CALICUT UNIVERSITY – FOUR-YEAR UNDERGRADUATE PROGRAMME (CU-FYUGP)

BSc CHEMISTRY

Programme	B.Sc Chemistry				
Course Title	**INORGANIC CHEMISTRY I**				
Type of Course	**MAJOR/MINOR**				
Semester	**I**				
Academic Level	**100-199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Scope of chemistry, Interdisciplinary areas involving chemistry. Fundamentals of periodic properties of elements, Atoms and molecules, Need for chemical bonding and its types, Awareness on nature of experiments and health risk, hazard associated with chemicals, Mole concept				
Course Summary	This course explores the importance of chemistry as a central discipline of science. It introduces the periodic properties of elements, concept of chemical bonding and explanation of inorganic molecular structure using hybridization and MO theory. A few basic topics of the emerging area of Nanochemistry are also introduced in this course. The basic laboratory safety, concepts in volumetric analysis and related practical experiments are also covered.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the role of chemistry in science and scientific research with emphasis on analytical data evaluation	U	C	Instructor- created exams/ Quizzes/Assignments
CO2	Conceptualize and predict chemical bonding, molecular structures using	An	P	Instructor- created exams/ Quizzes/assignments

	dipole moment, hybridisation, and MO Theory			
CO3	Develop a basic understanding of the extraordinary properties of nanomaterials and its applications.	U	C	Instructor- created exams/ Quizzes/Assignments
CO4	Apply the concepts of lab safety measurements and volumetric analysis	Ap	M	Instructor- created exams/ Assignments/problem solving
CO5	Enable students to develop analytical skills in inorganic quantitative volumetric analysis.	Ap	P	Group work /Viva Voce// Observation of practical skill
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45+30)	Marks
I	**CHEMISTRY AS A SCIENCE DISCIPLINE & SCIENTIFIC ANALYSIS**		**8**	**17**
	1	Science- Chemistry as a branch of science, History of chemistry, Involvement of chemistry in daily life (Mention only)	**1**	
	2	Introduction to analytical chemistry, Classification of analytical methods: Qualitative and Quantitative analysis (Mention with examples)	**1**	
	3	Treatment of analytical data - Significant figures – Accuracy – Precision – Methods of representing Accuracy, Absolute error, Relative error, Types of errors, Constant errors, Proportional errors, Correction of determinate errors	**3**	
	4	Methods of representing Precision –Mean, Average deviation, Standard deviation, Relative standard deviation, Coefficient of variation, Variance, Rejection of a result: Q test, Methods of least squares	**3**	
II	**CHEMICAL BONDING AND MOLECULAR STRUCTURE**		**17**	**38**
	5	Periodic Properties and their Periodic Trends: (a) Atomic and Ionic radius (include isoelectronic species in discussion) (b) Ionisation energy: (c) Electron	**2**	

