RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS)
LATUR – 413512

DEPARTMENT OF CHEMISTRY

Syllabus
M.Sc. (Second Year) Organic Chemistry
CBCS Pattern
(I & II Semester)

With Effect from 2020-2021

Rajarshi Shahu Mahavidyalaya (Autonomous), Latur
Syllabus
Faculty of Science
M.Sc. (Second Year) Organic Chemistry
Semester – III

Paper	Code No.	Title of the course	Hours / Week	Marks(100)		Credits
				In Sem.	End Sem.	
IX	P-ASM-343	Advanced Spectroscopic Methods	04	40	60	04
X	P-OTF-344	Organic Transformation	04	40	60	04
XI	P-CNP-345	Chemistry of Natural Products	04	40	60	04
XII	P-MDC-346(A) P-POC-346(B)	Elective: A. Medicinal Chemistry B. Polymer Chemistry	04	40	60	04
IX	P-LAC-347	Lab Course-IX	04	20	30	02
X	P-LAC-348	Lab Course –X	04	20	30	02
XI	P-LAC-349	Lab Course XI	04	20	30	02
		Seminar			25	01
	Total			**575**		**23**

Theory Papers 100 Marks: (Internal 40*+External 60*)
*External S.E.E. 60 Marks Theory
* Internal 40 Marks (Two unit test -30 marks+ Attendance 10Marks)
Unit Test I Activity Based 60 Marks
Unit Test II MCQ patterns 60 MCQ questions

Unit test (I+ II) = 120 converted to 30 Marks

M.Sc. (Second Year) Organic Chemistry

Semester - IV

Paper	Code No.	Title of the course	Hours/ Week	Marks(100)		Credits
				In Sem.	End Sem.	
XIII	P-ASM-439	Advanced Synthetic Methods	04	40	60	04
XIV	P-STE-440	Stereochemistry	04	40	60	04
XV	P-AHC-441	Advanced Heterocyclic Chemistry	04	40	60	04
XVI	P-AOC-442(A) P-DAI-442(B)	Elective: A. Applied Organic Chemistry B. Dyes and Intermediates	04	40	60	04
XII	P-LAC-443	Lab Course-XII	04	20	30	02
XIII	P-LAC-444	Lab Course –XIII	04	20	30	02
XIV	P-LAC-445	Lab Course XIV	04	20	30	02
XV	P-LAC-446	Lab Course XV (Project) Annual	04	40	60	04
		Seminar			25	01
	Total				**725**	**27**

Theory Papers 100 Marks: (Internal 40*+External 60*)

*External S.E.E. 60 Marks Theory

* Internal 40 Marks (Two unit test -30 marks+ Attendance 10Marks)

Unit Test I Activity Based 60 Marks

Unit Test II MCQ patterns 60 MCQ questions

Unit test (I+ II) = 120 converted to 30 Marks

Rajarshi Shahu Mahavidyalaya (Autonomous), Latur
Syllabus
M.Sc. II (Organic Chemistry) (Semester – III)
(w. e. f. – 2020-21)
Paper IX
Core Course Title - Advanced Spectroscopic Methods
Course Code: P-ASM-343

Marks:100 **Periods:60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1. To study principles of different advanced spectroscopic methods such as UV, IR, ^{1}H- NMR, ^{13}C- NMR and Mass-spectrometry methods for the analysis of organic compounds.

2. To study applications of all spectroscopic methods for the elucidation of structures of an organic compounds.

Course Learning Outcome:

1. After studying UV, IR, ^{1}H-NMR and Mass-spectrometry methods, students will be able to detect the nature as well as structure of organic compounds

2. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

3. By gaining knowledge of spectroscopic techniques students will be able to explore new areas of research in both chemistry and allied fields of science and technology

Unit-I UV and IR Spectroscopy: **15Periods**

A) Ultraviolet Spectroscopy

Introduction: spectroscopy, electromagnetic spectrum, Various Electronic transitions, Chromophores, Auxochromes, Bathochromic and Hypsochromic shifts, Hyperchromic and, Hypochromic shift, Effect of solvent on electronic transitions, Woodward-Fieser rules for dienes, polyenes, enones and aromatic compounds, Application of U.V. Spectroscopy.

B) IR Spectroscopy

Introduction, molecular vibration, fundamental modes of vibration, Hokes law, presentation of IR spectra, functional group region, finger print region, overtones; combination bands and Fermi resonance. Characteristic vibrational frequencies of alkanes;

alkenes; alkynes; aromatic compounds; alcohols; ethers; phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds [ketones; aldehydes; esters; amides; acids; anhydrides; lactones; lactams and conjugated carbonyl compounds] Effect of hydrogen bonding and solvent on vibrational frequencies.

Unit-II NMR Spectroscopy: 15 Periods

General introduction and definition; Principle of NMR spectroscopy.

PMR spectroscopy: spinning nuclei, magnetic moment and magnetic field, precessional motion, orientation and nuclear resonance, Equivalent and nonequivalent proton, Chemical shift; spin –spin interaction; shielding and deshielding mechanism of measurement; chemical shift values and correlation for protons bonded to carbons [aliphatic; olefinic; aldehydic and aromatic] and other nuclei [alcohols; phenols; enols; acids; ammines; amides and mercapto]; solvent effect. Fourier transform technique; Nuclear Overhauser effect [NOE]

Unit-III Mass Spectrometry: 15Periods

Introduction- ion production- EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak, McLafferty rearrangement, nitrogen rule. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

Unit –IV C^{13} NMR Spectroscopy: 15Periods

A) Carbon-13 NMR Spectroscopy

Resolution and multiplicity of ^{13}C NMR, ^{1}H-decoupling, noise decoupling, broad band decoupling; NOE signal enhancement, off- resonance, proton decoupling, Structural applications of CMR. DEPT. Calculations of chemical shift [Saturated, Unsaturated (Olefinic & Acetylenic) and substituted aromatic Carbon atom]

B) Structural problems based on combined spectroscopic techniques.

