Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/ Sci. & Tech./Sub-Campus/NEP/03/2024

It is hereby inform to all concerned that, the syllabi prepared by the Departmental Committee and recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 08 April 2024 has accepted** the following curriculum of All Post Graduate Degree Courses as per National Education Policy – 2020 under the Faculty of Science & Technology **run at Dr.Babasaheb Ambedkar Marathwada University, Sub-Campus, Dharashiv** as appended herewith.

Sr.No.	Syllabi of Deptt of BAMU, Sub Campus, Dharashiv .	Semester
1.	M.Sc. Chemistry specialization Analytical Chemistry, Organic Chemistry, Drug Chemistry.	IIIrd & IVth Semester
2.	M.Sc.Microbiology	IIIrd & IVth Semester
3.	M.Sc.Mathematics	IIIrd & IVth Semester
4.	M.Sc.Physics	IIIrd & IVth Semester
5.	M.Sc.Water & Land Management	IIIrd & IVth Semester

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar.-
431 004.
REF.NO.SU/NEP/2024/901-09
Date:- 18.06.2024.

Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **Head of the Department, All Departments**, Dr.Babasaheb Ambedkar Marathwada University, Sub-Campus, Dharashiv.
2] The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.

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1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR SUB-CAMPUS, DHARASHIV

NAAC Reaccredited with 'A' Grade

Department of Chemistry
(Autonomous)

Faculty of Science and Technology

National Education Policy-2020
Outcome Based Curriculum

M. Sc. II Year

(Semester III & IV)

Subject : Chemistry

Specialization : Analytical Chemistry

(Effective from 2024-25)

Illustrative Credit distribution structure for two years programme with Multiple Entry and Exit options

Head
Department of Chemistry
Dr. Babasaheb Ambedkar Marathwada
University Sub-Campus, Dharashiv.

Class: M.Sc. II Year Semester: III Specialization: Analytical Chemistry

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned			Marks		
			Theory	Practical	Theory	Practical	Total Credits	Conti. Eval.	Uni. Exam	Total Marks
Major Mandatory DSC	CHET-600	DSC-15 (Organic Spectroscopy)	2	-	2	-	10T	20	30	50
	CHET-601	DSC-16 (Molecular Spectroscopy)	2	-	2	-		20	30	50
	ACHET-602	DSC-17 (Environmental Chemistry-I)	2	-	2	-		20	30	50
	ACHET-603	DSC-18 (Environmental Chemistry-II)	2	-	2			20	30	50
	ACHET-604	DSC-19 (Analytical Methods in Chemical Analysis-I)	2	-	2	-		20	30	50
	ACHEL-605	DSC-20 (Analytical Chem. Lab Course-III)	-	4	-	2	4P	20	30	50
	ACHEL-606	DSC-21 (Analytical Chem. Lab Course-IV)	-	4	-	2		20	30	50
DSE (Choose any Two from pool of courses)	ACHETE-607	DSE-7 (Analytical Methods in Chemical Analysis-II)	2	-	2	-	4T	20	30	50
	ACHETE-608	DSE-8 (Forensic Analysis)	2	-	2	-		20	30	50
	ACHETE-609	DSE-9 (Advanced Analytical Technique-I)	2	-	2	-		20	30	50
	ACHETE-610	DSE-10 (Advanced Analytical Technique-II)	2	-	2	-		20	30	50
Research Project	ACHE-RP-649	Research Project-I	-	8	-	4	4P	40	60	100
Total			**14**	**16**	**14**	**08**	**22**	**220**	**330**	**550**

Corse Code Nomenclature:

DSC: Discipline Specific Core Course; **DSE:** Discipline Specific Elective; **T**: Theory; **L**: Laboratory Course; **P**: Practical; **ACHET**: Analytical Chemistry Theory Core Course; **ACHEL**: Analytical Chemistry Laboratory Core Course; **ACHETE**: Analytical Chemistry Elective Course; **ACHE**-RP: Analytical Chemistry Research Project

Class: M. Sc. Second Year (Semester III)

1. Major Mandatory (DSC)- Master Programme is based on DSC Specialization
   CHET-600: Organic Spectroscopy
   CHET-601: Molecular Spectroscopy
   ACHET-602: Environmental Chemistry-I
   ACHET-603 : Environmental Chemistry-II
   ACHET-604 : Analytical Methods in Chemical Analysis-I
   ACHEL-605: Analytical Chem. Lab Course-III
   ACHEL-606: Analytical Chem. Lab Course-IV
2. DSE: (Choose any two from pool of courses)
   ACHETE-607: Analytical Methods in Chemical Analysis-II
   ACHETE-608: Forensic Analysis
   ACHETE-609: Advanced Analytical Technique-I
   ACHETE-610: Advanced Analytical Technique-II
3. Research Project: ACHE-RP-649: Research Project I

Class: M. Sc. II Year Semester: IV Specialization: Analytical Chemistry

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned			Marks		
			Theory	Practical	Theory	Practical	Total Credits	Conti. Eval.	Uni. Exam	Total Marks
Major Mandatory DSC	ACHET-650	DSC-22 (Ores, Alloys and Explosive Analysis)	2	-	2	-	10T	20	30	50
	ACHET-651	DSC-23 (Pharmaceutical Analysis-I)	2	-	2	-		20	30	50
	ACHET-652	DSC-24 (Applied Nanomaterials Analysis)	2	-	2	-		20	30	50
	ACHET-653	DSC-25 (Polymer and Catalysis Analysis)	2	-	2			20	30	50
	ACHET-654	DSC-26 (Pharmaceutical Analysis-II)	2	-	2	-		20	30	50
	ACHEL-655	DSC-27 (Analytical Chem. Lab Course- V)	-	4	-	2	2P	20	30	50
DSE (Choose any Two from pool of courses)	ACHETE-656	DSE-11 (Food Analysis-I)	2	-	2	-	4T	20	30	50
	ACHETE-657	DSE-12 (Food Analysis-II)	2	-	2	-		20	30	50
	ACHETE-658	DSE-13 (Advanced Chemical Method-I)	2	-	2	-		20	30	50
	ACHETE-659	DSE-14 (Advanced Chemical Method-II)	2	-	2	-		20	30	50
Research Project	ACHE-RP-699	Research Project-II	-	12	-	6	6P	60	90	150
Total			**14**	**16**	**14**	**08**	**22**	**220**	**330**	**550**

Corse Code Nomenclature: DSC: Discipline Specific Core Course; **DSE**: Discipline Specific Elective;

T: Theory; **L**: Laboratory Course; **P**: Practical; **ACHET**: Analytical Chemistry Theory Core Course;

ACHEL: Analytical Chemistry Laboratory Core Course; **ACHETE**: Analytical Chemistry Elective Course;

ACHE-RP: Analytical Chemistry Research Project

Class: M. Sc. Second Year (Semester IV)

1. Major Mandatory (DSC)- Master Programme is based on DSC Specialization
   ACHET-650: Ores, Alloys and Explosive Analysis
   ACHET-651: Pharmaceutical Analysis-I
   ACHET-652: Applied Nanomaterials Analysis
   ACHET-653 : Polymer and Catalysis Analysis
   ACHET-654 : Pharmaceutical Analysis-II
   ACHEL-655: Analytical Chem. Lab Course (Spectral Analysis)
2. DSE: (Choose any two from pool of courses)
   ACHETE-656: Food Analysis-I
   ACHETE-657: Food Analysis-II
   ACHETE-658: Advanced Chemical Method-I
   ACHETE-659 : Advanced Chemical Method-II
3. Research Project: ACHE-RP-699: Research Project II

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

CHET-600- Organic Spectroscopy

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objectives:

1. Understand the principles, theory, and applications of ^{1}H NMR, ^{13}C NMR and mass spectroscopy.
2. To know about the two dimensional NMR techniques such as DEPT, COSY, HETCOR, NOESY, INEPT & INADQUATE.
3. To know about the fragmentation of different functional groups (In mass spectroscopy).
4. To know about metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.
5. Develop the skills to interpret spectral data obtained from different spectroscopic techniques. This includes understanding how to analyse peaks, identify functional groups, and determine molecular structures.

Course Outcomes:

1. The students will be able to assign the structures by using different spectral data.
2. He will be able to interpret the organic spectrum.

UNIT-I: Nuclear Magnetic Resonance Spectroscopy (^{1}H NMR) **08 Hrs**

Elementary ideas (Recapitulation); Spin-spin couplings, Different types of couplings, factors affecting on coupling constants, Karplus equation, Spin systems (AB, AX, ABX, AMX), Rate processes, spin decoupling, shift reagents, Nuclear Overhauser effect (NOE), INEPT and INADEQUATE.

UNIT-II: ^{13}C Nuclear Magnetic Resonance Spectroscopy **08 Hrs**

Elementary ideas, instrumental problems, chemical shifts (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbons); Effect of substituents on chemical shifts, Two dimensional (2D) NMR techniques: DEPT, COSY, HETCOR, NOESY, INEPT & INADQUATE.

UNIT-III: Mass Spectrometry **08 Hrs**

Introduction, ion production (EI, CI, FD and FAB), ion analysis, ion abundance, factors affecting on fragmentation, fragmentation of different functional groups, molecular ion peak, isotopic peaks, metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.

UNIT-IV **06 Hrs**

Problems based on joint applications of UV, IR, ^{1}H NMR, ^{13}C NMR and Mass spectroscopy.

Reference Books:

1) Spectrometric Identification of Organic Compounds, R.M. Silverstein- 6th Edition
2) Spectroscopy of Organic Compounds, V.M. Parikh.
3) Organic Spectroscopy, P.S. Kalsi
4) Introduction to Spectroscopy, D.L. Pavia, G.M. Lampman, G.L. Nelson.
5) Mass Spectroscopy, K.G. Das & James.
6) Spectroscopy Methods in Organic Chemistry D. H. Williams and I. Fleming

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

CHET-601- Molecular Spectroscopy

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course objective:

1. Understanding the concept of X-ray diffraction patterned using various methods *via* Bragg's law, Laue/Single Crystal, and Powder/Debye-Scherrer methods
2. Able to understand Indexing of lattice planes in the cubic system, while they determine the proper structure and sizes of the spectrum.
3. Able to understand the principle of Mossbauer's study for heavier metal-complex molecules.
4. To learn the concept of ESR, including Zero field splitting patterns that indicate the structural behaviour of lighter element molecules as well as metal-complex molecules.

Course Outcome:

1. Apply the recent knowledge about modern sophisticated technique.
2. The students will be to interpret the XRD, ESR and Mossbauer spectroscopy.

Unit I: X–ray Diffraction **10 Hrs.**

Generation of X–rays, Interaction of X–rays with matter, Bragg's law, Miller indices, Diffraction methods (Laue/Single crystal and Powder/Debye–Scherrer methods), General instrumentation, Factors affecting X–ray intensity calculations, Identification of unit cells from systematic absences, Structure factor and its relation to electron density and intensity, Indexing of lattice planes in cubic system, Structure of NaCl and KCl, Avogadro's number from cubic lattice dimensions, Applications.

Unit II: Mossbauer Spectroscopy **08 Hrs.**

Principle of Mossbauer spectroscopy, Instrumentation, Isomer shift and its factors affecting, Quadrupole splitting, Temperature Dependence of MB parameters, Zeeman Splitting (Six fingered MB lines), MB spectra of iron and tin compounds, Applications, Numerical.

Unit III: Electron Spin Resonance Spectroscopy **12 Hrs.**

Introduction, Principle of ESR Spectroscopy, Instrumentation, Presentation of spectrum, Hyperfine splitting in some simple systems, Hyperfine splitting in various structure (Naphthalene anion radical, Pyrazine anion radical, Isomers of Xylene anion radicals, VO^{2+}, Quinoline radical, Isoquinoline radical, Quinoxaline radical, Anthracene radical, Phenanthracne radical, Pyrene radical, Alkyl halide radicals, Quinone &Isoquinone anion radicals, nitrogen/deuterium containing radicals), Hyperfine splitting diagram, 'g' value, g-marker, Factors affecting the magnitude of 'g' values, Determination of g-value, Zero field splitting, Karmers's degeneracy, Applications, Numericals.

Reference Books

1. Physical Methods in Chemistry, IInd Edition, R. S. Drago.
2. P.H. Rieger, Electron Spin Resonance: Analysis & Interpretation, RSC Publishing, 2007.
3. B. Simovic, Introduction to the Technique of ESR Spectroscopy. 2004.
4. A. Lund, M. Siotani, S. Shimada, Principles and Applications of ESR Spectroscopy, Springer.
5. P. Gutlich, E. Bill, A.X. Trautwein, Mossbauer Spectroscopy & Transition Metal Chemistry, Springer Publications, 2011.
6. K. Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, Part A & Part B, John Wiley & Sons Publishers.
7. Mossbauer Spectroscopy: Principles and Applications of the Techniques, A.G. Maddock.
8. An introduction to Electron Paramagnetic Resonance, *M. Bersohn&J.C.Baired,* W.A.Benjamin, Inc N.Y.
9. High resolution ESR Spectroscopy, F.Gerson (John Wiley & sons)
10. An introduction to Electron Paramagnetic Resonance, M. Bersohn& J.C. Baired, W.A. Benjamin, Inc N.Y.
11. The Determination of Molecular Structure, P. J Wheatly
12. Instrumental Methods of Chemical Analysis, ChatwalAnand
13. A Text book of Physical Chemistry, A. S. Negi& S.C. Anand
14. Instrumental Methods of Chemical Analysis, Willard, Merritt, Dean &Seatle
15. Instrumental Methods of Chemical analysis, R.D. Braun
16. Principles of Instrumental Analysis, Skoog and West
17. Fundamental of Molecular Spectroscopy, Banwell
18. Atomic and Molecular structure, ManasChanda
19. Molecular Spectroscopy, B. D Acharya
20. Molecular Spectroscopy, Dyer

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHET-602-ENVIRONEMTAL CHEMISTRY-I

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objective:

1. Understand the air , water and Noise pollutant analysis
2. Understand the different types of pollutions like soil, noise and thermal pollutions
3. Study the organic, inorganic, domestic , industrial, agricultures pollutant and their analysis
4. To learn the control of noise pollution
5. Study the environmental protection policy.

Course Outcome:

1. Explain the analysis of air and noise pollutions
2. Determine the quality of industrial waste water
3. Study the treatment of waste water using COD method.
4. To explain the control of noise pollution
5. To Explain environmental protection policy .

Unit I: Air Pollution **10 Hrs.**

General consideration, Sources and sinks of air pollutants, Classification of air pollutants, Effect of air pollutants on living and non-living things, Sources and control of air pollution, Air quality standards and Sampling. Analysis of air pollutants (CO, CO_2, NOx, SOx, H_2S, NH_3, Hydrocarbons and particulates).Green house effect, Acid rain, Ozone depletion and their consequences on environment. Effects of air pollution, Photochemical smog and monitoring of air pollution.

Unit II: Water pollution **15 Hrs.**

A. General: Origin of wastewater, Types of water pollutants and their effects, Sources of water pollution: domestic, industrial, agricultural soil and radioactive wastes as sources of pollution. Water quality parameters & standards, Sampling methods & prevention, Objective of analysis, Parameters for analysis: colour, turbidity, total solid, conductivity, acidity, alkalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen. Heavy metal pollution, public health significance of Cadmium, Chromium, Copper, Zinc Lead, Manganese, Mercury and Arsenic.

B. Analysis & Treatment of Waste Water

General survey of instrumental techniques for the analysis of heavy metals in aqueous systems.Oxygen content of water and aquatic life. Measurements of Dissolved oxygen (DO), Biological Oxygen Demand & Chemical oxygen demand and their significance as pollution

indicators., Monitoring techniques & methodology with special reference to Ammonia, Chloride, Fluoride, Nitrate, Nitrite, Cyanide, Lead, Cadmium, Mercury. Sewage composition & treatment.

Unit III: Noise Pollution **5Hr**

Introduction, Difference between sound & noise pollution, Sources, Noise level measurments, Sonic boom, Anaerobic chamber & Reverberating of sound, Effects & Control.

References :

1. A.K. De, Environmental Chemistry, Wiley Eastern Ltd. New Delhi.
2. R.K. Trivedi, P.K. Goel, Chemical and Biological Methods for Water Pollution Studies Environmental publication.
3. S.C. Santara, Environmental Science, Central Publications.
4. S.L. Chopra, J.S. Kanwar, Analytical&AgricultaureChemistry, Kalyani publications.
5. S.M. Khopkar, EnvironmentalChemistry.

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHET-603-ENVIRONEMTAL CHEMISTRY-II

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objective:

1. Understand the pesticide, soils and Fertilizer analysis
2. Understand the different types of chemical toxicology.
3. To learn the various types of methods for soil, fertilizer and effluent analysis
4. To learn Legislation & recent amendments with respect to the pesticides materials
5. Study the environmental protection policy.

Course Outcome:

6. Explain the control of pesticides.
7. Explain the quality of soil and fertilizer.
8. Differentiate environmental protection policy and environmental legislations

Unit I: A. Chemical Toxicology **10 Hrs.**

Toxic chemicals in environment, Impact of toxic chemicals on enzymes, Biochemical effects of Arsenic, Cadmium, Lead, Mercury, Chromium, Carbon monoxide, Sulphur dioxide, Pesticides.

B. Analysis of Pesticides

Introduction and classification of pesticides

i) Legislation & recent amendments with respect to the pesticides materials

ii) Application dosage of different pesticides

iv) Analysis of DDT, BHC, Gammexane, Endosulphan, Zinab, Ziram, Malathion, Thiram, Thiometon, Simazine and Chloridane.

Analysis of Phosphatic fertilizers for ammonium sulphate, Analysis of Superphosphate, Analysis of water soluble phosphate (or available phosphate).

Analysis of Potassium by Perchlorate method, Cobaltnitrite method and Flame Photometric method.

Unit II: Soil and Fertilizer Analysis : 15Hrs

Fundamentals, Soil Sampling, Determination of soil moisture (Gravimetric, Electrical Conductivity, Tensitometer), pHdetermination of Soil (Colorimetric, Potentiometric methods) Determination of lime & liming materials in soil, Determination of silica and Phosphorus in soil,Determination of total manganese in soil, Determination of soluble salts (alkali salts) in soil.Factors affecting fertility of soil,Analysis of organic content in soil samples include total carbon by Wet method, total nitrogen by Wet &Kjeldahl methods.

Classification of fertilizers (Nitrogeneous, Phosphatic and Potassic fertilizers), Analysis of Nitrogenous fertilizers for ammonium sulphate (titrimetric, Spectrophotometric), Microdetermination of nitrogen (Duma's method), Determination of ammonical and Nitrate nitrogen.

Unit III : Effluent Analysis **5Hr**

Pollution due to cement industry, Distillery, pharmaceutical (drug) industries, Sugar industry, Paper and Pulp industries, Thermal power plants, Nuclear power plants, Metallurgical industries, Polymer industries, Recycle, reuse, recovery, disposal,and management of solid industrial waste.

Reference Books

1. V.Subramanim, Environmental Science, NarosaPublishing House.
2. E. Bhatucha, EnvironmentalStudies, UGC Press.
3. D.E. Newton, Chemistry of the Environment, Infobase Publishing-New York, 2007.
4. S.E. Manahan, Environmental Chemistry, Lewis Publishers.
5. A. Sharma & A. Kaur, Environmental Chemistry, Krishna publishers.
6. S.M. Khopkar, Environmental Pollution Analysis, Wiley Eastern Ltd. New Delhi.
7. Environmental Toxicology, Eds. J. Rose, Gordon and Breach Science Publications.
8. Atmospheric Pollution, W. Buch, McGraw Hill, New York.
9. Fundamentals of Air Pollution, S.J. Williason, Addison–Wesley Publishers.
10. Analytical Aspect of Environmental Chemistry, D.F.S. Natush and P.K. Hopke, John Wiley & Sons, New York.
11. J.W. Vanloon, Environmental Chemistry, Oxford University Press.
12. B. Pani, Environmental Chemistry
13. B. Ghosh, M.S. Ranganathan, S. Sridhar, Enzyme and Food Biotechnology, Wisdom Press.
14. M. Pansu, J. Gautheyrou, Handbook of Soil Analysis (Mineralogical, Organic and Inorganic Methods), Springer Publications, 2010.
15. B.K. Sharma, Analytical Chemistry.
16. Chopra and Kanwar, Analytical Agriculture Chemistry, Kalyani Publications.