		affinity (d) Electronegativity (Pauling, Mulliken Allred & Rochow scales).		
	6	Classification of bonds: Ionic bond - Definition, Factors affecting the formation of ionic bond. Characteristics of ionic compounds. Lattice energy	**1**	
	7	Born Haber cycle - Born Lande equation (derivation not needed) - Covalent –(Mention polar and non polar compounds) and Coordinate bond	**2**	
	8	Dipole moment and its applications: (Prediction of linearity and symmetry of polyatomic molecules, Prediction of position of substituents in aromatic compounds, Measurement of bond angle)	**2**	
	9	Covalent Bond, Lewis concept of covalent bond, Atomic orbital overlap, Concept of covalency, Variable covalency and Maximum covalency	**2**	
	10	Prediction of Covalent character in ionic bond using Fajans rule. Prediction of Ionic character in Covalent bond using Hannary Smidth equation.	**1**	
	11	Structure of molecules by the concept of Hybridisation: NO_3^-, CO_3^{2-}, SO_4^{2-} ,IF_7, XeO_3, XeO_4, XeF_2, XeF_4, XeF_6, ClF_3, BrF_5, SF_4	**3**	
	12	Introductory MO Theory: Homoatomic molecules in N_2 and O_2 and their ions (comparison of bond order, bond length and stability), MO Theory: Heteroatomic molecules like NO, CO, HCl, HF, LiF.	**4**	
III	**INTRODUCTION TO NANOMATERIALS**		**10**	**21**
	13	Definition of Nanomaterials, Historical revolution of Nanochemistry , Nanochemistry and Nanotechnology, Classification of nanostructures based on electron confinement (0D, 1D and 2D)	**2**	
	14	Synthesis of Nanomaterials: Bottom Up and Top down approaches (Elementary idea with examples)	**1**	
	15	Metal nanoparticles (gold and silver nanoparticles), Semiconductor nanoparticles (CdS and CdSe nanoparticles), Metal oxide nanoparticles (zinc oxide, iron oxide, silica and titania nanoparticles), Nanocomposites, Nanoceramics (Definition with examples), Carbon Based Nanomaterials: Graphene, Carbon Nanotubes, Fullerenes, Carbon dots (elementary idea only)	**2**	
	16	Characteristics of Nanomaterials: Surface area to volume ratio and its significance, Novel properties of Nanomaterials, Size dependent optical (surface	**3**	

		plasmon resonance), Electronic, Mechanical, magnetic and catalytic properties (No deep discussion is needed)		
	17	Applications of nanomaterials: Electronics (Batteries, Solar cell), Biomedical (Drug Delivery) and Environmental based applications (Water Purification, Dye Removal) (General idea only)	**2**	
IV	**FUNDAMENTALS OF ANALYTICAL CHEMISTRY**		**10**	**22**
	18	Lab safety measurements: Awareness of material safety data sheet (MSDS), Safe storage and handling of hazardous chemicals, Simple first aids; Electric shocks, fire, Cut by glass and inhalation of poisonous gas.	**2**	
	19	Accidents due to acids and alkalis, Burns due to phenol and bromine, Disposal of waste chemicals, Disposal of sodium and broken mercury thermometer, -R and S phrases (elementary idea only), Personal protective Equipment (PPE)	**1**	
	20	Mole concept - Equivalent mass - Methods of expressing concentration: Weight percentage, molality, molarity, normality, mole fraction, ppm and millimoles - Numerical Problems related to basic concepts.	**2**	
	21	Volumetric Analysis: Introduction - Primary and secondary standards – Standard solutions – Theory of titrations involving acids and bases, Permanganometry, Dichrometry, Iodometry, Iodimetry Precipitation and Complexometric titrations.	**3**	
	22	Indicators: Theory of acid-base, redox, adsorption and complexometric indicators. Double burette method of titration: Principle and advantages.	**2**	
V	**INORGANIC CHEMISTRY PRACTICAL I- VOLUMETRIC ANALYSIS**		**30**	
	1	**General Instructions:** Use a safety coat, gloves, shoes and goggles in the laboratory. For weighing electronic balance must be used. Double burette titration method may be used for titrations. Standard solution must be prepared by the student. A minimum of 7 experiments must be done from Section B and C.		

		Section D is open-ended and the experiments can be selected by the teacher **SECTION A** **Importance of lab safety** – Burns, Eye accidents, Cuts, Gas poisoning, Electric shocks, Treatment of fires, Precautions and Preventive measures. Weighing using electronic balance, Preparation of standard solutions. **SECTION B** **Neutralization Titrations** 1. Acidimetry and Alkalimetry: Strong acid Vs Strong base 2. Acidimetry and Alkalimetry: Strong acid Vs Weak base **SECTION C** **Redox Titrations** 1. Permanganometry: Estimation of Fe^{2+}/$FeSO_4$. 7H2O/Mohr's salt 2. Permanganometry: Estimation of Oxalic acid 3. Permanganometry: Estimation of Calcium using std KMnO4 4. Dichrometry: Estimation of Fe^{2+}/ $FeSO_4$. 7H2O /Mohr's salt 5. Dichrometry: Estimation of Ferric iron 6. Iodometry and Iodimetry: Estimation of Copper 7. Iodometry and Iodimetry: Estimation of Iodine **SECTION D** **Open Ended (Any two experiments are to be conducted. may be selected from the below list or the teacher can select related experiments)** 1. Determination of acetic acid content in vinegar by titration with NaOH.		

