

ANDHRAKESARI UNIVERSITY:: ONGOLE

M.Sc. ORGANIC CHEMISTRY/ SYLLABUS

Course Structure as per National Education Policy-2020 under CBCS

(*For the students admitted from the academic year 2026-2027 onwards (Regulation-R26)*)

COURSE STRUCTURE & SCHEME OF MARKS

Semester	Components of Study	Course Code	Title of the Course	Credits	Hr/Week	Internal Assessment	SemEnd Exams	Total
SEMESTER - I	Mandatory Core	R26CH11	Inorganic Chemistry-I	4	4	30	70	100
		R26CH12	Organic Chemistry-I	4	4	30	70	100
	Foundation Course	R26CH13	Essential Analytical Techniques for Industry	4	4	30	70	100
	FoundationElective (Opt' 1)	R26CH14A	Physical Chemistry-I	4	4	30	70	100
		R26CH14B	Polymer Science					
		R26CH14C	Nuclear Chemistry and Applications					
	Core Practical-I(SOC)	R26CH15	Inorganic & Physical Chemistry	4	6	30	70	100
	Core Practical-II(SOC)	R26CH16	Organic Chemistry	4	6	30	70	100
	Audit course	*R26CH17*	*Human Values and Professional Ethics*	*2*	*2*	*50*	-	-
	Sub-Total-I			**24**				**600**
SEMESTER - II	Mandatory Core	R26CH21	Physical Chemistry-II	4	4	30	70	100
		R26CH22	Organic Chemistry-II	4	4	30	70	100
	ResearchFoundation	R26CH23	Research Methodology, Ethics & Scientific Writing	4	4	30	70	100
	Elective Foundation (Opt' 1)	R26CH24A	Inorganic Chemistry-II	4	4	30	70	100
		R26CH24B	Nano Science & Technology					
		R26CH24C	Material Science					
	Core Practical-I(SOC)	R26CH25	Inorganic &Physical Chemistry	4	6	30	70	100
	Core Practical-II(SOC)	R26CH26	Organic Chemistry	4	6	30	70	100
	Skill Development	R26CH27	*MOOCS(https://swayam.gov.in/;https://swayam-plus.swayam2.ac.in/)*	*2*	--	*50*	--	--
	Sub-Total-II			**24**				**600**
SEMESTER - III	Mandatory Core	R26OC31	Organic Spectroscopy-I	4	4	30	70	100
		R26OC32	Organic Synthesis & Reaction Mechanisms-I	4	4	30	70	100
	Generic Elective-I (Opt' 1)	R26OC33A	Alkaloids, Terpenoids, Quinones & Phenothiazines	4	4	30	70	100
		R26OC33B	Chemistry of Aerospace Materials					
		R26OC33C	Drug Discovery, Design and Development					
	Open Elective-II (Opt' 1)	R26OC34A	Chemistry of Natural Products	4	4	30	70	100
		R26OC34B	Chemistry of High Energy Materials					
		R26OC34C	Applications of Synthetic Products					
	Core Practical-I(SOC)	R26OC35	Multistage Organic Synthesis	4	6	30	70	100
	Core Practical-II(SOC)	R26OC36	Industry Internship/Mini Research Project	4	6	30	70	100
	Skill Enhancement	R26OC37	*MOOC's (https://swayam-plus.swayam2.ac.in/)/AI in Chemistry*	*2*	--	*50*	--	--
	Sub-Total-III			**24**				**600**
SEMESTER - IV	Mandatory Core	R26OC41	Organic Spectroscopy-II	4	4	30	70	100
		R26OC42	Organic Synthesis & Reaction Mechanisms-II	4	4	30	70	100
	Core Elective-I (Opt' 1)	R26OC43A	Advanced Organic Chemistry	4	4	30	70	100
		R26OC43B	Engineering Chemistry					
		R26OC43C	Quality Control and Quality Assurance in Pharma Industry					
	Open Elective-II (Opt' 1)	R26OC44A	Chemistry of Antibiotics and Drugs	4	4	30	70	100
		R26OC44B	Forensic Science in Solving Crime					
		R26OC44C	Air, Water, Noise & Thermal Pollution					
	Core Practical-I(SOC)	R26OC45	Analysis of Binary Organic Mixture& Organic Estimations	4	6	30	70	100
	Core Practical-II (Multi-Disciplinary)	R26OC46	Research Project (Dissertation+ +Seminar+Viva-voce)	4	6	--	100 (50+20 +30)	100
	Sub-Total-IV			**24**				**600**
	Grand Total			**96**				**2400**

Note: Pass in Audit course, skill development and skill enhancement courses are mandatory; SOC-Skill Orientation Course.



ANDHRA KESARI UNIVERSITY::ONGOLE
DEPARTMENT OF CHEMISTRY
SYLLABUS FOR M.Sc. ORGANIC CHEMISTRY :: SEMESTER–III
(*For the students admitted from the academic year 2026-2027 onwards)*

PAPER–I:ORGANIC SPECTROSCOPY-I (R26OC31)

Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To learn about the basics of various spectroscopic techniques.
- ✓ To understand the instrumentation of UV, IR, NMR, and ESR spectroscopic techniques.
- ✓ To apply the spectroscopy knowledge for the structural elucidation of organic molecules.
- ✓ To understand the interpretation of NMR Spectroscopy of given compound.
- ✓ To learn and solve the spectral problems of UV-IR & PMR.

UNIT-I **14H**

UV-VisibleSpectroscopy:

a) **UV Spectroscopy**: Energy transitions – Simple chromophores – UV absorption of Alkenes – polyenes, unsaturated cyclic systems – carbonyl compounds, α,β-unsaturated carbonyl systems- Woodward-Fieser rules – aromatic systems – solvent effects –geometrical isomerism – acid and base effects – typical examples – calculation of λ_{max} values using Woodward - Fieser rules.

b) **ORD:** Theory of optical rotatory dispersion, α-Axial haloketone rule and octant rule – Application of these rules in the determination of absolute configuration of cyclohexanones, decalones and cholestanones.

c) **Circular Dichroism:** Principle – positive and negative Cotton effects – Absolute configuration.

UNIT-II **12H**

Infrared Spectroscopy(FT-IR): Fundamental modes of vibrations – Stretching and bending vibrations – overtones, combination bands and Fermi resonance, factors influencing vibrational frequencies, hydrogen bonding – fingerprint region and its importance – Study of typical group frequencies for – CH, -OH, -NH, -CO-NH_2, -CC, -CHO, -CO and aromatic systems.

Application in structural determination –Simple problems.

UNIT-III **14H**

^{1}H NMR Spectroscopy:

a) Magnetic properties of Nuclei, Nuclear resonance, Fourier Transformation and its importance in NMR. Equivalent and non-equivalent protons, The chemical shift and its importance, calculation of chemical shift, factors affecting the chemical shifts such as electronegativity and anisotropy, effect of deuteration, Signal integration, Spin-spin coupling: vicinal (Karplus relationships), geminal and long range. Coupling constants (*J*) and factors affecting coupling constants. Shielding and deshielding mechanisms in acetylene carbonyl and Benzene, anisotropy-Spin-Spin Interactions related to first order and higher order spectra (AB, A_2; AB_2, ABX, ABC, AMX)-temperature dependence spectra, Hydrogen bonding. Nuclear Overhauser effect (NOE).

b) Applications:Interpretation of NMR spectrum of a given compound leading to identification-typical examples of PMR spectroscopy.



PAPER–I:ORGANIC SPECTROSCOPY-I (R26OC31)

Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-IV **10H**

Electron Spin Resonance Spectroscopy(ESR):

a) Basic Principles, Comparison of NMR & ESR. Determination of 'g' value, Factors affecting the 'g' value. Isotropic and Anisotropic constants. Splitting, hyperfine splitting coupling constants. Line width, zero-field splitting, and Kramer degeneracy. Crystal field splitting, Crystal field effects.

b) **Applications:** Detection of free radicals; ESR spectra of
(a) Methyl radical ($CH_3^{\cdot}$), (b) Benzene anion ($C_6H_6^{-}$).

UNIT-V **10H**

Common Problems on UV-Vis, FT-IR, and ^{1}H NMR:

a) Problems involving individual spectral methods-UV, IR, and PMR
b) Problems involving any two of UV, IR, andPMR
c) Problems involving all three UV, IR, and PMR spectral data.

Reference Books:

1)Spectrometric identification of organic compounds by R.N. Silverstein & G.C. Bassier (JohnWiley).
2)Spectroscopic Methods in Organic Chemistry by Williams and Fleming (McGraw-Hill).
3)"Organic Photochemistry" by R.O.Kan (McGraw-Hill).
4)"Advanced Organic Chemistry Reaction Mechanisms and Structure" by J. March (McGraw-Hill &Kogshusha).

Learning Outcomes:

- ✓ Students can understand the fundamentals of spectroscopic techniques and apply to investigate the structural information of molecules.
- ✓ It can provide a platform to gain awareness towards UV, FTIR, ^{1}H NMR and ESR spectrometry, which aims to apply this knowledge towards research.
- ✓ Students can understand the interpretation of NMR and how to perform structural elucidation.
- ✓ Students can understand the applications of ESR spectra.
- ✓ Students can understand to solve problems of individual spectral methods of UV-IR & PMR.