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHET-604: ANALYTICAL METHODS IN CHEMICAL ANALYSIS-I

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objectives:

1. To furnish knowledge about Atomic Emission Spectrometry (AES).
2. To provide experience in some scientific methods employed in analytical chemistry.
3. To provide an understanding of chemical methods employed for elemental and compound analysis.
4. To develop the complete theoretical knowledge as well as instrumental Techniques.

Course Outcome:

1. Express theoretical concept of instrumentation.
2. Analyze the sample independently.
3. Learn how to prepare solutions quantitatively and analysis of the analyze with high accuracy.

Unit I Atomic Absorption & Flame Emission Spectroscopy **15Hr**

Flame Emission Spectroscopy: Elementary theory of flame photometry, Instrumentation and experimental techniques. Interferences & Methods for their Overcoming, Types of FES and Applications.

Atomic absorption spectrometry (AAS): Introduction, Principles, Advantages of AAS over FES, Instrumentation, Flame & Non-flame atomization. Sources of AAS (EDL, TGL, HCL), Interferences and Applications, Comparison of atomic absorption with flame emission spectroscopy, Numericals.

UnitII: Flurometry **15Hr**

(a) Fluorescence and phosphorescence Spectrophotometer

Difference between delayed fluoresesence and phosphorescence, Quenching of fluorescence, Formation of excimer and examples. Structural factors, Phosphorescence intensity as related to concentration, Instrumentation for fluorescence andphosphorescence measurements, Problems.

(b)Coulometry Introduction, Principle, Techniques, Coulometer at constant & controlled current and Potential Coulometer, Primary & Secondary coulometric titrations, Errors in coulometric titrations, and Applications.

(c) **Chemical & Bio- Sensors**

Introduction, Sensor Design, Detection Methods, Sensing Principle of sensors, Various Chemical sensors include Oxygen gas sensors, pH sensors, Acidic/basic gas sensors using pH sensitive dyes, Cationic sensors, Anionic sensors, Biosensors.

References:

1. Modern Instrumental Analysis, Volume 47. Eds. S. Ahuja, N. Jespersen, Elsevier Publications, 2006.
2. Vogel's Textbook of Quantitative Chemical Analysis, 5th Edition, G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney, John Wiley & Sons, 1989.
3. A.J. Bard, L.R. Faulkner, Electrochemical Methods: Fundamentals and Applications, John Wiley & Sons.
4. Fundamentals of Photochemistry, Rohatgi – Mukherjee.
5. Photochemistry, J.G.Calvert and J.N.Pitts.
6. Photo–luminescence of solutions, C.A. Parrker
7. Photochemistry, A. Singh and R. Singh
8. F.J. Welcher, Standards Methods of Chemical Analysis
9. Quantitative Analysis, 6th Eds., R.A. Day Jr., A.L. Underwood
10. Fundamental of Analytical Chemistry, 8th Eds., D.A. Skoog, D.M. West, F.J. Holler, S.R. Crough.
11. Analytical Chemistry, 6th Eds. G D. Christian.

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHEL- 605- Analytical Chem. Lab Course-III : 2 Credit : 4 Hr/week ; 50M

Objectives:

1. To provide to experimental knowledge the students various sample analysis.
2. To furnish knowledge about preparation of stock solutions, sample preparation and Suitable procedure for accuracy and precision.
3. Handling different types of sophisticated instruments.

Course Outcome:

1. Perform practical using basic techniques of instrumental analytical procedures.
2. Develop with skilled experimental hand
3. Distinguish between classical and modern procedures of analysis

EXPERMENTS :

1. Analysis of Bronze with respect to Copper and Tin
2. Determination of aluminum and magnesium from Magnalium alloy
3. Analysis of Dolomite ore for Ca, Mg and Silicate material
4. Analysis of bauxite ore
5. Analysis of Cement with respect to SiO2, Calcium, Iron, Magnesium and Aluminium
6. Analysis of Zn-Chrome pigment for Cr and Zn
7. Spectrophotometric determination of lead in leaves using Dithizone-chelating agent
8. Determination of alcohol from given sample by Spectrophotometrically
9. Determination of Nitrogen from Fertilizer sample
10. Estimation of Iron from syndent
11. Limit Tests: i) Iron from CaCo3 ii) Sulphate and Chloride from Paracetamol, Dextrose or any pharmaceutical Preparation
12. Analysis of Salbutalsulphate from asthma inhaler by UV spectrophotometry.
13. Estimation of Cu and Fe (III) by Spectrophotometric titration.
    a. (Standardization of EDTA is expected).
14. Isolation of B-carotene from spinach leaves or lycopene from tomato and its purification on silica gel column.
15. Estimation of glucose from blood sample by glucose oxidase method
16. Estimation of reducing sugars from food sample by spectrophotometry.

17. Estimation of ketone bodies from serum and creatinine from urine by kit method or colorimetry
18. Determination of cholesterol from blood or food sample or milk.
19. Estimation of tannin from tea sample by Folin-Denis method
20. Estimation of Fe from Syrup by spectrophotometric Method
21. Estimation of proteins in food sample by Lowry method
22. Estimation of HMF from Honey
23. Estimation of sulphur from sulphur fungicide.
24. Determination of iron from pharmaceutical preparation by titration with ceric ammonium sulphate.
25. Estimation of aspirin from given tablet by spectrophotometry
26. Determination of Strength of commercial phosphoric acid by potentiometric titrations using standard solution of sodium hydroxide
27. Spectrophotometric determination of inorganic phosphorous in human serum or urine
28. To determine chloride and iodide from given mixture by potentiometry
29. Analysis of Riboflavin from vitamin supplementary capsules / syrup / tablet sample by Photoflurometry
30. Determination of amount of each copper and bismuth or copper and iron(III) from the given mixture by spectrophotometric titration using standard EDTA solution
31. Determination of relative strength of acetic acid, chloroacetic acid and trichloroacetic acid through measuring their Ka value by conductivity measurement method
32. Photometric determination of aluminium from given antacid tablet by working curve method.
33. Determination of commercial vinegar by potentiometric titration.
34. Determination of boric acid by conductometry.
35. Determination of calcium from dairy whitener by Flame photometry
36. Determination of Na and K from water sample by flame photometry binary method/internal standard method.
37. Determination of Na and K from water sample by flame photometry. Calibration curve method or by standard addition method
38. Determination of SO_4 and Cl^- by turbidimetric method (turbidimetric titration or calibration curve method)

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHEL- 606- Analytical Chem. Lab Course-IV : 2 Credit : 4 Hr/week ; 50M

Objectives:

1. To provide to experimental knowledge the students analytical processes.
2. To furnish knowledge about preparation of solutions, sample preparation etc.
3. How to operate the various instruments to get expertise.

Course Outcome:

1. Perform practical using basic techniques of instrumental analytical procedures.
2. Develop with skilled experimental hand
3. Distinguish between classical and modern procedures of analysis

Experiments :

1. Determination of Phosphate from fertilizer sample by volumetric method.
2. Removal of dyes on activated charcoal by column chromatography
3. Determine amount of magnesium from given talcum powder
4. Determination of COD from waste water
5. Analysis of water with respect to sulphate& Chloride
6. Determination of Titanium from pigment/raw material
7. Determination of calcium from given sample of plaster of Paris
8. Analysis of nicrome alloy with respect to nickel and chromium
9. Determination of anion exchange capacity of anion exchange resin
10. Determination of organic carbon in soil
11. Determination of total cation concentration in waste water sample by cation exchange resin.
12. Analysis of copper ferrite (CuFe2O4) and determine amount of copper and iron volumetrically
13. To determine phosphoric acid in cold drink by molybdenum blue method.
14. Spectrophotometric determination of aluminium using Erichrome Cyanine R
15. Separation of amino acids by two dimensional paper chromatography.
16. Determination of glucose from glucon D by titration with Fehling solution.
17. Estimation of blood urea by kit method colorimetry.
18. Estimation of Vit. C using Dichlorophenol, Indophenols by volumetric method
19. Estimation of micronutrient from food by AAS (any two elements such as Fe,Cu, Zn, Mo, B, Mn)
20. Determination of Cu and Zn in brass alloy by polarography
21. Analysis of Paracetamol by HPLC
22. Determination of purity of Sugar sample by optical rotation by polarimetry
23. Estimation of Ca and Mg from form the mixture their oxalate by recording their TGA curve
24. Estimation of micronutrient from soil by AAS (any two elements)
25. Analysis of Alcohol from wine by GC
26. Estimation of waste water sample for heavy metals (any two elements) by AAS
27. Separation of proteins by gel filtration chromatography thereby determination molecular weight of protein sample by gel filtration chromatography

28. Determination of glucose from saline sample by polarimetrically.
29. To determine amount of each p-nitrophenol and m-nitrophenol from the given mixture by spectrophotometric titration using standard NaOH solution (λmax 280 nm)
30. To study the stoichiometry of ferric sulphate complex by Jobs Method.
31. To determine concentration in mg/lit of sulphate in given water sample by nephelometrically.
32. To determine constant of ferric thiocyanate complex by Ostwald method spectrophotometrically.
33. Analysis of paracetamol as per IP with respect to Identification, ash and assay
34. Analysis of caffeine in tablet as per IP with respect to identification, assay
35. Tablet dissolution and disintegration test for paracetamol tablet as per IP
36. Moisture content in pharmaceutical/food sample by Karl fisher titration method
37. Analysis of quinine sulphate from tablet by Photoflurometry
38. Assay of local anaesthetic (benzocaine) by non aqueous titration method.
39. Assay of thiamine from given sample
40. Determination of phosphorus content in serum by spectrophotometry
41. Detection of amino acids by ninhydrin after thin layer chromatographic separation

References:

1. Quantitative Inorganic Analysis including Elementary Instrumental Analysis by A. I. Vogels, 3rd Ed. ELBS (1964)
2. Standard methods of chemical analysis by F. J. Welcher
3. Environmental Chemistry by A. K. De
4. Biochemical Methods, Sadashivam and Manickem, Narosapublicatinon
5. Indian Pharmacoepia volume –I and II
6. Experiments in chemistry by D. V. Jahagirdar, Himalaya publication
7. Practical Pharmaceutical Chemistry, 4th Ed. part-2, Beckette, Stenlake
8. Standard Instrumental methods of Chemical Analysis, F. J. Welcher
9. Organic Laboratory technique a micro scale approach by Donald L. Pavia, Gary
10. M.Lampman, George S. Kriz, Randall G. Engel second edition.
11. Practical clinical Biochemistry, Harold Varley (4th Edition), CBS publishers and
12. Distributers. New Delhi -110002.
13. R. Ikan; Natural products.
14. Peach and Tracy; Methods of Plant analysis Vol. VII.
15. Pavia and others; Organic Laboratory Techniques, (Second Edition,1995),
16. Sannders Series(Harcofst Brace
17. Analytical Chemistry by Gary Christain, 6th edition, 2008
18. Green Chemistry By Paul T. Anastas and John C. Warner
19. Green Chemistry By RashmiSanghi and M. M. Srivastav
20. Green chemistry and catalyst, R. A. Sheldon, Isabella Arends, Ulf Hanefeld Wiley VCH verlagGmBH.

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHETE -607: ANALYTICAL METHODS IN CHEMICAL ANALYSIS-II

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objectives:

1. To provide an understanding of chemical methods employed for elemental and compound analysis.
2. To learn the thermal stability of various types of sample
3. To develop the complete theoretical knowledge as well as instrumental Techniques.

Course Outcome:

1. Express theoretical concept of instrumentation.
2. Explain the purity of various types of sample
3. Analyze the sample independently.

Unit I: (a) Polarography and Cyclic Voltametry. **20 Hrs.**

Introduction, Theory (include Ilkovic equation, Reversible & Irreversible electrode processes, Reversible polarographic waves), Instrumentation(DME, HDME), Modified Polarography techniques (include Sinusoidal ACPolarography, Square wave polarography, Oscillographic polarography, Rapid scan Polarography), Pulse Polarography,Chronopotentiometry& its practical aspects, Applications in qualitative andquantitativeanalysis,

Principle of cyclic voltammetry, Instrumentation, cyclicvoltamogram of $K_3[Fe(CN)_6]$, criteria of reversibility of electrochemical reaction , quasi reversible and irreversible process.

(b) Ion SelectiveElectrodes: Terminology, Types and construction ofelectrodes, Glass electrode, Solid state and Precipitate electrode, Liquid-liquid membrane electrodes, Enzyme & Gas electrodes, Applications.

(c)Electrogravimetry and Electrophoresis

Electrogravimetry: Introduction, type of electrogravimetry , term used in electro-gravimetric analysis, completeness of deposition, electro-analytical separation of metal , application.

Electrophoresis:Introduction, Paper electrophoresis and its advantages with limitations, Techniques in paper electrophoresis, Calculation of electrophoretic mobility, Factors affecting migration of the ions, Continuous electrophoresis, Thin layer electrophoresis, Density gradient electrophoresis, Zone electrophoresis, Curtain electrophoresis, Reverse Osmosis, Electrodialysis, Capillary electrophoresis or Capillary zone electrophoresis & its applications, Applications of paperelectrophoresis.

Unit II Thermal Analysis **10Hr**

General introduction, Classification of thermal methods of analysis,

Thermogravimetric analysis: Principles, Thermobalance, Factors affecting thermal curve, Derivative thermogravimetric analysis, Applications TGA for quantitative analysis (TG analysis of $CaC_2O_4H_2O$, $CuSo_45H_2O$, dolomite ore etc.)

Differential thermal analysis: Principles, Instrumentation, Factors affecting DTA curve, Applications (DT analysis of sulfur, $CuSo_45H_2O$, mixture of polymer, $CaC_2O_4H_2O$)

Differential scanning calorimerty: Principles, DSC vs DTA, Instrumentation, Applications(DCS curve of polyethylene terphthalate, DSC curve for isothermal crystallization of polyethylene , DSC of phenacetein), Thermometric titrations, Numericals.

Reference Books

1. D.K. Gosser (Jr.), Cyclic Voltammetry: Simulation and Analysis of Reaction Mechanisms, VCH Publishers, 1994.
2. K. Zutshi, Introduction to Polarography and Allied Techniques, New Age Publications, 2006.
3. Comprehensive Analytical Chemistry, Eds. D. Barcelo, Elsevier Publications, 2006.
4. Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.O. Barnes, M. Thomas, B. Sivasankar.
5. Instrumental Methods of Analysis, H.H. Willard, L.L. Merritt Jr., J.A. Dean, F.A. Settle Jr.
6. Basic Concepts in Analytical Chemistry, S.M. Khopkar,
7. Quantitative Analytical Chemistry, 2nd Eds. James S Fritz and George H. Schenk Jr.
8. Handbook of Instrumental Methods for Analytical Chemistry, F. Settle.
9. Treatise on Analytical Chemistry: Vol. I to Vol. II–I .M. Kolthoff.
10. Modern Instrumental Analysis, Volume 47. Edited by S. Ahuja, N. Jespersen, Elsevier
11. Vogel's Textbook of Quantitative Chemical Analysis, 5th Edition, G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney, John Wiley & Sons, 1989

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHETE- 608- Forensic Analysis

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objective:

1. Study the special feature of forensic analysis and classification of poison
2. To learn the analysis of various types drug using different instrumentation methods

Course Outcome:

1. To analyzed the poisons materials such as Lead, Arsenic and Mercury in biological samples
2. To analyzed the drug in vegetable samples
3. To determine the toxicity of Heroin, Caffeine, Barbiturates in biological samples

Unit I: Forensic Analysis **15 Hrs.**

(a)Vegetable drugs analysis: Sampling , foreign organic matter, ash value , acid soluble ash, acid insoluble ash, sulphated ash, extraction of alkaloids.

(b) Sources of Impurities in pharmaceutical raw material and finishing product:

Raw material , Method of manufacture , atmospheric contaminations, cross contamination, microbial contamination, container contamination, packing error, chemical instability, temperature effect and physical changes , self life pharmaceutical product and its determination.

(c) Forensic analysis:

Special features for forensic analysis, Sampling, Sample storage, Sample dissolution,

Classification of poisons, Lethal dose, Significance of LD50 & LC50

Toxicology: Isolation, Identification and determination of followings

Narcotics: Heroin, Morphine

Stimulants: Caffeine, cocaine, Amphetamines

Depressant: Barbiturates, Benzodiazepine pines.

Unit II : Drug Analysis **15Hrs**

Classification of drug , classification according to effect methods of screening and investigating the drugs , chemical methods, complexometric method of titration, acid base titration in non aqueous media, express analysis , physicochemical methods , optical methods , refractometry , polarimetry , fluorimetry, some determinations by fluorimetry , spectrophotometry , electrochemical methods , potentiometry, polarography , chromatographic methods , thin layer chromatography, separation of vitamins by thin layer chromatography. Paper chromatography,

separation of amino acid by paper chromatography, ion exchange chromatography, gas chromatography, separation of amino acid by gas chromatography , high performance liquid chromatography (HPLC), biological method , radioimmunoassay (RAI) methods.

Reference:

1. J.B. Crippin, Explosive and Chemical Weapons Identification, Taylor & Francis Publications, 2006.
2. M.M. Houck, Forensic Science: Modern Methods of Solving Crime, Library of Congress Publications, 2007.
3. Mozayani, C. Noziglia, The Forensic Laboratory Handbook Procedures and Practice, Springer-Humana Press, 2011.
4. S. Suzanne Nielsen, Food Analysis, Springer Publications, 2009.
5. Indian pharmacopeia Volume I and II
6. Practical pharmaceutical chemistry third edition value 1
7. By A. H. Beckett and J.B. Stenlake
8. Remington's Pharmaceutical Sciences.
9. AnselsPharmacetical Analysis.

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHETE- 609: Advanced Analytical techniques- I

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course objective:

1. Understanding of the principles flurimetry Spectroscopy.
2. To learn modern sophisticated techniques in Analytical Chemistry.
3. To learn use of spectroscopic methods for qualitative and quantitative analysis.

Course Outcome:

1. Apply the recent knowledge about modern sophisticated instruments.
2. Carry out chemical analysis using modern sophisticated Instruments.
3. Explain theory and application of sophisticated instruments.

Unit-I Molecular Luminescence Spectrometry: **15Hr**

Theory of fluorescence and phosphorescence, Instruments for measuring fluorescence and phosphorescence, Applications and photoluminescence methods, Chemiluminescence

Unit-II Surface Characterization by Spectroscopy and Microscopy: **15Hr**

Introduction to the study of surfaces, Spectroscopic surface methods, Ion spectroscopic techniques, Surface photons spectroscopic methods, Electron stimulated microanalysis methods, Scanning probe microscopes

a) Properties of Supercritical Fluids, Supercritical Fluid Chromatography, Supercritical Fluid Extraction.

b) Principle, Instrumentation and Applicationof the followings-

High performance thin layer chromatography, Ultra performance liquid chromatography, Advancedflash chromatography

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHETE- 610: Advanced Analytical techniques- II

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course objective:

1. Understanding of the core principles of ARS topics Spectroscopy , LCMS GC-IR, GC-MS,ICP-MS etc.
2. To learn the students with modern sophisticated techniques in Analytical Chemistry.
3. To learn use of spectroscopic methods for qualitative and quantitative analysis.

Course Outcome:

1. Apply the recent knowledge about modern sophisticated instruments.
2. Carry out chemical analysis using modern sophisticated Instruments.
3. Explain theory and application of sophisticated instruments.