		2. Determination of alkali content in antacid tablets by titration with HCl. 3. Determination of available chlorine in bleaching Powder. 4. Estimation of Cu in Brass		

References

1. C. N. R. Rao, *Understanding Chemistry*, Universities Press India Ltd, Hyderabad, 1999
2. George Gamow, *One, Two, Three...Infinity: Facts and Speculations of Science*, Dover
3. Publications, 1988.
4. *Resonance – Journal of Science Education*, Indian Academy of Sciences.
5. *Nature Chemistry*, Nature Publishing Group.
6. J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, *Vogel's Text Book of Quantitative Chemical Analysis*, 6th Edn., Pearson Education, Noida, 2013.
7. D. A. Skoog, D. M. West, F. J. Holler, S. R. Crouch, *Fundamentals of Analytical*
8. *Chemistry*, 8th Edn., Brooks/Cole, Thomson Learning, Inc., USA, 2004.
9. B. R. Puri, L. R. Sharma, K. C. Kalia, *Principles of Inorganic Chemistry*, 31st Edn., Milestone Publishers and Distributors, New Delhi, 2013.
10. Satya Prakash, *Advanced Inorganic Chemistry*, Vol. 1, 5th Edn., S. Chand and Sons, New Delhi, 2012.
11. J. D. Lee, *Concise Inorganic Chemistry*, 5th Edn., Oxford University Press, New Delhi, 2008
12. W. U. Malik, G. D. Tuli, R. D. Madan, *Selected Topics in Inorganic Chemistry*, S. Chand and Co., New Delhi, 2010.
13. J. E. Huheey, E. A. Keitler, R. L. Keitler, *Inorganic Chemistry – Principles of Structure and Reactivity*, 4th Edn., Pearson Education, New Delhi, 2013.
14. C.N.R., Rao, A. Müller, and A.K. Cheetham, (Eds.),"Chemistry of Nanomaterials", Wiley – VCH. 2005
15. T., Pradeep, *A Textbook of Nanoscience and Nanotechnology*, McGrawhill, New Delhi, 2012.
16. M. A. Shah, Tokeer Ahmad, *Principles of Nanoscience and Nanotechnology*, Narosa Publishing House, New Delhi, 2010.
17. V. S. Muralidharan, A. Subramania, *Nano Science and Technology*, CRC Press, London.
18. R. H. Hill, D. Finster, *Laboratory Safety for Chemistry Students*, 1st Edn., Wiley, Hoboken, NJ, 2010.

Further Reading

1. H. Collins, T. Pinch, *The Golem: What Everyone Should Know about Science*, Cambridge University Press, Cambridge, 1993.
2. C.R. Kothari, *Research Methodology: Methods and Techniques*, 2nd Revised Edition,

New Age International Publishers, New Delhi, 2004.
3. http://www.vlab.co.in
4. http://nptel.iitm.ac.in
5. D. F. Shriver, P. W. Atkins, *Inorganic Chemistry*, 5rd Edn., Oxford University Press, New York, 2010.
6. M. C. Day, J. Selbin, *Theoretical Inorganic Chemistry*, East West Press, New Delhi, 2002.
7. G. L. Miessler , D A. Tarr, *Inorganic Chemistry*, Pearson, 2010
8. K.J. Klabunde (Ed.), "Nanoscale Materials in Chemistry", John Wiley & Sons Inc. 2001
9. G., Schmidt, Nanoparticles: From theory to applications –Wiley Weinheim 2004.