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PAPER–II:ORGANIC SYNTHESIS & REACTION MECHANISMS-I (R26OC32)

Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To learn about the basics of tools required for determining reaction mechanisms.
- ✓ To understand different radical reactions involving additions, substitutions, and decompositions and their mechanisms.
- ✓ To learn different approaches and reagents of various oxidation processes in organic synthesis and also their mechanisms.
- ✓ To learn different approaches and reagents of various same with reduction processes in organic synthesis and also their mechanisms.
- ✓ To learn terminology and selectivity in asymmetric synthesis and also apply the approaches in organic synthetic reactions.

UNIT-I **10H**

Methods for Reaction Mechanism by Kinetic & Non-Kinetic studies

Kinetic studies: Kinetics of reaction, Energy profile diagram, Intermediate versus transition state, Reaction rate and rate-limiting step.

Non-Kinetic studies: Identification of products, testing possible intermediates, trapping of intermediates, crossover experiments, Isotopic labeling.

UNIT-II **10H**

Free Radicals

Free radicals and theirreactions-Introduction to radical reactions, Addition of halogens, Hydrogen halides. Substitution reactions- Halogenation, Aromatic substitution, Sandmeyer reaction, Autooxidation, Decomposition of dialkyl and diacyl peroxides.

UNIT-III **14H**

Oxidations

Introduction: Different Oxidative processes.

Hydrocarbons: Alkenes, aromatic rings saturated C-H groups (activated and unactivated), Alcohols, diols, aldehydes, Ketones, Carboxylic acids, Amines, hydrazines, sulphides. Oxidations with ruthenium tetroxide iodobenzenediaccetate and Tl(III) nitrate, lead tetraacetate, SeO_2, MnO_2, Ag_2CO_3, peracids.

Oxidation of C=C perhydroxylation using $KMnO_4$, OsO_4, peracids.

UNIT-IV **14H**

Reductions

Introduction: Reductive process. Hydrocarbons: Alkanes, alkenes, alkynes, and aromatic rings

Carbonyl compounds: aldehydes, ketones, acids and their derivatives. Nitro, nitroso, azo and oxime groups. Hydrogenolysis. Catalytic hydrogenations, Reduction by dissolving metals, Reduction with metal and acid. Reduction with metal in liquid ammonia (Birch reduction).

Reduction by hydride transfer reagents: aluminium alkoxide, LiAlH4, NaBH4, diisobutylaluminium hydride–Sodium cyanoborohydride, tryalkylborohydirdes-Reduction with diimide.



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PAPER–II:ORGANIC SYNTHESIS & REACTION MECHANISMS-I (R26OC32)

Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-V **12H**

Asymmetric Synthesis-I

Terminology: Topicity in molecules: homotopic, stereo Heterotopic (enantiotopic and diastereotopic) groups and faces- symmetry, substitution and addition criteria. Prochirality nomenclature: Pro-R, Pro-S, Re, and Si.

Selectivity in synthesis: Stereospecific reactions (substrate stereoselectivity). Conditions: Stereoselective reactions (product stereoselectivity): Enantioselectivity and diastereoselectivity.:

Analytical Methods:% enantiomeric excess, optical purity, % diastereomeric excess.

Reference Books:

1) Mechanism and Structure in Organic Chemistry, E.S.Could Henry – Holt and Co., Newyork.
2) Advances in Organic Reaction Mechanism and Structure, J. March (McGraw-Hill).
3) A Guide to Mechanism in Organic Chemistry by P.Sykes.
4) Synthetic approaches in organic chemistry by R.K.Bansal(NarosaPublications).
5) Some modern methods of synthesis by Carruthers (Cambridge).
6) Asymmetric synthesis by Nogradi.
7) Asymmetric organic reactions by it) Morrison and HS Moschcr.
8) Stereodifferentiating reactions by Izumi.

Learning Outcomes:

- ✓ Students can understand the fundamental tools required for the determination of reaction mechanisms.
- ✓ Students can able to understand the different types of radical reactions and their mechanisms.
- ✓ Students can able to apply the reagents and approaches for various synthetic reactions involving oxidations.
- ✓ Students can able to apply the reagents and approaches for various synthetic reactions involving reductions, and Students can understand the reduction by dissolving metals and reduction with metal and acid.
- ✓ Students can understand the terminology, selectivity in synthesis and analytical methods; the knowledge on asymmetric synthesis provides a platform for carrying out various stereochemical reactions wherever necessary to apply towards research.



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SYLLABUS FOR M.Sc. ORGANIC CHEMISTRY :: SEMESTER–III
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PAPER–III (Elective–A):ALKALOIDS, TERPENOIDS, QUINONES & PHENOTHIAZINES(R26OC33A)

Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To learn about definition and importance of various alkaloids.
- ✓ To know the structure elucidation and synthetic methods of important alkaloids such as Isoquinoline and stereochemistry.
- ✓ To know the structure elucidation and synthetic methods ofIndole alkaloids
- ✓ To know the classification of terpenoids, isoprene rule, structures and their natural sources.
- ✓ To know the structure characterization and synthesis of quinines and phenothiazines.

UNIT-I 14H

Alkaloids-I: Definition, General methods of identification of alkaloids-nomenclature–occurrence – isolation - chemical tests for identification-general methods of structural elucidation-degradation–classification based on nitrogen heterocyclic ring-role of alkaloids inplants.

a) Structure and synthesis of Atropine, Caffeine.
b) Quinoline alkaloids: Chemistry and synthesis of Quinine, Cinchonine, and their stereochemistry.

UNIT-II 12H

Alkaloids-II:

a) Isoquinoline-Morphine Group Alkaloids: Papaverine, Hydrastine, narcotine, canadine, Coclawrine, Morphine, Codeine, emetine, Apomorphine, Glaucine.
b) Stereochemistry ofemetine and morphine alkaloids.
c) Biogenesis of alkaloids.

UNIT-III 10H

Alkaloids-III:

a) Indole alkaloids: Reserpine, strychnine, brucine, lysergic acid, ergotamine.
b) Structure, stereochemistry, synthesis and biosynthesis of Ephedrine, Conine andnicotine.

UNIT-IV 10H

Terpenoids: Classification, sources, isolation, synthesis and stereochemistry with special reference to zingiberene, santonin, eudesmol, abietic acid, Biosynthesis of terpenoids.



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PAPER–III (Elective–A):ALKALOIDS, TERPENOIDS, QUINONES & PHENOTHIAZINES (R26OC33A)

Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-V **14H**

Quinones and Phenothiazines:

Quinones: Identification of quinones, Lapachol. Chrysophenol and Physcion-chemistryand synthesis.

Phenothiazines: Classification, pharmacological properties of phenothiazines, general methods of synthesis of phenothiazines with reference to Promazine, Prochlorperazine and Thioriazine.

Reference Books:

1) Alkaloids by K.W.Bentley Vols. I &II.
2) Text Book of Organic Chemistry I.L.FinarVol.II3.An introduction of alkaloids by G.A.Swain.
3) Naturally occurring quinines – R. H. Johnson, Vol. I & II, Academic Press, London.
4) Chemistry and physiology of alkaloids by Manske Vol. I &II,VII.
5) Medicinal Chemistry by A.Burger.
6) Isoquinoline Alkaloids byM.Shamma.
7) Heterocyclic Chemistry by JA Joule et al., Chapman –Hall.

Learning Outcomes:

- ✓ Students can understand the definitions and importance of various alkaloids.
- ✓ Students can understand structure elucidation and also know the applications of synthetic processes and synthetic methods of Isoquinoline alkaloids.
- ✓ Students can understand the structure elucidation, synthetic methods and stereochemistry of Indole alkaloids.
- ✓ Basic ideas of the isoprene rule, terpenoids classification, their natural sources, synthesis.
- ✓ Students can understand the structure characterization and synthesis of quinones and Phenothiazines.



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PAPER–III (Elective–B):CHEMISTRY OF AEROSPACE MATERIALS(R26OC33B)

Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To introduce the students to various classes of materials used in aerospace.
- ✓ To understand the materials used and their property requirements for different parts of spacecraft.
- ✓ To study composition- structure-processing-property correlation in aerospace materials to enable them to design new materials with improved properties.
- ✓ To understand metallic materials for cryogenic applications.
- ✓ To study the evaluation of materials for space environment and space worthiness.

UNIT-I **14H**

Carbon Based Materials: Carbon fiber, carbon-carbon composites, carbon aerogels and foams, **Ceramic Materials:** Polymer derived ceramics- synthesis, processing of pre-ceramic polymers, ceramic fibers, Ceramic matrix composites, Thermal barrier coatings, Ablative materials, Silica tiles, Ceramic aerogels, Porous ceramics and ceramic foams, Ultrahigh temperature ceramics- TiB_2, ZrB_2, HfB_2 and their composites, Materials with zero thermal expansion-glass ceramics- preparation and application.

UNIT-II **12H**

Metallic Materials: Super alloys, Titanium alloys, Intermetallics and metal matrix composites, Functionally graded materials -production, properties and application.

UNIT-III **10H**

High Temperature Polymers: Aromatic liquid crystalline polyesters, Phenolics, Polyimide, Poly ether ether ketones- synthesis, processing and applications.

UNIT-IV **12H**

Materials for Cryogenic Applications: Metals for low temperature applications, Austenitic stainless steel, Nitrogen containing steel, Aluminium, Aluminium-lithium alloys, Titanium alloys, Cryo insulation materials, Polymers and adhesive for cryo temperature applications.