Unit-I **15Hr**

a) Radioactive Nuclides, Instrumentation, Neutron activation methods, Isotope dilution methods

b) Atomic X-ray spectrometry- Fundamental principles, Instrument components, X-ray fluorescence methods, X-ray absorption methods

Unit-II **15Hr**

a) Introduction, Need for hyphenation, Possible hyphenation, Interfacing devices and applications of the following: LC-MS, GC-IR, GC-MS,ICP-MS, MS-MS.

b) Principle of automation, Flow – injection Analysis, Microfluidics, Discrete automatic systems

Reference Books

1. Instrumental Methods of Analysis–Willard, Merritt, Dean & Settle.
2. Instrumental Analysis- Skoog, Holler, Crouch.
3. Principles of Instrumental Analysis–Skoog, F.J.Holler&J.A.Nieman
4. Instrumental Methods of Chemical Analysis–Galen W. Ewing.
5. Analytical Chemistry – Gary D. Christian, 6^{th} edition
6. Handbook of Instrumental Techniques for Analytical Chemistry –Frank Settle,Editor
7. Introduction to Instrumental Analysis-R.D. Braun, McGraw Hill.
8. Fundamental of Analytical Chemistry,-D.A. Skoog, D.M.West and F.J. Holler.
9. Wilson and Wilson Compressive Analytical Chemistry. Ed. G. Svehla, A series of Volume

M. Sc. Second Year (*Third Semester*) Analytical Chemistry

ACHE-RP-649 : Research Project-I

8hrs/week: Credit:04: Marks:100

Course Objectives (CObs):

1. To create interest of research amongst the students.
2. To learn the basic knowledge and steps involved in the research.

Course outcome:

1. Understand literature survey, data analysis, report writing.
2. To choose research problem
3. Develop interest of research.

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHET-650: Ores, Alloys and Explosive Analysis

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objectives:

1. Understand the analysis of ores, alloys and explosive materials
2. To learn spectroscopic methods for this analysis
3. Remember analysis by other chemical methods

Course Outcome:

1. Explain the analysis of ores ,alloys and explosive materials
2. Determination of calorific value of fuels
3. Determination of purities of patrols

Unit I: (a) Analysis of Ores and Alloys **10Hrs.**

Constituents and Analysis of the following ores:

Iron ore for total iron by volumetric and gravimetric method (Hematite),

Manganese ore for total Manganese by gravimetric & volumetric method (Pyrolusite),

Chromium ore for chromium by volumetric and gravimetric method (Chromite),

Aluminium ore for aluminium by volumetric method (Bauxite),

Titanium ore for titanium by volumetric and colorimetric method (Ilemenite),

Monazite ore for thorium & its oxides, Copper ores (Malachite Green), Dolomite, Galena ores.

(a) **Analysis of Alloys**Analysis of major & minor components of the following Alloys:

Brass, Bronze, Monel-Metal, Types-metal, Solder, Silver-coin, Steel, Stainless steel

Unit II: Explosive Analysis **10M**

(a)Analysis of Cement and buildingmaterials.: Types of cement, Sampling, Analysis of-Silicon dioxide, Aluminum oxides, Ferric oxides, Calcium oxide, Magnesium oxide, Sodium and potassium oxide.

(b) Analysis of Glass: Types of glasses, Determination of lead and lead glass.

(c) Explosive : Explosion, Detonation, Classification of explosives, Propellant, Fulminates, Detonators, Blasting-cap, Thermochemistry, Hygroscopicity of explosives, Moisture by Karl-Fisher titration, Isolation from debris, Qualitative test,Cation& anion analysis by capillary electrophoresis, EDXRF, Analysis by TLC,HPLC, IR,GC-TEA method.

Unit – III: **10M**

(A) Fuels:

Introduction, calorific value.Determination of calorific value.Modern concept of fuels. Classifications of fuels ,criterion of selection of fuels , properties of fuels. Method of processing. Solids fuels ,Natural solid fuels, Artificial solid fuels ,Industrial solids fuels .Formation of coal properties of coal ,Classification of coal., coking and non-coking coals. pulverised coal. .Role of sulphur and ash in coal ,approximate analysis ,Ultimate analysis. .Numerical.

(B) Petroleum:

Occurrence, mining of petroleum. Prospecting colour and consistency. Origin composition, classification ,terms related to petroleum. .Distillation of crude petroleum.Treatment of the residual liquid, Determination of flash point. Determination of aniline point .Knocking and Anti-knocking compounds. Octane number .Cetanenumber,Numericals

References Books

1. S.K. Jain, Introduction to Metallurgical Analysis: Chemical Analysis and Instrumental.
2. F.J. Welcher, Standards Methods of Chemical Analysis.
3. P. G. Jeffery and. J. Hatchinsion, Chemical methods of rock analysis.
4. F. J. Welcher Standard methods of chemical analysis, A series of volume Robert and Krigeger Publishing Company.
5. Metallurgical analysis by S. K. Jain and K. K. Jain.

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHET-651: Pharmaceutical Analysis-I

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objectives:

1. To furnish knowledge about Cosmetic, paint and pigments Analysis.
2. To furnish knowledge the Tests for cosmetics paint and soap analysis

Course Outcome:

1. Understand the principles of theoretical aspect and reaction of Pharmaceutical and Cosmetic analysis.
2. Modify procedures assay and tests for cosmetics, paint with better results.
3. Carry out assay and tests for cosmetics, paint and soap indecently.

Unit I: Cosmetic Analysis: **15Hr**

(a) Cosmetic : Introduction, Evaluation of cosmetic material and raw material and additive . formulation, standard and methods of analysis

(b) **Deodorants and antiperspirants** : Al, Zn, Zr, Boric acid, chloride , sulphate, hexachlorophene, methanamine , phenolsulphonates and urea.

(c) **Face powder** : Fats, fatty acid, boric acid, Ca. Mg,$BaSO_4$, Ti, Fe, Oxides of TL, Fe and Al

(b)**Hair tonic** : Hair tonic: 2,5-diaminotoluene, potassium bromates, sodium perborate,pyrogallol, resorcinol, salicylic acid, dithioglycollic acid (in permanent wavers)

(c)**Creams and lotions** : types of emulsions, chloroform soluble material, glycerol, pH emulsion, ash analysis, non volatile matter by IR spectroscopy.

(d)**Lipsticks**: General analysis, determination of nonvolatile matter, ash analysis determination of lakes and fillers, trichloroethylene – acetone soluble contents.

Unit II: (a) Analysis of Paints & Pigments **15Hrs.**

Introduction, Determination of non-volatile & volatile components, Flash points, Separation, Isolation & Determination of pigments and thinners of solvent types coating, Types of Pigments, Isolation & Determinations of binders (IP method).

(b) Analysis of Soap & Detergents: Soap: Introduction, Types of soap, Manufacturing steps of soap (such as Boiling, Graining/Salting out, finishing), Cleansing action of soap.

Detergents: Introduction, Raw materials for detergents, Types of Detergents, Comparision of cleansing action between soaps and detergents.

References Books

1. Harry's Cosmetology, Longman scientific co.
2. Formulation and Function of cosmetics, Sa Jellineck.
3. Cosmetic Technology, Saggarin
4. Modern cosmetics, E. Thomessen Wiley Inter science
5. Hillenbrand Lhundel, Bright and Hoffman, Applied inorganic analysis, John Wiley.
6. Snell and Biffen, Commercial methods of analysis.
7. P. G. Jeffery, Chemical methods of rock analysis, pergamon.
8. Rieche, Outline of industrial organic chemistry, Butter worth.Kent, Rieg's Industrial chemistry, Rain hold
9. www.dghs.gov.in

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHET-652: Applied Nanomaterials Analysis

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objectives:

1. To furnish knowledge about most recent nanomaterials and highly sophisticated instruments.
2. To earn knowledge about recent and advanced techniques such as SEM, TEM, X–ray Hyphenated Techniques ,Laser Based Techniques. Probe-Techniques etc.

Course Outcome:

1. Understand the principles of theoretical aspect working spectroscopies
2. Explain the principles and theoretical aspect of working SEM, HR-HRTEM, Probe technique
3. Describe the various of properties and application for nanomaterials

Unit I: Synthesis of nanomaterials **10 Hrs**

General Introduction, Historical background,Chemical Methods include Reduction method for Metal Nanoparticles, Langmuir-Blodgett, Micelles-Microemulsions methods , Sol-gel, hydrothermal method, sonochemical Synthesis, Electrochemical Synthesis, Co-precipitation methods etc

Unit II Characterization Techniques and Properties **10Hr**

Electron Microscopy (SEM-EDS and TEM), Probe Microscopy (STM & AFM), Diffraction Techniques (XRD), UV-Visible-NIR spectroscopy etc. Mechanical, Optical, Magnetic, Electronic properties etc.

Unit III: Application of Nanomaterials **10Hr**

Carbon nanostructures include Carbon Nanotubes and graphene,Mesoporous materials include Metal oxides (Titania and ZnO) and Zeolites, Carbon-based Composites, Smart materials.

Electronics, Energy, Automobiles, Sports & toys, Textile, Cosmetics, Domestic appliances, Sensors, Biotechnology & medical field, Space &Defence, Catalysis, Nanotechnology & environment

References :

1. Nanotechnology (Principles and Practices) : Sulbha K. Kulkarni
2. Intrumentation methods of Chemical Analysis : V.K. Ahluwalia
3. Nanotechnology: T. Pradip
4. Nanomaterials Chemistry: Recent Developments and New Directions, Edited by C.N.R. Rao, A. Muller and A.K. Cheetam, Wiley-VCH, 2007.
5. C.N.R. Rao, P.J. Thomas, G.U. Kulkarni, Nanocrystals: Synthesis, Properties and Applications, Springer-Verlag Berlin Heidelberg, 2007.
6. Nanoparticles: From Theory to Applications, Edited By G. Schmid, Wiley-VCH, 2010.
7. G. Cao, C. J. Brinker Annual Review of Nano Research, Vol.1, World Scientific Publishing.

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHET-653: Polymer and catalysis Analysis

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objective ;

1. To learn the applied concepts of polymer chemistry and catalysts.
2. To study various mechanisms of polymerization and learn different techniques of polymerization.
3. To learn the mechanism involved catalysts

Course Outcome:

1. Explain the application of polymerization
2. Understand and apply core study of mechanism of catalyst.

Unit I: Polymer Chemistry **15 Hrs.**

i) Introduction (Monomer, Co-monomer, Mesomer, Homopolymer, Hetropolymer, Co-polymer)

ii) Classification of polymers, Different types of polymerizations (Condensation polymerization, Addition polymerization-Cationic/Ionic/Free radical/Co-ordination, Chain polymerization, Coordination polymerization, Ring opening polymerization, Group transfer polymerization) & their mechanism, Chain transfer reaction, Ionic copolymerization.

iii) Molecular weight of polymers and their determination by end group analysis, Osmometric, Viscometric, Light Scattering & Sedimentation method.

iv) Synthesis, Properties & Applications of following Polymers:

Polyethylene, polypropylene, polystyrene, polyvinyl chloride, polyacruly nitride, polyester, polyethylene glycols, polyvinyl alcohol, polyetraflueroethylen, silicone polymer, urea-formaldehyde resin, polyurethanes, epoxy resins.

Unit II : Catalysis **15 M**

Introduction, Catalyst and its types, General features of Catalysts (Catalytic efficiency, Catalytic cycles, Selectivity, Energetic, Life time).

Homogeneous Catalysis:

Various catalytic steps (Ligand co-ordination & dissociation, Insertion & elimination, Nucleophilic attack of co-ordinated ligands, Oxidation & reduction, Oxidative addition & reductive elimination), Illustrative examples include Hydrogenation of alkene, hydroformylation

of alkenes, Oxidation of alkenes (Wacker process), Carbonylation of methanol to acetic acid (Monsanto process).

Heterogeneous Catalysis:

Nature of heterogeneous catalysts (Surface area, Porosity, Surface acidic and basic sites, Surface metal sites), Various catalytic steps such as chemisorption and desorption surface migration, Illustrative examples include hydrogenation of alkene, Ammonia synthesis, SO_2 oxidation, Interconversion of aromatic Zeolites, Photocatalysis by TiO_2.

Reference Books

1. Introduction to polymer science ,V.R.Gowarnikar, N.V.Vishwanathan& J.
2. G.B. Sergeev, Nanochemistry, Elsevier Publications, 2006.
3. V.R.Gowarikar, N. V. Vishwanathan& J. Sreedhar, Polymer Science, Wiley Eastern.
4. D.D. Deshpande, Physical Chemistry Polymers, Tata McGraw Hill.
5. P.J. Flory, Principles of Physical Chemistry, Cornell University Press.
6. R.B. Seymour, Introduction to Polymer Chemistry by McGraw Hill.
7. E.K. Ridder&H.S.Taylor Catalysis: Theory and Practices.
8. Green chemistry and catalyst, R. A. Sheldon, Isabella Arends, Ulf Hanefeld Wiley VCH
9. verlagGmBH& co.
10. Sustainable residential development: planning and design for green neighborhoods. Avi
11. Friedman, McGraw Hill professional
12. Text Book of polymer science By F.W.Billmeyer, New York: Wiley
13. .Physical polymer science by L.H .Sperlingwiley –Interscience New York
14. Fundamentals of polymer science & Engineering By A Kumar &S.K.Gupta,Tatamcgraw Hill
15. Industrial Chemistry, B. K. Sharma, Goel publishing House Meerut.
16. Kent, Rieg's Industrial chemistry, Rain hold.
17. 20.Handbook of Instrumental Techniques for analytical chemistry. Frank Settle, editor 1st Indian print 2004.
18. Polymer science by VasantGovarikar, Wiley Earstewen. New York.
19. Principle of polymer science, Behadhar and Sastri, Narosa Publishing house.

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHET-654: Pharmaceutical Analysis-II

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objectives:

1. To furnish knowledge about Cosmetic and drug Analysis.
2. To earn knowledge about methods of Standardization and Quality Control.
3. To furnish knowledge Assay and Tests for Drugs.

Course Outcome:

1. Understand the principles of theoretical aspect and reaction of Pharmaceutical analysis.
2. Modify procedures assay and tests for clinical with better results.
3. Carry out assay and tests for Drugs, clinical indecently.

Unit I: Quality Assurance **10 Hrs.**

i) Basic terminology: Quality, QA, QC, Good laboratory practices (GLP) and Good Manufacturing practices (GMP)

ii) Pharmacopeia standards: BP, IP, USP, NF, EP.

iii) Different Drug Regulatory Authorities: FDA, NIBSC, TGA, MCC

iv) Drug Development and Regulatory Process: Introduction, Identification of New Molecules, Preclinical Research, Formulation & Development, Regulatory issues, Clinical trials, New Drug Applications.

v) Official method of analysis: Sources of impurities in pharma/food products, Limit test of As, Pb, Fe, Cl, SO_4, Stability studies.

vi) Concept of online analysis: Raw material, Documentation, Finished product, Record keeping

Unit II: Microbiological Analysis **10 Hrs.**

i) Introduction to micro-organism: Bactria, Fungus.

ii) Isolation & identification of important group of Bactria by plate count method.

iii) Determination of cell mass by direct & indirect method.

iv) Microbial growth & Factor affecting it : Temperature, pH, Media & Humidity

v) Counting techniques:

Sterilization: definition, various methods (Chemical/thermal/Radiation)

Disinfection: definition & various methods, Evaluation of antimicrobial agent & disinfects

Aseptic condition & Sterling test (HEPA filter).

vi) Microbiological test for Antibiotics standard preparation and unit of activity, test organism and Inoculums, Cylindrical-plate assay receptacles , Turbidimetric assay receptacles, assay designs, Cylinder plate or Cup plate method, plate count method, test for sterility. Pyrogen Test.

Unit III: Clinical Analysis and Blood Gas Analysis **10 Hrs.**

(a) Clinical Analysis

i) Introduction of blood : Composition, collection & Preservation of blood samples

ii) Analysis of blood sample for the followings :Glucose (Follin-Wu method), Urea (Diacetylmonoxime method & modified Diacetylmonoximethiosemicarboxime method), Blood urea nitrogen, Serum uric acid, Total Proteins (Albumin ,Globulin, & A.G. Ratio), Biuret method,

specific gravity method, Serum Barbiturates, Spectroscopic method, Serum alkaline phosphate Serum acid phosphate

(b) Blood Gas Analysis

i) Introduction

ii) Processes of obtaining arterial blood sample

iii) Blood gas symbols

iv) Blood gas instrumentation

v) Arterial blood gases

vi) Determination of Partial pressure of CO_2 (P CO_2), Oxygen saturation (SO_2), Oxygen contents (O_2), Partial Pressure Of Oxygen (PO_2), CO_2 contents Or total CO_2 contents, Blood p^H

Reference Books

1. P. Konieczka, J. Namiesnik, Quality Assurance and Quality Control in the Analytical Chemical Laboratory, CRC Press, 2009.
2. Quality Assurance of Pharmaceuticals, WHO, 2007.
3. B.W. Wenclawiak, M. Koch, E. Hadjicostas, Quality Assurance in Analytical Chemistry, Springer Publications, 2010.
4. J.B. Crippin, Explosive and Chemical Weapons Identification, Taylor & Francis Publications, 2006.
5. M.M. Houck, Forensic Science: Modern Methods of Solving Crime, Library of Congress Publications, 2007.
6. Mozayani, C. Noziglia, The Forensic Laboratory Handbook Procedures and Practice, Springer-Humana Press, 2011.
7. S. Suzanne Nielsen, Food Analysis, Springer Publications, 2009.
8. Indian pharmacopeia Volume I and II
9. Practical pharmaceutical chemistry third edition value 1;By A. H. Beckett and J.B. Stenlake
10. Remington's Pharmaceutical Sciences.
11. Ansels Pharmacetical Analysis.

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHEL-655 –Analytical Chem.Lab.Course-V

(Spectral Analysis): 2 Credit: 4 Hr/week; 50M

Course Objective:

1. The course aims to provide an advanced understanding of the spectrum based on the experimental results
2. To learn spectroscopic methods for the analysis of various types of spectrum.

Course Outcome:

1. To analyzed the spectra of given various types of samples
2. The students will be able to interpret the various spectrums and assign the structures to the compounds.

Course Content:

1. XRD
2. Mossbauer Method
3. UV-Visible
4. ^{1}H NMR
5. ^{13}C NMR
6. Mass Spectroscopic etc

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry
ACHETE-656: Food Analysis–I

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objectives:

1. This paper aims to introduce the students to different analytical methods used in the analysis of food and their compositions.
2. This course also deals with classification, and qualitative and quantitative estimation of food.

Course Outcomes:

1. This paper will ensure that the students learn to analyze and classify the above mentioned materials.
2. After completing this course they will be able to do the sampling and chemical analysis of these materials for ensuring the quality and standard of these materials

Unit I: (A) General Concepts of Food Analysis **15 Hrs.**

i) Food contamination & spoilage: Causes, Microbial spoilage of fish, Bacterial spoilage of meat & its products, spoilage of milk & its products

ii) Food safety considerations. Appearance, Texture, Flavor

iii) Legislation related to food & recent amendments

(B) Methods of Food Analysis

i) Food sampling for analysis

ii) Proximate composition of food: Water, Ash mineral matter, Nitrogen & crude nitrogen, Carbohydrates, Lipids/Fats, Proteins.

iii) Chemical characteristics & constituents.