References:

1. V.M. Parikh, Application spectroscopy of organic molecules. (Mehata)
2. D.W. Williams and Flemming, Spectroscopic methods of organic compound.
3. Silverstein and Basallar, Spectroscopic identification of organic compounds
4. V. M. Parikh Orption Spectroscopy of Organic Molecules (J. Wiley)
5. P. S. Kalsi Spectroscope of organic compounds (New age publisher)
6. J.R. Dyer. Application of absorption spectroscopy of organic compounds.
7. Jackman and Sterneil , Application of NMR spectroscopy
8. J.D. Roberts, Nuclear magnetic resonance (J. Wiley)
9. Jafee and Orchin, Theory and application of U.V. Spectroscopy
10. K. Benjamin. Mass spectroscopy
11. Beynon J H et.al , The mass spectra of organic molecules.
12. Wehli F. W, March and A. P. Interpretation of carbon 13 NMR (J. Wiley)
13. W. Kemp, Organic spectroscopy ELBS
14. Willard Merritt and Dean. Instrumental methods of analysis CBS
15. Das and Jame, Mass Spectroscopy..
16. Organic spectroscopy Y. R .Sharma
17. Organic spectroscopy Pavia

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Paper X
Core Course Title - Organic Transformation
Course Code: P- OTF-344

Marks: 100 **Periods: 60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1. To understand the general mechanistic consideration, nature of migration, migratory aptitude of various rearrangements
2. To learn mechanism, stereochemistry and synthetic applications of selective organic reactions.
3. Understand about different oxidativeprocesses.
4. To know about different reductive processes.

Course Learning Outcome:

After successful completion of the course the students will:

1. Understand the general mechanistic consideration, nature of migration, migratory aptitude Learn mechanism, stereochemistry and synthetic applications of Stork Enamine, Chichibabin, and Diels-Alder reactions etc.
2. Understand about Oxidative cleavage of 1,2-diols, oxidation of allylic and benzylic C-H bonds
3. Know about different Catalytic hydrogenation, Wolff-Kishner and diimide reductions.

Unit – I Rearrangements: **15Periods**

General Mechanistic Consideration, Nature of migration, migratory aptitude
Memory Effects of following rearrangements:

b) Rearrangement to Electron Deficient Carbon: Pinacol - pinacolone, Wagner-Meerwein, Benzillic acid, Wolf (Arndt–Eisterts Synthesis) Rupe and Demjanov rearrangements.
c) Rearrangement to Electron Deficient Nitrogen: Hofmann, Curtius, Schimdt, Lossen and Beckmann rearrangements
d) Rearrangement to Electron Deficient Oxygen: Baeyer-Villiger rearrangement.
e) Rearrangement to Electron Rich Carbon: Fovorskii, Wittig, Neber and Steven's rearrangements.
f) Aromatic Rearrangement: Fries, Claisen and Benzidine rearrangement, Smiles rearrangement.

Unit – II Selective Organic Reactions: **15Periods**

Mechanism, Stereochemistry and Synthetic Applications of following reactions

a) Stork Enamine, Chichibabin, Diels-Alder, Bucherer, Ullmann, Chugaev, Biginelli, Prins, Hunsdiecker Reactions, Arbuzov reaction, Bamford - Stevens reaction, Baylis – Hillman reaction, Dakin reaction, Darzen's reaction.

b) Negishi, Suzuki, Stille, Kumada, Heck coupling reactions.

Unit-III: Oxidation Reaction: **15 Periods**

Introduction, different oxidative processes.

a) Alcohols to carbonyl compounds: Chromium (VI) oxidants, Dimethyl sulfoxide and its modifications (Swern Oxidation), Mangnese (IV) oxide, Silver carbonate, Oppenauer oxidation.

b) Alkenes to epoxide: Peroxide induced epoxidation-epoxidation by H_2O_2, hydroperoxides and peroxy acids.

c) Alkenes to diols: oxidation by potassium permanganate, Osmium tetraoxide, Prevost oxidation and Woodward modifications.

d) Oxidative cleavage of 1,2-diols: Periodic acid, Lead Tetra acetate.

e) Oxidation of allylic and benzylic C-H bonds: NBS, DDQ, Chloranil, SeO_2.

Unit- IV Reduction Reaction: **15Periods**

Introduction, different reductive processes.

a) Catalytic hydrogenation: Homogeneous and heterogeneous catalytic reductions. Dissolving metal reductions including Birch reduction, Lindlar reduction, Luche reduction

b) Metal hydride reductions: Nucleophilic metal hydrides, LiAlH4, andNaBH4.

c) Non-metallic reductions: Wolff-Kishner and diimide reductions.

d) Electrophilic metal hydrides: BH_3 and DIBAL-H

References:

1. Designing Organic Synthesis – S. Warren, Willey
2. Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge Univ. Press
3. Modern synthetic reactions, H.O. House, W.A. Benjamin
4. Advanced Organic Reactions, Reactions, Mechanisms and Structure, J. March, Wiley
5. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic and Professional
6. Advanced Organic Chemistry Part – B. F. A. Carey and R. J. Sundberg, Plenum P.
7. Organic Reaction and Their mechanisms, P.S. Kalsi, New Age International Publishers.
8. Protective Groups in Organic Synthesis, T.W. Greene and P. G. M. Wuts. IInd Edition, John Wiley and Sons1991.
9. Organic synthesis: The Disconnection Approach, sturat Warren, John Wiley and sons.

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Paper XI
Core Course Title - Chemistry of Natural Products
Course Code: P-CNP-345

Marks: 100 **Periods:60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1.To learn general methods of structure determination, isoprene rule and synthesis of Terpenoids & Carotenoids.

2.To understand nomenclature, occurrence, isolation, classification and synthesis of alkaloids

3.To know isolation, structure determination and synthesis of steroids.

4.To learn nomenclature and general methods of structure determination, and synthesis of Anthocyanins and Flavones.

Course Learning Outcome:

After successful completion of the course the students will:

1.Learn general methods of structure determination, isoprene rule and synthesis of Citral, Menthol, Camphor, Phytol etc.

2.Understand nomenclature, occurrence, isolation, classification and synthesis of Ephedrine, atropine, Quinine and Morphine.

3. Know isolation, structure determination and synthesis of cholesterol, Androsterone.

4.Learn nomenclature and general methods of structure determination, and synthesis of cyanin, Hirsutidin chloride, Flavones and Flavonols.

Unit - I Terpenoids & Carotenoids: **15 Periods**

Classification, Nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule Structure determination, stereochemistry, and synthesis of the following representative molecules: Citral, Menthol, Camphor, Phytol, Abietic acid and β-Carotene.

Unit – II Alkaloids: **15Periods**

Definition, nomenclature and, occurrence, isolation, classification based on nitrogen heterocyclic ring. Structure, stereochemistry and synthesis of the following: Ephedrine, atropine, Quinine and Morphine.

Unit –III Steroids: **15Periods**

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of cholesterol, Androsterone, Testosterone, Estrone, Progestrone, Aldosterone.

Unit - IV Anthocyanins and Flavones: **15 Periods**

Occurrence, nomenclature and general methods of structure determination. Synthesis of cyanidin chloride, cyanin, Hirsutidin chloride, Flavones (Kostanecki and Baker-Venkataraman approaches), Flavonols.