PAPER–III (Elective–B):CHEMISTRY OF AEROSPACE MATERIALS(R26OC33B)

Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-V **12H**

Materials for Space Environment: Radiation shielding materials, Atomic oxygen resistant materials, Space suit materials and materials for life support systems, Evaluation of materials for space environment and space worthiness.

Reference Books:

1) G. Savage, Carbon-Carbon Composites, 1st ed., Chapman and Hall, 1993.
2) M. Scheffler, P. Colombo, Cellular Ceramics, Structure, Manufacturing, Properties and Applications, 1st ed., Wiley-VCH, 2006.
3) W.D. Kingery, H.K. Bowen, D.R. Uhlmann, Introduction to Ceramics, 2nd ed., Wiley-Interscience, 1976.
4) J.S. Reed, Principles of Ceramic Processing, 2nd ed., Wiley-Interscience, 1995.
5) H.M. Flower, High Performance Materials in Aerospace, 1st ed., Chapman & Hall, 1995.
6) B.Horst, B. Ilschner, K.C. Russel, Advanced Aerospace Materials, Springer-Verlag, Berlin, 1992.
7) F. Mohammad, Speciality Polymers: Materials and Applications, I.K. International publishing House Pvt. Ltd, 2007.
8) W. Krenkel, R. Naslain, H. Schneider, (Eds.) High Temperature Ceramic Matrix composites, 1st ed., Wiley-VCH, 2006.40 13
9) T.W. Clyne, P.J. Withers, E.A. Davis, I.M. Ward, Introduction to Metal Matrix Composites, Cambridge Solid State Science Series, 1st ed., Cambridge University Press, 1993.
10) R.R. Luise, Applications of High Temperature Polymers, CRC Press, 1st ed., 1996.

Learning Outcomes:

- ✓ Students will get introduced to different classes of aerospace materials.
- ✓ Students will understand property requirements of materials used in different areas of a spacecraft.
- ✓ Students will get an insight into composition-structure-processing-property correlation of aerospace materials to enable them to design new materials with improved properties.
- ✓ Students can understand the metallic materials for cryogenic applications.
- ✓ Students can understand the evaluation of materials for space environment and space worthiness.



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PAPER–III (Elective–C):DRUG DISCOVERY, DESIGN AND DEVELOPMENT (R26OC33C)
Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To learn about the definition of basic principles of pharmacology.
- ✓ To know the discovery of optimization of existing drugs as leads.
- ✓ To know the structure activity/relationship in various drugs.
- ✓ To know the introduction of QSAR & properties.
- ✓ To learn about the structure, uses & mechanisms of action of common drugs.

UNIT-I: Basic Principles of Pharmacology **14 H**

Definitions: Disease, drug, bioassay, pharmacokinetics and pharmacodynamics, stages involved in drug discovery,formulation, drug dosing, routes of drug administration,

Pharmacokinetics: Absorption, distribution, metabolism and excretion of drugs (ADME), drug delivery.

Pharmacodynamics: Nature of drug - receptor interactions, theories of drug action: occupancy theory, rate theory,induced-fit theory, macromolecular perturbation theory.

Drug synergism and antagonism, drug toxicity, clinical trials.

UNIT-II: Lead Discovery and Optimisation **14 H**

Lead Discovery: Existing drugs as leads (me too drugs), pharmacophore. Principles of design of agonists e.g.salbutamol, antagonists e.g. cimetidine and enzyme inhibitors e.g. captopril. Drug discovery without lead. Serendipity-penicillin and Librium as examples.

Lead Optimization: Bioisosterism, variation of alkyl substituents, chain homologation and branching, variation of aromatic substituents, extension of structure, ring expansion and ring contraction, ring variation, variation and position of hetero atoms, ring fusion, simplification of the lead, rigidification of lead, conformational blockers,discovery of oxamnquine.

UNIT-III: SA **10H**

Structure-Activity Relationship (SAR): SAR in sulfa drugs, benzodiazepines, and taxol analogs, principles of prodrug design.

UNIT-IV: QSAR Studies **10H**

Quantitative Structure-Activity Relationship (QSAR): Introduction to QSAR, physicochemical properties. Lipophilicity: partition coefficient (P) and the lipophilicity substituent constant (π), electronic effects: Hammettconstant (σ), steric effects: Traft's constant (Es), Hansch analysis, Craig's plot, Topliss scheme, free Wilsonapproach, Lipinski rule of five.



PAPER–III (Elective–C):DRUG DISCOVERY, DESIGN AND DEVELOPMENT (R26OC33C)
Max. Marks: 100 (Internal-30M & External-70M)

UNIT-V: Common Drugs **12 H**

Structure, uses, mechanism of action of antibacterial agents: sulfamethoxazole, penicillin G, antiviral agents:acyclovir, indinavir, anticancer agents: mechlorethamine, methotrexate, antifungal agents: fluconazole, griseofulvin,gastrointestrinal agents: ranitidine, omeprazole, metoclopramide, cardiovascular agents: amrinone, procainamide,captopril, propranolol, mehyl dopa, anticoagulants: warfarin, central nervous system agents: paracetamol,betamethasone, chlorpromazine, levodopa, diazepam, phenytion, procaine.

Reference Books:

1) Medicinal Chemistry and Pharmaceutical Chemistry, H. Singh and Kaur.
2) An Introduction to Medicinal Chemistry, 4th Ed., G. L. Patrik.
3) Fundamentals of Medicinal Chemistry, Gareth Thomas.
4) Biochemical Approach to Medicinal Chemistry, Thomas Nogrady.
5) Principles of Medicinal Chemistry, William Foye.
6) Medicinal Chemistry, Ashutosh Kar.
7) Medicinal Chemistry, R. R. Nadendla.
8) Berger's Medicinal Chemistry, Vols. 1-5, Manfred E. Wolf.

Learning Outcomes:

- ✓ Students can understand the pharmaco kinetics &pharmaco dynamics.
- ✓ Students understand the lead discovery of lead optimization of various existing drugs.
- ✓ Students understand structure activity relationship in sulpha drugs, benzodiazepines of principles of prodrug design.
- ✓ Students understand about the quantitative structure activity relationship of properties.
- ✓ Studetns understand the structure uses, mechanism of action of antibacterial, anti-fungal, anti-viral, anticancer agents and also about anti coagulants and central nervous system agents.



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PAPER–IV (Elective–A):CHEMISTRY OF NATURAL PRODUCTS (R26OC34A)
Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To know about classification and general methods of synthesis of various flavonoids.
- ✓ To know the structures and synthesis of Fat and water soluble vitamins.
- ✓ To know the classification of hormones and synthesis of some steroidal and non-steroidal hormones.
- ✓ To know about amino acids, proteins, enzymes, cofactors and prostaglandins.
- ✓ To know about the structures and synthesis of insecticides, Rotenoids and Isobutylamines.

UNIT-I **12H**

Flavonoids and Prostaglandins

Flavonoids: Classification,sources, isolation, general methods of synthesis of flavones, flavanones, flavonols. Chemistry and synthesis with special reference to quercetin and kaempferol.

Prostaglandins: Prostaglandins with special reference to PGE and PGF.

UNIT-II **12H**

Vitamins

Fat Soluble Vitamins: Chemistry,Synthesis& biosynthesis of vitamin A_1,vitamin E(α,β,γ,δ-tocopherols) and vitamin K

Water-soluble vitamins: Chemistry,Synthesis, and biosynthesis of B_1 and C.

UNIT-III **12H**

Steroidal Hormones

Chemistry & synthesis of equilenin, oestrone, progesterone, androsterone, testosterone, cortisone.

Non-Steroid Hormones: Chemistry & synthesis of thyroxin, epinephrine, and oxytocin.

UNIT-IV **12H**

Amino Acids: Classification of amino acids. Specific methods of preparation –Malonic ester synthesis and Erlenmeyer azlactone synthesis. Isoelectric point.

Proteins: General nature of proteins – annealing, Biuret reaction, Ninhydrin test. Classification of proteins. Merrifield solid-phase peptide synthesis. Primary, secondary, tertiary, and quaternary structure of proteins.

a) Enzymes: classification, kinetics, and mechanism of enzyme action
b) Coenzymes and cofactors: NAD FAD folic acid citric acid cycle.



PAPER–IV (Elective–A):CHEMISTRY OF NATURAL PRODUCTS (R26OC34A)
Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-V **12H**

Insecticides

Naturally Occurring Insecticides: Introduction, general properties, sources, isolation,synthesis, and stereochemistry of Pyrethrin I and II; Jasmolin I &II; Structure activity relationship (SAR) studies and biosynthesis of pyrethrins.

Rotenoids: Chemistry and synthesis of rotenone.

Isobutylamines: Chemistry and synthesis of anacyclin, and spilanthol.

Minor Insecticides of Plant Origin: Pachyrrhizin and custard-apple.

Reference Books:

1) Steroids by Fieser andFieser,
2) The Vitamins byS.F.Dykes,
3) The Natural Pigments byK.W. Bentley,
4) Biological Chemistry byHolum,
5) Organic Chemistry Vol.IIbyI.L.Finar,
6) Naturally occurring insecticides by M.Jacobson and D.G.Crosby, Marcel- Decker Inc, NewYork.
7) General Organic and Biochemistry by F.A. Bettelheim and Jerry March, Saunders College, Publishing.
8) The terpenoids by Simonsen,
9) The steroids by Shoppee,
10) Chemistry of Carbon compounds by Rodd.

