CVM UNIVERSITY

MASTER OF SCIENCE

(Pharmaceutical Chemistry)

PROGRAMME

Under Choice Based Credit Scheme

Structure with Effect From: 2020-21

M.Sc. Pharmaceutical Chemistry Programme Details

Programme Objectives (POs):

At the end of the program, post graduates will be developed the extensive knowledge of Pharmaceutical Chemistry. The program aims to develop interdisciplinary knowledge of Chemistry, Biology and Pharmacy among the students and to equip the students with excellence in the field of Pharmaceutical chemistry and to development the skills, thus enabling the student to pursue a career in Pharmaceutical Industry/Research Institute. Development through skill based, multi-dimensional education will provides self-confidence and self-reliance in the student. The student will be instilled with values of professional ethics and be made ready to contribute to society as responsible individuals.

Programme Specific Outcomes (PSOs):

At the end of the two-year programme the student will understand and be able to explain different aspects of Pharmaceutical Chemistry. The student will be able to describe different techniques of organic synthesis, reaction mechanisms, and their application to process chemistry, method development and drug discovery. Designing new techniques of organic synthesis using green chemistry approach, retrosynthesis and will be able to formulate new drug formulations and will be able to explain about mode of action of various classes of drugs. He/she will be able to Design and implement research projects independently. They will be able to execute a short research project incorporating techniques of synthetic, characterization, identification and analysis of pharmaceuticals entity. The student will be equipped to take up a suitable position in academia or Industry, and to pursue a career in research if so desired.

Programme Structure:

The M.Sc. Pharmaceutical Chemistry programme is a two-year course divided into four-semesters. A student is required to complete hundred credits for the completion of course and for the award of degree. A student has to accumulate twenty-five credits in each of the four semesters.

PART ONE	FIRST YEAR	SEMESTER I	SEMESTER II
PART TWO	SECOND YEAR	SEMESTER III	SEMESTER IV

Course Credit Scheme

Semester- I

Course Type	Course code	Course Title	T/P	Credit	Exam duration in hrs	Component of Marks		
						Internal	External	Total
						Total/ Passing	Total/ Passing	Total/ Passing
Core Course	101450101	Inorganic Chemistry	T	4	3	30/10	70/28	100/40
	101450102	Organic Chemistry-I	T	4	3	30/10	70/28	100/40
	101450103	Basic Physical Chemistry	T	4	3	30/10	70/28	100/40
	101450104	Lab I(sub I Inorganic Chemistry Sub II Organic Chemistry)	P	4	3	30/10	70/28	100/40
	101450105	Lab II (Sub IBasic Physical Chemistry Sub II Chemistry of Natural Product)	P	4	3	30/10	70/28	100/40
	101450106	Comphrehensive Viva-Voce	-	1			50/20	50/20
Elective Courses (any One)	101450107	Chemistry of Natural Product –I	T	4	3	30/10	70/28	100/40
	101450108	Fundamentals of Analytical	T	4	3	30/10	70/28	100/40

		Chemistry						
Total Credits				**25**				**650**

Course Wise Content Details for M.Sc. (Pharmaceutical Chemistry) Programme

CHARUTAR VIDYAMANDAL UNIVERSITY
VALLABH VIDHANAGAR
SEMESTER-I
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450101: Inorganic Chemistry

Course Objectives:

The main objective of the paper is to make students enable to understands inorganic drug chemistry and students will be able to explain the effects of impurities in pharmaceuticals and should able to explain the medicinal importance of pharmaceutical inorganic compounds. Further, he should discuss the principles and methodology of assay of several inorganic drugs.

Course Learning Outcomes:

1. To emphasize the importance and nature of Inorganic elements.
2. To understand the importance of inorganic entities in pharmaceuticals.
3. To provide knowledge about important inorganic pharmaceuticals in pharmacopoeia.
4. To highlight the domain of Gastro intestinal agents used in the pharmaceuticals.
5. To describe typical therapeutic classes and inorganic agents associated with them.

Contents:

UNIT -I

Introduction and chemical principles

Introduction of inorganic compound and their application, Pharmacopia, History of Pharmacopia, atom, molecules periodic table of element, general physical and chemical properties of elements, acid and bases, chemical bonding, coordination chemistry of inorganic compounds.

UNIT –II

Impurities in pharmaceutical substances: Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate.

