SEMESTER- VI			
Part III	**Core Integral II**	**Spectroscopy**	
Code : 18UCHI61	**Hrs/Week : 4**	**Hrs/ Sem : 60**	**Credits : 4**

Vision:

Aware of the excitement of science behind electromagnetic radiation and structural elucidation of molecules

Mission:

- Understand how molecules and materials behave, interact and transform at molecular , atomic and electronic level.
- Discover the applications of spectroscopic techniques which fundamentally relate to the interaction of light with matter.

CO No.	**Course Outcome Upon completion of this course, students should be able to:**	**PSOs addressed**	**CL**
CO-1	Have a basic knowledge of electromagnetic spectrum and various types of spectra	1 , 2 , 3	Re
CO-2	Understand the theory , instrumentation and applications of rotational spectroscopy	1, 2	Un
CO-3	Know the types of electronic transitions and various selection rules	1,3	Re
CO-4	Apply Woodward-Fieser rule for calculation of absorption maxima of dienes and α, β unsaturated ketones and enumerate the applications of UV spectroscopy in coordination complexes.	2, 3,6	Ap
CO-5	Generalise the theoretical principle, selection rules and instrumentation of IR and Raman spectroscopy	1, 2,4,6	Cr
CO-6	Categorise IR absorption frequencies and applications of IR and Raman spectroscopy	1 , 2,4	An
CO-7	Assess C^{13} NMR and the principle behind 31P, 19F and 15N NMR , Magnetic Resonance Imaging and applications of NMR spectroscopy.	1 ,2 ,4,6,7,8	Ev
CO-8	Know the basic principles and instrumentation of mass spectrometry	3,7,8	Re

UNIT-I Electromagnetic Spectrum and Rotational Spectroscopy

Regions of electromagnetic spectrum - interaction of radiation with matter – Different types of energy levels in molecules – rotation, vibration and electronic levels. Various types of spectra – atomic spectroscopy – molecular spectroscopy.

Rotational spectroscopy - Micro wave (rotational) spectra – theory – instrumentation and applications in the determination of bond distances in diatomic molecules –microwave oven

UNIT-II UV Spectroscopy

Theory – types of electronic transitions - selection rules – forbidden and allowed transitions - Chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic and hypochrmic effect – instrumentation - Woodward-Fieser rule for calculation of absorption maxima of dienes and α, β unsaturated ketones

UNIT-III IR Spectroscopy and Raman spectroscopy

Vibrational (IR) spectra – theoretical principle – harmonic oscillator and unharmonicity – modes of vibrations – selection rules – Number of fundamental vibrations – Force constant – Fermi resonance – zero point energy - instrumentation.. Finger print region, characteristics of IR absorption frequencies, intermolecular and intramolecular hydrogen bonding. – Applications in the determination of bond strength. Application of IR in coordination compounds.

Raman spectra – theoretical principle – selection rules – stokes and anti stokes line – PQR branches – instrumentation and Mutual exclusion principle – applications to CO_2 and HCN molecules

UNIT-IV NMR Spectroscopy

Introduction – theory – number of signals - instrumentation - internal standard(TMS) – chemical shift – factors influencing chemical shift – splitting of the signals, spin-spin coupling, coupling constant. NMR spectrum of ethanol, benzyl alcohol, propionic acid, anisole, benzaldehyde, 2,3-dibromopropene, ethyl methyl ketone and mesitylene. C^{13} NMR -. Principle - 31P, 19F and 15N NMR - Magnetic Resonance Imaging. Applications of NMR spectroscopy.

UNIT-V Mass spectrometry

Basic Principles - instrumentation– isotope abundance - techniques of Ion production - EI, CI - Base peak- molecular ion – meta stable ion - daughter ion--calculation of molecular formula - fragmentation pattern of various classes of organic compounds- hydrocarbons, alcohols, amines, aldehyde, ketone, ether, ester, acids and phenols- Mc-Lafferty rearrangement.

Books for Reference

1. Fundamentals of Molecular Spectroscopy C.N.Banwell, Mc.graw Hill, IV Edition.

2. Organic Spectroscopy , William Kemp, Third Edition, Palgrave Macmillan

3. Organic Spectroscopy Principles and Applications, Second Edition, Jag Mohan, Alpha Science International Limited, Harrow, U.K.

SEMESTER V		
Part IV	**Self study**	**Chemistry For Competitive Examination**
Code :18UCHSS3		**Credits : 2**

Vision: Prepare students to face competitive examinations

Mission:

- Classify the elements based on electronic configuration
- Know the importance of fullerenes in Nanoscience
- Know the importance of H bonding in day today life

Course Outcome

CO No.	Upon completion of this course, students should be able to:	PSO Mapped	CL
CO 1	Classify homogeneous and heterogeneous mixtures	1	Re
CO 2	Understand the separation principles used in metallurgy	1, 7	Un
CO 3	Know the Rutherford, J.J Thomson and Bohr's atomic models	1	Re
CO 4	Apply the principles governing the filling up of electrons in the orbitals	1	Ap
CO 5	Classify elements into s, p, d and f block	1, 3	Un
CO 6	Categorise Ionic, Covalent and Coordinate bond	1, 3	An
CO 7	Assess the difference between diamond and graphite.	1 ,6	Ev
CO 8	Know the desalination of water using Reverse Osmosis	5,7	Re

Unit I Matter

Definition— classification — physical classification, properties of solids, liquids and gases changes of physical state — chemical classifications — elements, compounds, mixtures — elements — definitions and their classifications viz. metals, non-metal and metalloids with example — physical states of some important elements. Compounds — definition — classifications viz. inorganic and organic compounds with examples. Some important compounds and their common names and uses — characteristics of compounds. Mixtures — definitions- classifications — homogenous and heterogeneous — examples — properties of mixtures — differences between compounds and mixtures. Separation of mixtures —

techniques, principles and examples : Handpicking, sieving, magnetic separation, sublimation, sedimentation; Decantation, filtration, evaporation, Distillation, Crystallization.

