SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to BarkatullahVishvavidhyalaya, Bhopal)

DEPARTMENT OF APPLIED CHEMISTRY

Subject Code	AC 301	Subject Name	Advanced Organic Chemistry

Marks Allotted				Duration of Theory Paper	Weekly Contact Hours	
Theory						
Maximum Marks		Minimum Marks			L	T
End Sem	Sessional	End Sem	Sessional	3 Hours	3	1
80	20	21*	12			

Total Minimum in Theory* 40% = 128

Syllabus Description	Hrs.
UNIT I - Fundamentals of Organic Chemistry Introduction, classification and nomenclature of organic compounds, Hydrocarbons, Compounds containing Functional Groups(Aliphatic, Aromatic), Fundamental concepts in Organic Reaction Mechanism: Homolytic and Heterolytic fission,Reaction Intermediates: Carbocations, Carbanions, Free radicals, Carbenes, &Nitrenes, Electrophiles and Nucleophiles, Electronic Displacements in a covalent bond: Inductive effect, Electromeric effect, Mesomeric effect, Resonance and Hyperconjugation, Benzene: resonance, aromaticity. Types of organic reactions: Addition, Substitution, Elimination, Oxidation Reduction, Polymerisation, Condensation etc	8
UNIT II-Stereochemistry: Isomerism, types (Structural & Stereo isomerism), Structural: Chain, position, functional, metamerism, tautomerism, Stereoisomerism: conformational isomers, Molecular representations: Wedge, Fischer, Newman and Saw-Horse formulae. **Geometrical isomerism**: cis-trans, , E&Z notations with Cahn Ingold and prelog rules. **Optical isomerism**: Element of symmetry, chiral and achiral molecules enantiomers, and diastereoisomers, meso structures, racemic mixtures, Relative and absolute configuration: D&L, R&S designations, introduction of stereospecific and stereo-selective reactions, conformational analysis of mono and di-substituted cyclohexanes. Effect of conformation on reactivity in acyclic compounds and cyclohexanes. Thermodynamic control and kinetic control of reactions.	8
UNIT III - Organic Reaction Mechanisms I: **(a) NucleophilicSubstitution reaction**: **(i)Aliphatic:**Nucleophilic Aliphatic Substitution Reaction;SN^1, SN^2, SN^i,neighbouring group participation in aliphatic nucleophilic substitutions. **(ii)Aromatic:**Nucleophilic Aromatic Subtitution Reactions; Effect of substrates, leaving groups, Nucleophilic displacement in areno-diazonium salts by different nucleophiles, Chichibabin reaction. **(b) Electrophilic Substitution Reaction Mechanism:** **(i) Aliphatic:** Electrophilic substitution reaction mechanisms, Effect of substrate, leaving group and solvent, Reactions (hydrogen exchange, migration of double bonds, keto-enoltautomerism, halogenation, aliphatic diazonium coupling, Stork-enamine reaction). **(ii)Aromatic:** Structure reactivity relationship in mono-substituted benzene, ring isomer proportions, orientation in benzene ring with one or more than one substituent, Orientation in other ring systems, Nitration, Sulphonation, Halogenation, Alkylation.	8