Learning Outcomes:

- ✓ Students can understand the classification and general methods of synthesis of various flavonoids.
- ✓ Students can understand the synthesis of fat and water soluble vitamins.
- ✓ To know the classification of harmones, and synthesis of some steroidal and non-steroidal harmones.
- ✓ Students can able to understand functions, structures and synthesis aminoacids, proteins, enzymes, cofactors and prostaglandins.
- ✓ Students able to understand different types of naturally occurring insecticides and their specific and commercial importance.



PAPER–IV (Elective–B):CHEMISTRY OF HIGH ENERGY MATERIALS(R26OC34B)

Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To learn about the definitions of high energy materials.
- ✓ To learn about the basis of energetic materials.
- ✓ To know about the theoretical basis of thermodynamics.
- ✓ To know about the importance of various novel energetic materials.
- ✓ To know the handling & synthesis of energetic materials.

Unit -I **10H**

High Energy materials: Introduction, Definitions, Combustion, Deflagration, Detonation, Fire and Combustion, Deflagration and Detonation.

Unit-II **12H**

Classification of Energetic Materials: Primary Explosives, High (Secondary) Explosives, Propellant Charges, Rocket Propellants, Chemical Thermal Propulsion (CTP), Pyrotechnics, Detonators, Initiators, Delay Compositions and Heat-Generating Pyrotechnics, Light-Generating Pyrotechnics, Decoy Flares, Smoke Munitions, Near-Infrared (NIR) Compositions.

Unit-III **14H**

Detonation, Detonation Velocity and Detonation Pressure,

Thermodynamics: Theoretical Basis, Computational Methods, Thermodynamics, Detonation Parameters, Combustion Parameters, Example: Theoretical Evaluation of New Solid Rocket Propellants 101 4.2.5 Example: EXPLO5 Calculation of the Gun Propellant Properties of Single, Double and Triple Base Propellants.

Unit-IV **12H**

Design of Novel Energetic Materials: Classification, Polynitrogen Compounds, High-Nitrogen Compounds, Tetrazole and Dinitramide Chemistry, Tetrazole, Tetrazine and Trinitroethyl Chemistry, Ionic Liquids, Dinitroguanidine Derivatives, Co-Crystallization, Future Energetics.



PAPER–IV (Elective–B):CHEMISTRY OF HIGH ENERGY MATERIALS(R26OC34B)
Max. Marks: 100 **(Internal-30M & External-70M)**

Unit-V **12H**

Synthesis of Energetic Materials: Molecular Building Blocks, Nitration Reactions, Processing, Safe Handling of Energetic Materials in the Laboratory, General Protective Equipment, Laboratory Equipment.

Energetic Materials of the Future.

Reference Books:

1) G.Majano, S.Mintova, T.Bein, T.M.Klapotke, Advanced Materials.
2) R.M.Doherty, Novel Energetic Materials and Applications.
3) H.D.B. Jenkins, Chemical Thermodynamics at a Glance, Black well, Oxford.
4) J.P. Agarwal, R.D. Hodgson Organic Chemistry of Explosives.
5) Prof. Dr. Thomas Kal Potke Energetic Materials-LMU Munich.(https://www.hedm.cup.uni-muenchen.de/personen/professors/klapoetke/index.html)
6) https://www.uidaho.edu/sci/chem/people/faculty/jshreeve

Learning Outcomes:

- ✓ Students can able to understand the definitions of high energy materials.
- ✓ Studetns can understand the categorization of energetic materials.
- ✓ Students able to understand theoretical basis of thermodynamics with examples.
- ✓ Students can understand about the design of various novel energetic materials.
- ✓ Students understand the synthesizing the energetic material of their importance in future.



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PAPER–IV (Elective–C):APPLICATIONS OF SYNTHETIC PRODUCTS(R26OC34C)
Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To know the basics of dyes, drugs and also their importance.
- ✓ To know about the production and working of soaps, detergents and formulations of cosmetics.
- ✓ To know about flavours, sweeteners, insecticides, and their applications.
- ✓ To know about explosions and polymer types.
- ✓ To introduce the students to biodegradable and Non-biodegradable polymers and their industrial importance.

UNIT-I **12H**

Dyes: Colour and constitution, classification, dyeing method, and their industrial importance.
Drugs: Basic concepts, classification, sources, the requirement of an ideal drug.

UNIT-II **12H**

Synthetic Drugs: Structure and medicinal properties.
Sulphanilamide: An example of a sulpha drug-paracetamol, aspirin, oil of wintergreen; Mephensin.
A muscle relaxant; Ibuprofen-an anti-inflammatory drug; L-dopa-cures Parkinson's disease;

UNIT-III **12H**

Soaps and Detergents: Production and their cleansing action.
Liquid crystals and their applications. Surfactants
Cosmetics: Detailed study of formulations and manufacturing of cream and lotions, lipstick and nail polish, shampoos, hair dyes, and toothpastes.
Flavours: Natural flavouring materials and classification.

UNIT-IV **12H**

Sweeteners: Natural and Synthetic sweeteners.
Pesticides: Introduction, Classification, Applications and their effect on the environment.
Insecticides: Introduction, Classification, Applications and their effect on the environment.
Explosives: Introduction, RDX, Gun Powder.



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PAPER–IV (Elective–C):APPLICATIONS OF SYNTHETIC PRODUCTS (R26OC34C)

Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-V **12H**

Polymers: Introduction, biodegradable and non-biodegradable polymers and their industrial importance, plastics (uses and effects on environment), natural and synthetic rubbers, polyamides, and polyesters like nylon, Dacron, Terelyne. Thermoplastics–Polycarbonates, polyacrylates in lens applications, Polyurethanes, and conducting polymers.

Reference Books:

1) I.L. Finar, Organic Chemistry, ELBS Longman, Vol. I & II, 1984.742.
2) K. Albert, L. Lehninger, D. L. Nelson, M.M. Cox, Principles of Biochemistry, CBZ Publishers, 1st Edition, New Delhi, 1993.
3) Harper's Biochemistry, Ed. R. Harper, 22nd Edition, Prentice Hall Press, New York, 1990.
4) Encyclopedia of Chemical Technology – Kirk–Othmer Series.
5) Harper's Review of Biochemistry – P.W. Martin, P.A. Mayer & V.W. Rodfwell, 15th Edition, Maurzen Asian Edition, California, 1981.
6) Polymer Science, Gowarikar.
7) Industrial Chemistry, B.K. Sharma.

Learning Outcomes:

- ✓ The students able to understand dyes and their industrial importance.
- ✓ The students understand the cleansing action of soaps, manufacture of cosmetics and use of flavours and sweetness.
- ✓ The students able to understand effects of pesticides and insectides to the environment.
- ✓ The students understand about explosive materials and preparation & use of polymers in industries.
- ✓ Students understand the biodegradable and Non-biodegradable polymers and their industrial importance.



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PRACTICAL–I: MULTISTAGE ORGANIC SYNTHESIS (R26OC35)

Max. Marks: 100 **(Internal-30M & External-70M)**

(Minimum Five Experiments must be carryout)

Expt-1: Synthesis of paracetomol from benzene

Step 1: Benzene to Nitrobenzene (Nitration)

Step 2: Nitrobenzene to N-phenyl hydroxylamine (reduction)

Step 3: N-phenyl hydroxyl amine to *p*-aminophenol (Rearrangement)

Step 4: *p*-amino phenol to *p*-hydroxy acetanilide/paracetomol(acetylation)

Expt-2: Synthesis of *o*-chlorobenzoic acid from phthalic acid

Step 1: Phthalic acid to phthalic anhydride (Dehydration)

Step 2: Phthalic anhydride –phthalic amide (Amide formation)

Step 3: Phthalmide-Anthranilic acid (Hoffman's Bromamide reaction)

Step 4: Anthranilic acid -*ortho*-chloro benzoic acid

Expt-3: Synthesis of sulpha drug from aniline

Step 1: Aniline to acetanilide

Step 2: Acetanilide to *p*-acetamide benzene sulphonyl chloride (sulphonation)

Step 3: *p*-acetamide benzenesulphonylchloride to *p*-acetamide benzenesulphonamide (s-amination)

Step 4: *p*-acetamide benzene sulphonamide to *p*-amino benzenesulphonamide(hydrolysis)

Expt-4: *m*-Chloro-nitrobenzene from nitrobenzene

Step 1: Nitro benzene to *m*-dinitro benzene (nitration)

Step 2: *m*-dinitrobenzene to *m*-nitro aniline (partial reduction)

Step 3: *m*-nitro aniline to *m*-nitrodiazoniumchloride (diazotization)

Step 4: *m*-nitrodiazoniumchloride to *m*-Chloro-nitrobenzene (sandmayers reaction)

Expt-5: Synthesis of *p*-bromo benzanilide from benzophenone

Step 1: Benzophenone to benzopenone oxime (Addition)

Step 2: Benzophenone oxime to benzanilide (Beckman's rearrangement)

Step 3: Benzanilide to *p*-bromobenzanilide) (bromination)



PRACTICAL–I: MULTISTAGE ORGANIC SYNTHESIS (R26OC35)

Max. Marks: 100 **(Internal-30M & External-70M)**

Expt-6: Synthesis of Methyl orange from aniline

Step 1: Aniline to sulphonic acid (sulphonation)

Step 2: sulphonic acid to Diazonium chloride (diazotization)

Step 3: Diazonium chloride to methyl orange (coupling reaction)

Expt-7: Synthesis of Acridone from Anthranilic acid

Step 1: Anthraninilc acid to o-chlorobenzoic acid (Diazotosation followed by sand mayer's reaction)

Step 2: o-chlorobenzoic acid to N-phenyl anthranilic acid (Substitution)

Step 3: N-phenyl anthranilic acid to acridone (Cyclisation)

Note: All the students must submit the TLC for all the stages of preparation and a photo copy must be pasted in records.