Unit II Structure of Atoms

Atoms – Definition – Dalton's atomic theory - sub atomic particles - charges of sub - atomic particles discoveries of subatomic particles - atomic and mass number - isotopes -- symbols for elements - principles governing filling up of electrons in the orbitals - Electronic configurations of first twenty elements. Rutherford; J.J Thomson and Bohr!s atomic models - valency; formula and naming of compounds - Molecular mass and mole concept.

Unit III Classification of Elements and Periodicity of Properties

Classification of elements Doberiner, Newlands, Mendeleev and modern Periodic tables - Groups & Periods - classifications of elements into s, p, d and f block with examples - periodicity of properties - metallic character, atomic - ionic radii,. ionization potential energy, electron affinity and electronegativity.

Unit IV Chemical Bonding and Non - Metals

Need for the Chemical bond formation - introduction to ionic bond, covalent bond, co-ordinate bond and metallic bond - ionic bond formation - definition, and explanation using NaCl, - covalent bond - definition and explanation using H_2, O_2, N_2, CH_4, Properties of ionic and covalent compounds Noble gases and their applications - Halogens and their applications preparation and uses of hydrogen, phosphorus and sulphur, Differences between diamond and graphite.- Fullerenes.

Unit V Air and Water

Atmosphere - different layers of atmosphere and their compositions - composition of air - uses of various components of air - air pollution - sources, effects and control measures - water - abnormal properties of water and its explanation using H-bonding - Hard and soft water - temporary and permanent. hardness - Removal of hardness - Boiling, Clarks process, washing soda process, Calgon - Reverse osmosis -preparation and uses of distilled water.

Reference: Question Bank

SEMESTER- V			
Part III	**Common Core**	**Solid State and Material science**	
Code : 18UPCC51	**Hrs/Week : 6**	**Hrs/ Sem : 90**	**Credits : 4**

Vision: Understand the usage of the appropriate materials while designing electronic system.

Mission: Enrich the students to know the background theory and properties of different materials.

Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO1	Understand the basic symmetry elements and operations of crystals.	1, 2	Un
CO2	Distinguish the types of crystals and enumerate the various crystal imperfections.	3,4	An
CO3	Get a clear knowledge about metallic glasses, ceramics and biomaterials.	1, 3, 5,7, 8	Re
CO4	Justify the wave nature of matter and its experimental study.	1,3	Ev
CO 5	Apply Bragg's law for x-ray study.	2	Ap
CO 6	Distinguish magnetic materials based on susceptibility.	2	An
CO 7	Usage of magnetic materials in various field.	2	Ap
CO 8	Discuss the synthesis methods of nano materials.	2	Un

Unit-I Crystal structure and crystal imperfections

Crystal lattice -primitive and unit cell- Basic symmetry elements and operations - Plane of symmetry, centre of symmetry & axis of symmetry -Types of crystals - Bravais lattices - Simple cubic, body centered cubic, FCC, structures with an example - miller indices, inter planar spacing – crystal imperfections – point defects – Schottky and Frenkel defects – line defects – Edge & screw dislocations – surface defects – volume defects (imperfection).

Unit-II New materials

New materials – metallic glasses – Fiber reinforced plastics – Fiber reinforced metals – Bio materials – Ceramics – Cements – High temperature materials – intermetallic compounds - Alloys - Smart materials.

Unit-III Wave nature of matter and X-ray diffraction

Wave nature – introduction – De Broglie Hypothesis – experimental study of matter waves – Davison – Germer's experiment – Heisenberg's Uncertainity principle.

Bragg's law – Derivation of Bragg's equation - Experimental methods of X-ray study – Laue, rotating crystal and powder methods.

UNIT-IV Magnetic and dielectric materials

Classification of magnetic materials – Langvein theory of diamagnetism – theory of paramagnetism– Domain theory of ferromagnetism – Antiferro magnetic materials –Application of Different magnetic materials.

Dielectric materials – Types of dielectric materials – different types of electric polarization –-Internal field – Clausius-Mossotti equation – Frequency and temperature dependence of dielectric constant.

Unit- V Nanomaterials

Nanomaterials- Synthesis- Plasma arcing – Chemical vapour deposition – Sol gels- Electro deposition – Ball milling –Properties of nano particles and applications. Carbon nanotubes fabrication – Arc method –Pulsed laser deposition- Chemical vapour deposition- Structure- Properties- Applications.

Text books

1. M.Arumugam, Material Science, Anuradha Publication 2008.

2. C M Sri Vasta & C Srinivasan, Science of Engineering materials,New Age International (P) Ltd, Second Edition,1999.

3. P. K. Palanisamy, Solid state Physics Copyright (2003), Scitech Publication (India) Pvt Ltd Chennai, 3rd reprint 2008.

4. R.Mureghesan, Modern Physics, Kiruthiga Sivaprasath, S.Chand & Co Ltd, 17th Edition, 2013.

5. Dr. P.Mani, A Text Book of Engineering Physics, Dhanam Publications Chennai, Revised Edition, 2008.

Books for Reference

1. Charles Kittel, Introduction to solid state Physics, John Wiley and Sons 2010

2. P. K. Palanisamy, Material Science, Scitech Publication (India) Pvt Ltd., Chennai, 2005.

3. M.H Fulekar, Nano Technology Importance and applications, I.K International Publishing House Pvt Ltd,2010.