(c) Free radical Substitution: Intermediates, Reaction at sp^2 carbon, Reactivity in aliphatic substrates, Reactivity at bridge head position, Reactivity in aromatic substrates.	
UNIT IV- Organic Reaction MechanismsII: **(a) Elimination Reactions**: E_1, E_2 and E_iMechanisms, orientations in E_2 reaction (Saytezeff and Hofmann rule), Pyrrolyticsyn-elimination. **(b) Addition Reactions**: Electrophilic addition to carbon-carbon multiple bond. Nucleophilic addition to carbon-oxygen double bond and activated carbon carbon double bond, Markownikoff's & Anti-Markownikoff's rule. **(c) Pericyclic Reactions:** Cycloaddition, Sigmatropic rearrangements, electrocyclization. **(d) Polymerisation Reactions:** Addition &Condensation Reactions.	8
UNIT V- Organic Name Reactionsand their Applications: Wurtz Reaction, Wurtz-Fittig Reaction, Friedel Craft Reaction, Williamson Synthesis, Aldol Condensation Reaction, Cannizaro Reaction, Perkin Reaction, Dieckmann condensation, Reformatsky condensation, Benzoin condensation, Wittig reaction, Reimer Tiemann, Clemmensen Reduction, Balz-Schiemann Reaction, Etard Reaction, Finkelstein Reaction, Swartz Reaction, Gabriel Phthalimide Synthesis, Gattermann Reaction, Gattermann-Koch Reaction, Grignard Synthesis, Rosenmund Reduction, Sandmeyer Reaction, Stephen Reaction, Wolff-Kishner Reduction, Hell-Volhard-Zelinsky Reaction, Hoffmann Bromamide Reaction, Carbylamine Reaction, Fischer Esterification, Haloform Reaction, Diels-Alder Reaction, Shapiro reaction, Sharplessepoxidation reaction, Mannich reaction, Kolbe Reaction, Kolbe synthesis, Hunsdiecker reaction, Vilsmeir-Haack reaction, Pechmann reaction. Pinacol-Pinacolone rearrangement, Wagner-Meerwein rearrangement, Beckmann, Hofmann, Curtius, Schmidt, Lossen, Sommelet-Hauser, Favoroskii and Cope rearrangement, Claisen rearrangement.	8
Total Hours	40

TEXT BOOKS:

- Stereochemistry of Organic Compounds by D. Nashipuri.
- Organic Reaction Mechanism by Kalsi.
- Stereochemistry with Applications to Organic Reactions by Jagdamba Singh.
- Reaction Mechanism in Organic Chemistry by S.M Mukherjee.

REFERENCE BOOKS:

- Advanced Organic Chemistry: Reaction Mechanism and Structure by Jerry March (Willey Eastern Limited)
- Stereochemistry by Kalsi
- Stereochemistry by Elliel

List/Links of e-learning resource

Recommendation by Board of studies on	23.6.2023
Approval by Academic council on	28.6.2023
Subject handled by department	Applied Chemistry

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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DEPARTMENT OF APPLIED CHEMISTRY

Subject Code	AC 302	Subject Name	Advanced Separation Techniques		
Marks Allotted			Duration of Theory Paper	Weekly Contact Hours	
Theory					
Maximum Marks		Minimum Marks		L	T
End Sem	Sessional	End Sem	Sessional		
80	20	21*	12	3 Hours	3	1

Total Minimum in Theory* 40% = 128

Syllabus Description	Hrs.
Unit-I Advanced Extraction & Separation methods: **Solvent extraction**: Principles and process of solvent extraction, Distribution law and partition coefficient, nature of partition forces, different types of solvent extraction systems-batch extraction, continuous extraction, counter current extraction & solvent extraction systems. Comparison of the efficiency of various techniques and methods improvement. Different processes used for separation-filtration, evaporation, drying and crystallizations. Introduction and classification of Distillation methods. .	8
. **Unit –II Chromatographic Separation:** **Chromatography: I**ntroduction, Principle and types of chromatography, Classification of different chromatographic techniques, Rate and Plate theory, methods of development-Elution development, Gradient elution development, Displacement development and Frontal analysis. Adsorption phenomena, partition coefficient, retardation factor, retention time and volume and temperature effects on the chromatography. Qualitative and quantitative analysis of chromatography.	8
Unit –III Chromatographic Techniques-I **Paper Chromatography:** Principle, paper as a chromatographic medium, modified papers, solvent systems, mechanism of paper chromatography, experimental techniques, different development methods- ascending, descending, horizontal, circular spreading, multiple development and two dimensional development. Reverse phase paper chromatographic technique, visualization and evaluation of chromatograms and applications of PC in the sample analysis. **Thin Layer Chromatography**: Principle, Chromatographic media- coating materials, activation of adsorbent, sample development, solvent systems, Stahl's Triangle, development of chromato-plates, types of development ,visualization methods, documentation and applications of TLC in the separation. Technique and applications of HPTLC	8
Unit-IV Chromatographic Techniques-II **Column Chromatography**: Principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column chromatography without detectors and liquid chromatography with detectors and applications. Efficiency of chromatographic column, Zone spreading, Height Equivalent to Theoretical Plate (HETP),Van Deemter equation, resolution, choice of column, length and flow velocity, **Capillary Electrophoresis**: Principle, details of the instrument and applications of CE for inorganic and organic compounds.	8

