

Subject Code: 1RI3000102	Subject Title: Essentials of Disciplinary Research Subject-1 (Advance Organic Chemistry)
Pre-requisite Subject	Advance Organic Chemistry

Objectives of course: By using this advanced organic chemistry like heterocyclic compound, nanoparticle, student synthesis the novel heterocyclic compounds & nanoparticles and their application in different field.

To provide the basic knowledge & concepts of the green chemistry, synthesis of novel compound by green synthesis.

Learning outcomes: Understanding the principles of chromatographic techniques, with the emphasis on the application in chemistry, biochemistry. Updating the recent developments in the field of Chromatography. Students can able to design, perform, and interpret chromatographic experiments results for biochemical, and sensor applications.

Teaching Scheme (Credit Distribution)				Evaluation Scheme(% Marks)	Total Marks
Lecture	Tutorial	Practical	Credit	Continuous (Internal) Assessment	100
3	1	--	4	100%	

Unit	Content	Lecture	Wt. (%)
1	Heterocyclic chemistry Systematic nomenclature of monocyclic fused and bridged heterocycles, Classification of heterocyclic compounds, Synthesis reactivity and aromatic character of following Heterocycles (1) Furan, Pyrrole, Thiophene, Pyrazole, Imidazole, Indole, Pyrimidine, Pyridine and quinoline (2) Condensed heterocycles: Benzofuran, benzothiazole, benzoimidazole, benzothiophene, quinoline, benzoxazole, (3) 1,2,3-triazole, 1,2,4-triazole, 1,2,4-oxadiazole, 1,3,4-oxadiazole, Quinolone, Quinazoline Application of heterocyclic compound in various field.	1	25
2	Supramolecule Calix[4]arene, Calix[8]arene, calyx[4]resorcinarene, crown ether, oxacalixarene, Supramolecular based heterocyclic assemblies. Nanotechnology What is nanotechnology? Classification of Nano-structured materials. Nano-scale Architecture. Synthesis of Nanomaterials: Top down –ball milling; Bottom up co-precipitation, sol-gel, electro deposition, using natural nano-particles chemical vapor deposition. Introduction of fullerene chemistry. The Carbon Nanotube New Forms of Carbon –Types of Nanotubes Formation of Nanotubes Application of Carbon Nanotubes.	1	25
3	Reagents in Organic Synthesis [Oxidation] : CrO ₃ , MnO ₂ , KMnO ₄ , SeO ₂ , Pb(OAc) ₄ , OsO ₄ , HIO ₄ , DMSO, H ₂ O ₂ ,	1	25

	CH ₃ COOAg (Dry & wet), RCOOOH, Ozone, HgO, NBS, K ₃ Fe(CN) ₆ , DDQ, Al(O-t-Bu) ₃ ; Some Miscellaneous Reagents in Organic Synthesis : LDA, Sharpless epoxidation, wilkinson catalyst , Grignard Reagent and Gilman reagent. Reagents in Organic Synthesis [Reduction]: Al(O-iPr) ₃ , Zn/HCl, N ₂ H ₄ /OH, NaBH ₄ , LiAlH ₄ , Complex Hydrides, Na/NH ₃ , Cat.H ₂ , TBTH. Introduction to Green Chemistry, Basic Principles of Green Chemistry; Importance of PTC, ILs, microwave and ultra sonication in green synthesis.		
4	Reagents in Organic Synthesis [Reduction]: Al(O-iPr) ₃ , Zn/HCl, N ₂ H ₄ /OH, NaBH ₄ , LiAlH ₄ , Complex Hydrides, Na/NH ₃ , Cat.H ₂ , TBTH. Introduction to Green Chemistry, Basic Principles of Green Chemistry; Importance of PTC, ILs, microwave and ultra sonication in green synthesis.	1	25

List of References:

1. Organic Reactions, Stereochemistry and Mechanism: P.S. Kalsi (New Age.)
2. Principles of Organic Synthesis: R.O.C Norman & J.M. Coxon (ELBS)
3. Mechanism in Organic Chemistry: Peter Sykes (Orient Longman)
4. Modern Methods of Organic Synthesis: W. Carruthers (Cambridge)
5. Organic Reaction Mechanism: V.K.Ahluwalia and R.K.Parashar (Narosa)
6. Advanced organic chemistry part-A F.A.Carey and R.G.Sundbreg
7. Stereochemistry of carbon compounds by E.L.Eliel
8. Stereochemistry of organic compounds by Nasipuri
9. Advanced Organic chemistry reaction mechanism and structure by Jerry March
10. Organic chemistry by J. Clayden, Oxford University Press
11. Reaction Mechanism in Organic chemistry by S.M.Mechanism and S.P.Singh
12. Pericyclic reaction by Jagdamba singh
13. Principles of organic synthesis R O C Norman and J.M. Coxon. Blackie academic and Professional
14. A Guide book to Mechanism in organic chemistry, Peter Sykes Longman
15. Organic chemistry by R.T. Morrison and R.N. Boyd, Prentice-Hall.
16. Reaction and mechanism in organic chemistry by P.S. Kalsi, New Age International.
17. A. Rauk, Orbital Interaction Theory of Organic Chemistry, John Wiley, 1994.
18. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry, 6th edition, Wiley, 1999.
19. March J. Advanced Organic Chemistry: Reactions, Mechanisms and Structure, Wiley-India
20. Joule J. A. and Mills K. Heterocyclic Chemistry, Wiley-blackwell.
21. Clayden, Greeves, Warren & Wothers, Organic Chemistry, Oxford University.

