beer's law.

Dielectric Constant and dipole Moment

1. Determination of dielectric constants of some organic liquids and composition of unknown mixtures.
2. Determination of dipole moments of some organic liquids.

Refractometry

3. Find the molar refractivity of benzene, toluene and propyl alcohol and CH2 group of homologous series
4. Refractometric determination of the composition of solutions

Polarography

5. To determine the dissolved oxygen in aqeous solution of organic solvent
6. Determination of half wave potentials of some cations in aqueous and in non aqueous

solutions

7. Determination of half wave potentials of ions in mixtures
8. Amperometric titrations involving : (i) Pb $(NO_3)_2$ VS $K_2Cr_2O_7$ and (ii) Pb $(NO_3)_2$ vs K_2SO_4
9. Study of the complex formation between (i) Cd and ammonia and (ii) Cu and ammonia

Polarimetry

10. Determination of relative strength of acids by study of inversion of sucrose
11. Determination of velocity constant of mutarotation of glucose in presence of acid or alkali

Interferrometry

12. Determination of speed of sound of pure liquids/ mixtures using interferometer

Flame Photometry

13. Determination of Na, K , Ca, Mg ions in tap water

Assessment Model:

- Total Assessment Out of 30 Mark

Preferred Reading:

1. Practical Physical chemistry, A.M.James and F.E.Prichand, Longman
2. Findley Practical Physical Chemistry, B.P.Lavitt, Longman
3. Practical Physical Chemistry, S.R.Palit and S.K.De
4. Experimental physical chemistry, R.C.Das and B.Behera, Tata McGraw Hill

SEMESTER-IV

Course Code	Course Title	L	T	P	Cr.
PCH-261	**BIOINORGANIC AND ENVIRONMENTAL CHEMISTRY**	5	0	0	5

Prerequisites: B.Sc

Objective:

1. To gain an understanding of which metals are found in biological systems and why.
2. To learn about the structure and function of several enzymes that activate small molecules.
3. To learn about the goals and methods of chemists that aim to mimic biological systems.
4. To learn about selected organometallic and inorganic complexes that do a good job of mimicking biological catalysis.

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Transport and Storage of Dioxygen

Oxygen carriers-Hb and Mb: Structure and mechanism of their function, cooperativity, inhibition and poisoning by ligands and metal ions, hemocyanins and hemerythrin

Biochemistry of Iron

Availability of iron, competition for iron, storage transport of iron: Transferrin, ferritin, absorption and exchange of iron, iron toxicity and nutrition, Na^+/ K^+ ion pump.

UNIT-II

Photosynthesis and Photophosphoryltion

Cholorophyll: structure, function, photosystem I and II in cleavage of water, cyclic and non-cyclic photophosphorylation

Bioredox Agents and Mechanism

Enzymes and their functioning, Vitamin B_{12} coenzyme, its function and application, intake of alcohol and its remedy.

UNIT-III

Nitrogenase

Biological N_2 fixation, molybdenum nitrogenase.

Metals in Medicine

Metal deficiency and disease, toxic effects of metals, chelation therapy, role of gold and its compounds in chemotheraphy, synthetic metal chelates as antitumor, anticancer drugs.

UNIT-IV

Environmental Chemistry

Chemical composition of water bodies-lakes, streams, rivers and wet lands etc. Hydrological cycle. Aquatic pollution – inorganic, organic, pesticide, agricultural, industrial and Sewage, detergents, oil spills and oil pollutants.

Water Quality parameters – Dissolved oxygen, biochemical oxygen demand, solids, metals, content of Chloride, sulphate, phosphate, nitrate and micro-organisms. Water quality Standards. Analytical methods for measuring BOD, DO, COD, F, Oils, metals (As, Cd, Cr, Hg, Pb, Se etc.), residual chloride and chlorine demand. Purification and treatment of water.