Reference Books:

1) Practical Organic Chemistry A.I.Vogel (Longmans).
2) Text Book of practical organic Chemistry F.G.Mann& B.C. Sanders.
3) A Manual of Practical Organic Chemistry Day Sitaramam&Govindachari.
4) Organic Experiments L.F.Fieser.
5) Practical Organic Chemistry H.T.Openshaw.
6) Systematic Identification of Organic Compounds, P.L.Shriner, R.C.Fuson&D.Y.Curtin.
7) Identification of Organic Compounds N.D.Cheronis&J.B.Entrilkin.
8) Advanced Organic Synthesis by R.S.Monson Academic Press.

Note: For University Practical Examination the Duration is a 6-9 hours.



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PRACTICAL–II: INDUSTRY INTERNSHIP/MINI RESEARCH PROJECT (R26OC36)

Max. Marks: 100 **(Internal-30M & External-70M)**

The University students must attend one "**INDUSTRY INTERNSHIP**"program with the necessary permissionsfrom the Head of the Department, Chemistry.

Further, the student must submit a book of at least 30 to 40 pages on the internship project report.

However, the students of affiliated colleges may opt for "**MINI RESEARCH PROJECT"**with one faculty as mentor and has to submit the project consisting of 30 to 40 pages book



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SEMESTER–III

Paper-VII: MOOCS (R260C37) / AI in Chemistry

Max. Marks: 50

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1) The students can choose a course from Swayam or Swayam plus platform using the below links with not less than 4 weeks course

https://swayam.gov.in/

(OR)

https://swayam-plus.swayam2.ac.in/

Note: Finally, the student has to submit the certificate issued ny MOOCs to the University through respective College Principal.

(OR)

2) The students may specifically choose thepaper of **AI in Chemistry**



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PAPER–I:ORGANIC SPECTROSCOPY-II (R26OC41)

Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To learn about the basics of ^{13}C NMR, Mass, and 2D NMR spectroscopic techniques.
- ✓ To understand the instrumentation of Mass, types of ionizations, types of analyzers in Mass spectroscopic techniques.
- ✓ To apply the spectroscopy knowledge for the structural elucidation of natural products and stereochemistry of organic compounds.
- ✓ To learn about the structural elucidation of natural products.
- ✓ To know the spectral problems – UV; ^{1}H,^{13}C,Mass spectrometry.

UNIT-I **12H**

^{13}C NMR Spectroscopy:

Types of ^{13}C NMR spectra,Undecoupled, proton- decoupled, single frequency off-resonance decoupled (SFORD) and selectively decoupled spectra. Signal enhancement by Nuclear OVER HAUSER effect. ^{13}C chemical shifts, factors affecting the chemical shifts. Noise decoupled and off-resonance spectra of simple Compounds. Calculation of chemical shifts of alkanes, alkenes, alkynes, and aromatic compounds. Typical examples of CMR spectroscopy –problems.

UNIT-II **12H**

Mass Spectroscopy:

Introduction, Principles of Ionization Methods: EI, CI, FDI, PDI, LDI, FAB, TSI and ESI, Types of mass analyzers; Types of fragments-odd electron and even electron containing neutral and charged species (even electron rule), nitrogen rule, molecular-ion peak, base peak, metastable ion, isotopic abundance. High Resolution-MS (HRMS), index of hydrogen deficiency (IHD). Fragmentation of typical organic compounds-hydrocarbons, aromatics, alcohols, alkyl halides, ethers, Carbonyls, carboxylic acids, esters, amines, amides, nitro compounds. Generalmethods of mass spectral fragmentation-β-cleavage, Mclafferty rearrangement, retro Diels-Alder fragmentation and ortho effect. Factors affecting fragmentation-Mass spectra related problems.

UNIT-III **12H**

2D NMR Techniques:

Principles of 2D NMR, classification of 2D-experiments, 2D-J-resolved spectroscopy. Correlation spectroscopy (COSY), HOMO COSY (^{1}H-^{1}H COSY), COSY of *m*-dinitrobenzene, isopentyl acetate, Hetero COSY (^{1}H, ^{13}C COSY) Hetero COSY of isopentyl acetate and 4-methyl-2-pentanol, HMQC, HMQC of codeine, long range ^{1}H, ^{13}C COSY (HMBC), HMBC of codeine and NOESY, NOESY of 9-benzylanthracene, 2-D INADEQUATE experiments.



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PAPER–I:ORGANIC SPECTROSCOPY-II (R26OC41)

Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-IV **12H**

Spectral Characteristics of Natural Products involving all Spectral Data: Use of spectroscopic methods UV, IR, ^{1}H and ^{13}CNMR and Mass spectra in the structure elucidation of natural products. Illustration with suitable compounds like Apigenin(Flavone), Kaempferol (flavonol), Umbelliferone (coumarin), Camphor (Terpenoid), Lawsone (Naphthoquinone), Papaverine (Alkaloid), and Equilenine (steroid).

UNIT-V **12H**

Spectral Problems:

Applications of ^{13}C NMR spectroscopy: Stereochemistry, and reaction mechanisms.
Applications of ^{1}H NMR spectroscopy: Stereochemistry-Geometrical and optical isomerism.
Spectral Problems involving all spectral data UV-Vis. ^{1}H NMR, ^{13}C NMR, Mass spectrometry & 2D NMR techniques.

Reference Books:

1) Spectrometric identification of organic compounds by R.N.Silverstein&G.C.Bassier (John Willey)
2) Spectroscopic methods in Organic Chemistry by Williams and Fleming (McGraw Hill).
3) Organic photochemistry by R.O.Kan (McGrawHill)
4) Advanced organic Chemistry Reaction Mechanisms and Structure by J March (Mc Graw Hill &Kogshusha).
5) Carbon-13 NMR Spectroscopy by J.B.Stothers.

Learning Outcomes:

- ✓ Students can understand the fundamentals of ^{13}C NMR and Mass spectroscopic techniques and apply to investigate the structural information of molecules.
- ✓ It can provide ability to apply the spectroscopy knowledge for the structural elucidation of natural products and stereochemistry of organic compounds.
- ✓ It also provides platform for awareness towards ^{13}C NMR and Mass Spectrometry which aims to apply these knowledge towards research.
- ✓ Students can understand the spectral characterstics of natural products involving all spectral data.
- ✓ Students can understand the spectral problems involving all spectral dataUV-Vis. ^{1}H NMR, ^{13}C NMR, Mass spectrometry & 2D NMR techniques.



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PAPER–II:ORGANIC SYNTHESIS & REACTION MECHANISMS-II (R26OC42)

Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To learn about the basics of C-C single and double bond formations and Diels-Aider reactions.
- ✓ To learn terminology and develop skills in writing retro-synthetic routes for target molecules with one and two functional groups.
- ✓ To learn different approaches in photochemical and pericyclic reactions.
- ✓ To learn terminology and selectivity in asymmetric synthesis and also apply the approaches in organic synthetic reactions.
- ✓ To learn the Nucleophilic additions to chiral carbonyl compoundsandFelkin-Anhmodel.

UNIT-I **12H**

Formation of C-C Single &Double Bonds and Diels–Aider &Related Reactions:

Formation of C-C single bonds–enamines and related reactions.

Formation of C-C double bonds–Corey-winter olefination, Peterson olefination, Julia olefination, McMurry coupling, witting reaction of Phosphorus ylides–stereoselective synthesis of tri and tetra- substituted alkenes.

Diels–Aider and related reactions –diene-dienophile, intramolecular Diels –Alder reactions, Stereochemistry and mechanism Retro Diels – Alder reaction –1,3-dipolar reactions.

UNIT-II **12H**

Synthetic Strategies or Retro Synthetic Analysis: Terminology- Target Molecule(TM), synthon, synthetic equivalent, functional group interconversion (FGI), and representation of disconnection of bonds. Linear and convergent synthesis. One group and two group disconnections in simple molecules- Alcohols, Olefins, aryl ketones, α,β-Unsaturated compounds –1,3 dicarbonyl compounds. synthesis involving chemoselectivity, regioselectivity, reversal of polarity and cyclizations.

UNIT-III **12H**

Photochemistry: Photochemistry of olefins–conjugated olefins–Aromatic compounds–isomerisation–additions. Photochemistry of carbonyl compounds–Norrish type I and II reactions–Paterno–Buchi Reaction. Photo reduction, Photochemical rearrangements–Photo Fries rearrangement, Di-π-methane rearrangement.

UNIT-IV **12H**

Pericyclic Reactions: Definition, classification, MO theory, Electronic configuration in ground and first excited states of aliphatic conjugated polyene system (upto 4 double bonds).