Unit V Chromatographic Techniques-III **Gas chromatography**: Theory, principle and types of Gas chromatography, Instrumental description of equipment and different parts, Chromatographic columns (packed and capillary columns), methods of sample introducing or injection(split, splitless , split-splitless and purge and trap). Temperature control and detectors used for gas chromatography. Quantitative and qualitative applications of GC. Principle and applications of GC-MS for trace constituents and drug sample analysis.. **High Performance Liquid Chromatography**: Introduction of High performance Liquid Chromatography (HPLC), principles and theory of operation, instrumentation of HPLC, stationary phases, mobile phases, choosing a mobile phase. Isocratic v/s gradient elution, sample introduction in the instrument, solvent delivery, types of detectors, types of pumps and their requirements, column specification and polarity and applications of HPLC in the separation of the samples analysis.	8
Total Hours	40

TEXT BOOKS:

1. Quantitative Chemical Analysis, Daniel C. Harris, 8th edition,2010, W. H. Freeman & Co., New York, ISBN: 9781429218153.
2. Schoen, H.M., "New Chemical Engineering Separation Techniques"Interscience Publishers,
3. Treybal, R.E., "Mass Transfer Operations", 3rd Edition, McGraw Hill Book Co., 1980.
4. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev.by G.H.Jeffery and others) 5th Ed., The English Language Book Society Longman.
5. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017).
6. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & SonsNew York, 2004.
7 R.P.W Scott,Techniques and practice of chromatography, Marel Dekker Inc., New York.
8. M.N.Sastri,Separation methods,Himalaya Publishing Company, Mumbai.

REFERENCE BOOKS:

1. Principles of Instrumental Analysis", D. A. Skoog, F. J. Holler, S.R. Crouch, Brooks Cole; 6th edition (Dec 6 2006) , ISBN: 0495012017 , 978-0495012016.

2. King, C. J., "Separation Processes", Tata McGraw Hill, 1982.

3. Roussel, R. W., "Handbook of Separation Process Technology", John Wiley, New York1987

4. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.

5. Analytical Chemistry, G.D. Christian, 5th edition, 2001 John Wiley & Sons, Inc. India.

6. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993 Prentice Hall, Inc. Delhi.

7. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003 Pearson Education Pvt. Ltd.,Delhi.

8. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California, 1990.

9. Instrumental Method of Analysis, W.M. Dean and Settle, 7th edition, 1986, CBS Publishers, New Delhi.

List/Links of e-learning resource	
Recommendation by Board of studies on	23.6.2023
Approval by Academic council on	28.6.2023
Subject handled by department	Applied Chemistry

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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DEPARTMENT OF APPLIED CHEMISTRY

Subject Code	AC 303	Subject Name	Drugs & Pharmaceutical Chemistry II		
Marks Allotted			Duration of Theory Paper	Weekly Contact Hours	
Theory					
Maximum Marks		Minimum Marks		L	T
End Sem	Sessional	End Sem	Sessional		
80	20	21*	12	3 Hours	3	1