Learning Outcomes: Students will be able to:

1) know the essential chemical elements in biological system
2) recognize the biological metal ion complexation
3) learn the fundamental biochemistry
4) know the basic structure of the hemoglobin and myoglobin
5) choose model compounds for the biologically important molecules.
6) discuss about the structure of the enzymes.
7) discuss critically the role of relevant inorganic species in living organisms.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Principles of Bioinorganic Chemistry, S. J. Lippard and Berg, University Science books.
2. J.E. Huheey : Inorganic Chemistry III & IV Ed. Pearson Education Asia – (2002).
3. Inorganic Biochemistry, Vol I and II. Ed. G. L. Eichhorn, Elsevier.
4. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 5^{th} Edition.
5. Progress in Inorganic Chemistry, Vols 18 and 38 Ed. J. J. Lippard, Wiley

Course Code	Course Title	L	T	P	Cr.
PCH-262	**ORGANIC SYNTHESIS**	**5**	**0**	**0**	**5**

Prerequisites: B.Sc Organic Chemistry

Objective:

1. Students are introduced to the theoretical models of the dynamics of light-induced electron transfer and applications to several exemplary cases.
2. They will master the principles of photoredox processes taking place at the surface of solids and current technological applications and get familiar with most recent advances in the fields of photochemical enrgy conversion and data recording.

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Pericyclic Reaction

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene, 1, 3, 5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions conrotatory and disrotatory motions 4n, 4n +2 and allyl system. Cycloadditions-antarafacial suprafacial additions, 4n and 4n+2 systems, 2+2 additiion of ketenes, 1, 3-dipolar cycloadditions and cheleotropic reactions.Sigmatropic rearrangements-Suprafacial and antarafacial shifts of H.Sigmatropic shifts involving carbon moieties, [3, 3]-and [5, 5]- sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangement. Fluxional tautomerism. Ene reaction.

UNIT-II

Photochemistry: Introduction and Basic principles of photochemistry, Interaction of electromagnetic radiations with matter. Singlet and Triplet states, Types of excitations, fate of excited molecules (Jablonski diagram), transfer of excitation energy, Laws of photochemistry, Franck-Condon principle, Mechanism of Photochemical Reactions**:** quantum yield, Sensitisation and Quenching. Photo Fries rearrangement.

UNIT-III

Photochemistry of alkenes: cis-trans isomerization of alkenes, conjugated dienes and cycloalkenes, dimerization of alkenes, photochemistry of conjugated olefins, di-pi-methane rearrangement, photo-oxidation of alkenes and polyenes.

Photochemistry of Aromatic compounds: Photo valence isomerisation reactions, addition and substitution, Photochemistry involving molecular oxygen, generation and reactions of singlet oxygen. photo-reduction of aromatic hydrocarbons, Photo-fragmentation reactions (Barton, Hofmann-Loffler-Freytag).

Photochemistry of Carbonyl compounds Norrish Type I and II, Intermolecular and Intramolecular hydrogen abstraction, Paterno-Buchi reaction, α and β- cleavage reactions of cyclic and acyclic carbonyl compounds,

UNIT-IV

Reagents in Organic Synthesis: Synthesis and applications of BF3, NBS, Diazomethane, Lead tetra-

acetate, Osmium tetraoxide, Woodward Prevorst hydroxylation reagent, Grignard reagent, organozinc, Willkinson catalyst, LiAlH4, Lithium dialkyl cuprates, Lithium diisopropylamide (LDA), Dicyclohexylcarbobiimide (DCC), and SeO2, Baker yeast.

Learning Outcomes:

Upon successful completion of this course, students should be able to:

1. Demonstrate an understanding of excited states and apply group theory to photochemical problems
2. Explain natural and anthropogenically derived photochemical phenomena
3. Describe and apply photochemical reactions of certain homologous series of organic compounds
4. Analyze, discuss, conduct and defend their own investigation into a photochemical phenomenom
5. Critically evaluate photochemical theories and literature

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Organic Photochemistry – Chapman and Depuy.
2. Organic Photochemistry – W.H. Horsepool.
3. Photochemistry of Excited States – J.D.Go

Web Resources:

Google, Journal of American chemical society, Journal of royal chemical society

Course Code	Course Title	L	T	P	Cr.
PCH-263	**INORGANIC CHEMISTRY SPECIAL-II**	5	0	0	5

Prerequisites: Nil

Objective:

1. To gain an understanding of which metals are found in biological systems and why.
2. To learn about the structure and function of several enzymes that activate small molecules.
3. To learn about the goals and methods of chemists that aim to mimic biological systems.
4. To learn about selected organometallic and inorganic complexes that do a good job of mimicking biological catalysis.