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3			2	1	1	3				3	1	1
CO 2	2	2					2				2		1
CO 3	2		1	2	2	3	2			1	2	1	2
CO 4			3		2	2	2		1		1	1	1
CO 5			3		2	3	3		1		2	1	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Practical exam (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment/ Viva/ Seminar	Practical skill evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	

CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

B. Sc. CHEMISTRY

Programme	B.Sc Chemistry				
Course Title	**PHYSICAL CHEMISTRY – I: STATES OF MATTER**				
Type of Course	**MAJOR/MINOR**				
Semester	**II**				
Academic Level	**100-199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	NCERT or equivalent chemistry syllabus of XI and XII, https://onlinecourses.swayam2.ac.in/nce24_sc07/preview				
Course Summary	Atoms and molecules form the matter that is recognisable for us in the real world, as gases, liquids and solids. Why would they exist as they are? And why would they behave as they do? This course is designed to introduce first year UG students, the physical chemistry of matter in different states of its existence through theory and laboratory experiments. The course explains the various types of interactions between atoms and molecules and their important role in physical and chemical characteristics of the different states of matter. The course introduces the theory and experimental methods that are commonly used to study the various states of matter.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the basic nature of real gases and understand interactions at molecular levels	U	C	Assignments/Quiz designed by the instructor
CO2	To recognise the significance of various interactions in condensed matter	U	C	Assignments/Quiz designed by the instructor

CO3	To analyse the physical properties of liquids through theory and practical experiments	An	P	Seminars and exams
CO4	To explain the regular, periodic arrangement of atoms in solids and appreciate the concept of unit cells	An	P	Seminars/ exams
CO 5	To evaluate and understand the importance of the X-ray diffraction technique for characterisation of crystalline solids	Ap	P	Lab/Discussion/Assignments
CO 6	To execute experiments to determine and tune the various colligative properties of dilute solutions	C	P	Lab/Viva voce exams

* - Remember (R), Understand (U), Apply (Ap), Analyze (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (45+30)	Marks
I		**GASEOUS STATE**	**15**	**33**
	1	Kinetic theory of gasses: derivation	**1**	
	2	Maxwell-Boltzmann distribution of molecular velocities -– Average velocity, RMS velocity and most probable velocity (derivations not required)	**2**	
	3	Collision theory – Collision diameter- Collision number-Collision frequency - Mean free path – Molecular beams (Mention only)	**2**	
	4	Real gas- Deviation from ideal behavior- Compressibility factor – Virial equation and Virial coefficients- van der Waals equation of state (derivation required)-features of van der Waals equation - Expression of van der Waals equation in virial form and calculation of Boyle temperature - PV isotherms of real gasses – Andrews' experiments - Continuity of states - Isotherm of van der Waals equation	**6**	

	5		Critical phenomena - Critical constants - Relationship between critical constants and van der Waals constants - Experimental determination of critical constants - Supercritical carbon dioxide and its applications.	**4**	
II	**LIQUID STATE**			**8**	**17**
	6		Discussion of different types (with suitable examples) of molecular interactions- dipole-dipole, dipole-induced dipole, induced dipole-induced dipole interactions, Lennard-Jones 6-12 potential.	**2**	
	7		Properties of liquids- Vapour pressure, Refractive index, Surface tension- Interfacial tension and viscosity - Poiseuille's equation – Explanation of these properties on the basis of intermolecular forces.	**3**	
	8		Hydrogen bonding in water and other polar molecules, its relevance in biological systems.	**2**	
	9		Liquids on solid surfaces- Hydrophobic and Hydrophilic, Superhydrophilic and Superhydrophobic surfaces- simple explanation by using the water drop contact angles on surfaces	**1**	
III	**SOLID STATE**			**15**	**33**
	10		Crystalline and amorphous solids- atomic and molecular solids- nucleation and growth of crystals.	**2**	
	11		Crystalline Materials – Periodicity- Types of Close packing and packing fraction.	**1**	
	12		Space Lattice - Unit cell (use models)- Lattice planes and Miller indices (use models) - 7 crystal systems- 14 Bravais lattices- Types of cubic crystals and their planes- Distance formula for cubic systems- Calculation of crystal density (Use of software like Crystal viewer is recommended).	**4**	
	13		X-ray diffraction- Bragg's law (derivation)- Powder and single crystal X-ray diffraction methods, Atomic scattering factor, Structure factor,	**3**	
	14		Systematic absences for simple, face centered, and body centered cubic crystals, Analysis of XRD patterns of NaCl, KCl and CsCl. Basic idea of electron and neutron diffraction.	**3**	
	15		Structural transitions in TiO_2- anatase, rutile and brookite phases	**1**	
	16		Concepts of melting point/boiling point and molecular/atomic/ionic interactions, Examples: CO_2, N_2, H_2O, NH_3, NaCl, TiO_2	**1**	
IV	**SOLUTIONS**			**7**	**15**