Unit II Analysis of Food Additives **15Hrs.**

i) Food Preservatives: Definition, Preservation methods (Temperature control, Moisture control), Organic/Inorganic Chemicals as a preservatives (Benzoic acid, Sorbic Acid, Parabens, Sulfites, Nitrates, Nitrites, Sodium Chloride, Hydrogen Peroxides)

ii) Food Emulsifiers: Algin, Alginates in foods, Detection of alginates in foods

iii) Food Adulterants: Definition, Adulteration of juice, soft drinks, milk.

iv) Food stabilizers: Definition, Extraction of gum from fruits and vegetable products.

v) Sweetners: Definition, Different artificial sweeteners (Saccharin, Aspertame, Cyclamate, Dulcin, Acesulfame-K, Sucralose)

References:

1. L. Amsel, L. Hirsch, Food Science and Security, Nova Science Publishers, 2009.
2. J.M. deMan, Principles of Food Chemistry, ASPEN Publications, 1999.
3. K.V. Ramesh, Food Microbiology, MJP Publishers.
4. S.N. Mahindru, Food Science and Technology, APH Publishing Corporation.
5. M. Bennion, Introductory Foods, Prentice Hall, Inc.
6. M. Bockisch, Fats and Oils Handbooks, AOCS Publications, 1998.

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHETE-657: Food Analysis–II

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objectives:

1. To learn different analytical methods used in the analysis of Oil and facts in food as well as their composition
2. This course also deals with classification, and qualitative and quantitative estimation of protein, carbohydrate, vitamins in foods.

Course Outcomes:

1. This paper will ensure that the students learn to analyze and classify the above mentioned foods materials.
2. After completing this course they will be able to do the sampling and chemical analysis of these materials for ensuring the quality and standard of these materials

Unit I: Oil and Fat Analysis in Food **15 Hrs.**

A) Introduction, General Classification of lipids (natural fats & oils) Components of Fats and Oils, Structure of triglycerides, Smoke point, Flash point, Fire point, Cloud point, Acid Value, Saponification Value, Iodine Value, Peroxide Value, Unsaponifiable matter, Water Content, Phosphorus Content, Colorimetric Value, Hexane in extraction meal, Crude Fibre in meal, Protein in meal, Ash, Solid Fat content, Dilatation (Solid fat Index).

B) Analysis :, Solvent extraction methods (Continuous, Semicontinu- ous, Discountious), Nonsolvent Wet extraction methods.

Unit II: (A)Protein Analysis in Food **15Hrs**

Introduction, Analysis by Dumas method, Biuret method, Lowry method, Dye-binding method, Bicinchonic method

(B) Carbohydrate Analysis in Food

Introduction, Analysis of total Carbohydrates by Phenol-Sulfuric acid method, Total Reducing Sugar by Somogyi-Nelson method, Analysis of Total Starch.

(C) Vitamin Analysis in Food

Importance of Analysis, Vitamin Units, Methods for Vitamin Assay (Bioassay, Microbiological assay, Physicochemical assay). Analysis of the following Vitamins: Vitamin A, Vitamin E (Toropherols and Torotrienols), Vitamin C by titrimetric and microfluorometric methods, Vitamin B_1bythiochromefluorometric method, Vitamin B_2 by fluorometric method.

References Books

1. S. Suzanne Nielsen, Food Analysis, Springer Publications, 2009.

2. Handbook of Food Analytical Chemistry, Eds. By R.E. Wrostad, T.E. Acree, E.A. Decker, M.H. Penner, D.S. Reid, S.J. Schwartz, C.F. Shoemaker, D. Smith, P. Sporns, Wiley-IntersciencePubls.

3. L. Amsel, L. Hirsch, Food Science and Security, Nova Science Publishers, 2009.

4. J.M. deMan, Principles of Food Chemistry, ASPEN Publications, 1999.

5. K.V. Ramesh, Food Microbiology, MJP Publishers.

6. S.N. Mahindru, Food Science and Technology, APH Publishing Corporation.

8. M. Bennion, Introductory Foods, Prentice Hall, Inc.

9. M. Bockisch, Fats and Oils Handbooks, AOCS Publications, 1998.

S. Suzanne Nielsen, Food Analysis, Springer Publications, 2009.

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHETE-658: Advance Chemical Method -I

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objective

1. To study analytical Techniques Classical and Instrumental methods in detail.
2. To learn the application in various field.

Course Outcome:

4. Understand various techniques, processes in terms of Analytical Chemistry
5. Develop modified procedures of various analysis.

Unit I: Radiochemical Methods **15 Hrs.**

Elementary working, Principles of Geiger Muller, Ionization, proportional and l-ray counters. Radiotracer techniques, Application of radiotracers in analytical Chemistry.

Neutron activation analysis (NAA): Principle, technique and applications in preparation of some commonly used radioactive isotopes. Isotopic Dilution Analysis (IDA), Substoichiometric IDA, Experimental technique and applications of IDA, Advantages and limitations of IDA and comparison of IDA with NAA. Principle of Radiometric titrations, Types, Experimental techniques and its applications.Carbondating.Numericals.

Unit II: Online Analyzers **15 Hrs.**

Introduction, Classification of automated methods, Principles andtechniques of auto-analyzers employed for microanalysiswith emphasis on the basis sequences in operational modesin segmented and non-segmented flow and applications.Selection of online analyzers.

Flow Injection Analysis: Introduction, Principal, theoretical aspects of FIA, Techniques, Pretreatment of sample in packed reactions, Components of FIA apparatus, Factors affecting FIA and applications for the determination F^-, Cl^-, PO_4^{-3}, NO^-_2, NO_3^-, SO_4^{2-},BO_3^{3-}, Ca^{2+}, Mg^{2+}, Al^{3+}, Mn^{2+}, Cr^{6+}, Fe^{3+} in water.

References :

1. Instrumentation methods of chemical Analysis : B.K.Sharma

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHETE-659: Advance Chemical Method -II

2Hrs/Week , Credit :02 , 50Marks **30Hours**

Course Objective

1. To study analytical Techniques Classical and Instrumental methods in detail.
2. To learn the application in various field.

Course Outcome:

1. Understand various techniques, processes in terms of Analytical Chemistry
2. Develop modified procedures of various analysis.

Unit I: Atomic Emission spectroscopy **10Hrs.**

Introduction, Arc and spark atomization, spectra from higher energy sources, emission spectroscopy based upon plasma sources, atomic fluorescence method based upon plasma atomization. Emission spectroscopy based upon arc and spark sources. X-ray fluorescence and its principle.

Unit II: Neutron & Electron diffraction **10Hrs.**

Neutron Diffraction: Introduction, NRD vs. XRD, Instrumentation, Magnetic Scattering, Applications.

Electron Diffraction: Scattering intensity Vs scattering angle, Wierl equation, Measurment techniques, Elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surface.

Unit V: Optical Rotatory Dispersion (ORD) and circular Dichroism (CD) **10 Hrs.**

Definition, cotton effect, deduction of absolute configuration, octant rule for ketones.

References :

1. Instrumentation methods of chemical Analysis : B.K.Sharma

M. Sc. Second Year (*Fourth Semester*) Analytical Chemistry

ACHE-RP-699 -Research Project II: 6 credit; 12hr/week; 150Mark

Course Objective :

1. To provide to knowledge literature survey about research work.
2. Students will learn to carry out reaction/ analysis independently
3. To develop the student with analytical skill to establish the relation between the outcomes and experiment carried out.

Course Outcome:

1. Search various published research papers/ articles with concerned research topics
2. Develop with skilled experimental hand and in characterization/ analysis of research outcomes.
3. Apply knowledge to carry out major research project in industries/academics

=======Department of Chemistry, Sub campus Dharashiv ======

Head
Department of Chemistry
Dr.Babasaheb Ambedkar Marathwada
University Sub-Campus, Dharashiv.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR SUB-CAMPUS, DHARASHIV

NAAC Reaccredited with 'A' Grade

Department of Chemistry
(Autonomous)

Faculty of Science and Technology

National Education Policy-2020
Outcome Based Curriculum

M. Sc. II Year

(Semester III & IV)

Subject : Chemistry

Specialization : Drug Chemistry

(Effective from 2024-25)

Illustrative Credit distribution structure for two years programme with Multiple Entry and Exit options

Head
Department of Chemistry
Dr.Babasaheb Ambedkar Marathwada
University Sub-Campus, Dharashiv.

Class: M. Sc. II Year Semester: III Specialization : Drug Chemistry

Course type	Course Code	Course Name	Teaching Scheme (Hrs. / week)		Credits Assigned			Marks		
			Theory	Practical	Theory	Practical	Total Credits	Conti. Eval.	Uni. Exam	Total Marks
Major Mandatory DSC	CHET-600	DSC-15 (Organic Spectroscopy)	2	-	2	-	10T	20	30	50
	CHET-601	DSC-16 (Molecular Spectroscopy)	2	-	2	-		20	30	50
	DCHET-602	DSC-17 (Introduction to Medicinal Chemistry)	2	-	2	-		20	30	50
	DCHET-603	DSC-18 (Drug action I)	2	-	2			20	30	50
	DCHET-604	DSC-19 (Drug action II)	2	-	2	-		20	30	50
	DCHEL-605	DSC-20 (Drug Chem. Lab Course)	-	4	-	2	4P	20	30	50
	DCHEL-606	DSC-21 (Drug Chem. Lab Course)	-	4	-	2		20	30	50
DSE (Choose any Two from pool of courses)	DCHETE-607	DSE-7 (Organic Reactions)	2	-	2	-	4T	20	30	50
	DCHETE-608	DSE-8 (Organic Rearrangements)	2	-	2	-		20	30	50
	DCHETE-609	DSE-9 (Pharmaceutical Dosage Forms)	2	-	2	-		20	30	50
	DCHETE-610	DSE-10 (Natural Products)	2	-	2	-		20	30	50
Research Project	DCHE-RP-649	Research Project-I	-	8	-	4	4P	40	60	100
Total			**14**	**16**	**14**	**08**	**22**	**220**	**330**	**550**

Corse Code Nomenclature:

DSC: Discipline Specific Core Course; **DSE**: Discipline Specific Elective; **T**: Theory; **L**: Laboratory Course; **P**: Practical; **CHET**: Chemistry Theory Core Course; **DCHET**: Drug Chemistry Theory Core Course; **DCHEL**: Drug Chemistry Laboratory Core Course; **DCHETE**: Drug Chemistry Elective Course; **DCHE-RP**: Drug Chemistry Research Project

Class: M. Sc. Second Year (Semester III)

1. Major Mandatory (DSC)- Master Programme is based on DSC Specialization
   CHET-600 : Organic Spectroscopy
   CHET-601 : Molecular Spectroscopy
   DCHET-602 : Introduction to Medicinal Chemistry
   DCHET-603 : Drug Action I
   DCHET-604 : Drug Action II
   DCHEL-605 : Drug Chemistry Laboratory Course
   DCHEL-606 : Drug Chemistry Laboratory Course
2. DSE: (Choose any two from pool of courses)
   DCHETE-607 : Organic Reactions
   DCHETE-608 : Organic Rearrangements
   DCHETE-609 : Pharmaceutical Dosage Forms
   DCHETE-610 : Natural Products
3. Research Project :
   DCHE-RP-649 : Research Project I

Class: M. Sc. II Year Semester: IV Specialization: Drug Chemistry

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned			Marks		
			Theory	Practical	Theory	Practical	Total Credits	Conti. Eval.	Uni. Exam	Total Marks
Major Mandatory DSC	CHET-650	DSC-22 (Photochemistry)	2	-	2	-	10T	20	30	50
	CHET-651	DSC-23 (Pericyclic Reactions)	2	-	2	-		20	30	50
	DCHET-652	DSC-24 (Drug Synthesis I)	2	-	2	-		20	30	50
	DCHET-653	DSC-25 (Drug Synthesis II	2	-	2			20	30	50
	DCHET-654	DSC-26 (Pharmaceutical & Industrial Practices)	2	-	2	-		20	30	50
	DCHEL-655	DSC-27 (Drug Chem. Lab Course)	-	4	-	2	2P	20	30	50
DSE (Choose any Two from pool of courses)	DCHETE-656	DSE-11 (Applied Organic Chemistry I)	2	-	2	-	4T	20	30	50
	DCHETE-657	DSE-12 (Applied Organic Chemistry II)	2	-	2	-		20	30	50
	DCHETE-658	DSE-13 (Green Chemistry)	2	-	2	-		20	30	50
	DCHETE-659	DSE-14 (Drug Design & Drug Discovery)	2	-	2	-		20	30	50
Research Project	DCHE-RP-699	Research Project-II	-	12	-	6	6P	60	90	150
Total			14	16	14	08	22	220	330	550

Corse Code Nomenclature:

DSC: Discipline Specific Core Course; **DSE**: Discipline Specific Elective; **T**: Theory; **L**: Laboratory Course; **P**: Practical; **CHET**: Chemistry Theory Core Course; **DCHET**: Drug Chemistry Theory Core Course; **DCHEL**: Drug Chemistry Laboratory Core Course; **DCHETE**: Drug Chemistry Elective Course; **DCHE-RP**: Drug Chemistry Research Project

Class: M. Sc. Second Year (Semester III)

1. Major Mandatory (DSC)- Master Programme is based on DSC Specialization
   CHET-650 : Photochemistry
   CHET-651 : Pericyclic Reactions
   DCHET-652 : Drug Synthesis I
   DCHET-653 : Drug Synthesis I
   DCHET-654 : Pharmaceutical & Industrial Practices
   DCHEL-655 : Drug Chemistry Laboratory Course
2. DSE: (Choose any two from pool of courses)
   DCHETE-656 : Applied Organic Chemistry I
   DCHETE-657 : Applied Organic Chemistry II
   DCHETE-658 : Green Chemistry
   DCHETE-659 : Drug Design & Drug Discovery
3. Research Project :
   DCHE-RP-699 : Research Project II

M. Sc. Second Year (Semester III) Drug Chemistry

CHET-600: Organic Spectroscopy

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Understand the principles, theory, and applications of ^{1}H NMR, ^{13}C NMR and mass spectroscopy.
2) To know about the two dimensional NMR techniques such as DEPT, COSY, HETCOR, NOESY, INEPT & INADQUATE.
3) To know about the fragmentation of different functional groups (In mass spectroscopy).
4) To know about metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.
5) Develop the skills to interpret spectral data obtained from different spectroscopic techniques. This includes understanding how to analyse peaks, identify functional groups, and determine molecular structures.

Course Outcomes:

The students will be able to assign the structures by using different spectral data. He will be able to interpret

Course Contents:

UNIT-I: Nuclear Magnetic Resonance Spectroscopy (^{1}H NMR) **08 Hrs**

Elementary ideas (Recapitulation); Spin-spin couplings, Different types of couplings, factors affecting on coupling constants, Karplus equation, Spin systems (AB, AX, ABX, AMX), Rate processes, spin decoupling, shift reagents, Nuclear Overhauser effect (NOE), INEPT and INADEQUATE.

UNIT-II: ^{13}C Nuclear Magnetic Resonance Spectroscopy **08 Hrs**

Elementary ideas, instrumental problems, chemical shifts (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbons); Effect of substituents on chemical shifts, Two dimensional (2D) NMR techniques: DEPT, COSY, HETCOR, NOESY, INEPT & INADQUATE.

UNIT-III: Mass Spectrometry **08 Hrs**

Introduction, ion production (EI, CI, FD and FAB), ion analysis, ion abundance, factors affecting on fragmentation, fragmentation of different functional groups, molecular ion peak, isotopic peaks, metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.

UNIT-IV **06 Hrs**

Problems based on joint applications of UV, IR, ^{1}H NMR, ^{13}C NMR and Mass spectroscopy.

Reference Books:

1) Spectrometric Identification of Organic Compounds, R. M. Silverstein- 6th Edition
2) Spectroscopy of Organic Compounds, V. M. Parikh.
3) Organic Spectroscopy, P. S. Kalsi
4) Introduction to Spectroscopy, D. L. Pavia, G. M. Lampman, G. L. Nelson.
5) Mass Spectroscopy, K. G. Das & James.
6) Spectroscopy Methods in Organic Chemistry D. H. Williams and I. Fleming

M. Sc. Second Year (Semester III) Drug Chemistry
CHET-601: Molecular Spectroscopy

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Understanding the concept of X-ray diffraction patterned using various methods *via* Bragg's law, Laue / Single Crystal, and Powder / Debye-Scherrer methods
2) Able to understand Indexing of lattice planes in the cubic system, while they determine the proper structure and sizes of the spectrum.
3) Able to understand the principle of Mossbauer's study for heavier metal-complex molecules.
4) To learn the concept of ESR, including Zero field splitting patterns that indicate the structural behaviour of lighter element molecules as well as metal-complex molecules.

Course Outcomes:

The students will be to interpret the XRD, ESR and Mossbauer spectroscopy.

Course Contents:

Unit I: X–ray Diffraction **10 Hrs**

Generation of X–rays, Interaction of X–rays with matter, Bragg's law, Miller indices, Diffraction methods (Laue / Single crystal and Powder / Debye–Scherrer methods), General instrumentation, Factors affecting X–ray intensity calculations, Identification of unit cells from systematic absences, Structure factor and its relation to electron density and intensity, Indexing of lattice planes in cubic system, Structure of NaCl and KCl, Avogadro's number from cubic lattice dimensions, Applications.

Unit II: Mossbauer Spectroscopy **10 Hrs**

Principle of Mossbauer spectroscopy, Instrumentation, Isomer shift and its factors affecting, Quadrupole splitting, Temperature Dependence of MB parameters, Zeeman Splitting (Six fingered MB lines), MB spectra of iron and tin compounds, Applications, Numerical.

Unit III: Electron Spin Resonance Spectroscopy **10 Hrs**

Introduction, Principle of ESR Spectroscopy, Instrumentation, Presentation of spectrum, Hyperfine splitting in some simple systems, Hyperfine splitting in various structure (Naphthalene anion radical, Pyrazine anion radical, Isomers of Xylene anion radicals, VO2+, Quinoline radical, Isoquinoline radical, Quinoxaline radical, Anthracene radical, Phenanthracne radical, Pyrene radical, Alkyl halide radicals, Quinone & Isoquinone anion radicals, nitrogen/deuterium containing radicals), Hyperfine splitting diagram, 'g' value, g-marker, Factors affecting the magnitude of 'g' values, Determination of g-value, Zero field splitting, Karmers's degeneracy, Applications, Numericals.

Reference Books

1) Physical Methods in Chemistry, IInd Edition, R. S. Drago.
2) P. H. Rieger, Electron Spin Resonance: Analysis & Interpretation, RSC Publishing, 2007.
3) B. Simovic, Introduction to the Technique of ESR Spectroscopy. 2004.
4) A. Lund, M. Siotani, S. Shimada, Principles and Applications of ESR Spectroscopy, Springer.
5) P. Gutlich, E. Bill, A.X. Trautwein, Mossbauer Spectroscopy & Transition Metal Chemistry, Springer Publications, 2011.
6) K. Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, Part A & Part B, John Wiley & Sons Publishers.
7) Mossbauer Spectroscopy: Principles and Applications of the Techniques, A.G. Maddock.
8) An introduction to Electron Paramagnetic Resonance, M. Bersohn & J. C. Baired,
9) High resolution ESR Spectroscopy, F. Gerson (John Wiley & sons).
10) The Determination of Molecular Structure, P. J. Wheatly
11) Physical Chemistry, G. M. Barrow

M. Sc. Second Year (Semester III) Drug Chemistry

DCHET-602: Introduction to Medicinal Chemistry

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

(i) To know the basic concepts of medicinal chemistry.

(ii) To learn the classification and sources of drugs.

(iii) To learn the drug development process.

Course Outcomes:

The students will get knowledge about ideal drugs and their classification. Also, they will understand the process of drug development.

Course Contents:

Unit I: Introduction and classification of drugs **10 Hrs**

(A) What are Drugs? Definition, Characteristics of ideal drugs, Why do you need drugs?

(B) Classification of Drugs: i) Based on the chemical structures; examples of each class; ii) Based on the Pharmacological action; examples of each class, Physiological action, Pro-drug; mode of action.