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Electroanalytical methods of analysis

Electrogravimetry: current voltage relationship during an electrolysis, decomposition potential, constant current electrolysis, apparatus, electrodes, mercury cathode, applications, physical properties of electrolytic precipitates, chemical factors of importance in electrodeposition

Coulometric analysis: coulometric methods of constant electrode potential, coulometric titrations, apparatus and applications

Amperometric titrations

Anodic stripping voltammetry

Cyclic voltammetry

Polarography: general priniciples, diffusion controlled current, Ilkovic equation (without proof), half wave potentials, overpotential, theories of hydrogen overvoltage

UNIT-II

Photometric methods

Atomic absorption spectroscopy

General principles, resonance line, its natural width, Doppler's effect, broadening due to pressure, hollow cathode lamp, application to alkali and alkaline earth metals,

Flame Photometry

Theory of flame photometry, falme temperature, emission flame photometry, intensity of spectral lines, selection of optimum working conditions, applications in trace metal analysis

UNIT-III

Inorganic Photochemistry

Photochemistry and its relevance. Introduction to photophysical laws. Quantum yield. Photophysical processes in electronically excited molecules. Photochemical processes. Ligand field photochemistry of Cr, Co and Ru complexes. Quenching and stabilization processes of coordination compounds.

UNIT-IV

Chemistry of Main Group Elements

Zintl cations and anions, their structure, Interhalogen compounds and their utility as synthetic precursers. Pseudohalides. Recent development in the chemistry of noble gas compounds. Chemistry of polycations of chalcogens and halogens (preparation, structure and bonding).

Learning Outcomes:

1. Discuss the chemistry of noble gas compounds
2. Knowledge of a variety of Inorganic Photochemistry
3. To develop an understanding of the importance and advantages of AAS and flame photometery.
4. Carry out Electroanalytical methods of analysis of compounds.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Inorganic chemistry, K.F.Purcell , J.C.Kotz, Holt-Sanders, International Editions.
2. Principles and application of organotransition metal chemistry, J.P.Collman,L.S.Hedsdus,
3. J.R.Norton and R.G.Finke, University Science Books.
4. Organo metallic Chemistry, R.C. Mehrotra and A. Singh, New Age International
5. The Organometallic Chemistry of the Transition metlas, R.H.Crabtree, John Wiley

Course Code	Course Title	L	T	P	Cr.
PCH-264	**ORGANIC CHEMISTRY SPECIAL-II**	**5**	**0**	**0**	**5**

Prerequisites: B. Sc in chemistry

Objective:

To teach development of heterocyclic compounds

To teach fundamental principles of asymmetric synthesis

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Introduction and Nomenclature of Heterocycles: Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic, fused andbridged heterocycles.**Three membered ring with one heteroatom:** Oxirane, Aziridine, Thirane: Introduction; Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reactions; Nucleophillic and Electrophillic ring opening and General chemical reactions.

UNIT-II

Five membered Heterocyclic with two heteroatoms: ,Pyrazole, Imidazoles, Isoxazole, Oxazole, Isothiazole and Thiazoles: Introduction, Structure, Synthetic method, Electrophillic and Nucleophillic reactions

UNIT-III

Six membered Heterocyclic with one and two heteroatoms: Introduction: pyridine, Pyridazine, Pyrimidine, Pryazine. Synthetic approaches. Chemical reactions; Electrophillic substitution, Nucleophillic substitution, Side chain reactivity.

UNIT-IV

Benzo-Fused Heterocycles: Synthesis, reactions and medicinal applications of benzopyrroles, benzofurans, benzothiophenes, quinoline, isoquinoline

Learning Outcomes:

A systematic understanding and knowledge of the main areas of medicinal chemistry.