	17	Solubility of gases in liquids – Henry's law and its applications	**1**	
	18	Colligative properties - Relative lowering of vapour pressure	**1**	
	19	Colligative properties- Elevation in boiling point and depression in freezing point	**1**	
	20	Colligative properties- Osmotic pressure - Laws of osmotic pressure - Reverse osmosis and its technological relevance	**1**	
	21	Determination of molecular mass using colligative properties	**1**	
	22	Solid Solutions: Substitutional and interstitial solid solutions, Differences between Alloys, Mixtures and Composites. Colloids: Dispersed phase and dispersing medium, Sol, Emulsion, Foam, and Aerosol, Tyndall effect, Nephelometry	**2**	
V		**PHYSICAL CHEMISTRY PRACTICALS**	**30**	
		A minimum of 5 practical experiments out of which ONE EACH from sections 1, 2 and THREE from section 3 must be performed and reported. For plots/graphs, suitable softwares may be used and printed hard copies may be presented. Practical records may be in handwritten or computer-typed printed form. **Section 1** 1. Determination of cryoscopic constant (K_f) of solid solvent using a solute of known molecular mass. (Solvent: Naphthalene, biphenyl Solute: Naphthalene, biphenyl, 1,4-dichlorobenzene, diphenylamine) 2. Determination of molecular mass of the solute using a solvent of known cryoscopic constant (K_f). (Solvent: Naphthalene, biphenyl Solute: Naphthalene, biphenyl, 1,4-dichlorobenzene, diphenylamine) **Section 2** 3. Determination of molal transition point depression constant (K_t) of salt hydrate using solute of known molecular mass. (Salt hydrates: $Na_2S_2O_3.5H_2O$, $CH_3COONa.3H_2O$. Solutes: Urea, Glucose) 4. Determination of molecular mass of the solute using a solvent of known molal transition point depression constant (K_t). (Salt hydrates: $Na_2S_2O_3.5H_2O$, $CH_3COONa.3H_2O$. Solutes: Urea, Glucose)	**3** **3** **3** **3**	

		Section 3 5. Determination of viscosity of various liquids using Ostwald's viscometer. 6. Study of glycerine-water system and determination of percentage of glycerine using viscometer [plot composition (c) *versus* time of flow x density of the solution (td)]. 7. Determination of the surface tension of a liquid or a dilute solution (NaCl / surfactant) using a stalagmometer (drop number method). 8. Determination of composition of glycerine-water mixture by refractive index method. 9. Determination of refractive indices of KCl solutions of different concentrations and unknown concentration of KCl solution. 10. Indexing powder XRD patterns and determination of unit cell parameters of simple and/or bcc and/or fcc systems (Instructors must provide the powder XRD patterns and ask students to index it and calculate unit cell parameters)	**3** **3** **3** **3** **3**	
		References: **Module I o IV** 1. Physical Chemistry: Thermodynamics, Structure and Change, 10th Edition, P. Atkins and J. de Paula, (W. H Freeman and Company, New York) 2. D. A. McQuarrie, J. D. Simon, Physical Chemistry – A Molecular Approach, (Viva, 2001.) 3. Solid State Chemistry and its Applications, 2nd Edition, A R West, (Wiley, 2014) **Module V** 4. Findlay's Practical Physical Chemistry, Ninth Edition, Revised and Edited by B P Levitt, (Longman, London, 1973) 5. J. B. Yadav, Advanced Practical Physical Chemistry, Goel Publications, Meerut, 2008.. 6. R. C. Das, B. Behra, Experiments in Physical Chemistry, Tata McGraw Hill, New Delhi, 1983.		