References:

1. The Organic chemistry of Drug Design and Drug Action, R.B. Silverman, Academic press.
2. Natural Products: Chemistry and Biological Significance, J. Mann, R.S. Davidson,
3. J. B. Hobbs, D.V. Banthrope and J. B. Harborne, Longman, Essex.
4. Organic chemistry, Vol. 2, I. L. Finar, ELBS.
5. Introduction to Flavonoids, B.A. Bohm, Harwood Academic publishers
6. New Trends in natural product chemistry, Atta-ur-Rahman and M.I. Choudhary, Harwood Academic publishers.

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Elective
Paper XII
Course Title – Medicinal Chemistry
Course Code: P-MDC-346 (A)

Marks: 100 **Periods:60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1. Introduction of Medicinal chemistry and its terminology.
2. Drug designing, SAR and study of pro and soft drugs.
3. Synthesis, properties and uses of different drugs
4. Study of different antibiotics, their synthesis and mode of action.

Course Learning Outcome:

After successful completion of the course the students will:

1. Understand about Medicinal chemistry and its terminology like pharmacodynamic agents, pharmacophore, pharmacodynamics, etc.
2. Know about Drug designing methods, SAR and study of Pro and Soft drugs.
3. Understand about Synthesis, properties and uses of analgesic, antipyretic, antacids, antimalerial etc. drugs.
4. Learn about different antibiotics, their synthesis and mode of action.

Unit - I Concepts of Medicinal Chemistry: 15Periods

A) Concepts of Medicinal chemistry: Important terminology in medicinal chemistry: Drugs, Pharmacy, Pharmaceutics, Toxicology; Pharmacodynamic agents, Pharmacophore, Pharmacodynamics, metabolite and antimetabolites, chemotherapy. Mechanism of chemotherapeutic actions: 1) Biological defences2) Chemical defences.

a) Surface active agent, b) Metabolic antagonism. Assay of Drugs: Chemical assay, Biological assay, Immunological assay, LD-50 andED-50

Unit-II Drug Discovery; Concept of pro drugs and soft drugs 15 Periods

A] Drug Discovery.

i) Introduction

ii) Procedure followed in drug design.

iii) Lead modification: Drug design and development

a) Identification of the active part: The pharamcophore, b) Functional group modification,

c) Structure-activity relationship, d) Structure modification to increase potency and the therapeutic index; 1) Homologation, 2) Chain branching, 3) Ring-chain transformation. 4) Bioisosterism.

B] Concept of pro drugs and soft drugs.

a) Pro drugs: i) Pro drugs designing, types of pro drugs, ii) Pro drug formation of compounds containing various chemical groups.

b) Soft drugs: i) Soft drug concept ii) Properties of soft drug.

Unit III: Study of the following drugs: **15Periods**

a) Analgesic and antipyretic- Paracetamol, meperidine, aminopyrene
b) Anti-inflammatory- Ibuprofen, oxyphenbutazone, indomethacin, arachidonic acid
c) Anesthetic- Lidocaine, thiopental, mechanism of action
d) Antihistamine- Phenobarbiton, diphenylhydramine, mechanism of action
e) Antiaids drugs- Cause and antiaids drugs
f) Antimaleria-Trimethupim, role of folic acid and its inhibition.

Unit IV: Anti micobacterial drugs **15 Periods**

A] Ant tubercular drugs:

Introduction:

a) First-line agents (Primary tubercular drugs): Structure and activity of streptomycin and dihydro-streptomycin, Synthesis and SAR of 4-amino salicylic acid and isoniazid.
b) Second line agents (Secondary anti tubercular agents): Structure and activity of Rifampicin, Cycloserine, Enthionamide, Ethambutol, (Synthesis of Cycloserine and Ethambutolexpected)

B] Antileprotic drugs.

Chaulmoogra and hydrocarpus oil, Multidrug therapy, SAR of sulphones, Dapsone (DDS), Acedapsone, (Synthesis of Acedapsone expected)

C] Antibiotics. Drugs:

a) Cell wall synthesis inhibitors (β-Lactams antibiotics): Synthesis of Penicillin-V, Penicillin-G, amoxicillin, ampicilin from 6-APA, Structure and activity of benzyl penicillin, semi-synthetic penicillin, cephalosporin, Mode of action of penicillin and cephalosporin.
b) Protein synthesis inhibitors: Structure activity of tetracycline Synthesis and SAR of chloramphenicol, Mode of action of chloramphenicol.

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References:

1. Medicinal chemistry-William O. Foye
2. T. B. of Organic medicinal and pharmaceutical chemistry-Wilson and Gisvold's (Ed. Robert F. Dorge)
3. An introduction to medicinal chemistry-Graham L. Patrick
4. Principles of medicinal chemistry (Vol. I and II)-S. S. Kadam, K. R. Mahadik and K. G. Bothara (Nirali prakashan)
5. Medicinal chemistry (Vol. I and II)-Burger
6. An introduction to drug design-S. S. Pandeya and J. R. Dimmock (New ageinternational)
7. The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
8. Strategies for organic drug synthesis and design-D. Lednicer Wiley

Elective Paper

Paper XII

P-POC-346-(B)

Core Course Title – Polymer Chemistry

Marks: 100 **Periods: 60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1.To understand the concepts of Petroleum based raw materials, types and source of crude oils acetylene and derivatives, propylene and derivatives

2. To know about Chain/step growth polymers, Nomenclature of polymers, names based on source

3.To familiarize with, H-T and H-H polymerization, ATRP, RAFT and nitroxidemediated polymerization.

4. To understand about basic concepts of cationic and anionic methods of polymerization, Ring opening polymerization.

Course Learning Outcome:

After completion of course students will know about:

1.The concepts of Petroleum based raw materials, types and source of crude oils acetylene and derivatives, propylene and derivatives

2. Types of polymers. linear, branched, hyper branched, star branched dendrimers.

3. Experimental determination of rate of polymerization. Initiation by free radical, redox, photochemical, ionizing radiation and thermal methods.

Unit I : RAW MATERIALS AND INTERMEDIATESFORPOLYMERS **10Periods**

Petroleum based raw materials: Crude oil, natural gas, petroleum hydrocarbons, types and source of crude oil, refining various petroleum fractions, cracking (thermal and catalytic), knock and octane rating, petrochemical as building blocks, Acetylene and derivatives, propylene and derivatives, butane/butene, butadiene fractions, BTX and their derivatives: Polymer feed stocks (monomers, solvents), petroleum industry Carbon monoxide, Carbon dioxide as building block for monomers and polymers

Unit II: CLASSIFICATIONOFPOLYMERS **10Periods**

Addition- condensation, (Chain/step growth polymers) organic-inorganic, natural-synthetic, polar- nonpolar with suitable examples, types of polymers. linear, branched, hyper branched, star branched dendrimers, semiladder, ladder, crosslinked, and layer-latties- polymers. Nomenclature of polymers, names based on source, based on structure (IUPAC and Non IUPAC) Trade names.