Unit II: Sources of drugs and historical development of medicinal chemistry **10 Hrs**

(A) Sources of Drugs: i) Plant sources; examples of methods of isolation; ii) Marine sources; examples of methods of isolation; iii) Micro-organism sources; examples of methods of isolation

(B) Historical development of Medicinal Chemistry, Genetic engineering

Unit III: Drug development **10 Hrs**

(A) Development of drugs: Lead discovery, lead development; Pharmacological / Microbiological / Biochemical evaluation of drugs; Clinical trials;

(a) Pharmacokinetic: (i) Drug absorption, Distribution and deposition of drugs. (ii) Excretion and elimination of drugs, Bioavailability.

(b) Pharmacodynamics: (i) Mechanism of drug action: Enzyme stimulation and enzyme inhibition, antimetabolites, membrane active drugs, chelation; (ii) Drug metabolism and inactivation: Factors affecting drug metabolism, pathways of drug metabolism [Metabolicreaction (Phase I) and conjugation reaction (Phase II)].

(B) Dosage forms; Need and Benefits; Mode of administration of drugs; Types, Advantages; Disadvantages.

Reference books:

1) FOYE'S Principles of Medicinal Chemistry VIth Edition: Thomas L. Lemke, David A. Williams, Victoria F. Roche and S. William Zito.
2) Introduction of Medicinal Chemistry: A. Gringuage, Wiley-VCH.
3) Medicinal chemistry (Vol. I and II)-Burger.
4) The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
5) Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
6) Medicinal Chemistry- Ashutosh Kar
7) Medicinal Chemistry- Balkishen Razdan

M. Sc. Second Year (Semester III) Drug Chemistry

DCHET-603: Drug action I

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Able to know the analogue, pro-drug, concept of lead, factors governing, methods of variations, drug design and development as rational approach.
2) To know the dissociation constant, isosterism, bioisosterism, stereochemistry as an appreciation of pharmacology requires an understanding of physicochemical properties of drugs.
3) Know about the target of action of drug as a receptors, cells, nucleus etc.

Course Outcomes:

The will be get the knowledge of drug design and target of action of drugs.

Course Contents:

Unit I: Drug Design- A Rational Approach **10 Hrs**

Introduction, Analogus and prodrugs, Concept of lead, Factors governing drug-design, Rational Approach to drug-design, Drug design-methods of variations, Drug design and development, Molecular hybridisation, rigidity and flexibility vs Drug-design.

Unit II: Physical-Chemical Factors and Biological Activities **10 Hrs**

Introduction, Physical properties, Factors governing ability of drugs, Dissociation constants, Isosterism and bio-isosterism, Stereochemistry and drug action, Chemical properties.

Unit III: Target of action of drugs **10 Hrs**

a) Receptors: Definition, mode of action: agonists, antagonists (description): Families of receptors
b) Cell: Definition, types, structure
c) Nucleus: Definition, types, nucleic acid, DNA (structure, drug, that work on DNA); RNA (structure, that work on RNA) Drugs related to nucleic acid and building blocks.

Reference Books:

1) Medicinal chemistry (Vol. I and II)-Burger.
2) The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
3) Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
4) Medicinal Chemistry- Ashutosh Kar
5) Medicinal Chemistry- Balkishen Razdan
6) V. K. Ahluwalia and Madhu Chopra, Medicinal Chemistry, Anes Student Edition, 2008
7) S. K. Gupta, Drug screening methods, New Delhi: Jaypee Brothers Medical Publishers (P) Ltd
8) Graham L. Patrick, An Introduction to Medicinal Chemistry, Oxford University Press, 1995.
9) A. Gringuage, Introduction to Medicinal Chemistry, Wiley-VCH, 1997.
10) E. Stevens, Medicinal Chemistry-The Modern Drug Discovery Process, Pearson, 2014.
11) R. S. Satoskar, S. D. Bhandarkar, Pharmacology and Pharmacotherapeutics, Popular Prakeshan.

M. Sc. Second Year (Semester III) Drug Chemistry

DCHET-604: Drug action II

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Learn the mode of action and development of different classes of drugs includes anti-cancer drugs, analgesics, anti-inflammatory, anti-biotic, anti-malarial, anti-fungal etc.
2) Know about development and semi synthesis of e.g. Penicillin, Cephalosporin, Macrolides, Quinolines, Sulphonamides, and Sulphones.

Course Outcomes:

The students will learn about mode of action of various drugs.

Course Contents:

Unit I: Mode of action and development of following classes of drugs **10 Hrs**

a) Cancer and anticancer drugs: Mechloroethamines hydrochlorides, Chloroambucil, Methotrexate, Daunorubicin, Colchicine.

b) Analgesics and anti-inflammatory: Indomethacin, Ibuprofen, Ibufenac, Indoprofen, Naproxen.

c) Antibiotic-Historical development and semi synthesis e.g. Penicillin, Cephalosporin's, Macrolides, Quinolones, Sulplhonamides and sulphones

Unit II: Mode of action and development of following classes of drugs **10 Hrs**

a) Anti-malerials: Chloroquine phosphate, Pamaquine, Pyrimethamine, Dapsone, Trimethoprim.

b) Anti-virals and AIDS: Amantidine hydrochloride, Idoxuridine, Acyclovir, Ribavirin, Vitrasert, foscarnet.

c) Anti-fungals: Griseofulvin, Chlormidazole, Naftifine, Flucytosine.

Unit III: Mode of action and development of following classes of drugs **10 Hrs**

a) Cardiovascular disorders and managements: Hypertension, Myocardial infraction, angina, Arrythemia: Hydralazine, Clonidine, Diazoxide, Sodium nitroprusside, Propranolol.

b) Antidiabetics: Chlorpropamide, Metformin, Nateglinide, Rosiglitazone, Pioglitazone

c) Central nervous system and disorder managements Anticonvulsant, Antidepressant, Sedatives: Caffenie, Theobromine, Pemoline, Phentermine, Bemegride.

Reference Books:

1) Medicinal chemistry (Vol. I and II)-Burger.
2) The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
3) Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
4) Medicinal Chemistry- Ashutosh Kar
5) Medicinal Chemistry- Balkishen Razdan
6) V. K. Ahluwalia and Madhu Chopra, Medicinal Chemistry, Anes Student Edition, 2008
7) S. K. Gupta, Drug screening methods, New Delhi: Jaypee Brothers Medical Publishers (P) Ltd
8) Graham L. Patrick, An Introduction to Medicinal Chemistry, Oxford University Press, 1995.
9) A. Gringuage, Introduction to Medicinal Chemistry, Wiley-VCH, 1997.
10) E. Stevens, Medicinal Chemistry-The Modern Drug Discovery Process, Pearson, 2014.

M. Sc. Second Year (Semester III) Drug Chemistry
DCHEL-605: Drug Chemistry Laboratory Course
(Drug Synthesis)

4 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To apply the preparation methods for useful drug compounds.
2) To perform the stoichiometry of various substrates required to carry drug synthesis.
3) To use the techniques involved in purification, identification of final product.
4) To apply the multistep organic transformations.
5) To calculate overall yield of the product in Two or Three-stage preparations.

Course Outcomes:

The students will able to perform multistep synthesis of drug compounds. He will achieve different practical skills like distillation, recrystallization and characterization of drug compounds.

Course Contents:

The multistep synthesis of drug compounds will be performed. It will be include:

(i) Various organic transformation by using different reagents and catalysts.

(ii) Monitoring of reactions by TLC.

(iii) Isolation of intermediates and final compounds.

(iv) Purification of compounds by different techniques like recrystallization, distillation and column chromatography.

(v) Physical properties of compounds.

M. Sc. Second Year (Semester III) Drug Chemistry
DCHEL-606: Drug Chemistry Laboratory Course
(Drug Assay)

4 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Learn the isolation of organic compound from natural sources.
2) Able to carry out the estimations.
3) Able to do the assay of drugs.
4) Able to perform the experiments with accuracy.
5) Able to know the role of reagents in different tests.

Course Outcomes:

The students will be able to learn different isolation, separation, distillation and purification techniques.

Course Contents:

The course will be involve isolation of organic compounds and their estimations by using different techniques. The assay of drug molecules will be taken.

M. Sc. Second Year (Semester III) Drug Chemistry

DCHETE-607: Organic Reactions

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn various name reactions for C-C and C-N bond formations.
2) To learn reaction mechanism and their applications.

Course Outcomes:

The students will get knowledge of various name reactions, their mechanism and applications.

Course Contents:

Unit I **15 Hrs**

Reaction, Mechanism and applications of following reactions: Gabriel synthesis, Streker amino acid synthesis, Ullmann, Mitsnobu, Favorski, Hofmann-Loffler-Freytag, Shapiro, Dakin, Von Richter, Henery, Mukaiyama reaction, Reimer-Tiemann, Chichibabin.

Unit II **15 Hrs**

Reaction, Mechanism and applications of following reactions: Arndt-Eistert, Michael, Darzen, Prins, Vilsmeier, Bamford-Steven, Baylis-Hillmann, Ritter, Stille, Heck, Suzuki, Sonogishira reaction, Duff, Chugaev, McMurry reaction and Coupling.

Reference books:

1) Organic Chemistry: Clayden, Greeves, Warren and Wothers
2) Organic Syntheis: Jagdama Singh and L. D. S. Yadav
3) Advanced organic Chemistry: Part A & B, F. A. Carey and R. J. Sundberg.
4) Principle of organic synthesis: Norman and Coxon
5) Organic Synthesis: M. B. Smith.
6) Organic Synthesis: W. Carruthers
7) Organic Reagents: Fieser & Fieser
8) Some Modern Methods of Organic Synthesis: W. Carruthers

M. Sc. Second Year (Semester III) Drug Chemistry

DCHETE-608: Organic Rearrangements

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn various rearrangements involving migration to electron deficient carbon, nitrogen and oxygen atoms.
2) To learn electrophilic rearrangements.

Course Outcomes:

The students will get knowledge of various rearrangements, their mechanism and applications.

Course Contents:

Unit I : Migration to Electron deficient Carbon **10 Hrs**

i) Pinacol-Pinacolone, ii) Wagner-Meerwein, iii) Demjanov, iv) Wolf,
v) Benzil-Benzilic acid rearrangement.

Unit II: Migration to Electron deficient Nitrogen **10 Hrs**

i) Beckmann, ii) Hoffmann, iii)Curtius, iv) Lossen, v) Schimidt rearrangement.

Unit III: Migration to Electron deficient Oxygen **05 Hrs**

i) Favorskii, ii) Neber, iii) Dakin rearrangement.

Unit IV: Electrophilic Rearrangement **05 Hrs**

i) Stevens, ii) Wittig, iii) Smile rearrangement.

Reference books:

1) Organic Chemistry: Clayden, Greeves, Warren and Wothers
2) Organic Syntheis: Jagdama Singh and L. D. S. Yadav
3) Organic Reagents: Fieser & Fieser
4) Some Modern Methods of Organic Synthesis: W. Carruthers
5) Advanced organic Chemistry: Part A & B, F. A. Carey and R. J. Sundberg.
6) Principle of organic synthesis: Norman and Coxon
7) Organic Synthesis: M. B. Smith.
8) Organic Synthesis: W. Carruthers

M. Sc. Second Year (Semester III) Drug Chemistry

DCHETE-609: Pharmaceutical Dosage Forms

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn about the various routes of drug administration and their advantages / disadvantages.
2) To different dosage forms and drug formulation.
3) To study the concept of drug delivery.

Course Outcomes:

The students will get knowledge about various dosage forms, drug formulation and delivery.

Course Contents:

Unit-I: Dosage Forms **10 Hrs**

Routes of administration, Types of dosage forms, Oral solids: tablets, types of tablets, methods of tablet production- wet granulation, coating of tablets. Quality control methods and measurement of tablet properties, packaging.

Oral liquids: Suspensions and Emulsions: Definition, types, stability, suspending/ emulsifying agents, evaluation, and packaging. Parenteral, Ophthalmic products, Aerosols, Inhalation products. Topical lipids, semisolids, and powders.

Unit-II: Drug Formulation **10 Hrs**

Concept of excipients, classifications with examples, colours, flavours and preservatives in formulations. Concept of Pre-formulation, factors influencing designing of dosage forms, drug excipients interaction, stability studies.

Unit-III: Drug delivery systems **10 Hrs**

Fundamental of novel drug delivery: Rationale of sustained release, controlled release dosage forms. Oral controlled drug delivery systems, mucosal drug delivery system, ocular drug delivery systems, parenteral drug delivery systems, transdermal drug delivery systems.

Reference Books:

1) The theory and practice of Industrial pharmacy (CBS) Leon Lachman,
2) Dispensing of pharmaceuticals (CBS) Cooper and Gunn
3) The Science and Practice of Pharmacy by Remington
4) Biopharmaceutics and Pharmacokinetics by Brahmankar
5) Pharmaceutical dosage forms and drug delivery systems by Ansel
6) The science of dosage forms design by Aulton

M. Sc. Second Year (Semester III) Drug Chemistry

DCHETE-610: Natural Products

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To explain the basic classification and role of alkaloids.
2) To explain the structural elucidation and degradation of alkaloids.
3) To describe the synthesis and structure of alkaloids.
4) To describe the stereochemistry of alkaloids.
5) To explain the isolation and structural determination of alkaloids.
6) To explain the terpenoids and its classification.
7) To explain isoprene rule.

Course Outcomes:

The course will be give the knowledge of natural products isolation, characterization, applications and their synthesis.

Course Contents:

UNIT-I: Terpenoids & Carotenoids **15 hrs**

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

UNIT-II: Alkaloids **15 hrs**

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry and synthesis of the following: Ephedrine, (+)-coniine, nicotine, atropine, Quinine and Morphine.

Reference books:

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, J. B. Hobbs, D. V. Banthrope and J. B. Harborne, Longman, Essex.
3) Organic Chemistry: Vol. II, I. L. Finar, ELBS.
4) Introduction to Flavonoids: B. A. Bohm, Harwood Academic Publishers
5) New Trends in Natural Product Chemistry: Atta-ur-Rahman and M. I. Choudhary
6) Biogenesis of Natural Products: Baldev Kumar and Harishkumar Chopra (Narosa Publication)

M. Sc. Second Year (Semester III) Drug Chemistry

DCHE-RP-649: Research Project I

8 Hrs/Week | Credits: 04 | Marks 100

Course Objectives:

1) To design research oriented project on particular context.
2) To search literature on selected research oriented project work.
3) To identify/search the recent advances in current research.
4) To conduct experiment scientifically with safety.
5) To characterize the prepared material by using microscopic, spectroscopic, diffraction, adsorption and thermal techniques.
6) To demonstrate the skill to write dissertation, communication skill in presentation.

Course Outcomes:

The students will be able to perform multistep synthesis of organic compounds. They will acquire practical skill required for pharmaceutical industries.

Course Contents:

Candidates are expected to work on assigned research project and submit the results at the end of the semester in the form a dissertation. Open defense of the student on his/her dissertation shall be arranged. This defense shall be in front of the panel of examiners.

Project work involving organic synthesis and characterizations / biological screening of newly synthesized compounds / development of new methods for organic transformations / synthesis of nanomaterial and characterizations will be considered. Project should be completed under the guidance of a faculty member in the same department.

Guidelines for Assessment

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Clarity of objective and scope
- Quality of work attempted
- Presentation skills

M. Sc. Second Year (Semester IV) Drug Chemistry

CHET-650: Photochemistry

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To describe the Photochemical excitation and Jablonski diagram.
2) To explain the study of photochemistry of ketone-photo reduction-photo cycloaddition.
3) To learn photochemistry of carbonyl and aromatic compounds.

Course Outcomes:

The students will acquire the knowledge about principle of photochemistry. They will be understand the photochemistry of carbonyl and aromatic compounds.

Course Contents:

Unit I: Photochemistry of Alkenes **10 Hrs**

Intermolecular reactions of the Olefinic Bond-Geometrical Isomerism, Cyclization reactions, Rearrangement of 1, 4- and 1, 5-dienes.

Unit II: Photochemistry of Carbonyl compounds **15 Hrs**

Intermolecular reactions of the Carbonyl compounds-saturated, Cyclic and acyclic, β, γ-gamma unsaturated and α, β-unsaturated compounds, Cyclohexadienones, Intermolecular Cycloaddition reactions, Dimerizations and Oxetane formation.

Unit III: Photochemistry of Aromatic Compounds **05 Hrs**

Isomerization, Additions and Substitutions.

Reference books:

1) Organic Chemistry: Stanley H. Pine
2) Photochemistry: Organic Photochemistry. Vol. 1. Orville L. Chapman
3) Designing Organic Synthesis: S. Warren, Wiley.
4) Organic Chemistry: J. Clayden, N. Greeves, S. Warren and P. Wothers
5) Organic Syntheis: Jagdama Singh and L. D. S. Yadav
6) Advanced organic Chemistry: Part A & B, Reactions and Synthesis, F. A. Carey and R. J. Sundberg.
7) Principle of organic synthesis: Norman and Coxon
8) Organic Photochemistry: Robert Kan

M. Sc. Second Year (Semester IV) Drug Chemistry

CHET-651: Pericyclic Reactions

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To describe electrocyclic, cycloaddition and sigmatropic pericyclic reactions.
2) To describe stereochemical problems in relation to chemical transformations.
3) To describe synthetically the processes relevant organic-chemical reactions and be able to discuss the mechanism of these reactions.

Course Outcomes:

The students will bet knowledge about various pericyclic reactions and their applications.

Course Contents:

Unit I: Cycloaddition reactions **10 Hrs**

Cycloaddition reactions and their stereochemical aspects, Woodward-Haffman rule, Selection rule for cycloaddition reaction, Details with examples of Diels-Alder reaction, (2+2) cycloaddition, (1, 3) polar cycloaddition, Cycloaddition of alkenes with OsO_4 and ozone, Cheletropic reactions, Analyses of cycloaddition by FMO, Mobius-Huckel and Correlation diagram methods.

Unit II: Electrocyclic reactions **10 Hrs**

Electrocyclic reactions and their stereochemical aspects, Selection rule of electrocyclic reaction, Con-rotations and dis-rotations, Methods of analyses of the electrocyclic reactions: FMO, Mobius-Huckel and Correlation diagram approaches.

Unit III: Sigmatropic rearrangements **10 Hrs**

Sigmatropic rearrangements and their stereochemistry, Rules for Sigmatropic rearrangements, Examples on (1, 3), (1, 5), (1, 7), (3, 3), (2, 3) Sigmatropic shifts, Claisen, Cope, Oxy-cope, Aza-cope, Sommelet-Hauser rearrangements, Ene reaction, Methods of analyses of the rearrangements: FMO, Mobius-Huckel and Correlation diagram approaches.

Reference books:

1) Organic Chemistry: Stanley H. Pine
2) Designing Organic Synthesis: S. Warren, Wiley.
3) Organic Chemistry: J. Clayden, N. Greeves, S. Warren and P. Wothers
4) Organic Syntheis: Jagdama Singh and L. D. S. Yadav
5) Advanced organic Chemistry: Part A & B, Reactions and Synthesis, F. A. Carey and R. J. Sundberg.
6) Organic Synthesis: M. B. Smith.
7) Principle of organic synthesis: Norman and Coxon

M. Sc. Second Year (Semester IV) Drug Chemistry

DCHET-652: Drug Synthesis I

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Able to know about different classes of drugs (Anti-Infective, Psychoactive Drugs, Cardiovascular drugs, Anti-neoplastic agents, Analgesics and Anti-inflammatory and Antiacids / Antiulcer).
2) Able to know about different anti-infective drugs and synthesis of Penicillin, Cephalosporins (semi-synthetic), Chloramphenicol, Ciprofloxacin, Sulphonamides, Metronidazoie, Clotrimazole, Griseofulvin.
3) Able to know about psychoactive drugs, neurotransmitters, CNS depressant, general anaesthetics, mode of action of hypotics, sedatives, anti-anxiety drugs, synthesis of some psychoactive drugs e.g. Diazepam, Barbiturates, Fluoxetine, Alprazolam.
4) Get the information about cardiovascular drugs. Know the synthesis of Atenelol, Captopril, Diltiazem, Reserpine, Prostaglandins.