Subject Code: 1RI3000103	Subject Title: Essentials of Disciplinary Research Subject-2 (Advanced Instrumental Techniques)
Pre-requisite Subject	Advanced Instrumental Techniques

Objectives of course: Separation and Spectroscopic techniques are the basis of instrumental analysis widely applied in industry, chemistry, biochemistry, environment science. These techniques are based on principles of chemistry. Therefore in this module we shall study the principles on which these techniques are based and acquire the basic skills necessary to use the techniques. To provide the basic knowledge & concepts of the Analytical chemistry. To provide overview of the application of analytical chemistry in applied field to the students.

Learning outcomes: To impart knowledge and training in chemistry at advanced level, make aware with recent analytical technique, use of technique in laboratory, synthesis and analysis of materials, and their properties.

Teaching Scheme (Credit Distribution)				Evaluation Scheme(% Marks)	Total Marks
Lecture	Tutorial	Practical	Credit	Continuous (Internal) Assessment	50
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Unit	Content	Wt. (%)
1	Chromatography: TLC, HPTLC, Ion exchange, Ion chromatography (Principles, Working Applications in separation, purification and identification. Advanced Application, High performance liquid Chromatography, Gas chromatography HPLC, (Principle, theory, instrumentation and applications of high performance liquid chromatography (HPLC) and its comparison with other chromatography. Advanced applications. Gas Chromatography GC principle, theory, types of columns, packed columns, Capillary columns, Bonded phase columns,, detector types and applications in pharmaceutical analysis. Head space gas chromatography; Pyrolysis gas chromatography; GC-MS, TGA, DTA, DSC, TEM, SEM, DLS, AFM Instrument and their application.	25
2	Infrared Spectroscopy Instrumentation and sampling, Characteristic vibration frequencies of alkanes, alkenes, alkynes, compounds, alcohols, ethers, phenol and amines. Detailed Study of frequencies of Carbonyl Compounds ketones, aldehydes, esters, acids, amides, anhydrides, lactones, lactams and conjugated carbonyl compounds) effect of hydrogen bonding and effect of solvent on vibrational frequencies, overtones, combinations bands and Fermi resonance, FTIR, IR of gaseous, solids and polymeric materials. Example Based on IR Spectra Fundamentals of Spectrophotometry and UV-Visible Spectroscopy:	25

	Various electronic transition(185-800nm), Beer-Lambert law effect of solvent on electronic transition, Ultraviolet bands of carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Fiesher- Woodward's rule for conjugated dienes, and carbonyl compounds, UV spectra of aromatic and heterocyclic compounds, Steric effects in biphenyls. Example based on UV spectra MASS Spectroscopy Introduction ion production, EI, CI, FD and FAB factors affecting fragmentation, ion analysis ion abundance, Mass spectral fragmentation of organic compounds, common functional group, molecular ion peak, McLafferty rearrangement, Nitrogen rule, High resolution mass spectrometry, Example of mass spectral fragmentation of organic compound with respect to their determination. Fundamental of NMR & CMR Spectroscopy: ^1H NMR Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin spin interactions, factors influencing coupling constant 'j'. Classification (ABX, AMX, ABC, A2B2 etc.) spin decoupling; basic ideas about instrument. Advantages of FT NMR use of NMR in medical diagnostics. Principal, basic of NMR (Peak height, Peak signal, Chemical shift,) instrumentation and applications of NMR, Criteria for a compound to be NMR active. Basic components of instrumentation of PMR and CMR. Shielding deshielding, splitting	
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List of References:

1. Quantitative Chemical Analysis" by Daniel C. Harris, 5th Edition, W.H. Freeman and Company, New York.
2. Analytical Chemistry" by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.
3. Principles of Instrumental Analysis" by Douglas A. Skoog, 3rd Edition, Holt-Saunders International Edition.
4. Instrumental Methods of Chemical Analysis" by Galen W. Ewing, 4th Edition, International Student Edition
5. Handbook of instrumental techniques for analytical chemistry, F. Settle, Prentice Hall
6. Spectroscopy of organic compounds by Silverstein 7. Spectroscopy of organic compounds by P.S. Kalsi