A critical awareness of the role of medicinal chemistry and the future development of the subject.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Wilson and Gisvsld's Textbook of Organic Medicinal & Pharmaceutical Chemistry, Ed. Robert F. dorge.
2. The Organic Chemistry of drug design and drug action, R. B. Silverman.
3. Strategies for organic drug synthesis & design, D. Lednicer John Wiley.
4. Principles of Medicinal Chemistry, William O. Foye, Lippincott, William and Wilkins.
5. Total synthesis of Natural products, Apsimon (Series).

6. Textbook of Medicinal Chemistry by A. Kar, Asian Age. Publication.
7. Pharmaceutical substances by A. Kaleemann & Engle.

Web Resources:
Google, Journal of American chemical society, Journal of royal chemical society

Course Code	Course Title	L	T	P	Cr.
PCH-265	**PHYSICAL CHEMISTRY SPECIAL-II**	5	0	0	5

Prerequisites: B.Sc Chemistry

Objective:

1. This course will provide the deep understanding of role of spectroscopy in physical chemistry and radiation chemistry

The question paper will consist of 8 questions. Student has to attempt total five questions atleast one question from each Unit and not more than two questions from each unit. All questions carry equal marks.

UNIT-I

Pure Rotational Spectroscopy: Classification of molecules according to their moment of inertia. Rotational spectra of diatomic molecules (rigid rotator), Intensities of spectral lines, isotopic substitution effects, non-rigid rotator, polyatomic linear and symmetric top molecules, Stark effect.

UNIT-II

Electron Spin Resonance Spectroscopy

Basic principles, relaxation and line width, zero field splitting, and Krammers Degeneracy, g-factor for paramagnetic and g-factors for organic radicals, factors affecting the g-factors

Isotopic and anisotropic hyperfined coupling constants. Spin Hamiltonian, spin densities and fine splitting in triplet spectra.

UNIT-III

Electronic Spectroscopy: Electronic spectroscopy of transition metal complexes. octahedral and tetrahedral complexes, correlation diagram of octahedral field and field of lower symmetry.

Vibrational Spectroscopy: Group theory and symmetry classification of normal modes of vibrational. Normal cooridinate annlysis in Cartesian and internal coordinates of small molecules: BF_3, NH_3. Square planar, trigonal bipyramid, framework and cage molecules, Jahn Teller distortions.

UNIT-IV

Radiation Chemistry: An overview G-value, the mechanism of interaction of high energy radiation with matter, photoelectric effect, Compton effect, pair production, total absorption coefficient, excitation and ionization, stopping power and linear energy transfer.

Flash photolysis: principle and its application. Radiolysis of water and aqueous solution. Radiolysis of molecules of biological interest(carbohydrates, amino acids, peptides, and nucleic acid

Learning Outcomes:

1. Apply scientific principles to specific circumstances or problems.
2. Apply Radiation Chemistry to solve scientific problems and/or situations.
3. Construct program graphs from raw data.
4. Analyze graphical representation of spectroscopic data.

5. Learn about Krammers Degeneracy, g-factor for paramagnetic and g-factors for organic radicals, factors affecting the g-factors, Isotopic and anisotropic hyperfined coupling constants.
6. Able to know the Jahn Teller distortions.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of TWO Mid-Terms (50 Marks)–20 Marks
- Attendance-5 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Physical Chemistry, P. W. Atkins.
2. Textbook of polymer science, F. W. Billmeyer Jr. Wiley.
3. Polymer science, V. R. Gowariker, N. V. Viswanathan and J. Sreedhar, Wiley- Eastern

Course Code	Course Title	L	T	P	Cr.
PCH-269	**PROJECT**	0	0	6	3

Prerequisites: B.Sc Chemistry

Objective:

1. This course will cover the research methodology and advance research in chemistry
2. Student will be able to learn the various advanced instruments
3. Will be able to search the latest literature on research

Course outcomes:

Students can be exploring their mind toward advance research in chemistry and give their valuable output toward the benefit of society.

Major thrust area:

1. **Waste water treatment**
2. **Bioremediation**
3. **Nanocomposite**
4. **Sensors**
5. **Photodegradation**
6. **Biopolymer**
7. **Nano-Hydrogel**

Assessment Model:

Total Assessment Out of 100 Mark and 50 mark in respective sem (III & IV SEM).