Electrocyclic Reactions: Mechanism, stereochemistry, PMO, FMO, correlation diagram, Woodward Hoffman rules. **Cycloaddition Reactions**: FMO and correlation diagram methods-(2+2) and (4+2) cycloaddition reactions, stereochemistry. Woodward Hoffman rules.

Sigmatropic Rearrangement: classification, Mechanism by FMO method, Woodward Hoffman rules. Cope, Claisen and Aza-cope rearrangements.



PAPER–II:ORGANIC SYNTHESIS & REACTION MECHANISMS-II (R26OC42)
Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-V **12H**

Asymmetric Synthesis-II: Substrate Controlled Asymmetric Synthesis: Nucleophilic additions to chiral carbonyl compounds. 1,2- asymmetric induction, Cram's rule, and Felkin-Anhmodel. i) Chiral auxiliary controlled asymmetric synthesis: Į-Alkylation of chiral Enolates, azaenolates, 1,4-Asymmetric induction and Prelog's rule. Use of chiral auxiliaries in Diels-Alder and Aldol reactions. ii) Chiral reagent controlled asymmetric synthesis: Asymmetric reductions using BINAL-H.; Asymmetric Hydroboration using $(IPC)_2BH$ and $IPCBH_2$.

Reference Books:

1) Some Modern methods of synthesis By Caruthers (Cambridge)
2) Organic synthesis by Robert & Ireland (Printce Hall ofIndia)
3) Designing Organic Synthesis B Staurt Warron, John Wiley &Sons
4) "Pericyclic reactions a mechanistic study"S.M.Mukheji
5) Synthetic approaches in Organic Chemistry " R.K.Bansal, NarosaPublications
6) Advances in Organic Chemistry – Reaction mechanism and structure" by J. March (McGrawHill).
7) Organic Photo chemistry and Pericyclic reactions, M.G.Arora Anmol Publications Pvt.Ltd.
8) Fundamentals of photochemistry by K.K.Rohatgi–Mukharjee Now Age internationalpublishers.
9) Photochemistry by C W S Wells.
10) Organic Photochemistry by Turro.
11) Molecular Photochemistry by Gilbert &Baggo.
12) Organic Photochemistry by D Coyle.
13) Asymmetric synthesis by Nogradi.
14) Asymmetric organic reactions, J. D. Morrison and H. S. Moschcr.
15) Principles of Asymmetric synthesis, R. E. Gawley and J. Aube, 2nd Ed., Elsevier, 2012.

Learning Outcomes:

- ✓ Students understand the basics of C-C single and double bond formations and Diels–Aider reactions.
- ✓ Students learnt the terminology and develop skills in writing retro-synthetic routes for target molecules with one and two functional groups.
- ✓ Students learnt different approaches in photochemical and pericyclic reactions
- ✓ Students are able to understand the terminology and able to know selectivity in asymmetric synthesis and also able to apply the approaches in organic synthetic reactions.
- ✓ Students understand the Nucleophilic additions to chiral carbonyl compounds and Felkin-Anhmodel.



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PAPER–III (Elective–A):ADVANCED ORGANIC CHEMISTRY (R26OC43A)
Max. Marks: 100 (Internal-30M & External-70M)

Learning Objectives:

- ✓ To introduce novel named reactions in modern organic synthesis.
- ✓ To know importance and principles of green chemistry, and microwave assisted reactions.
- ✓ To know the role of nanochemistry in various fields and synthesis methods (Solid and Gase phase).
- ✓ To introduce green chemistry and microwave assisted reactions.
- ✓ To know use of organoboranes and organosilanes in synthesis.
- ✓ To introduce supramolecular chemistry and to know the mechanism of building blocks.

UNIT-I: 12H

Advanced named Reactions in Organic Synthesis:

Baylis-Hillmon reaction, RCM Olefin metathesis, Grubb's catalyst, Mitsunobu reaction, Suzuki Coupling, Heck Coupling, Stille Coupling, Sonagashia, Coupling, Negishi Coupling, Hiyama Coupling, Buchwold – Hartwig Reaction, Click Reaction.

UNIT-II: 10H

Nano Chemistry

Introduction, Carbon Nanotubes:Structure of single and multi wall carbon nanotubes, synthesis-solid and gaseous carbon source-based production techniques, synthesis with controlled orientation. Growth mechanism of carbon nanotubes-catalyst free growth, catalyst activated growth, nano buds, nanotorus; Properties-general, adsorption, electronic & optical, Mechanical and reactivity. Defects, Toxicity Applications.

UNIT-III 12H

Green Synthesis: Introduction, Principles, Green solvents- supercritical fluids, water, ionic liquids and PEGs as green solvents for organic reactions. Examples of green reactions-synthesis of Ibuprofen, Clean Fischer-Indole synthesis comparison of the above with conventional methods.

Microwave Organic Synthesis: Introduction, Applications: Microwave-assisted reactions in water (oxidation of toluene to benzoic acid, oxidation of alcohols); organic solvents (Diels-Alder reaction and Decarboxylation); solvent-free reactions (solid state reaction)-Michael addition and Knoevenagel reaction), multistep V/s single pot synthesis.

UNIT-IV: 12H

Organoboranes and Silanes:

Organoboranes: Synthetic applications of organoboranes–protonolysis, oxidation, carbonylation Reaction of alkenyl borane–enantioselective synthesis of secondary alcohols from alkenes.

Organosilanes: Synthesis of organosilanes, general features of carbon-carbon bond forming reactions of organosilicon compounds, addition reactions with aldehydes and ketones, acylation reactions, conjugate addition reactions.



PAPER–III (Elective–A):ADVANCED ORGANIC CHEMISTRY (R26OC43A)
Max. Marks: 100 (Internal-30M & External-70M)

UNIT-V: 12H

Supramolecular Chemistry: Introduction-the meaning of supramolecular chemistry, phenomenon of molecular recognition and their quantification Building blocks of supramolecular chemistry-acyclic receptors for neutral and charged guests, macrocycles and crown ethers, macrobicycles and cryptands, macropolycycles, cucurbituril and cyclodextrins.

Reference Books:

1) New trends in green Chemistry by V.K.Ahluwalia
2) Organic synthesis by Robert & Ireland (Printce Hall ofIndia)
3) Designing Organic Synthesis B staurt Warron, John Wiley &Sons
4) Green chemistry, ***V.K.Ahluwalia***, Anebooks.
5) P.T. Anastas and J.C.Warner***Greenchemistry***,Oxford.
6) G.A.Ozin, A.C. Arsenault ***Nano chemistry***,RSC.
7) Diwan, Bharadwaj, ***Nanocomposites***,Pentagon.
8) V.S.Muralidharan, A.Subramania, ***Nanoscience and Technology,*** AneBooks.
9) J.W Steed and J.L Atwood, Supramolecular chemistry, John Wiley & Sons, Ltd. New York.
10) Piet W.N.M.van Leeuwen, Supramolecular Catalysis, Wiley-VCH Verlag GmbH &Co.
11) Principles and methods in supramolecular chemistry, Hans-Jorg Schneider and A.Yatsimirsky, John Wiley and Sons.
12) Analytical Chemistry of Macrocyclic and Supramolecular Compounds, S.M.Khopkar, Narosa Publishing House.

Learning Outcomes:

- ✓ Students able to understand novel named reactions and applications in modern organic synthesis.
- ✓ Students understand the importance and principles of green chemistry, microwave assisted reactions and know applying the green synthesis to organic reactions.
- ✓ Students know current importance of nanochemistry in various fields and their synthetic methods(Solid and Gase phase).
- ✓ It provides the knowledge of using organoboranes and organosilanes in synthesis.
- ✓ Students understand requirements of guest and host and formation of building blocks of supramolecular chemistry.



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PAPER–III (Elective–B):ENGINEERING CHEMISTRY (R26OC43B)
Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives: The student should be conversant with the:

- ✓ Chemistry of engineering materials and their applications.
- ✓ Principles of polymer chemistry and engineering applications of polymers.
- ✓ Principles of electro chemistry, electrochemical cells, Reference electrodes, Solar and fuel cells, Energy Storage Devices.
- ✓ Mechanism of corrosion and Principles of corrosion control.
- ✓ Analytical techniques and their importance.

UNIT-I: Engineering Materials **12H**

Refractories: Classification – Acidic, Basic and Neutral refractories; Properties: refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling; Preparation, Properties and applications of alumina, magnesite and zirconia bricks,

Composites: Introduction Constituents of Composites, types-Fibre reinforced Particulate and Layered composites and their applications.

Lubricants: Mechanism of lubrication, Liquid lubricants - properties: viscosity index, flash and fire points, cloud and pour points, oiliness; Solid lubricants - graphite and molybdenum sulphide.

UNIT-II: Polymer Chemistry **12H**

Introduction, polymerization: types – addition and condensation polymerization; Mechanism of free radical addition polymerization with suitable example; Polymer Tacticity and Ziegler Natta polymerization (mechanism).

Plastics: Classification (Thermoplastic and thermosetting); Preparation, properties and uses of PVC, Teflon, Bakelite, Nylon-6,6.

Rubbers: Natural rubber**,** drawbacks of raw rubber**,** Vulcanization of rubber; Synthetic rubbers: Buna-S, Buna-N and Poly urethane.