Unit 3: RADICALCHAINPOLYMERIZATION **16Periods**

Structural arrangement of monomer units, propagation modes, H-T and H-H polymerization, mechanism and kinetics: energetics, experimental determination of rate of polymerization. Initiation by free radical, redox, photochemical, ionizing radiation and thermal methods, efficiency of initiator in transfer reactions, retardation, auto acceleration. Controlled radical polymerization. ATRP, RAFT and nitro oxide mediated polymerization.

Unit IV: CHAINPOLYMERIZATION **12 Periods**

Basic concepts of cationic and anionic methods of polymerization, distinguishing between radical and ionic polymerization. Group transfer polymerization. Ring opening polymerization, mechanism of ROP of cyclic ethers, cyclic amides and cyclosiloxanes; Ring opening metathesis polymerization.

Unit V: STEPGROWTHPOLYMERIZATION **12Periods**

Polymerization which proceed with C-C, C-O and C-N bond formation Suzuki, Heck, ADMET, Chain-growth poly condensation [examples-polyamides, polyether-ketones], enzyme/metal catalyzed step growth polymerization; Reactivity of functional groups, basis for analysis of step growth polymerization kinetics. Kinetic equation for poly esterification, Carothers equation for DP, control of molecular weights in linear step-growth polymers.

References :

1. Polymer Synthesis P. Rempp and E.W. Merill Huethig and Wepf, Heidelberg.
2. Polymer Synthesis Theory and Practice D. Braun, H. Cherdrown and H. Ritter Springer, Heidelberg (2001) ISBN 3-540–41697-8
3. Principles of Polymer Chemistry, 2nd Ed. A Ravve Kluwer Academic Publisher (2000) ISBN 0-306-48368-7
4. Organic Chemistry of Synthetic High Polymers R. W. LenzInter science Publishers, New York (1967).
5. Principles of Polymer Chemistry, P. J. Flory.
6. Principles of Polymerization, G. Odian, John Wiley & Sons (1981).
7. Polymer Chemistry, B. Vollmert, Springer Verlag Basel (1973)
8. Structure Property Relationship in Polymers, R. B. Seymour and C. E. Carraher Jr.
9. Fundamental Principles of Polymeric Materials, S. L. Rosen
10. Principles of Polymer Engineering, N. G. Mecrum, C. P. Buckley, C. B. Bucknall.
11. Introduction to Physical Polymer Science, L. H. Sperling.
12. Polymer Processing Fundamentals, T. A. Osswald.
13. Commercial Polymer Blends, L. A. Utracki.
14. Polymer Chemistry, M. G. Arora & M. Singh, (Amol Publ. Pvt. Ltd. New Delhi- 110002)

M. Sc. III Semester
Laboratory Course-IX
Mixture Analysis
Course Code: P-LAC-347

Marks: 50 **Periods: 60**
Credit: 02 **06 Periods Per Week**

Course Learning Objective:

1. To understand analysis of ternary mixtures of organic compound by separation with physical methods.
2. Learn about chromatographic Separation (TLC) techniques.

Course Learning Outcome:

1. Students will able to separate ternary mixture and can analyze each component of the mixture.
2. They can know about chromatographic Separation (TLC) techniques.

Qualitative Analysis (At least 05 Organic Mixtures)

Semi-micro Qualitative Analysis of Ternary Mixtures (Two Solids and One Liquid) containing single/poly functional compounds by Chemical and Physical Method with Chromatographic Separation (TLC) for purity of all three components and its Expected Theoretical Spectral Data (IR, ^{1}H NMR &^{13}C NMR).

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M. Sc. Semester III
Laboratory Course-X
Synthesis of Organic Molecules
Course Code: P-LAC-348

Marks: 50 **Periods: 60**
Credit: 02 **06 Periods Per Week**

Course Learning Objective:

1. To synthesize different compounds by multi component reactions.
2. To learn the use of ultrasound in synthesis of organic compounds.

Course Learning Outcome:

1. They obtained the skill in synthesis of different compounds by multi component reactions.
2. They can use of ultrasound in synthesis f organic compounds.

1. Multistage Synthesis (At least four):

a) Benzophenone → benzopinacol →benzopinacolone

b) Benzoin → benzil → benzilicacid

c) Benzaldehyde → chalcone → chalconeepoxide,

d) Acetanalide → 4-bromoacetanalide → 4-bromo-2-chloroacetanalide → 2-chloro-4-bromoaniline.

e) Cyclohexanone → cyclohexanoneoxime →caprolactone

f) Anthranilic acid → o-chlorobenzoic acid → N-phenyl Anthranilic acid →acridone

2. Use of ultrasound in organic synthesis. (One Each)

a) Ultrasound-assisted one-pot synthesis of 2,4,5-triarylimidazole catalyzed by Ceric (IV) ammonium nitrate in aqueous media from benzaldehyde, benzil/benzoin and ammonium acetate .

b) Synthesis of Benzotriazoles by Ultrasound Irradiation from o-phenylenediamine.

Note:

1. Synthesis is carried out in molar quantities (Less than 5gm).
2. Reaction with possible mechanism.
3. Calculate theoretical and practical %yield.
4. Product conformation by physical constant and TLC.
5. Give expected spectral data (IR and NMR) of starting material, intermediate and final product.
6. All the prepared organic compounds should be stored as a sample and present at the time of University examination.

M. Sc. Semester III
Laboratory Course-XI
Physico-Organic Estimations
Course Code: P-LAC-349

Marks: 50 **Periods: 60**
Credit: 02 **06 Periods Per Week**

Course Learning Objective:

1. To understand the Physico organic estimations of drugs by titrimetric methods.
2. To learn the skill in estimation of drugs by instrumental methods.

Course Learning Outcome:

1. They perform the Physico organic estimations of drugs by titrimetric methods.
2. They got the skill in estimation of drugs by instrumental methods.

A] Estimation of Drugs by Titrimetry: (At least three)

a) Assay of Aspirin.
b) Assay of Ibuprofen.
c) Assay of Analgin.
d) Determination of Chloride in Ringer Lactate solution for Injection.
e) Determination of Calcium ions in Calcium Gluconate Injection.

B] Estimation of Drugs by Instrumental Methods: (At least Two)

a) Assay of sulfanilamide by Potentiometry.
b) Assay of Riboflavin by Colorimetry.
c) Assay of ascorbic acid by Colorimetry.
d) Assay of Diazepam by UV-Vis Spectrophotometer.