Course Outcomes:

The students will get knowledge of different drug synthesis.

Course Contents:

Unit I: Anti-Infective **10Hr**

Introduction, Different classes, Mode of action examples of synthesis of each class e.g. Penicillin, Cephalosporins (semi-synthetic), Chloramphenicol, Ciprofloxacin, Sulphonamides, Metronidazoie, Clotrimazole, Griseofulvin

Unit II: Psychoactive Drugs **10Hr**

Introduction, neurotransmitters, CNS depressant, general anaesthetics, mode of action of hypotics, sedatives, anti-anxiety drugs, synthesis of some psychoactive drugs e.g. Diazepam, Barbiturates, Fluoxetine, Alprazolam.

Unit III: Cardiovascular drugs **10Hr**

Introduction, Cardiovascular diseases, Drug inhibitors of peripheral sympathetic function, central intercention of cardiovascular output, direct acting anterior dilators, synthesis of some cardiovascular drugs e.g. Atenelol, Captopril, Diltiazem, Reserpine, Prostaglandins.

Reference Books:

1) Synthesis of Essential Drugs- R. S. Vardanyan and V. J. Hruby, Elsevier.
2) Contemporary Drug Synthesis- J. J. Li, D. S. Johnson, D. R. Sliskovic, B. D. Roth, John Wiley.
3) Medicinal chemistry (Vol. I and II)-Burger.
4) The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
5) Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
6) Medicinal Chemistry- Ashutosh Kar
7) Medicinal Chemistry- Balkishen Razdan

M. Sc. Second Year (Semester IV) Drug Chemistry

DCHET-653: Drug Synthesis II

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Get the information about cancer chemotherapy, role of alkylating agents and anti-metabolites, carcinolytic antibiotics and mitotic inhibiters. Know about synthesis of Taxol in detail.
2) Able to know the synthesis of analgesis and anti-inflammatory compounds e.g. Ibuprofen, Indomethacin, Diclofenac, Rofecoxib.
3) Get the detailed information about steroids such as: Introduction, Nomenclature, Structure elucidation Cholesterol, Bile acids, Estrogens, Gestogens, Androgens, Cortisone, Vitamins: A, D, E, K, Vitamin B Complex, B1, B2, B6, B12, C, H.
4) Know the general information about antacids/antiulcer drugs and the synthesis of Omeprazole, Ranitidine.

Course Outcomes:

The students will get knowledge of different drug synthesis.

Course Contents:

Unit I: Anti-neoplastic agents **10Hr**

Introduction, cancer chemotherapy, special problems; Role of alkylating agent and anti-metabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibiters, synthesis of some antineoplastic agent-e.g. Taxol.

Unit II: Analgesics and Anti-inflammatory **12Hr**

Introduction, Synthesis of some: Analgesis and Anti-inflammatory compounds e.g. Ibuprofen, Indomethacin, Diclofenac, Rofecoxib, Steroids: Introduction, Nomenclature, Structure elucidation Cholesterol, Bile acids, Estrogens, Gestogens, Androgens, Cortisone, Vitamins: A, D, E, K, Vitamin B, Complex, B1, B2, B6, B12, C, H.

Unit III: Antiacids / Antiulcer **08Hr**

Introduction, synthesis: Omeprazole, Ranitidine.

Reference Books:

1) Synthesis of Essential Drugs- R. S. Vardanyan and V. J. Hruby, Elsevier.
2) Contemporary Drug Synthesis- J. J. Li, D. S. Johnson, D. R. Sliskovic, B. D. Roth, John Wiley.
3) Medicinal chemistry (Vol. I and II)-Burger.
4) The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
5) Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
6) Medicinal Chemistry- Ashutosh Kar
8) Medicinal Chemistry- Balkishen Razdan

M. Sc. Second Year (Semester IV) Drug Chemistry

DCHET-654: Pharmaceutical & Industrial Practices

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Get the outline and overall idea of each department in pharmaceutical industry.
2) Know about pharmaceutical formulation, production and analysis of prepared drug.
3) Know about regulatory affairs, various packaging materials, designs are used for the packing.
4) Know about distribution channel, selling, advertisement and waste disposal.

Course Outcomes:

The students will be familiar with each department of pharmaceutical industry. They will be get knowledge of formulation, production, packaging and selling of drug products.

Course Contents:

Unit I: Various departments in a Pharmaceutical Industry **20 Hrs**

Information about each section-their organization, work carried out, monitoring, interactions with various departments.

Overall idea of each department: Drug discovery, Process development, Pharmaceutical formulation, Production (Bulk drugs & Fine chemicals), Analysis (Intermediates, Finished goods & formulations)

Unit II: Intellectual Property Rights and Regulatory affairs **10 Hrs**

Product protection, Patenting, Regulated-non regulated markets, Packaging: (Designing & Stability), Distribution: (Local & Overseas), Selling: (Local & Overseas), Advertising: (Local & Overseas), Waste disposal: An environment protection

Reference books:

1) Medicinal chemistry (Vol. I and II)-Burger.
2) The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
3) Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
4) Medicinal chemistry-William O. Foye
5) T. B. of Organic medicinal and pharmaceutical chemistry-Wilson and Gisvold's
6) An introduction to medicinal chemistry-Graham L. Patrick.
7) An introduction to drug design-S. S. Pandeya and J. R. Dimmock (New age international)
8) Pharmacological basis of therapeutics-Goodman and Gilman's (McGraw Hill)
9) Manual of patent practice and procedure-Patent office, India (2005)

M. Sc. Second Year (Semester IV) Drug Chemistry
DCHEL-655: Drug Chemistry Laboratory Course
(Spectral Interpretation)

4 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Able to interpret the UV-Visible, IR, NMR and mass spectra.
2) Able to create a data from the given spectra.
3) Able to analyse the data obtained from the given spectra to elucidate the structure of organic compound.
4) Able to interpret and analyse the XRD, Mossbauer, and ESR spectra.

Course Outcomes:

The students will be able to interpret the various spectrums and assign the structures to the compounds.

Course Contents:

The will be provided various spectrums of UV, IR, ^{1}H NMR, ^{13}C NMR, Mass, XRD spectrums. By using the values on spectrums the structures will be assigned to the compounds.

M. Sc. Second Year (Semester IV) Drug Chemistry

DCHETE-656: Applied Organic Chemistry I

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn about organometallic reagents and their applications.
2) To learn about ylides and enamines.
3) To understand generation, stability and applications of reaction intermediates.

Course Outcomes:

The students will get knowledge about organometallic reagents. They will know about ylides and enamines intermediates.

Course Contents:

Unit I: Organometallic Reagents **15 Hrs**

Principle, Preparation, Properties and applications of the mechanistic details: Li, Mg, Hg, Cd, Zn, Ce, Cu, Pd, Ni, Fe, Co, Rh, Cr, Si, and B compounds.

Unit II: Ylides and Enamines **15 Hrs**

(i) Ylides: Preparation and their synthetic applications along with their stereochemical aspects of Phosphorous, Sulphur and Nitrogen ylides.

(ii) Enamines: Generation & application in organic synthesis with mechanistic pathways, stork enamine reaction.

Reference Books:

1) Organic Chemistry: Clayden, Greeves, Warren and Wothers
2) Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
3) Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
4) Organic Synthesis: W. Carruthers
5) Organic Reagents: Fieser & Fieser
6) Organic Synthesis: M. B. Smith
7) Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
8) Some Modern Methods of Organic Synthesis: W. Carruthers

M. Sc. Second Year (Semester IV) Drug Chemistry

DCHETE-657: Applied Organic Chemistry II

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn about the free radical reactions.
2) To learn various organic reagents.
3) To understand about polynuclear hydrocarbons.

Course Outcomes:

The students will get knowledge about free radical reactions, organic reagents and polynuclear hydrocarbons.

Course Contents:

Unit I: Free Radical Reactions **10 Hrs**

Types of radical reaction, Free radical substitution mechanism, mechanism at an aromatic substrate, Neighbouring group assistance, Reactivity for aliphatic and aromatic substrates at a bridgedhead, reactiviy in the attacking radicals, The effect of solvents on reactivity. Allylic halogenations (NBS), Oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazoniu salts, Sandmeyer reaction, Free radical rearrangement, Hunsdiecker reaction.

UNIT-II Organic Reagents **10 Hrs**

DCC, EDC, DDQ, 1,3 Dithiane, LDA, DMDO, OsO_4, RuO_4, SmI_2, Dess-Martin Periodinane, Diazomethane, Lawesson's reagent.

Unit III: Polynuclear Hydrocarbons **10 Hrs**

Introduction, Comparative study of the aromatic character of linear and nonlinear Ortho fused Polynuclear Hydrocarbon. General methods of preparation of fluorine, anthracene and phenanthrene.

Reference Books:

1) Organic Chemistry: Clayden, Greeves, Warren and Wothers
2) Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
3) Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
4) Organic Synthesis: W. Carruthers
5) Organic Reagents: Fieser & Fieser
6) Organic Synthesis: M. B. Smith
7) Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg

M. Sc. Second Year (Semester IV) Drug Chemistry

DCHETE-658: Green Chemistry

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To understand the concept of green chemistry.
2) To learn twelve principles of green chemistry.
3) To learn different methods of green synthesis.

Course Outcomes:

1) The students will get knowledge of green chemistry and their principles.
2) They will be able to understand the different methods of green synthesis.

Course Contents:

Unit I: Introduction to Green Chemistry **06 Hrs**

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry

Unit II: Principles of Green Chemistry and Designing a Chemical synthesis **08 Hrs**

Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following: (a) Designing a Green Synthesis using these principles; Prevention of Waste/ by products; maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions. (b) Prevention/ minimization of hazardous/ toxic products reducing toxicity. risk = (function) hazard × exposure; waste or pollution prevention hierarchy. (c) Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solvent less processes, immobilized solvents and how to compare greenness of solvents. (d) Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy. (e) Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups. (f) Use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis. (g) Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD "What you don't have cannot harm you", greener alternative to Bhopal Gas Tragedy (safer route to carcarbaryl) and Flixiborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation. (h) Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

Unit III : Examples of Green Synthesis/ Reactions and some real world cases **08 Hrs**

(a) Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis); (b) Microwave assisted reactions in water: Hofmann Elimination,

methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction; (c) Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine); (d) Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments; (e) Designing of Environmentally safe marine antifoulant; (f) Right fit pigment: synthetic azopigments to replace toxic organic and inorganic pigments; (g) An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn; (h) Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils; (i) Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting

Unit IV : Future Trends in Green Chemistry **08 Hrs**

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solvent less reactions; co crystal controlled solid state synthesis (C^2S^3); Green chemistry in sustainable development.

Reference books:

1. Organic Chemistry IV Edn -G. Marc Loudon.
2. Green Chemistry - Paul T. Anastas and John C. Warner
3. Green Chemistry -Rashmi Sanghi and M. M. Srivastav

M. Sc. Second Year (Semester IV) Drug Chemistry

DCHETE-659: Drug Design & Drug Discovery

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1. Able to know about various aspect in drug design and discovery includes: Folklore drugs, stages involved in drug discovery- disease, drug targets, bioassay. Discovery of a lead, screening of natural products and synthetic compound libraries.
2. Able to know about principles of design of agonists (e.g. Salbutamol), antagonists (e.g. cimitidine) and enzyme inhibitors (e.g. captopril), Drug discovery without lead, principles of prodrug design.

Course Outcomes:

The students will get knowledge of drug design and discovery.

Course Contents:

UNIT-I: Principles of Drug design and drug discovery **15 hrs**

Introduction to drug discovery, Folklore drugs, stages involved in drug discovery- disease, drug targets, bioassay. Discovery of a lead, screening of natural products and synthetic compound libraries. Pharmacokinetics (ADME), pharmacodynamics, Nature of drug-receptor interactions and their theories-Occupancy theory, Induced-fit theory, Macromolecular purturbation theory and Two-state model of receptor activation. Natural products as lead structures in drug discovery, Pharmacophore, structure pruning technique e.g. morphine. Discovery of lead structure from natural hormones and neurotransmitters, Principles of design of agonists (e.g. Salbutamol), antagonists (e.g. cimitidine) and enzyme inhibitors (e.g. captopril), Drug discovery without lead, serendipity, Penicillin and Librium as examples, Principles of prodrug design.

UNIT-II: Lead modification and SAR Studies **15 hrs.**

SAR: Lead modification strategies, 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. Discovery of oxaminquine, salbutamol, cimitidine and captopril SAR studies in sulfa drugs, benzodiazepines, and taxol analogs.

Reference books

1) Burger's medicinal chemistry and drug discovery - Manfred E. Wolf.
2) Introduction to Medicinal chemistry - Patrick.
3) Introduction to drug design - R Silverman
4) Comprehensive medicinal chemistry. Vol 1-5 - Hanzsch.
5) Principles of medicinal chemistry- William Foye
6) Biochemical approach to medicinal chemistry - Thomas Nogrady.
7) Pharmaceutical Chemistry and Drug synthesis - Roth and Kleeman
8) Drug design - E. J. Arienes
9) Principles of Medicinal Chemistry Vol I & II - Kadam et al
10) Medicinal chemistry An introduction - Garreth Thomas

M. Sc. Second Year (Semester IV) Drug Chemistry

DCHE-RP-699: Research Project II

12 Hrs/Week | Credits: 06 | Marks 150

Course Objectives:

1) To design research oriented project on particular context.
2) To search literature on selected research oriented project work.
3) To identify/search the recent advances in current research.
4) To conduct experiment scientifically with safety.
5) To characterize the prepared material by using microscopic, spectroscopic, diffraction, adsorption and thermal techniques.
6) To demonstrate the skill to write dissertation, communication skill in presentation.

Course Outcomes:

The students will be able to perform multistep synthesis of organic compounds. They will acquire practical skill required for pharmaceutical industries.

Course Contents:

Candidates are expected to work on assigned research project and submit the results at the end of the semester in the form a dissertation. Open defense of the student on his/her dissertation shall be arranged. This defense shall be in front of the panel of examiners.

Project work involving organic synthesis and characterizations / biological screening of newly synthesized compounds / development of new methods for organic transformations / synthesis of nanomaterial and characterizations will be considered. Project should be completed under the guidance of a faculty member in the same department.

Guidelines for Assessment

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Clarity of objective and scope
- Quality of work attempted
- Presentation skills

Head
Department of Chemistry
Dr.Babasaheb Ambedkar Marathwada
University Sub-Campus, Dharashiv.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR SUB-CAMPUS, DHARASHIV

NAAC Reaccredited with 'A' Grade

Department of Chemistry
(Autonomous)

Faculty of Science and Technology

National Education Policy-2020
Outcome Based Curriculum

M. Sc. II Year

(Semester III & IV)

Subject : Chemistry

Specialization : Organic Chemistry

(Effective from 2024-25)

Illustrative Credit distribution structure for two years programme with Multiple Entry and Exit options

Head
Department of Chemistry
Dr.Babasaheb Ambedkar Marathwada

Class: M. Sc. II Year Semester: III Specialization : Organic Chemistry

Course type	Course Code	Course Name	Teaching Scheme (Hrs. / week)		Credits Assigned			Marks		
			Theory	Practical	Theory	Practical	Total Credits	Conti. Eval.	Uni. Exam	Total Marks
Major Mandatory DSC	CHET-600	DSC-15 (Organic Spectroscopy)	2	-	2	-	10T	20	30	50
	CHET-601	DSC-16 (Molecular Spectroscopy)	2	-	2	-		20	30	50
	OCHET-602	DSC-17 (Introduction to Medicinal Chemistry)	2	-	2	-		20	30	50
	OCHET-603	DSC-18 (Asymmetric Synthesis I)	2	-	2			20	30	50
	OCHET-604	DSC-19 (Asymmetric Synthesis II)	2	-	2	-		20	30	50
	OCHEL-605	DSC-20 (Org. Chem. Lab Course)	-	4	-	2	4P	20	30	50
	OCHEL-606	DSC-21 (Org. Chem. Lab Course)	-	4	-	2		20	30	50
DSE (Choose any Two from pool of courses)	OCHETE-607	DSE-7 (Organic Reactions)	2	-	2	-	4T	20	30	50
	OCHETE-608	DSE-8 (Organic Rearrangements)	2	-	2	-		20	30	50
	OCHETE-609	DSE-9 (Pharmaceutical Dosage Forms)	2	-	2	-		20	30	50
	OCHETE-610	DSE-10 (Natural Products)	2	-	2	-		20	30	50
Research Project	OCHE-RP-649	Research Project I	-	8	-	4	4P	40	60	100
Total			**14**	**16**	**14**	**08**	**22**	**220**	**330**	**550**

Corse Code Nomenclature:

DSC: Discipline Specific Core Course; **DSE**: Discipline Specific Elective; **T**: Theory; **L**: Laboratory Course; **P**: Practical; **CHET**: Chemistry Theory Core Course; **OCHET**: Organic Chemistry Theory Core Course; **OCHEL**: Organic Chemistry Laboratory Core Course; **OCHETE**: Organic Chemistry Elective Course; **OCHE-RP**: Organic Chemistry Research Project

Class: M. Sc. Second Year (Semester III)

1. Major Mandatory (DSC)- Master Programme is based on DSC Specialization
   CHET-600 : Organic Spectroscopy
   CHET-601 : Molecular Spectroscopy
   OCHET-602 : Introduction to Medicinal Chemistry
   OCHET-603 : Asymmetric Synthesis I
   OCHET-604 : Asymmetric Synthesis II
   OCHEL-605 : Organic Chemistry Laboratory Course
   OCHEL-606 : Organic Chemistry Laboratory Course
2. DSE: (Choose any two from pool of courses)
   OCHETE-607 : Organic Reactions
   OCHETE-608 : Organic Rearrangements
   OCHETE-609 : Pharmaceutical Dosage Forms
   OCHETE-610 : Natural Products
3. Research Project :
   OCHE-RP-649 : Research Project I

Class: M. Sc. II Year Semester: IV Specialization: Organic Chemistry

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned			Marks		
			Theory	Practical	Theory	Practical	Total Credits	Conti. Eval.	Uni. Exam	Total Marks
Major Mandatory DSC	CHET-650	DSC-22 (Photochemistry)	2	-	2	-	10T	20	30	50
	CHET-651	DSC-23 (Pericyclic Reactions)	2	-	2	-		20	30	50
	OCHET-652	DSC-24 (Retrosynthesis)	2	-	2	-		20	30	50
	OCHET-653	DSC-25 (Heterocyclic Chemistry)	2	-	2			20	30	50
	OCHET-654	DSC-26 (Multicomponent Reactions)	2	-	2	-		20	30	50
	OCHEL-655	DSC-27 (Org. Chem. Lab Course)	-	4	-	2	2P	20	30	50
DSE (Choose any Two from pool of courses)	OCHETE-656	DSE-11 (Applied Organic Chemistry I)	2	-	2	-	4T	20	30	50
	OCHETE-657	DSE-12 (Applied Organic Chemistry II)	2	-	2	-		20	30	50
	OCHETE-658	DSE-13 (Green Chemistry)	2	-	2	-		20	30	50
	OCHETE-659	DSE-14 (Drug Design & Drug Discovery)	2	-	2	-		20	30	50
Research Project	OCHE-RP-699	Research Project II	-	12	-	6	6P	60	90	150
Total			14	16	14	08	22	220	330	550

Corse Code Nomenclature:

DSC: Discipline Specific Core Course; **DSE**: Discipline Specific Elective; **T**: Theory; **L**: Laboratory Course; **P**: Practical; **CHET**: Chemistry Theory Core Course; **OCHET**: Organic Chemistry Theory Core Course; **OCHEL**: Organic Chemistry Laboratory Core Course; **OCHETE**: Organic Chemistry Elective Course; **OCHE-RP**: Organic Chemistry Research Project

Class: M. Sc. Second Year (Semester III)

1. Major Mandatory (DSC)- Master Programme is based on DSC Specialization
   CHET-650 : Photochemistry
   CHET-651 : Pericyclic Reactions
   OCHET-652 : Retrosynthesis
   OCHET-653 : Heterocyclic Chemistry
   OCHET-654 : Multicomponent Reactions
   OCHEL-655 : Organic Chemistry Laboratory Course
2. DSE: (Choose any two from pool of courses)
   OCHETE-656 : Applied Organic Chemistry I
   OCHETE-657 : Applied Organic Chemistry II
   OCHETE-658 : Green Chemistry
   OCHETE-659 : Drug Design & Drug Discovery
3. Research Project :
   OCHE-RP-699 : Research Project II

M. Sc. Second Year (Semester III) Organic Chemistry

CHET-600: Organic Spectroscopy

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Understand the principles, theory, and applications of ^{1}H NMR, ^{13}C NMR and mass spectroscopy.
2) To know about the two dimensional NMR techniques such as DEPT, COSY, HETCOR, NOESY, INEPT & INADQUATE.
3) To know about the fragmentation of different functional groups (In mass spectroscopy).
4) To know about metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.
5) Develop the skills to interpret spectral data obtained from different spectroscopic techniques. This includes understanding how to analyse peaks, identify functional groups, and determine molecular structures.