Total Minimum in Theory* 40% = 128

Syllabus Description	Hrs.
UNIT I – MEDICINAL CHEMISTRY- I **(a) Pharmacognosy:** History, scope and development of drugs and Pharmacognosy, Sources and classification of crude drugs, Organized drugs, unorganized drugs, Cultivation, Collection, Processing and storage of drugs of natural origin. **(b) Pharmocology:** Introduction**,** scope of pharmacology, Nature and sources of drugs, Essential drugs concept, Routes of drug administration.	8
UNIT II – MEDICINAL CHEMISTRY- II **Pharmacokinetics-** Membrane transport, absorption, distribution, metabolism and excretion of drugs, Factors affecting drug metabolism including stereo chemical aspects, Enzyme induction, enzyme inhibition. **Pharmacodynamics-** Principles and mechanisms of drug action. Receptor theories, classification of receptors, regulation of receptors. Drug receptors interactions. Dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. Adverse drug reactions, Drug interactions (pharmacokinetic and pharmacodynamic), Physicochemical properties in relation to biological action.	8
UNIT III – DRUG ANALYSIS AND BIOLOGICAL METHODS OF ASSAY, IMPURITIES IN PHARMACEUTICAL SUBSTANCES Pharmacopoeia: Introduction to IP, BP, USP. History and development of Indian Pharmacopoeia, Sources and types of impurities in medicinal agents, Classification of assay, Principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate, Moisture determination by Karl Fischer methods, Relation of chemical composition and reactivity of drugs (Structural Activity Relationship).	8
UNIT IV- CHEMOTHERAPY CLASSIFICATION- I **(a) Antibiotics:** Introduction and Classification of antibiotics, Constitution, isolation, synthesis, mode of action and therapeutic uses of following antibiotics: Penicillin, Streptomycin, **Chloromycetin, & Tetracycline.** **(b) Sulphonamides:** Synthesis, mode of action and therapeutic uses of following Sulpha Drugs: Sulphacetamide, Sulphadiazine, Sulpha guanidine, Sulphameracine, Sulphathiazole, Sulphamethoxazole. **(c) Antipyretic and Analgesics:** Mode of action of Pyrazolnes, Pyrazolidines, Acetenalide, Parcetamol, Phenacetin, Aspirin, Pentazocine, Ibuprofin, & Analgin.	8

UNIT V- CHEMOTHERAPY CLASSIFICATION –II **(a) Antimalarials:** Introduction, Classification of antimalarial drugs, mode of action of antimalarial drugs, Synthesis of 4-amino quinoline derivatives including Chloroquin, Santaquin and camoquin, and 8-amino quinoline derivatives including Pamaquine, Primaquin, and Pentaquin. **(b) Anaesthetics:** Introduction, Classification of Anaesthetics, Mode of action of General and Local Anaesthetics. Synthesis, Properties and applications of following: **Local Anaesthetic drugs:** Benzoic Acid derivatives (Cocaine, Piperocaine), Amino benzoic acid derivatives (Benzocaine, Procaine), Lidocaine/Anilide derivatives (Lignocaine, Prilocaine), Miscellaneous**:** Phenacaine, Dibucaine. **General Anaesthetic drugs:** Inhalation anesthetics (Halothane), Narcotic analgesics (Morphine, Codeine, Heroine, Loperamide hydrochloride, Propoxyphene hydrochloride), Narcotic antagonists **(**Nalorphine hydrochloride, Levallorphan tartarate), Non-Narcotic analgesics (Aspirin).	8
Total Hours	40

TEXT BOOKS:

- Pharmacognosy by C K Kokate, A P Purohit, S B Gokhle.
- Pharmacognosy: Fundamentals, Applications and Strategies by Rupika Delgoda,
- Practical Pharmaceutical Chemistry Vol I &II by Beckett and Stenlake.
- Textbook of Pharmacology by Prasan R. Bhandari.
- Physical Pharmacy and Pharmaceutical Sciences by Martins, Patrick J. Sinko, Lippincott. William and Wilkins.
- Text Book of Physical Pharmaceutics, IInd edition, Vallabh Prakashan-.C.V.S. Subramanyam.
- Medicinal Chemistry (Organic Pharmaceutical Chemistry), G.R Chatwal, Himalaya Publishing house.
- Textbook of Pharmaceutical Chemistry by ,Jayshree Ghosh, S. Chand & company Ltd.
- Pharmaceutical Chemistry by Dr. S. Lakshmi, Sultanchand & Sons.