		Further reading 7. 1. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 46th Edn., Vishal Publishing Company, New Delhi, 2013. 8. G. M. Barrow, Physical Chemistry, 5th Edn., Tata McGraw Hill Education, New Delhi, 2006. 9. F. Daniels, R. A. Alberty, Physical Chemistry, 5th Edn.,John Wiley and Sons, Canada, 1980. 10. D. P. Shoemaker, C. W. Garland, Experiments in Physical Chemistry, McGraw-Hill Book Company, New York, 1962. 11. W. G. Palmer, Experimental Physical Chemistry, Cambridge University Press, Cambridge, 2009		

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	-	-	3	2	3	2	2	-	2	-	1
CO 2	3	2	-	-	3	2	3	2	1	-	2	-	1
CO 3	3	2	-	-	3	2	3	2	1	-	2	-	1
CO 4	3	2	-	-	3	3	3	2	1	-	1	-	1
CO 5	3	2	2	1	3	3	3	2	1	-	3	-	1
CO 6	2	-	3	3	3	3	3	2	1	2	3	2	1

Correlation Levels:

Level	Correlation
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Practical exam (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment /viva	Practical skill evaluation	End Semester Examinations
CO 1		✓		✓
CO 2		✓		✓
CO 3	✓			✓
CO 4	✓			✓
CO 5	✓	✓		✓
CO 6	✓	✓	✓	✓

CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc CHEMISTRY

Programme	B. Sc. Chemistry				
Course Title	**ORGANIC CHEMISTRY 1**				
Type of Course	**MAJOR /MINOR**				
Semester	**III**				
Academic Level	**200 - 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basics of organic chemistry-Functional groups, Homologous series, Nomenclature and isomerism				
Course Summary	This course explores basics of organic chemistry reaction mechanism, Reactions and mechanism of important functional groups and stereochemistry				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the basics of Organic chemistry	U	C	Test /Seminar
CO2	To understand the basic concepts of reaction mechanisms	U	p	Discussion/ Assignment
CO3	To recognize the various types of organic reactions and reaction intermediates	An	P	Quizzes/Test
CO4	To realise the importance of stereoisomerism, optical activity and chirality	Ap	P	Discussion/Seminar /Assignment
CO5	To enable the students to improvise Molecular models	Ap	P	Assignment/Test

CO6	To empower students in various separation and purification techniques	Ap	P	Lab work/Viva

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I	**Introduction**		**12**	**26**
	1	IUPAC Nomenclature of multifunctional acyclic and cyclic compounds. Structural isomerism.	2	
	2	Hybridization and bonding in organic compounds (methane, ethane, ethylene and acetylene	2	
	3	Localised and delocalised bonding. Hydrogen bonding, effect of hydrogen bonding on physical and chemical properties of compounds	1	
	4	Organic acids and bases	2	
	5	Basics of MO theory as applied to organic molecules -Ethylene and Buta-1,3-diene.	3	
	6	Aromaticity-Huckel's rule for aromaticity (Benzenoid compounds)	2	
II	**Organic reaction mechanisms**		**12**	**26**
	7	Types of bond fission-Homolytic and Heterolytic fission	1	
	8	Arrow formalism used in reaction schemes.	1	
	9	Electrophiles and Nucleophiles	1	
	10	Electron displacement Effects: Inductive effect and Field effect, Steric effect- Acidity and basicity of organic compounds based on Field effect and steric effect.	2	
	11	Electromeric effect, Mesomeric effect	2	
	12	Hyperconjugation- Stability of alkenes.	1	
	13	Reactive intermediates: Structure, formation and stability of carbocations, carbanions, free radicals, carbenes and nitrenes.	3	
	14	Pericyclic reactions and its classifications	1	