UNIT-III: Electro Chemistry **12H**

Electrode potential, Determination of single electrode potential; Nernst equation (problems); Electrochemical series – significance; Electro chemical cells, Reversible and irreversible cells, Reference electrodes – Standard Hydrogen electrode, Calomel electrode, Ion selective electrode (glass electrode) – measurement of pH;

Solar cells: Introduction, Solar Panels, Applications;

Fuel Cells: Hydrogen – Oxygen Fuel Cell;

Batteries: Lead – acid, NiCad and Lithium Batteries.



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PAPER–III (Elective–B):ENGINEERING CHEMISTRY (R26OC43B)

Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-IV: Corrosion and Corrosion Control **12H**

Corrosion: Types of corrosion-Chemical or dry corrosion, Pilling–Bedworth rule; Electrochemical or wet corrosion; Galvanic corrosion, pitting, stress and differential aeration corrosion; factors influencing corrosion;

Corrosion Control–sacrificial anodic method and impressed current cathodic methods, corrosion inhibitors; Protective coatings: Metallic coatings–electro plating (Au) and electroless plating (Ni). Paints–constituents and functions,

UNIT-V: Analytical Techniques **12H**

Beer-Lambert's law; Colorimetry:principle, instrumentation (with block diagram) and Estimation of iron, Flame photometry: principle, instrumentation (with block diagram) and estimation of sodium; Atomic Absorption Spectroscopy: principle, instrumentation (with block diagram) and estimation of nickel.

Conductometric titrations (Acid-Base) and Potentiometric titrations (Redoxtitrations–Fe^{2+}*vs* dichromate).

Reference Books:

1) P.C. Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi 15th edition (2010).
2) S.S. Dara &Mukkanti K. "A text book of engineering chemistry" S. Chand & Co. Ltd., New Delhi (2006).
3) B. Sivasankar "Engineering Chemistry" Tata McGraw Hills co., New Delhi (2008).
4) Dr. B. K. Sharma, Instrumental methods of analysis, Krishna Prakashan Media, 2000.
5) Text Book of Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
6) Engineering Chemistry by K. Maheswaramma, Pearson publishers 2015.

Learning Outcomes: To impart a sound knowledge on the principles of Engineering Chemistry involving the different application oriented topics required for all chemistry courses. After studying this course, students will be able to:

- ✓ Apply their knowledge in designing and preparing different materials and their utility at various needs to overcome all the problems that commonly arise in construction, automobile, metallurgical industries etc.
- ✓ Design economically new synthetic methods of polymers, their usages, and substitute metals with Cheaper, durable & light weight polymer materials.
- ✓ Have the capacity of applying energy sources efficiently and economically for various needs with knowledge of construction of energy devices.
- ✓ Understand corrosion methods and able to develop methods to prevent corrosion of metals and also to protect the environment by designing safer chemical techniques.
- ✓ Apply their knowledge in analyzing the structure of organic compounds and estimations of elements in various samples by using different instrumental techniques.



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PAPER–III (Elective–C):QUALITY CONTROL AND QUALITY ASSURANCE IN PHARMA INDUSTRY (R26OC43C)

Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To know about the basics of quality audit like SOP, ICH, ISO etc.
- ✓ To understand the various documentation processes and handling of materials.
- ✓ To understand the organizational responsibilities and personal responsibilities in the pharma sector.
- ✓ To acquire basic knowledge about the regulatory aspects and quality control.
- ✓ To know about the Basic concepts of Quality Assurance

UNIT-I: **12H**

Pharmaceuticals Concept of drug, lead compound and lead modification, prodrugs and soft drugs.Importance of quality control, drugs and pharmaceuticals, sources of impurities in pharmaceutical chemicals, analytical quality control in finished/final products, common methods of assay.

UNIT-II: **12H**

Quality Audit, Documentation Quality audit. Standard operating procedure (SOP); international conference harmonization (ICH); ISO-9000; ISO-14000, WHO specifications, USFDA guidelines and ICMR. Documentation and Handling : Manufacturing documents, Master Formula, batch formula, Record, Distribution of records, Handling of returned goods, Recovered materials and Reprocessing.

UNIT-III: **12H**

Organization and Personnel Responsibilities Training, Hygiene, Premises: Location, Design, Plant layout, Construction, Maintenance and Sanitations. Environmental control, sterile areas, control of contamination.

UNIT-IV: **12H**

Regulatory Aspects and Quality Control Regulatory aspects. Validation f Personnel, Equipment and cleaning methods, regulatory aspects of pharmaceutics. Quality Control. In-process quality Control on various dosage forms, Sterile and non-sterile operations.

UNIT-V: **12H**

Basic concepts of Quality Assurance Basic concepts, principles or prescription, Needs, requirements and expectations, characteristics of quality, Achieving, sustaining and improving quality, Quality dimensions and costs of quality. Elements of quality Assurance, Quality Management System, Quality management concepts and principles: ISO 9001:2000, QMS Case studies on ISO 9001: 2000 in chemical industries.



PAPER–III (Elective–C):QUALITY CONTROL AND QUALITY ASSURANCE IN PHARMA INDUSTRY (R26OC43C)

Max. Marks: 100 **(Internal-30M & External-70M)**

Reference Books:

1) R. Pannerselvam, Production and Operations Management, Prentice Hall India Learning Pvt. Ltd 3rdEd., 2012.
2) M. Savsar, Quality Assurance and Management, InTech-Croatia, 2012, ISBN 978-953-51-0378-3.
3) D.C. Montgomery, Statistical Quality Control, John Wiley & Sons, 5th Ed., 2005.
4) M. K. Starr, Production and Operations Management, Biztantra, Delhi, 2004.
5) D.H. Shah, QA Manual, Business Horizons, 2000.
6) D.H. Besterfield, C. Besterfield-Michna, G.H. Besterfield, M. BesterfieldSacre, TotalQuality Management, Pearson Education, Inc., 3rd Ed., 2003.
7) P. Konieczka, J. Namiesnik, Quality Assurance and Quality Control in the Analytical Chemical Laboratory: A Practical Approach, 1st Ed., CRC press 2009.
8) D. Hoyle, ISO 9000 Quality Systems Handbook, 5th Ed., Butterworth Heinemann-Elsevier, New York, 2006.
9) E. Prichard, V. Barwick, Quality Assurance in Analytical Chemistry, John Wiley & Sons, 2007.

Learning Outcomes: On the successful completion of the course, student will be able:

- ✓ To learn the preliminary issues of standard operating procedure, international conference harmonization, ISO-9000, ISO-14000 etc.
- ✓ To get awareness about the methods of documentation and handling of materials.
- ✓ To gain detailed knowledge on organizational responsibilities and personal responsibilities in the maintenance of Pharma industry.
- ✓ To develop knowledge validation procedures and regulatory aspects of and quality control aspects
- ✓ To understand the basics of Quality Assurance.



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PAPER–IV (Elective–A):CHEMISTRY OF ANTIBIOTICSANDDRUGS (R26OC44A)
Max. Marks: 100 (Internal-30M & External-70M)

Learning Objectives:

- ✓ To know the basics on antibiotics, their importance and various drugs in medicinal chemistry.
- ✓ To know the chemistry of structures and synthesis of some antimalarials, sulpha drugs, antiseptic and antifungals.
- ✓ To know the classification of herbal drugs and their therapeutic efficacy and isolation.
- ✓ To know the types & classification of Antiseptics.
- ✓ To know the CNS stimulants.

UNIT-I **12H**

Antibiotics:

Synthesis of penicillin-G, ampicillin, amoxicillin, chloramphenicol, cephalosporin.

Streptomycin, tetracyclines, Terramycin, aureomycin,gramicidin.

UNIT-II **12H**

Drugs and Medicinal chemistry:

Anticancer Agents: Synthesis & Activity relationship of Taxol, Vinblastine, Vincristine,Camptothecin.

CNS Stimulants: Strychnine (CNS activity only), caffeine, Nicotine; CNS depressants, General anesthetics, mode of action of Sedatives & Hypnotics.

UNIT-III **12H**

Antimalarials: Paludrin – quinacrin – chloroquin – camoquin – pamaquin –sontoquine.

SulphaDrugs: Sulphanilamide – Dihydrocurprine – Prontosil

UNIT-IV **12H**

Antiseptics and Antifungal agents

Antiseptics: Common types, triclosan, aminacrine hydrochloride. Antiseptics *Vs* Disinfactants-Properties, Mechanism of action, classification

Antifungal Agents: 1,8-dihydroxyanthranol –griseofulvin.



PAPER–IV (Elective–A):CHEMISTRY OF ANTIBIOTICSANDDRUGS (R26OC44A)
Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-V **12H**

Herbal Drugs: i) Classification of herbal drugs- Pharmacological and Chemical classification. ii) Adulteration and evaluation of drugs. iii) Different chemical groups of Herbal drugs- Alkaloids, Terpenoids, Glycosides, Volatile oils, Isolation of volatile oils, Tannins, and carbohydrates. iv) Herbal drugs and their therapeutic efficacy. Isolation of- Laxative-Aloe-emodin from Aloes. Anti-diabetics- Neem oil (Neem); Anti-malarial- Quinine (cinchona); Anti-hypertensive- Reserpine (rauwolfia).