Note:

1. All required solutions must be prepared by the students.
2. In examination one experiment is on Instrumental and one should be on non instrumental.

References:

1. Modern Experimental organic chemistry by Royston M. Robert, John C. Gilbert, Lyuu B. Rodewald & Alan S. Wingrove, Saunder International Edition
2. Advanced practical organic chemistry by N.K. Vishnoi
3. Experimental organic chemistry by L. M. Harwood & C. I. Moody, Blackwell Scientific Publications.
4. The systematic identification os organic compounds by R.L. Shriner & D.Y. Curtin
5. Semi-micro qualitative organic analysis by N.D. Cheronis, J.B. Entrikin& E. M. Wodnett
6. Small scale organic preparation by P.J. Hill
7. Vogel's textbook of practical organic chemistry by ELBS, Longmann.

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Rajarshi Shahu Mahavidyalaya (Autonomous), Latur
M Sc II Year
Semester-IV
Paper -XIII
Core Course Title: Advanced Synthetic methods
Course Code: P-ASM-439

Marks: 100 **Periods: 60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1. To learn how to design a new route for synthesis of various reactions.

2. To understand Retro- synthesis of aromatic heterocyclic 5 and 6 membered rings.

3. To familiarize with protection and deprotection of functional groups.

4. Know about the role of various reagents in synthetic methods.

Course Learning Objective:

After successful completion of the course the students:
1. Can understand how to design a new route for synthesis of various reactions.

2. Can use Retro- synthetic methods in synthesis of aromatic 5 and 6 membered

heterocyclic compounds.

3. Familiarize with protection and deprotection of functional groups.

4.Can know the role of LDA, DCC, DDQ, trimethylsilyl iodide etc. reagents inorganic synthesis.

Unit - I Disconnection Approach: **15 Periods**

An introduction to Synthons and synthetic equivalents, disconnection approach, functional group interconversions. One group C-X and two group disconnections in 1,2,1,3 -,1,4-& 1,5-difunctional compounds , Retro- synthesis of Alkene ,acetylenes and aliphatic nitro Alcohols and carbonyl compounds, amines , the importance of the order of events in organic synthesis, chemoselectivity, regioselectivity. Diels Alder reaction, Michael addition and Robinson annulations. Retro- synthesis of aromatic Heterocycles and 5 and 6 membered carbocyclic and heterocyclic rings. Reversal of polarity (Umpolung).

Unit-II Protection and Deprotection of Groups:

15 Periods

(A) Protecting Groups: Principle of protection of alcohol, amine, carbonyl and carboxyl

(B) Application of the following in synthesis Merrifield resin, polymeric reagents. Solid phase synthesis of polypeptide & oligonucleotides, electro organic synthesis, enzyme catalyzed reaction in synthesis & resolution of racemic mixtures.

Unit - III: Reagents & Reactions in Synthesis. **15 Periods**

Complex metal hydrides, lithium dialkylcuprate, lithium diisopropylamide(LDA) Dicyclohexylcarbodiimide(DCC), Trimethylsilyl iodide, tributyltin hydride, peracids, lead tetra acetate, PPA, Diazomethane , ozone phase transfer catalyst, Barton and Shapiro Hoffmann – Loffler- Freytag , Peterson synthesis , selenium dioxide, crown ethers, DDQ ,Dess-Martin periodic acid, Iodo isobenzyl diacetate, Fetizons reagent, Lambardo reagent, Tebbe reagent, AIBN, 9-BBN.

Unit – IV: Transition Metal Complexes in Organic Synthesis: **15 Periods**

A) Fe, Mn, Co**,** Ni, Cr, Zn, Ti. (**07**)

B) Application of following metal in organic synthesis Pd, Hg, and Rh, Tl and *Si.* (**08**)

References:

1. Designing of Organic Synthesis S. Warren:
2. Organic synthesis (2nd ed.) J. Fuhrhop & G. Penzlin.
3. Some modern methods of organic synthesis. Carruthers:
4. Modern synthetic reaction. H. O. House:
5. Reagent in organic synthesis Fieser & Fieser :
6. Principle of organic synthesis. R. O. C. Norman
7. Advanced organic Chemistry Carey & Sundberg.
8. Organic synthesis P.E. Realand
9. Comprehensive organic Chemistry. Bartan and Ollis.
10. Organic reactions R. Admas.

11.Advances in Organometallic Chemistry. Stone & West

12. Transition metal intermediate in organic synthesis. C.W. Bird

13. Organometallic in organic synthesis. Swan & black:

14. Synthesis of prostaglandins. A. Mitra:

15. Total synthesis of natural products. John Apsimon:

16. Polymers as aid in organic synthesis. M. K. Mathur, C. K. Narang & R.E. Williams:

17. Polymer supported reaction in organic synthesis. P. Hodge & D.C. Sherrington

18. Enzyme Catalysed reactions. C.J.Gray:

19. Protecting groups in organic Chemistry 20.T.Shona: Electro organic Chemistry. T.W. Green & P.G.M. Wats:

21. Phase transfer catalyst in organic synthesis. Weber & Gokel :

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Chemistry Paper – XIV
Core Course Title – Stereochemistry
Course Code: P-STE-440

Marks:100 **Periods:60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1. To understand the basic concept of stereochemistry, stereo chemical principles.
2. To familiarize with newer methods of stereo selective synthesis.
3. To know about conformational analysis and stereochemistry of ring systems.
4. To learn about stereochemistry of fused and bridged rings.

Course Learning Outcome:

After successful completion of the course the students will:

1. Understand the basic concept of stereochemistry like chirality, stereo chemical principles like enantiometric and distereomeric relationship, D & L, R & S and E & Z nomenclature.
2. Familiarize with newer methods of stereo selective synthesis like Regioselective and Chemoselective reactions, Stereospecific and stereoselective reactions etc.
3. Know about conformation alanalysis of cyclohexane, monosubstituted and disubstituted cyclohexanes and stereochemistry of ring systems.
4. Learn about stereochemistry of fused and bridged rings, O.R.D. and C.D

Unit - I Basic concepts in Stereochemistry: **15Periods**

Introduction: definition-Stereoisomerism

1) Molecular symmetry and concept of Chirality. Simple or proper axis of symmetry, plane of symmetry, centre of symmetry, improper or alternating or rotation reflection axis of symmetry
2) Stereo chemical principles: enantiometric relationship, distereomeric relationship. D & L, R & S and E & Z nomenclature. Threose and Erythose nomenclature. Racemic Modification and Resolution. Prochiral relationship.