Course Outcomes:

The students will be able to assign the structures by using different spectral data. He will be able to interpret

Course Contents:

UNIT-I: Nuclear Magnetic Resonance Spectroscopy (^{1}H NMR) **08 Hrs**

Elementary ideas (Recapitulation); Spin-spin couplings, Different types of couplings, factors affecting on coupling constants, Karplus equation, Spin systems (AB, AX, ABX, AMX), Rate processes, spin decoupling, shift reagents, Nuclear Overhauser effect (NOE), INEPT and INADEQUATE.

UNIT-II: ^{13}C Nuclear Magnetic Resonance Spectroscopy **08 Hrs**

Elementary ideas, instrumental problems, chemical shifts (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbons); Effect of substituents on chemical shifts, Two dimensional (2D) NMR techniques: DEPT, COSY, HETCOR, NOESY, INEPT & INADQUATE.

UNIT-III: Mass Spectrometry **08 Hrs**

Introduction, ion production (EI, CI, FD and FAB), ion analysis, ion abundance, factors affecting on fragmentation, fragmentation of different functional groups, molecular ion peak, isotopic peaks, metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.

UNIT-IV **06 Hrs**

Problems based on joint applications of UV, IR, ^{1}H NMR, ^{13}C NMR and Mass spectroscopy.

Reference Books:

1) Spectrometric Identification of Organic Compounds, R. M. Silverstein- 6th Edition
2) Spectroscopy of Organic Compounds, V. M. Parikh.
3) Organic Spectroscopy, P. S. Kalsi
4) Introduction to Spectroscopy, D. L. Pavia, G. M. Lampman, G. L. Nelson.
5) Mass Spectroscopy, K. G. Das & James.
6) Spectroscopy Methods in Organic Chemistry D. H. Williams and I. Fleming

M. Sc. Second Year (Semester III) Drug Chemistry
CHET-601: Molecular Spectroscopy

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Understanding the concept of X-ray diffraction patterned using various methods *via* Bragg's law, Laue / Single Crystal, and Powder / Debye-Scherrer methods
2) Able to understand Indexing of lattice planes in the cubic system, while they determine the proper structure and sizes of the spectrum.
3) Able to understand the principle of Mossbauer's study for heavier metal-complex molecules.
4) To learn the concept of ESR, including Zero field splitting patterns that indicate the structural behaviour of lighter element molecules as well as metal-complex molecules.

Course Outcomes:

The students will be to interpret the XRD, ESR and Mossbauer spectroscopy.

Course Contents:

Unit I: X–ray Diffraction **10 Hrs**

Generation of X–rays, Interaction of X–rays with matter, Bragg's law, Miller indices, Diffraction methods (Laue / Single crystal and Powder / Debye–Scherrer methods), General instrumentation, Factors affecting X–ray intensity calculations, Identification of unit cells from systematic absences, Structure factor and its relation to electron density and intensity, Indexing of lattice planes in cubic system, Structure of NaCl and KCl, Avogadro's number from cubic lattice dimensions, Applications.

Unit II: Mossbauer Spectroscopy **10 Hrs**

Principle of Mossbauer spectroscopy, Instrumentation, Isomer shift and its factors affecting, Quadrupole splitting, Temperature Dependence of MB parameters, Zeeman Splitting (Six fingered MB lines), MB spectra of iron and tin compounds, Applications, Numerical.

Unit III: Electron Spin Resonance Spectroscopy **10 Hrs**

Introduction, Principle of ESR Spectroscopy, Instrumentation, Presentation of spectrum, Hyperfine splitting in some simple systems, Hyperfine splitting in various structure (Naphthalene anion radical, Pyrazine anion radical, Isomers of Xylene anion radicals, VO2+, Quinoline radical, Isoquinoline radical, Quinoxaline radical, Anthracene radical, Phenanthracne radical, Pyrene radical, Alkyl halide radicals, Quinone & Isoquinone anion radicals, nitrogen/deuterium containing radicals), Hyperfine splitting diagram, 'g' value, g-marker, Factors affecting the magnitude of 'g' values, Determination of g-value, Zero field splitting, Karmers's degeneracy, Applications, Numericals.

Reference Books

1) Physical Methods in Chemistry, IInd Edition, R. S. Drago.
2) P. H. Rieger, Electron Spin Resonance: Analysis & Interpretation, RSC Publishing, 2007.
3) B. Simovic, Introduction to the Technique of ESR Spectroscopy. 2004.
4) A. Lund, M. Siotani, S. Shimada, Principles and Applications of ESR Spectroscopy, Springer.
5) P. Gutlich, E. Bill, A.X. Trautwein, Mossbauer Spectroscopy & Transition Metal Chemistry, Springer Publications, 2011.
6) K. Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, Part A & Part B, John Wiley & Sons Publishers.
7) Mossbauer Spectroscopy: Principles and Applications of the Techniques, A.G. Maddock.
8) An introduction to Electron Paramagnetic Resonance, M. Bersohn & J. C. Baired,
9) High resolution ESR Spectroscopy, F. Gerson (John Wiley & sons).
10) The Determination of Molecular Structure, P. J. Wheatly
11) Physical Chemistry, G. M. Barrow

M. Sc. Second Year (Semester III) Organic Chemistry

OCHET-602: Introduction to Medicinal Chemistry

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

(i) To know the basic concepts of medicinal chemistry.

(ii) To learn the classification and sources of drugs.

(iii) To learn the drug development process.

Course Outcomes:

The students will get knowledge about ideal drugs and their classification. Also, they will understand the process of drug development.

Course Contents:

Unit I: Introduction and classification of drugs **10 Hrs**

(A) What are Drugs? Definition, Characteristics of ideal drugs, Why do you need drugs?

(B) Classification of Drugs: i) Based on the chemical structures; examples of each class; ii) Based on the Pharmacological action; examples of each class, Physiological action, Pro-drug; mode of action.

Unit II: Sources of drugs and historical development of medicinal chemistry **10 Hrs**

(A) Sources of Drugs: i) Plant sources; examples of methods of isolation; ii) Marine sources; examples of methods of isolation; iii) Micro-organism sources; examples of methods of isolation

(B) Historical development of Medicinal Chemistry, Genetic engineering

Unit III: Drug development **10 Hrs**

(A) Development of drugs: Lead discovery, lead development; Pharmacological / Microbiological / Biochemical evaluation of drugs; Clinical trials;

(a) Pharmacokinetic: (i) Drug absorption, Distribution and deposition of drugs. (ii) Excretion and elimination of drugs, Bioavailability.

(b) Pharmacodynamics: (i) Mechanism of drug action: Enzyme stimulation and enzyme inhibition, antimetabolites, membrane active drugs, chelation; (ii) Drug metabolism and inactivation: Factors affecting drug metabolism, pathways of drug metabolism [Metabolicreaction (Phase I) and conjugation reaction (Phase II)].

(B) Dosage forms; Need and Benefits; Mode of administration of drugs; Types, Advantages; Disadvantages.

Reference books:

1) FOYE'S Principles of Medicinal Chemistry VIth Edition: Thomas L. Lemke, David A. Williams, Victoria F. Roche and S. William Zito.
2) Introduction of Medicinal Chemistry: A. Gringuage, Wiley-VCH.
3) Medicinal chemistry (Vol. I and II)-Burger.
4) The organic chemistry of drug design and drug action-R. B. Silverman (Academic Press)
5) Strategies for organic drug synthesis and designing - D. Lednicer Wiley.
6) Medicinal Chemistry- Ashutosh Kar
7) Medicinal Chemistry- Balkishen Razdan
8) Medicinal Chemistry: David J. Triggle.

M. Sc. Second Year (Semester III) Organic Chemistry

OCHET-603: Asymmetric Synthesis I

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn different methods for asymmetric synthesis.
2) To know the chiral pool and auxiliary techniques for asymmetric synthesis.
3) To understand the chiral reagents and catalyst used for asymmetric synthesis.

Course Outcomes:

The student will get the knowledge of asymmetric synthesis methods by using chiral pool, auxiliary, reagents and catalysts.

Course Contents:

Unit I : Asymmetric Synthesis by Chiral Pool & Auxiliary **10 Hrs**

Introduction to Stereoselective and stereospecific reactions

Chiral Pool: [α-hydroxy acids and α-amino acids]

Chiral auxiliary: SAMP/RAMP, Mayers Oxazolines, Evans Oxazolidinones, L-valine (Schollkopf Bislactimethers), Seebach Imidazolens from (S)-mandelic acid, Seebach α-hydroxy acids i.e. (S)-lactic acids, Cyclic hydrazones.

Unit II : Asymmetric Synthesis by Chiral Reagent **10 Hrs**

Chiral reagent: BINAL, BINAP; Hydroboration- Ipc2BH, IpcBH2, R/S-Alpine borane, DIP-Cl (diisopinocamphylborone chloride), Misamane's Ligand (2, 5-dimethylborolane);

Unit III : Asymmetric Synthesis by Chiral Catalyst **10 Hrs**

Chiral catalyst: CBS, NADH, baker's yeast. Asymmetric epoxidation: Sharpless epoxidation, Jacobson-katsuki epoxidation and Shi epoxidation. Sharpless asymmetric dihydroxylation

Reference books:

1) Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
2) Stereochemistry : Conformation and Mechanism: P. S. Kalsi
3) Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
4) Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
5) Organic Chemistry: Clayden, Greeves, Warren and Wothers

M. Sc. Second Year (Semester III) Organic Chemistry

OCHET-604: Asymmetric Synthesis II

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn stereoselective and stereospecific reactions.
2) To understand the different methods for diastereoselective synthesis.
3) To know about diastereoselective alkylation and reduction reactions.

Course Outcomes:

The students will get knowledge of stereoselective, stereospecific and diastereoselective synthesis.

Course Contents:

Unit I : **10 Hrs**

Acyclic Stereocontrol – attack on aldehydes and ketones with α-stereocentres (Crams Model, Felkin-Anh model, Cram-Chelate model); Diastereoselective enolate alkylation, Diastereoselectivity of aldol reactions (Zimmerman-Traxler transition state model),

Unit II : **10 Hrs**

Diastereoselective enolate alkylation by Evans oxazolidinone auxiliaries; Diastereoselective allylation reactions of crotyl boronates and chiral allyl boron reagents; Proline catalyzed asymmetric aldol reactions, mannich reactions;

Unit III : **10 Hrs**

Diastereoselective Reduction; Diastereoselective reduction (Evans-Saksena and Evans-Tishenko); Stereocontrol– attack on alkenes with α-stereocentres in hydroboration and epoxidation reaction.

Reference books:

1) Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
2) Stereochemistry : Conformation and Mechanism: P. S. Kalsi
3) Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
4) Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
5) Organic Chemistry: Clayden, Greeves, Warren and Wothers

M. Sc. Second Year (Semester III) Organic Chemistry
OCHEL-605: Organic Chemistry Laboratory Course
(Organic Synthesis)

4 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To apply the preparation methods for useful compounds.
2) To perform the stoichiometry of various substrates required to carry organic synthesis.
3) To use the techniques involved in purification, identification of final product.
4) To apply the multistep organic transformations.
5) To calculate overall yield of the product in Two or Three-stage preparations.

Course Outcomes:

The students will able to perform multistep synthesis of organic compounds. He will achieve different practical skills like distillation, recrystallization and characterization of organic compounds.

Course Contents:

The multistep synthesis of organic compounds will be performed. It will be include:

(i) Various organic transformation by using different reagents and catalysts.

(ii) Monitoring of reactions by TLC.

(iii) Isolation of intermediates and final compounds.

(iv) Purification of compounds by different techniques like recrystallization, distillation and column chromatography.

(v) Physical properties of compounds.

M. Sc. Second Year (Semester III) Organic Chemistry
OCHEL-606: Organic Chemistry Laboratory Course
(Isolation & Estimations of Organic Compounds)

4 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Learn the isolation of organic compound from natural sources.
2) Able to carry out the estimations.
3) Able to perform the experiments with accuracy.
4) Able to know the role of reagents in different tests.

Course Outcomes:

The students will be able to learn different isolation, separation, distillation and purification techniques.

Course Contents:

The course will be involve isolation of organic compounds and their estimations by using different techniques.

M. Sc. Second Year (Semester III) Organic Chemistry

OCHETE-607: Organic Reactions

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn various name reactions for C-C and C-N bond formations.
2) To learn reaction mechanism and their applications.

Course Outcomes:

The students will get knowledge of various name reactions, their mechanism and applications.

Course Contents:

Unit I **15 Hrs**

Reaction, Mechanism and applications of following reactions: Gabriel synthesis, Streker amino acid synthesis, Ullmann, Mitsnobu, Favorski, Hofmann-Loffler-Freytag, Shapiro, Dakin, Von Richter, Henery, Mukaiyama reaction, Reimer-Tiemann, Chichibabin.

Unit II **15 Hrs**

Reaction, Mechanism and applications of following reactions: Arndt-Eistert, Michael, Darzen, Prins, Vilsmeier, Bamford-Steven, Baylis-Hillmann, Ritter, Stille, Heck, Suzuki, Sonogishira reaction, Duff, Chugaev, McMurry reaction and Coupling.

Reference books:

1) Organic Chemistry: Clayden, Greeves, Warren and Wothers
2) Organic Syntheis: Jagdama Singh and L. D. S. Yadav
3) Advanced organic Chemistry: Part A & B, F. A. Carey and R. J. Sundberg.
4) Principle of organic synthesis: Norman and Coxon
5) Organic Synthesis: M. B. Smith.
6) Organic Synthesis: W. Carruthers
7) Organic Reagents: Fieser & Fieser
8) Some Modern Methods of Organic Synthesis: W. Carruthers

M. Sc. Second Year (Semester III) Organic Chemistry

OCHETE-608: Organic Rearrangements

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn various rearrangements involving migration to electron deficient carbon, nitrogen and oxygen atoms.
2) To learn electrophilic rearrangements.

Course Outcomes:

The students will get knowledge of various rearrangements, their mechanism and applications.

Course Contents:

Unit I : Migration to Electron deficient Carbon **10 Hrs**

i) Pinacol-Pinacolone, ii) Wagner-Meerwein, iii) Demjanov, iv) Wolf,
v) Benzil-Benzilic acid rearrangement.

Unit II: Migration to Electron deficient Nitrogen **10 Hrs**

i) Beckmann, ii) Hoffmann, iii)Curtius, iv) Lossen, v) Schimidt rearrangement.

Unit III: Migration to Electron deficient Oxygen **05 Hrs**

i) Favorskii, ii) Neber, iii) Dakin rearrangement.

Unit IV: Electrophilic Rearrangement **05 Hrs**

i) Stevens, ii) Wittig, iii) Smile rearrangement.

Reference books:

1) Organic Chemistry: Clayden, Greeves, Warren and Wothers
2) Organic Syntheis: Jagdama Singh and L. D. S. Yadav
3) Organic Reagents: Fieser & Fieser
4) Some Modern Methods of Organic Synthesis: W. Carruthers
5) Advanced organic Chemistry: Part A & B, F. A. Carey and R. J. Sundberg.
6) Principle of organic synthesis: Norman and Coxon
7) Organic Synthesis: M. B. Smith.
8) Organic Synthesis: W. Carruthers

M. Sc. Second Year (Semester III) Organic Chemistry

OCHETE-609: Pharmaceutical Dosage Forms

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn about the various routes of drug administration and their advantages / disadvantages.
2) To different dosage forms and drug formulation.
3) To study the concept of drug delivery.

Course Outcomes:

The students will get knowledge about various dosage forms, drug formulation and delivery.

Course Contents:

Unit-I: Dosage Forms **10 Hrs**

Routes of administration, Types of dosage forms, Oral solids: tablets, types of tablets, methods of tablet production- wet granulation, coating of tablets. Quality control methods and measurement of tablet properties, packaging.

Oral liquids: Suspensions and Emulsions: Definition, types, stability, suspending/ emulsifying agents, evaluation, and packaging. Parenteral, Ophthalmic products, Aerosols, Inhalation products. Topical lipids, semisolids, and powders.

Unit-II: Drug Formulation **10 Hrs**

Concept of excipients, classifications with examples, colours, flavours and preservatives in formulations. Concept of Pre-formulation, factors influencing designing of dosage forms, drug excipients interaction, stability studies.

Unit-III: Drug delivery systems **10 Hrs**

Fundamental of novel drug delivery: Rationale of sustained release, controlled release dosage forms. Oral controlled drug delivery systems, mucosal drug delivery system, ocular drug delivery systems, parenteral drug delivery systems, transdermal drug delivery systems.

Reference Books:

1) The theory and practice of Industrial pharmacy (CBS) Leon Lachman,
2) Dispensing of pharmaceuticals (CBS) Cooper and Gunn
3) The Science and Practice of Pharmacy by Remington
4) Biopharmaceutics and Pharmacokinetics by Brahmankar
5) Pharmaceutical dosage forms and drug delivery systems by Ansel
6) The science of dosage forms design by Aulton

M. Sc. Second Year (Semester III) Organic Chemistry

OCHETE-610: Natural Products

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To explain the basic classification and role of alkaloids.
2) To explain the structural elucidation and degradation of alkaloids.
3) To describe the synthesis and structure of alkaloids.
4) To describe the stereochemistry of alkaloids.
5) To explain the isolation and structural determination of alkaloids.
6) To explain the terpenoids and its classification.
7) To explain isoprene rule.

Course Outcomes:

The course will be give the knowledge of natural products isolation, characterization, applications and their synthesis.

Course Contents:

UNIT-I: Terpenoids & Carotenoids **15 hrs**

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

UNIT-II: Alkaloids **15 hrs**

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry and synthesis of the following: Ephedrine, (+)-coniine, nicotine, atropine, Quinine and Morphine.

Reference books:

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, J. B. Hobbs, D. V. Banthrope and J. B. Harborne, Longman, Essex.
3) Organic Chemistry: Vol. II, I. L. Finar, ELBS.
4) Introduction to Flavonoids: B. A. Bohm, Harwood Academic Publishers
5) New Trends in Natural Product Chemistry: Atta-ur-Rahman and M. I. Choudhary
6) Biogenesis of Natural Products: Baldev Kumar and Harishkumar Chopra (Narosa Publication)

M. Sc. Second Year (Semester III) Organic Chemistry

OCHE-RP-649: Research Project I

8 Hrs/Week | Credits: 04 | Marks 100

Course Objectives:

1) To design research oriented project on particular context.
2) To search literature on selected research oriented project work.
3) To identify/search the recent advances in current research.
4) To conduct experiment scientifically with safety.
5) To characterize the prepared material by using microscopic, spectroscopic, diffraction, adsorption and thermal techniques.
6) To demonstrate the skill to write dissertation, communication skill in presentation.