III	**Stereochemistry-I**		**14**	**30**
	15	Stereoisomerism: Conformational isomerism and configurational isomerism. Representation of stereostructures of organic molecules using Flying wedge, Fischer, Sawhorse and Newmann projections.	3	
	16	Inter conversion of different projections of L-tartaric acid and 3-chloro-2-butanol.	3	
	17	Conformational Isomerism – Conformational analysis of Ethane, n- butane and cyclohexane with PE diagram.	3	
	18	Conformation of mono substituted cyclohexanes. Relative stability of conformations.	2	
	19	Configurational isomerism: Geometrical isomerism in alkenes, cycloalkanes and oximes. Cis-trans, Syn-Anti and E-Z notations, sequence rule.	3	
IV	**Purification and Characterization Techniques**		**7**	**16**
	20	Distillation- Simple, fractional, steam and vacuum distillations	2	
	21	Recrystallisation, sublimation, solvent extraction.	2	
	22	Chromatography, stationary phase, mobile phase, Rf values, -TLC, Column chromatography, HPLC and GC (basic concepts only).	3	
V	**Practicals**		**30**	
	1.	**Introduction to organic lab**	4	
	2	1. Distillation of Aniline, 2. Distillation of Limonene (from orange peels) 3. Purification of organic compounds by crystallization using the following solvents: a. Water b. Alcohol 4. Sublimation of a dicarboxylic acid/Naphthalene 5. Molecular model construction and conformation of ethane 6. Molecular model construction of Ethylene or Acetylene 7. Molecular model construction of acetaldehyde and Cyclohexane.	20	
	3	Open ended	6	

References

1. Morrison, R. N. & Boyd, R. N., Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2. Bhal and Bhal, Advanced Organic Chemistry, 2nd Edition, S. Chand Publisher, 2012.

3. Kalsi, P. S., Stereochemistry Conformation and Mechanism; 8thEdn, New Age International, 2015

4. I. L. Finar, *Organic Chemistry*, Vol. I, 5th Edn., Pearson Education, New Delhi, 2013.

5. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry,* 3rd Edn., Vishal Publishing Company Co., 2010.

6. K. S. Tewari, N. K. Vishnoi, S. N. Mehrotra, *A Textbook of Organic Chemistry*, 2nd Edn., Vikas Publishing House, New Delhi, 2004.

7. B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, *Vogel's Textbook of Practical Organic Chemistry*, 5th Edn., Pearson Education, Noida, 2014.

8. F. G. Mann, B. C. Saunders, *Practical Organic Chemistry*, 4th Edn., Pearson Education, Noida, 2011.

9 . Arthur I. Vogel, *Elementary Practical Organic Chemistry- Small Scale Preparations,* 2nd Edn., Pearson Education, Noida, 2013

10.An Improved Method for the Extraction and Thin-Layer W Chromatography of Chlorophyll a and b from Spinach Hao T. Quach, Robert L. Steeper, and G. William Griffin, J Chem Edn, 2004, 81, 385

11. Chemistry for Pharmacy Students: General, Organic and Natural Product Chemistry, S D Sarkar and L Nahar, John Wiley and sons, Ltd.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1						3				1	1	1
CO 2	2						2				2		1
CO 3	3						2				2		1
CO 4				2	2		2				2		1
CO 5	2						2		1	1	1	1	1
CO 6			3			2	2		1		2	1	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment/viva/seminar	Practical skill Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2		✓		✓
CO 3	✓			✓
CO 4		✓		✓
CO 5	✓	✓		✓
CO 6		✓	✓	✓