Unit – II Newer methods of stereoselective synthesis: 15Periods

Regioselective and Chemoselective reactions, Stereospecific and stereoselective reactions, Enantioselective synthesis (chiral approach) reactions with hydride donors, Bromination, hydroboration, catalytic hydrogenation via chiral hydrazones and oxazolines.

Sharpless epoxidation. Diels Alder selective synthesis, use of calculations of optical purity and enantiomeric excess, Introduction of optical activity in absence of chiral carbon (biphenyls, spiranes and allenes) assignment of configuration, Configuration of distereomers based on physical and chemical methods. Dynamic Stereochemistry

Unit-III Conformational Analysis: 15Periods

a) Conformational analysis of cyclohexane, mono substituted and disubstituted cyclohexane

b) Some aspects of the stereochemistry of ring systems: Stereoisomerism and determination of configuration Stability of rings and ease of rings formation)

c) The shapes of the rings other than six membered: Shapes of five, and seven membered rings. Conformational effects in medium sized rings, Concept of I strain.

Unit - IV Stereochemistry of Fused and Bridged Rings: 15Periods

a) Fused and bridged rings: Fused bicyclic ring systems: Cis and trans decalins and perhydro phenanthrene. Bridged rings, Nomenclature stereochemical restrictions, and The Bredt's rule, Reactivities.

b) O.R.D. and C.D.: Types of curves, the axial haloketone rule. The Octant rule. Determination of conformation and configuration.

References :

1. Stereochemistry of carbon compounds. E.L. Eliel
2. Stereochemistry of organic compounds. D. Nasipuri
3. Stereochemistry: conformation and Mechanism. P.S. Kalsi:
4. Conformational analysis. Eliel, Allinger, Angyal and Morrison:
5. Organic stereochemistry. Hallas
6. Introduction to stereochemistry. Mislow and Benjamin:
7. Organic stereochemistry. H. Kagan
8. Optical rotator dispersion. Carl Djerassi
9. Optical rotatory dispersion and C.D. P. Crabbe :

Chemistry Paper - XV
Core Course Title - Advanced Heterocyclic Chemistry
Course Code: P-AHC-441

Marks:100 **Periods:60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1.To outline the role of Heterocycles, their spectral characteristics and reactivity.

2. To understand the synthesis and aromatic character of Heterocycles.

3. To know the synthesis of Indole Quinoline, Isoquinoline, Benzothiaphene.

Course Learning Outcome:

1. Student can understand the role of Heterocycles, their spectral characteristics , reactivity.

2. They can know how to synthesize Azirines, Oxaranes, Thiiranes, Diazirenes etc.

3.They can understand the synthesis and reactivity of Indole Quinoline, Isoquinoline, Benzothiaphene, etc.

Unit - I Introduction to Heterocycles and Small (3 and 4) membered Heterocycles:

15 Periods

Nomenclature (Hantzsch Widman System), spectral characteristics, reactivity and aromaticity of monocyclic, fused and bridged Heterocycles, Different types of strains, interactions and conformational aspects on nonaromatic Heterocycles. Synthesis, reactivity and importance of the following ring systems, Azirines, Oxaranes, Thiiranes, Diazirenes, Diaziridines, Azetidines.

Unit II : Five and six- membered Heterocycles with two hetero atoms: 15 Periods

Synthesis, reactivity, aromatic character and importance of the following Heterocycles: Pyrazole, Imidazole, Oxazole, Thiazole, Pyrimidine, Pyrazine, Oxazine, and Thiazine.

Unit III: Heterocycles with more than two hetero atoms: 15 Periods

Synthesis, reactivity, aromatic character and importance of the following Heterocycles: Triazoles, Oxadiazoles, Thiadiazoles,Triazines, tetrazole, furazan.

Unit-IV: Larger ring and Benzofused Heterocycles: 15 Periods

Synthesis and reactivity of Indole Quinoline, Isoquinoline, Benzothiaphene, Benzofuran Azepines, Oxepines and Thiepines, Synthesis and rearrangement of Diazepines, Synthesis of Benzoazepines, Benzodiazepines, Benzooxepines, Benzothiepines, Azocines, and Azonines.

References :

1. Heterocyclic Chemistry, T. L.Gilchrist.
2. An Introduction to the Chemistry of Heterocyclic compounds, R. M. Acheson.
3. Heterocylic chemistry, J. A. Joule & K.Mills.
4. Principals of Modern Heterocyclic Chemistry, A.Paquette.
5. Heterocyclic Chemistry, J. A. Joule &Smith.
6. Handbook of Heterocyclic Chemistry, A. R. Katritzky.
7. Heterocyclic Chemistry R.K.Bansal.

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Chemistry Paper – XVI
Semester IV
Course Title: Applied Organic chemistry
Course Code: P-AOC-442

Marks: 100 **Periods:60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1. Introduction of supra molecular chemistry

2.To know in detail about structural features of carbohydrate and vitamins

3.To familiarize with role of green reagents in organic synthesis.

4. To learn about green synthetic routes of reactions.

Course Learning Outcome:
After successful completion of the course the students will:

1. Learn about supra molecular chemistry and structures of supra molecules like nucleic acid, crown ether, cyclophanes, calixarenes

2.To know in detail about structural features of carbohydrate & vitamins

3.To familiarize with role of green reagents in organic synthesis.

4. To learn about green synthetic routes of reactions.

Unit - I Supra molecular Chemistry: **15 Periods**

Principles of molecular associations and organizations as exemplified in biological macromolecules like nucleic acids, proteins and enzymes. **(3L)**

Synthetic molecular receptors: receptors with molecular cleft, molecular tweezers, receptors with multiple hydrogen sites. **(3L)**

Structures and properties of crown ethers, cyclophanes, calixarenes, Synthesis of crown ethers, cryptands and calixarenes. **(6L)**

Unit - II Carbohydrates and Vitamins: **15Periods**

A) Carbohydrates

Introduction to naturally occurring sugars: Deoxysugars, amaminosugars, branched sugars, structure elucidation of lactose, D-glucosamine and mesoinositol (synthesis not expected), Structural features and applications of inositol, starch, cellulose, and heparin.

B) Vitamins

Classification, sources, biological functions, deficiency diseases and synthesis of A, B1, B2, B6, and E.