REFERENCE BOOKS:

- Medical Pharmacology by Padmaja Udaykumar
- Essentials of Medical Pharmacology by K D Tripathi.
- Cooper and Gunn's Tutorial Pharmacy ,6th edition by S.J. Carter, CBS Publisher Ltd.
- Radiopharmaceuticals-Adrian D. Nunn, Marcel Dekker Publishers.
- Physical Pharmacy- Physical Chemical principles in the pharmaceutical sciences, Alfred Martins, James Swarbrick, Arthur Cammarata ,3rd edition Indian edition, K.M.Varghese Publishing House.
- Wilson & Gisvold; Text book of Medicinal Chemistry, Philadelphia Williams & Lippinctt Wilkins.

List/Links of e-learning resource

- Semalty et al. Essentials of Pharmaceutical Technology, II Edn 2018, reprint 2019, Pharma Med Press, Hyderabad

Recommendation by Board of studies on	23.6.2023
Approval by Academic council on	28.6.2023
Subject handled by Department	Applied Chemistry

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DEPARTMENT OF APPLIED CHEMISTRY

Subject Code	AC 304	Subject Name	Spectroscopic Methods of Analysis		
Marks Allotted			Duration of Theory Paper	Weekly Contact Hours	
Theory					
Maximum Marks		Minimum Marks		L	T
End Sem	Sessional	End Sem	Sessional		
80	20	21*	12	3 Hours	3	1

Total Minimum in Theory* 40% = 128

Syllabus Description	Hrs.
UNIT I - (a) Atomic Absorption Spectroscopy Introduction, Elementary Theory, Instrumentation, Flames, Nebuliser Burner System, Non Flame Techniques (Graphite Furnace, Cold vapour Technique), Resonance line sources, Monochromators, Detectors, Interferences, Chemical Interferences, Background correction methods, Atomic Absorption Spectrophotometers, Experimental Preliminaries, (Calibration curve method, Standard Addition method), Preparation of sample (Wet Ashing, Fusion, Dry Ashing, Microwave Dissolution, Concentration Procedures), Detection Limits, Applications. **(b) Flame Emission Spectroscopy** Introduction, Emission Spectra, Principle of Flame Emission Spectroscopy, Difference between Atomic Absorption Spectroscopy and Flame Photometry, Instrumentation or Flame Photometers, Measurement of Emission of Atomic species, Interference in Emission Spectroscopy, Methods of Analysis: Calibration Curve Method, Standard Addition Method, Internal Standard Method, Applications. Numericals.	8
UNIT II – (a) IR Spectroscopy Introduction, Divisions of IR, Infra red Radiations and Types of vibrations, Principle of IR Spectroscopy, Vibrational Frequency, Instrumentation, Sampling Techniques, IR spectroscopy in some organic molecules, Characteristic IR absorption of some groups, Factors affecting vibrational Frequency, Applications of IR Spectroscopy. Numericals **(b) Raman Spectroscopy** Introduction, Characteristic properties of Raman lines, Difference between Raman spectra and IR spectra, Instrumentation, Applications.	8
UNIT III – Mass Spectrometry Introduction, Features of Mass Spectrometry, Principle, Fragmentation pattern, Factors controlling general Fragmentation modes, Instrumentation, , Recording and Resolution of Mass Spectrometer, Interpretation of Mass spectra, Nitrogen Rule, Ring rule, Applications of Mass Spectrometry, General introduction of GCMS. Numericals	8
UNIT IV- NMR Spectroscopy Introduction, Principle of NMR, Number of signals, Nuclear signals, Instrumentation, Chemical Shifts, Units of Chemical Shift, Shielding and Deshielding, Splitting of signals, Spin Spin Coupling and its rules, Mechanism of Spin Spin Coupling, Coupling Constant, Applications, Limitations of NMR, Numericals	8
UNIT V- X Ray Spectroscopy Introduction, Types of X Ray methods, Theory, Interaction of X Rays with matter(by Absorption, by Scattering and Diffraction), Instrumentation: Production of X rays, Collimator, Monochromator, Detectors (Photographic, Counter), Applications of X ray absorption methods, Applications of X ray diffraction methods(Laue's methods, Bragg's method, Rotating Crystal, Powder method).	8
Total Hours	40
TEXT BOOKS:	