Reference Books:

1) Introduction to Medicinal Chemistry – Wiley-VCH.
2) Text Book of Organic Medicinal and Pharmaceutical Chemistry, Wilson and Gisvild, (ed Robert F.Dorge)
3) An introduction to drug design by SSPandeya
4) Buger's Medicinal Chemistry and drug discovery Vol.I by (Ed) ME Wolff – John – WileybyA.Burger
5) The Organic Chemistry of drug design and drug action by RB Silverman, Academicpress
6) Principles of Medicinal Chemistry by William O. Foye, Lea &Febiger, Philadelphia/London,1989.
7) Natural products. By P.S.Kalsi
8) Medicinal chemistry. By Chatwal and ByAshtoshkar.
9) Chemistry of Drugs. By V.N.Ivers.
10) May's chemistry of synthetic drugs. Hand Book of Reagents for organic synthesis. By Reich,Rigby
11) Top Drugs: The synthetic routes. J.Saunders
12) Organic natural products By Barton and Ollis
13) Organic natural products by OP Agarwal
14) Organic natural products By Barton and Ollis.

Learning Outcomes:

- ✓ Students under the basics on antibiotics, their importance and various drugs used in medicinal chemistry.
- ✓ Students are able to understand chemistry and synthesis of antimalarials, sulpha drugs, antiseptic and antifungals used in medicine.
- ✓ Students can identify the classification of herbal drugs in various types and understand their therapeutic afficacy and isolation methods.
- ✓ Students understand the types of Antifungal agents.
- ✓ To understand the mode of action of sediatives.



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PAPER–IV (Elective–B):FORENSIC SCIENCE IN SOLVING CRIME (R26OC44B)
Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ The significance of Forensic science to human society.
- ✓ The fundamental principles and functions of Forensic science.
- ✓ The divisions in a Forensic science laboratory.
- ✓ The various steps to be taken to thoroughly record the crime scene.
- ✓ The legal importance of chain of custody.

UNIT-I **12H**

Introduction to Forensic Science: Need and functions of Forensic science. Historical aspects of Forensic science. Development of Forensic Science Laboratories. Definitions and concepts in Forensic science. Basic principles of Forensic science. Scope of Forensic science. Governing principals of Forensic Science. Forensic Science in Indian scenario. Admissibility in Indian Courts. Frye standard and Daubert standard.

Unit-II **12H**

Divisions of Forensic Science

Branches of Forensic science and their importance. Hierarchical set up of various Government Forensic Science Laboratories.

Forensic Evidences: Concise of Forensic Physical, Biological, Chemical and Psychological evidences, Medico-Legal Cases. Legal and Scientific problems. Forensic intelligence and Interviews.

UNIT-III **12H**

Crime Scene

Types of crime scenes. Safety measures at crime scenes. Role of First Responding Officer. Coordination between police personnel and Forensic scientists at crime scenes. The evaluation of 5Ws (who? what? when? where? why?) and 1H (how?)

UNIT-IV **12H**

Police and Forensic Science

Relationship between police and forensic expert, Role of Police at the Crime scene, scientific help at crime scene,Importance of Chain of custody, handling of various types of crime scenes by police, forensic teaching of police personals, forensic case documentation by Police, Technological Advance and Police, Mobile device forensics, Role of Media, Human Rights Commission & Criminal Justice System.



PAPER–IV (Elective–B):FORENSIC SCIENCE IN SOLVING CRIME (R26OC44B)
Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-V **12H**

Administration and Organizational Setup:

DFSS, CFSL, GEQD, SFSL, RFSL, MFSL, FPB, NICFS, CDTS, NCRB, BPR&D, Qualifications and duties of Forensic Scientists Academic centres of education and research: Indian and Academy of Forensic Science, American Board of Forensic Science, American Board of Forensic Odontology, Bureau of Alcohol Tobacco and Firearms, Interpol and FBI, Australian Academy of Forensic Sciences. Forensic Science in India: Teaching Courses and Research fields in Forensic Science, Scope and jobs in Forensic Science.

Reference Books:

1) Max. M. Houck, Forensic Science: Modern Methods of Solving Crime.
2) U.S. Attroney'sBulletion: Forensic Science & Forensic Evidence.
3) Ross M. Gardeneer and Tom Bevel: Practical Crime scene analysis and reconstruction.
4) Dr. Karanam Satyanarayana: Step by step in police investigation and ground realities, Ist edition.

Learning Outcomes:

- ✓ The definition and difference between Forensic Science and Criminalists.
- ✓ The major contributors to the development of Forensic Science.
- ✓ Importance of physical evidence.
- ✓ To Learn Forensic Technology solving crimes with advanced technology
- ✓ Explain the steps typically required to maintain appropriate health and safety standards at the crime scene.



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PAPER–IV (Elective–C):AIR, WATER, NOISE & THERMAL POLLUTION (R26OC44C)

Max. Marks: 100 **(Internal-30M & External-70M)**

Learning Objectives:

- ✓ To understand the properties and measurement of air pollution.
- ✓ To understand the control methods of SO2, NOX & CO.
- ✓ To understand the various types of water pollution & water quality methods.
- ✓ To understand the study of noice pollution & its parameters.
- ✓ To understand the thermal pollution.

UNIT-I: Air Pollution **12H**

Classification and properties of air pollutants-emission sources-major emissions from global sources-importance of anthropogenic sources-behavior and fate of air pollutants photochemical smog and its effects on health-vegetation-material damage in India.

Air pollution sampling and measurement-ambient air sampling-collection of gaseous air pollutants-collection of particulate pollutants-stack sampling-analysis of air pollutants-sulphur dioxide-carbon monoxide-nitrogen dioxide-oxidants-ozone-hydro carbons and particulate matter

UNIT- II: Control Methods **12H**

Sources-correction methods-particulate emission control-gravitational settling chambers-cyclone separators-fabric filters-electrostatic precipitator-wet scrubbers-control of gaseous emissions by adsorption of solids and liquids-control methods of sulphur dioxide emission, flue gasesanalysis-control method, nitrogen oxides, carbon monoxide and hydrocarbon-mobile sources.

UNIT-III: Water Pollution and Quality Assessment: **12H**

Domestic, industrial, agricultural, soil and radioactive wastes as sources of pollution; assessment of toxic metal ions in water; impact of organic pollutants. DO, BOD, COD, TOC.

UNIT-IV: Noise Pollution **12H**

Noise pollution: sources-measurement of noise and indices-effect of meteorological parameters on noise propagation-noise exposure levels and standards–measurement of noise-impact of noise on human health



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PAPER–IV (Elective–C):AIR, WATER, NOISE & THERMAL POLLUTION
(R26OC44C)

Max. Marks: 100 **(Internal-30M & External-70M)**

UNIT-V: Thermal Pollution **12H**

Thermal Pollution: Introduction-definition-sources-harmful effects-toxic compounds in traces-prevention and control of thermal pollution –thermal power projects in India.

Reference Books:

1) Environmental Chemistry by AK.DE.
2) Environmental Chemistry by Tyagi & Mehra.
3) Engineering Environmental Chemistry P. Anandan.

Learning Outcomes: On the successful completion of the course, student will be able:

- ✓ Student understand the sampling collection of gases air.
- ✓ Student understand Source & Control methods of pollutants.
- ✓ Student understand the DO, BOD, COD determination.
- ✓ Student understand noise propagation & noise exposure.
- ✓ Studetns understand prevention & control methods of thermal pollution.



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PRACTICAL–I: ANALYSIS OF BINARY ORGANIC MIXTURE& ORGANIC ESTIMATIONS(R26OC45)

Max. Marks: 100 **(Internal-30M & External-70M)**

Part- A: Two Component Organic Mixture Analysis **50M**

The Mixture Separation should be done by chemical methods, and their identification by chemical reactions. Separation is based on solvent selection like ether, dil HCl, 5 % aqueous $NaHCO_3$, and Na_2CO_3 solutions, checking the purity of two components by TLC, identification of the compounds by a systematic study of the physical characteristics (mp/bp), extra elements (nitrogen, halogens and sulphur), functional groups, preparation of crystalline derivatives and identification by referring to literature data.

(The student must be trained in at least five mixtures with different functional groups)

Note: 1. *For University examinations the student has to submit at least one derivative for each individual component in the given binary mixture.*

Part-B Organic estimations **40M**

The following are the Estimations/Isolations

Expt. 1: Estimation of hydroxyl group by acetylation or pthalation method

Expt. 2: Estimation of phenol (Bromination method)

Expt. 3: Estimation of aniline (Bromination method)

Expt. 4: Estimation of carbonyl groups (Hydrazone formation method)

Expt. 5: Estimation of sugars-glucose and sucrose by using Fehlings solution

Expt. 6: Determination of iodine value of oil or fat

Expt. 7: Determination of saponification value of oil or fat

Expt. 8: Estimation of vitamin ‘C’ in lime juice.

Expt. 9: Isolation of caffeine from tea/coffee sample.

(The student has to be trained in at least five experiments in regular lab)

Note: In University examination one experiment will be given for 40 Marks

Section-C: Record submission **10M**

Further, the student needs to do one Practical from Part-A and one Practical from Part–B



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PRACTICAL-II: RESEARCH PROJECT WORK (R26OC46)
Max. Marks:100 M (Dissertation +Seminar+ Viva –Voce)

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1) **Project Work:** ResearchProject /Industry Internship is compulsory for each student, and the student has to submit a dissertation containing the background of the work, experimental work, Results and discussion, and Summary.

(50 M)

2) **Seminar:** The student has to present his Project work in PowerPoint mode for 10-15Min.

(20 M)

3) **Viva-voce**: Further, the student has to face the Viva-voce examination

(30 M)