Course Outcomes:

The students will be able to perform multistep synthesis of organic compounds. They will acquire practical skill required for pharmaceutical industries.

Course Contents:

Candidates are expected to work on assigned research project and submit the results at the end of the semester in the form a dissertation. Open defense of the student on his/her dissertation shall be arranged. This defense shall be in front of the panel of examiners.

Project work involving organic synthesis and characterizations / biological screening of newly synthesized compounds / development of new methods for organic transformations / synthesis of nanomaterial and characterizations will be considered. Project should be completed under the guidance of a faculty member in the same department.

Guidelines for Assessment

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Clarity of objective and scope
- Quality of work attempted
- Presentation skills

M. Sc. Second Year (Semester IV) Organic Chemistry

CHET-650: Photochemistry

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To describe the Photochemical excitation and Jablonski diagram.
2) To explain the study of photochemistry of ketone-photo reduction-photo cycloaddition.
3) To learn photochemistry of carbonyl and aromatic compounds.

Course Outcomes:

The students will acquire the knowledge about principle of photochemistry. They will be understand the photochemistry of carbonyl and aromatic compounds.

Course Contents:

Unit I: Photochemistry of Alkenes **10 Hrs**

Intermolecular reactions of the Olefinic Bond-Geometrical Isomerism, Cyclization reactions, Rearrangement of 1, 4- and 1, 5-dienes.

Unit II: Photochemistry of Carbonyl compounds **15 Hrs**

Intermolecular reactions of the Carbonyl compounds-saturated, Cyclic and acyclic, β, γ-gamma unsaturated and α, β-unsaturated compounds, Cyclohexadienones, Intermolecular Cycloaddition reactions, Dimerizations and Oxetane formation.

Unit III: Photochemistry of Aromatic Compounds **05 Hrs**

Isomerization, Additions and Substitutions.

Reference books:

1) Organic Chemistry: Stanley H. Pine
2) Photochemistry: Organic Photochemistry. Vol. 1. Orville L. Chapman
3) Designing Organic Synthesis: S. Warren, Wiley.
4) Organic Chemistry: J. Clayden, N. Greeves, S. Warren and P. Wothers
5) Organic Syntheis: Jagdama Singh and L. D. S. Yadav
6) Advanced organic Chemistry: Part A & B, Reactions and Synthesis, F. A. Carey and R. J. Sundberg.
7) Principle of organic synthesis: Norman and Coxon
8) Organic Photochemistry: Robert Kan

M. Sc. Second Year (Semester IV) Organic Chemistry

CHET-651: Pericyclic Reactions

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To describe electrocyclic, cycloaddition and sigmatropic pericyclic reactions.
2) To describe stereochemical problems in relation to chemical transformations.
3) To describe synthetically the processes relevant organic-chemical reactions and be able to discuss the mechanism of these reactions.

Course Outcomes:

The students will bet knowledge about various pericyclic reactions and their applications.

Course Contents:

Unit I: Cycloaddition reactions **10 Hrs**

Cycloaddition reactions and their stereochemical aspects, Woodward-Haffman rule, Selection rule for cycloaddition reaction, Details with examples of Diels-Alder reaction, (2+2) cycloaddition, (1, 3) polar cycloaddition, Cycloaddition of alkenes with OsO_4 and ozone, Cheletropic reactions, Analyses of cycloaddition by FMO, Mobius-Huckel and Correlation diagram methods.

Unit II: Electrocyclic reactions **10 Hrs**

Electrocyclic reactions and their stereochemical aspects, Selection rule of electrocyclic reaction, Con-rotations and dis-rotations, Methods of analyses of the electrocyclic reactions: FMO, Mobius-Huckel and Correlation diagram approaches.

Unit III: Sigmatropic rearrangements **10 Hrs**

Sigmatropic rearrangements and their stereochemistry, Rules for Sigmatropic rearrangements, Examples on (1, 3), (1, 5), (1, 7), (3, 3), (2, 3) Sigmatropic shifts, Claisen, Cope, Oxy-cope, Aza-cope, Sommelet-Hauser rearrangements, Ene reaction, Methods of analyses of the rearrangements: FMO, Mobius-Huckel and Correlation diagram approaches.

Reference books:

1) Organic Chemistry: Stanley H. Pine
2) Designing Organic Synthesis: S. Warren, Wiley.
3) Organic Chemistry: J. Clayden, N. Greeves, S. Warren and P. Wothers
4) Organic Syntheis: Jagdama Singh and L. D. S. Yadav
5) Advanced organic Chemistry: Part A & B, Reactions and Synthesis, F. A. Carey and R. J. Sundberg.
6) Organic Synthesis: M. B. Smith.
7) Principle of organic synthesis: Norman and Coxon

M. Sc. Second Year (Semester IV) Organic Chemistry

OCHET-652: Retrosynthesis

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To explain retrosynthetic analysis with some examples.
2) To describe important functional group interconversion in alkene synthesis.
3) To explain the concepts of one-, two-group C-C bond disconnections.
4) To describe ring synthesis via retrosynthetic approach.
5) To explain the utility of retro-synthesis in complex molecules and natural products.
6) To describe protective groups in organic synthesis; special emphasis on protection and deprotection of hydroxyl-, carbonyl-, carboxylic acid and amines.

Course Outcomes:

The course will be useful to understand the concept of retrosynthetic analysis. The students will be able to disconnect the molecules and write the synthetic path way for organic compounds.

Course Contents:

UNIT-I : Disconnection Approach **12 hrs**

Introduction to: (i) Grounding of organic chemistry for understanding retrosynthesis; (ii) Retrosynthetic analysis and designing of the synthesis; (iii) Disconnection approach: An introduction to synthons, synthetic equivalents, disconnection approach, functional group interconversion, importance of order of events in organic synthesis, one and two group C-X disconnections, selective organic transformations: chemoselectivity, regioselectivity, stereoselectivity, enentioselectivity, Reversal of polarity, cyclization reactions, amine synthesis.

UNIT-III C-C Disconnections **12 hrs**

(i) One group C-C Disconnections: Alcohols (including stereo-selectivity), carbonyls (including regioselectivity), Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

(ii) Two group C-C Disconnections: Diels-Alder reactions, 1, 3 difunctionalized compounds and α, β-unsaturated compounds, control in carbonyl condensations, 1, 5 difunctionalized compounds, Michael addition and Robinson annellation.

UNIT-III Protecting Groups **06 hrs**

Protection and deprotection of hydroxyl, carbonyls in aldehydes and ketones, amines, carboxylic acids, alkenes and alkynes.

Reference books:

1) Organic Chemistry: Clayden, Greeves, Warren and Wothers
2) Organic Synthesis: The Disconnection Approach: Stuart Warren
3) Organic Synthesis: Strategy and Control: Paul Wyatt and Stuart Warren
4) The Logic of Chemical Synthesis: E. J. Corey and Xue-Min Chelg
5) Classics in Total Synthesis I, II and III: K. C. Nicolaou and others
6) Organic Synthesis Concepts, Methods, Starting Materials: J. Fuhrhop, G. Penzlin
7) Principles of Organic Synthesis: R. Norman and J. M. Coxan.
8) Protective Groups in Organic Synthesis: T. W. Greene, G. M. Wuts.

M. Sc. Second Year (Semester IV) Organic Chemistry

OCHET-653: Heterocyclic Chemistry

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Describe the structures of classes of heterocyclic aromatic organic compounds.
2) Classify simple heterocyclic aromatic compounds as electron deficient or electron rich and explain their reactivity based on these properties.
3) Apply organometallic reactions that applied in heterocyclic chemistry.

Course Outcomes:

The students will get knowledge about different types of heterocyclic compounds and their methods of synthesis. They will learn to synthesis of organic compounds by using different reagents and catalysts.

Course Contents:

UNIT-I **10 hrs**

Nomenclatures of all types of heterocycles, Classification of heterocycles: as aromatics based upon various membered ring systems.

UNIT-II **20 hrs**

General synthetic routes based on name reactions, reactivities, utilities and wherever possible spectral analyses of the following class of heterocycles.

Four membered: Azitidines, including β- lactums.

Five membered: Thiazoles, Oxazoles, Pyrazoles and Imidazoles.

Six membered: Pyridines, Pyrimidines.

Reference books:

1) Heterocyclic Chemistry: vol. I, II, III: R. R. Gupta, M. Kumar and M. Gupta
2) Heterocyclic Chemistry: Joules and Mills
3) Modern heterocyclic Chemistry: L. A. Paquette (Benjamin)

M. Sc. Second Year (Semester IV) Organic Chemistry
OCHET-654: Multicomponent Reactions

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn about the concept of multicomponent reactions.
2) To study the reaction mechanism and applications of various reactions.

Course Outcomes:

The students will acquire the knowledge about multicomponent reactions and their mechanism.

Course Contents:

Unit I **10 Hrs**

Introduction to Multicomponent Reactions: Strecker amino acid synthesis, Biginelli reaction, Gewald reaction, Hantzsch pyridine synthesis, Mannich reaction, Ugi reaction, Passerini reaction, Petasis reaction. Direct synthesis of heterocycles *via* MCRs using a name reaction: Biginelli reaction, Hantzsch reaction, Click reaction, Gewald reaction, Ugi reaction and Ugi-azide reaction.

Unit II **10 Hrs**

Synthesis of heterocycles *via* MCRs, using a name reaction in combination with another reaction: Michael addition reaction, Mannich reaction, Aldol reaction, Knovenagel reaction and Wittig reaction.

Unit III **10 Hrs**

Corey-Fuchs Reaction, Julia olefination, Peterson olefination, Corey-Winter olefination, Ring closing metathesis (Grubb's metathesis), Aldol- Tishchenko (Evans-Tishchenko reaction), Pummerer, Payne, Eschenmoser fragmentation, Brook, Hunds-Diecker reaction,

Reference books:

1) (Topics in Heterocyclic Chemistry 25) Géraldine Masson, Luc Neuville (auth.), Romano V. A. Orru, Eelco Ruijter (eds.) - Synthesis of Heterocycles *via* Multicomponent Reactions II-Springer-Verlag Berlin
2) Jieping Zhu, Qian Wang, Meixiang Wang - Multicomponent Reactions in Organic Synthesis-Wiley-VCH (2015)
3) K. L. Ameta, Anshu Dandia - Multicomponent Reactions: Synthesis of Bioactive Heterocycles-CRC Press (2017)
4) Zhu J., Bienhame H. (eds.) - Multicomponent Reactions-Wiley-VCH (2005)
5) Raquel P. Herrera, Eugenia Marqués-L_pez - Multicomponent Reactions: Concepts and Applications for Design and Synthesis-Wiley (2015)
6) Majid M. Heravi, Vahideh Zadsirjan - Recent Advances in Applications of Name Reactions in Multicomponent Reactions-Elsevier (2020)

M. Sc. Second Year (Semester IV) Organic Chemistry
OCHEL-655: Organic Chemistry Laboratory Course
(Spectral Interpretation)

4 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) Able to interpret the UV-Visible, IR, NMR and mass spectra.
2) Able to create a data from the given spectra.
3) Able to analyse the data obtained from the given spectra to elucidate the structure of organic compound.
4) Able to interpret and analyse the XRD, Mossbauer, and ESR spectra.

Course Outcomes:

The students will be able to interpret the various spectrums and assign the structures to the compounds.

Course Contents:

The will be provided various spectrums of UV, IR, ^{1}H NMR, ^{13}C NMR, Mass, XRD spectrums. By using the values on spectrums the structures will be assigned to the compounds.

M. Sc. Second Year (Semester IV) Organic Chemistry

OCHETE-656: Applied Organic Chemistry I

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn about organometallic reagents and their applications.
2) To learn about ylides and enamines.
3) To understand generation, stability and applications of reaction intermediates.

Course Outcomes:

The students will get knowledge about organometallic reagents. They will know about ylides and enamines intermediates.

Course Contents:

Unit I: Organometallic Reagents **15 Hrs**

Principle, Preparation, Properties and applications of the mechanistic details: Li, Mg, Hg, Cd, Zn, Ce, Cu, Pd, Ni, Fe, Co, Rh, Cr, Si, and B compounds.

Unit II: Ylides and Enamines **15 Hrs**

(i) Ylides: Preparation and their synthetic applications along with their stereochemical aspects of Phosphorous, Sulphur and Nitrogen ylides.

(ii) Enamines: Generation & application in organic synthesis with mechanistic pathways, stork enamine reaction.

Reference Books:

1) Organic Chemistry: Clayden, Greeves, Warren and Wothers
2) Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
3) Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
4) Organic Synthesis: W. Carruthers
5) Organic Reagents: Fieser & Fieser
6) Organic Synthesis: M. B. Smith
7) Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
8) Some Modern Methods of Organic Synthesis: W. Carruthers

M. Sc. Second Year (Semester IV) Organic Chemistry

OCHETE-657: Applied Organic Chemistry II

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To learn about the free radical reactions.
2) To learn various organic reagents.
3) To understand about polynuclear hydrocarbons.

Course Outcomes:

The students will get knowledge about free radical reactions, organic reagents and polynuclear hydrocarbons.

Course Contents:

Unit I: Free Radical Reactions **10 Hrs**

Types of radical reaction, Free radical substitution mechanism, mechanism at an aromatic substrate, Neighbouring group assistance, Reactivity for aliphatic and aromatic substrates at a bridgedhead, reactiviy in the attacking radicals, The effect of solvents on reactivity. Allylic halogenations (NBS), Oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazoniu salts, Sandmeyer reaction, Free radical rearrangement, Hunsdiecker reaction.

UNIT-II Organic Reagents **10 Hrs**

DCC, EDC, DDQ, 1,3 Dithiane, LDA, DMDO, OsO_4, RuO_4, SmI_2, Dess-Martin Periodinane, Diazomethane, Lawesson's reagent.

Unit III: Polynuclear Hydrocarbons **10 Hrs**

Introduction, Comparative study of the aromatic character of linear and nonlinear Ortho fused Polynuclear Hydrocarbon. General methods of preparation of fluorine, anthracene and phenanthrene.

Reference Books:

1) Organic Chemistry: Clayden, Greeves, Warren and Wothers
2) Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
3) Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
4) Organic Synthesis: W. Carruthers
5) Organic Reagents: Fieser & Fieser
6) Organic Synthesis: M. B. Smith
7) Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg

M. Sc. Second Year (Semester IV) Organic Chemistry
OCHETE-658: Green Chemistry

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1) To understand the concept of green chemistry.
2) To learn twelve principles of green chemistry.
3) To learn different methods of green synthesis.

Course Outcomes:

1) The students will get knowledge of green chemistry and their principles.
2) They will be able to understand the different methods of green synthesis.

Course Contents:

Unit I: Introduction to Green Chemistry **06 Hrs**

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry

Unit II: Principles of Green Chemistry and Designing a Chemical synthesis **08 Hrs**

Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following: (a) Designing a Green Synthesis using these principles; Prevention of Waste/ by products; maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions. (b) Prevention/ minimization of hazardous/ toxic products reducing toxicity. risk = (function) hazard × exposure; waste or pollution prevention hierarchy. (c) Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents. (d) Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy. (e) Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups. (f) Use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis. (g) Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD "What you don't have cannot harm you", greener alternative to Bhopal Gas Tragedy (safer route to carcarbaryl) and Flixiborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation. (h) Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

Unit III : Examples of Green Synthesis/ Reactions and some real world cases **08 Hrs**

(a) Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis); (b) Microwave assisted reactions in water: Hofmann Elimination,

methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction; (c) Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine); (d) Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments; (e) Designing of Environmentally safe marine antifoulant; (f) Right fit pigment: synthetic azopigments to replace toxic organic and inorganic pigments; (g) An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn; (h) Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils; (i) Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting

Unit IV : Future Trends in Green Chemistry **08 Hrs**

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solvent less reactions; co crystal controlled solid state synthesis (C^2S^3); Green chemistry in sustainable development.

Reference books:

1. Organic Chemistry IV Edn G.Marc Loudon.
2. Green Chemistry By Paul T. Anastas and John C. Warner
3. Green Chemistry By Rashmi Sanghi and M. M. Srivastav

M. Sc. Second Year (Semester IV) Organic Chemistry
OCHETE-659: Drug Design & Drug Discovery

2 Hrs/Week | Credits: 02 | Marks 50

Course Objectives:

1. Able to know about various aspect in drug design and discovery includes: Folklore drugs, stages involved in drug discovery- disease, drug targets, bioassay. Discovery of a lead, screening of natural products and synthetic compound libraries. Pharmacokinetics (ADME), pharmacodynamics, Nature of drug-receptor interactions and their theories-Occupancy theory, Induced-fit theory, Macromolecular purturbation theory and Two-state model of receptor activation, natural products as lead structures in drug discovery.
2. Able to know about principles of design of agonists (e.g. Salbutamol), antagonists (e.g. cimitidine) and enzyme inhibitors (e.g. captopril), Drug discovery without lead, principles of prodrug design.

Course Outcomes:

The students will get knowledge of drug design and discovery.

Course Contents:

UNIT-I: Principles of Drug design and drug discovery **15 hrs**

Introduction to drug discovery, Folklore drugs, stages involved in drug discovery- disease, drug targets, bioassay. Discovery of a lead, screening of natural products and synthetic compound libraries. Pharmacokinetics (ADME), pharmacodynamics, Nature of drug-receptor interactions and their theories-Occupancy theory, Induced-fit theory, Macromolecular purturbation theory and Two-state model of receptor activation. Natural products as lead structures in drug discovery, Pharmacophore, structure pruning technique e.g. morphine. Discovery of lead structure from natural hormones and neurotransmitters, Principles of design of agonists (e.g. Salbutamol), antagonists (e.g. cimitidine) and enzyme inhibitors (e.g. captopril), Drug discovery without lead, serendipity, Penicillin and Librium as examples, Principles of prodrug design.

UNIT-II: Lead modification and SAR Studies **15 hrs.**

SAR: Lead modification strategies, 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. Discovery of oxaminquine, salbutamol, cimitidine and captopril SAR studies in sulfa drugs, benzodiazepines, and taxol analogs.

Reference books

1) Burger's medicinal chemistry and drug discovery by Manfred E. Wolf.
2) Introduction to Medicinal chemistry by Patrick.
3) Introduction to drug design by R Silverman
4) Comprehensive medicinal chemistry. Vol 1-5 by Hanzsch.
5) Principles of medicinal chemistry. by William Foye
6) Biochemical approach to medicinal chemistry by Thomas Nogrady.
7) Pharmaceutical Chemistry and Drug synthesis by Roth and Kleeman
8) Drug design by E.J.Arienes
9) Principles of Medicinal Chemistry Vol I & II by Kadam et al
10) Medicinal chemistry An introduction by Garreth Thomas

M. Sc. Second Year (Semester IV) Organic Chemistry

OCHE-RP-699: Research Project II

12 Hrs/Week | Credits: 06 | Marks 150

Course Objectives:

1) To design research oriented project on particular context.
2) To search literature on selected research oriented project work.
3) To identify/search the recent advances in current research.
4) To conduct experiment scientifically with safety.
5) To characterize the prepared material by using microscopic, spectroscopic, diffraction, adsorption and thermal techniques.
6) To demonstrate the skill to write dissertation, communication skill in presentation.

Course Outcomes:

The students will be able to perform multistep synthesis of organic compounds. They will acquire practical skill required for pharmaceutical industries.

Course Contents:

Candidates are expected to work on assigned research project and submit the results at the end of the semester in the form a dissertation. Open defense of the student on his/her dissertation shall be arranged. This defense shall be in front of the panel of examiners.

Project work involving organic synthesis and characterizations / biological screening of newly synthesized compounds / development of new methods for organic transformations / synthesis of nanomaterial and characterizations will be considered. Project should be completed under the guidance of a faculty member in the same department.

Guidelines for Assessment

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Clarity of objective and scope
- Quality of work attempted
- Presentation skills

Head
Department of Chemistry
Dr.Babasaheb Ambedkar Marathwada
University Sub-Campus, Dharashiv.