- G.D. Christian, Analytical Chemistry, 6thed. John Wiley & Sons (2001).
- A.l. Vogel, Textbook of Quantirati\e Chemical Anallsis, 5th ed., Addison Wesley Long man Singapore Ltd. (1999)
- Galen W. Eving, lnstrumental Methods of Chemical Analysis, 5th ed., Mc-Graw Hill Book company (1985).
- Willard, Merritt, Dean, and Settle, Instrumental Methods ofAnalysis, 7th ed., C B S Publishers &Distuibutors (1986).
- Douglas A. Skoog et al "Instrumental Analysis" Cengage Learning, edition 2007 .

REFERENCE BOOKS:

- Spectroscopy by Chatwal Anand Himalaya Publishing House.
- Analytical & Industrial Chemistry by Naik, Vithalkar, Bajaga, Bidkan, Ghatage, Mulik.
- Instrumentation in Analytical Chemistry, 1988 – 1991" by Louise Voress.

List/Links of e-learning resource

- Sourced from the Analytical Sciences Digital Library
- http://www.chemindustry.com/db/category/cat179.asp
  Theory and applications - Polarography, Potentiometry, Cyclic
- http://www.topac.com/polarography.html
  Polarography
- http://www.aesociety.org
  Electroanalytical techniques
- http://www.chemindustry.com/chemnames/V/Voltametry.asp
  Voltameter.

Recommendation by Board of studies on	23.6.2023
Approval by Academic council on	28.6.2023
Subject handled by department	Applied Chemistry

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DEPARTMENT OF APPLIED CHEMISTRY

Subject Code	AC 305	Subject Name	PRACTICAL CHEMISTRY	
Marks Allotted			Duration of Practical Examination	Weekly Contact Hours
Practical				
Maximum Marks		Minimum Marks		
End Sem	Sessional	End Sem	Sessional	
80	20	40	12	8 Hours / 12

Syllabus Description

Suggested List of Practicals (Minimum 12 Experiments be performed):

EX-1 Determination of Saponification value of a given lubricating oil or fat sample.
EX-2 Determination of Iodine value of a lubricating oil or fat sample (Wij's method).
EX-3 To determine the strength of the given glucose solution by Fehling solution.
EX-4 To determine the strength of the given glucose solution by Benedict solution method.
EX-5 To prepare phenyl benzoate from phenol.
EX-6 To prepare 2,4,6 trinitrophenol (picric acid) from phenol.
EX-7 To prepare phenyl azo β-naphthol from aniline.
EX-8 To prepare methyl orange from sulphanilic acid.
EX-9 To prepare glucose from cane sugar.
EX-10 To prepare acetanilide from aniline.
EX-11 To prepare Fluorescein dye from phthalic anhydride.
EX-12 Estimation of Phenol by Acetylation method
EX-13 Estimation of amine by acetylation method.
EX-14 To prepare phenyl benzoate from phenol.
EX-15 Estimation of available oxygen in a sample of H_2O_2.
EX-16 Determination of available chlorine in a given sample of Bleaching powder.
EX-17 Thin layer chromatography (TLC) of crude leaves extract or dyes.
EX-18 Any other Experiment given by department.

Recommendation by Board of studies on	23.6.2023 (Friday)
Approval by Academic council on	28.6.2023
Subject handled by department	Applied Chemistry