Unit - III Green Chemistry-I: **15Periods**

Introduction, basic principles of green chemistry, designing a green synthesis: Green starting materials, green reagents, green solvents and reaction conditions, green catalysts**.**

Use of the following in green synthesis with suitable examples:

a) Green reagents: dimethyl carbonate.

b) Green catalysts: Acid catalysts, oxidation catalysts, basic catalysts, phase transfer catalysts [benzyltrimethyl ammonium chloride (TMBA), Tetra-n-butyl ammonium chloride.

c) Green solvents: water, ionic liquids, deep eutectic solvents, supercritical carbon dioxide

Unit - IV: Green Chemistry-II **15 Periods**

a) Solid state reactions: solid phase synthesis, solid supported synthesis.

b) Microwave assisted synthesis: reactions in water, reactions in organic solvents, solvent free reactions

c) Ultrasound assisted reactions.

d) Multi-component reaction

References :

1. Bioorganic, Bioinorganic and Supramolecular chemistry, P.S. Kalsi and J. P.Kalsi. New Age International Publishers
2. Supramolecular Chemistry; Concepts and Perspectives, J. M. Lehn, VCH.
3. Crown ethers and analogous compounds, M. Hiraoka, Elsevier,1992.
4. Large ring compounds, J. A. Semlyen, Wiley-VCH,1997
5. Enzyme catalysis in organic synthesis, 3rd edition. Edited by Karlheinz Drauz, Harold Groger, and Oliver May, Wiley-VCH Verlag GmbH & Co Kga A,2012.
6. Biochemistry, Dr U Satyanarayan and Dr U Chakrapani, Books and Allied (P)Ltd.
7. Bioorganic, Bioinorganic and Supramolecular chemistry, P. S. Kalsi and J.P. Kalsi. New Age International Publishers
8. The Organic Chemistry of Enzyme-Catalysed Reactions, Academic Press, By Richard B. Silverman
9. Enzymes: Practical Introduction to structure, mechanism and data analysis, By Robert A. Copeland, Wiley-VCH, Inc.
10. The Organic Chemistry of Biological Pathways By John McMurry, Tadhg Begley by Robert and company publishers.
11. Biochemistry By Lehninger
12. Bioorganic Chemistry- A practical approach to Enzyme action, H. Dugas and C. Penny. Springer Verlag,1931
13. Biochemistry: The chemical reactions in living cells, By E. Metzler. Academic Press.
14. Concepts in biotechnology by D. Balasubrarmanyam & others
15. Principals of biochemistry by Horton &others.
16. Bioorganic chemistry - A chemical approach to enzyme action by Herman Dugas and Christopher Penney.
17. Natural product chemistry, A mechanistic, biosynthetic and ecological approach, Kurt B.G. Torssell, Apotekarsocieteten – Swedish pharmaceutical press.
18. NaturalproductsChemistryandapplications,SujataVBhat,B.A.Nagasampagiand S. Meenakshi, Narosa Publishing House
19. Natural Products Volume- 2, By O. P. Agarwal
20. Chemistry of Natural Products, F. F. Bentley and F. R. Dollish,1974

21. Natural Product Chemistry Vol.1 and 2, K. Nakanishi J. Goto. S. Ito Majori and S. Nozoo, Academic Press,1974.
22. Chemistry of natural products, V.K. Ahluwalia, Vishal Publishing Co.
23. Green Chemistry: An Introductory Text,2ndEdition, Published by Royal Society of Chemistry, Authored by Mike Lancater
24. Organic synthesis in water. By Paul A. Grieco, Blackie.
25. Green chemistry, Theory and Practical, Paul T. Anastas and John C. Warner.
26. New trends in green chemistry By V. K. Ahulwalia and M. Kidwai, 2ndedition, Anamaya Publishers, New Delhi.
27. An introduction to green chemistry, V.Kumar, Vishal Publishing Co.
28. Organic synthesis: Special techniques. V. K. Ahulwalia and Renu Aggarwal.

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Elective

Chemistry Paper – XVI

Semester IV

P-DAI- 442 (B)

Course Title: Dyes and Intermediates

Marks: 100 **Periods:60**
Credit: 04 **04 Per Week**

Course Learning Objective:

1. To understand the concepts of Commercial processes for Azo dyes, reactive dyes.
2. To know about Diazotization, mechanism and different methods of diazotization, Evaluation of dyes.
3. To familiarize with Fluorescent Whitening Agents, Types of Fibres and Basic Operations In Dyeing Process.

Course Outcome:

After completion of course students will understand:

1. Concepts of Commercial processes for Azo dyes, reactive dyes, thermal sensitive dyes, dispenses dyes.
2. Synthesis of Monoazo dyes, Bisazo dyes and Azoic dyes. Evaluation of dyes
3. Theory of fluorescence–Classification of FWA, Various methods of dyeing, Different classes of organic pigments and synthesis.

UNIT-I Dyes and Intermediates **15periods**

Synthesis of important dye intermediates. Commercial processes for Azo dyes, reactive dyes, optical brighteners, thermal sensitive dyes, dispenses dyes.

UNIT-II AZO DYES **15 periods**

General Introduction: Diazotization, mechanism and different methods of diazotization and laws of coupling, General introduction, classification and synthesis of Monoazo dyes, Bisazo dyes and Azoic dyes. Evaluation of dyes. Synthesis of the following: Disperse Red 13, Acid

Blue 92, Mordant Black 11, Acid Black 1, Acid Blue 113, Direct Blue 15, Direct Violet 1, Direct Red 28, Naphthol AS-BR, Fast Orange GGD.

UNIT-III **15 Periods**

(A) Fluorescent Whitening Agents

Introduction, Theory of fluorescence–Classification of FWA and synthesis of important member of each class and their uses.

(B) Types of Fibres And Basic Operations In Dyeing Process

Types of fibres: Natural, semi-synthetic and synthetic, Dyeing and Interactions: Ionic Interactions, Hydrogen bond, Van der Waal's Interactions and Covalent Interactions. Basic Operations in Dyeing Process: Preparation of the fibres, Preparation of the dye bath, application of the dye bath and finishings, Various methods of dyeing: Direct dyeing, Vat dyeing, Mordant dyeing, Disperse dyeing and Formation of dye on the fibre, Dyeing of wool with the acid dyes, Dyeing with the reactive dyes, Fastness properties: Colour fastness, Light fastness, Sublimation fastness and Burnt gas fumes fastness.

UNIT-IV **15 Periods**

(A) Heterocyclic Dyes

Pyrazolone dyes, cyanine dyes, dyes containing azine, oxazine and thiazine ring systems. Thiazole dyes.

(B)Pigments

Different classes of organic pigments and synthesis.

Synthesis of only the following: Basic Yellow 11, Basic Orange 21, Safranine B, Rosinduline G G, Sirius Supra Blue FFRL, Brilliant Alizarin Blue 3R, Sirius Supra Yellow RT, Acid Yellow 19, Copper Phthalocyanine, Sirius Supra Light Green FFGL.

References

1. The chemistry of synthetic Dyes, Vol. I to VII by Venkataraman, Academic Press, New York.
2. Chemistry of Synthetic Dyes & Pigments by Lubs.
3. Dyes and their intermediates by E. N. Abrahart.
4. Handbook of synthetic dyes and pigments, Vol. I & II by K. M. Shah.
5. Industrial Dyes by Klans Hunger, Germany by Wiley-VCH.
6. Development in the Chemistry and technology of Organic Dyes by J. Griffiths, Blackwell Sci. Pub., Oxford, London.
7. Principles of colour Technology by Fred W. Billmeyer and Max Saltzman, John Wiley & Sons.

M. Sc. IV Semester

Laboratory Course-XII

Mixture Analysis

Course Code: P-LAC-443

Marks: 50 **Periods: 60**

Credit: 02 **06 Periods Per Week**

Course Learning Objective:

1. To perform the semi-micro qualitative analysis of ternary mixtures containing single/poly functional compounds by Chemical and Physical Method.
2. To check the purity of compounds by performing TLC method.

Course Learning Objective:

1. Students can perform semi-micro qualitative analysis of ternary mixtures.
2. They can check purity of compounds by TLC.

Qualitative Analysis (At least 05 Organic Mixtures):

Semi-micro Qualitative Analysis of Ternary Mixtures (One Solid and Two Liquids) containing single/poly functional compounds by Chemical and Physical Method with Chromatographic Separation (TLC) for purity of all three components and its Expected Theoretical Spectral Data (IR, ^{1}H NMR &^{13}C NMR).

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M. Sc. Semester IV
Laboratory Course-XIII
Physico-Organic Estimations
Course Code:P-LAC-444

Marks: 50 **Periods: 60**
Credit: 02 **06 Periods Per Week**

Course Learning Objective:

1. To develop the skill in the isolation and purification of natural products like beta carotene, piperine, licopene.
2. To estimate the amount of drug sample by instrumental methods.

Course Learning Outcome:

1. Students can develop the skill in the isolation and purification of natural products like beta carotene, piperine and lycopene.
2. They can perform assay of drugs.

A] Isolation of natural products. (At least three)

a) Isolation of caffeine from tealeaves.
b) Isolation of piperine from black pepper
c) Isolation of β-carotene from carrots
d) Isolation of lycopene from tomatoes
e) Isolation of limonene from lemon peel
f) Isolation of euginol from cloves

B] Estimation of Drugs by Instrumental Methods: (At least Two)

a) Assay of Riboflavin by UV-Vis Spectrophotometer.
b) Estimation of carbohydrates, amino acids, proteins by UV-Vis spectrophotometer.
c) Determination of Hammett constants and determine its substitution effect.
i) Benzoic acid, ii) p-Nitro Benzoic acid, iii) p-Methoxy Benzoic acid, iv) p Methyl benzoic acid, v) p-chloro benzoic acid.
(Out of two compounds one compound must be benzoic acid and another should be substituted benzoic acid is given to the students)

Note:

1. All required solutions must be prepared by the students.
2. In examination one experiment is on Instrumental and one should be on non instrumental.

References:

1. Modern Experimental organic chemistry by Royston M. Robert, John C. Gilbert, Lyuu B. Rodewald & Allan S. Wingrove, Saunder International Edition
2. Advanced practical organic chemistry by N. K. Vishnoi
3. Experimental organic chemistry by L. M. Harwood & C. I. Moody, Blackwell Scientific Publications.
4. The systematic identification of organic compounds by R. L. Shriner & D. Y. Curtin
5. Semi-micro qualitative organic analysis by N.D. Cheronis, J. B. Entrikin & E. M. Wodnett
6. Small scale organic preparation by P. J. Hill
7. Vogel's textbook of practical organic chemistry by ELBS, Longmann.

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M. Sc. Semester IV

Laboratory Course- XIV

Synthesis of Organic Molecules
Course Code:P-LAC-445

Marks: 50 **Periods: 60**
Credit: 02 **06 Periods Per Week**

Course Learning Objective:

1.To develop the skill in the synthesis of different antibacterial, anticancer, anti-convulsant drugs.

2.To use ultrasound techniques in the synthesis of heterocyclic compounds.

Course Learning Outcome:

1. Students are able to synthesize different drugs like antibacterial, anticancer, anti-convulsant etc.

2. 2.They can use ultrasound techniques in the synthesis of heterocyclic compounds.

3. Synthesis of Drug Molecules (At least Four)

a) Synthesis of anaesthetic drug Benzocaine.

b) Synthesis of anticancer drug 6-methyluracil.

c) Synthesis of antibacterial drug sulfanilamide.

d) Synthesis of anti-epileptic drug antypyrine.

e) Synthesis of anti-convulsant drug Phenytoin.

4. Use of ultrasound in organic synthesis. (One Each)

a) Ultrasound assisted Hantzch dihydropyridine synthesis from aldehydes, ethyl aceto acetate and urea.

b) Synthesis of coumarin by Knoevenagel synthesis using salicyladehyde, ethyl acetate in presence of base by ultrasound assistance.

c) Ultrasound promoted synthesis of dihydropyrimidones from Biginelli Reaction by acid-catalyzed, three component reaction between an aldehydes, ß-ketoester and urea.

Note:

1. Synthesis is carried out in molar quantities (Less than 5gm).
2. Reaction with possible mechanism.
3. Calculate Theoretical and practical %yield.
4. Product conformation by Physical constant and TLC.
5. Give expected spectral data (IR and NMR) of starting material, intermediate and final product.
6. All the prepared organic compounds should be stored as a sample and present at the time of University examination.

M. Sc. Semester IV
Laboratory Course-XV
Course Code: P-LAC446
Project

Marks: 50 **Periods: 60**
Credit: 04 **06 Periods Per Week**

Course Learning Objective:

1. To learn about Literature Survey, synthesis of different natural products and organic compounds.
2. To learn about different standardization of reaction Conditions and their synthetic methods.
3. To learn about the methods of characterization of synthesized organic compounds by different techniques.

Course Learning Outcome:

1. Students can learn about literature survey, synthesis of different natural products and organic compounds.
2. They can understand about different standardization of reaction Conditions and their synthetic methods.
3. Students are able to characterize synthesized organic compounds by different techniques.

Literature Survey, Studies of Reactions, Synthesis, Mechanism, Isolation of Natural Products, Standardization of Reaction Conditions, New Synthetic Methods etc.

Note:

1. External and Internal Examiners will examine this project jointly at the time of practical examination.
2. The students will have to give at least one seminar in each semester in their subject of specialization is compulsory.
3. Project work must be carried out only in specialized branch.
4. All synthesized organic compounds should be submitted at the time of University Examination.
5. The project work carried out during the year should be presented in power point presentation in presence of University Examiners.