UNIT –III

Gastrointestinal agents Acidifiers: Ammonium chloride and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium 40 Bicarbonate, Aluminum hydroxide gel, Magnesium hydroxide mixture Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide, Chlorinated lime, Iodine and its preparations.

UNIT –IV

Miscellaneous compounds Expectorants: Potassium iodide, Ammonium chloride. Emetics: Copper sulphate, Sodium potassium tartarate.

Haematinics: Ferrous sulphate, Ferrous gluconate Poison and Antidote: Sodium thiosulphate, Activated charcoal, Sodium nitrite, Astringents: Zinc Sulphate, Potash Alum.

Basic text and Reference Books

1. Inorganic Pharmaceutical Chemistry By Dr,. K. G. Bothara.
2. Inorganic Pharmaceutical Chemistry By P. Gundu.
3. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4 th edition.
4. A.I. Vogel, Text Book of Quantitative Inorganic analysis.
5. M.L Schroff, Inorganic Pharmaceutical Chemistry.
6. Bentley and Driver's Textbook of Pharmaceutical Chemistry.
7. Anand & Chatwal, Inorganic Pharmaceutical Chemistry.
8. Indian Pharmacopoeia.

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER- I

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450102: Organic Chemistry-I

Course Objectives:

The main objective of the paper is to make students enable to know and recall the fundamental principles of organic chemistry that include in various type of chemical reaction, structural arrangement of compounds, Students will be able to understands heterocycles, concept of green chemistry and application of green synthesis, type of catalyst and its applications and should be able to design new route of synthesis.

Course Learning Outcomes: After the successful completion of the course, students will be able :

1. To emphasize the nature of organic compounds and its various chemical reactions.
2. To understand fundamentals, naming rules of heterocyclic compounds and their physical and chemical properties.
3. To provide knowledge about green synthesis as modern synthetic method and importance of green chemistry in organic synthesis.
4. To provide knowledge of various common catalysts and their application in chemical reaction.

Contents:

UNIT -I

Various Reaction Mechanisms:

Substitution Reaction: Nucleophilic substitution reactions in aliphatic and aromatic system, SN1, SN2 reactions, Hydride transfer reaction, Participation of neighboring group in nucleophilic substitution reaction and rearrangements.

Elimination Reaction: Beta Elimination reactions, E1, E2 and E1cb mechanisms, Hoffman and saytzeff's rule for elimination, stereochemistry of E2 reaction, Elimination from alicyclic compounds.

Addition Reaction: Electrophilic and Nucleophilic additions, Stereochemistry involved, Markonikovs rule.

Free Radical Reaction: Formation, Detection, Reactions, Homolysis and free radical displacements, addition and rearrangements of free radicals.

UNIT - II

Heterocylic chemistry: Nomenclature, synthesis, physical, chemical and spectroscopic properties of pyrrole, furan, thiophen, pyridine, pyridazine, pyrimidine, pyrazine, quinoline, isoquinoline, indole, oxazole, imidazole and benzimidazole.

UNIT - III

Modern synthetic methods: Green Synthesis: Introduction; Green reagents; green catalysts; ionic solvents; phase transfer catalysis in green synthesis; application of phase transfer catalysts in green synthesis of heterocyclic compounds: Williamson's synthesis, Wittig reaction.

Microwave assisted synthesis: Introduction; microwave reactions in water (Hofmann elimination, hydrolysis and oxidation); microwave reactions in organic solvents; solid state reactions; advantages of microwave technique.

UNIT - IV

Oxidation and reduction reactions: Oxidation reaction involving use of potassium permanganate, potassium dichromate, chromic acid, selenium dioxide, periodic acid, N-bromosuccinimide and oppenaure oxidation. Reduction reactions using metal and acid, metal amine reduction, catalytic reduction, hydrogenation of double bond, triple bond and aromatic rings, birch reduction, Meerwein-Pondroff-Verley reduction.

Basic Text & Reference Books:

1. Morrison RT and Boyd RN, Organic Chemistry, 11th edition, Prentice-Hall of India Pvt. Ltd, New Delhi,
2. Thomas L. Gilchrist, 2008, Heterocyclic Chemistry, 3rd edition, Pearson Education.
3. Raj K. Bansal, 2010, Heterocyclic Chemistry, 5th edition, New Age International Publishers.
4. J. March, 2005, Advanced Organic Chemistry – Reaction, Mechanism and Structure, 4th edition, A Wiley-Interscience Publication, John Wiley & Sons, New York.
5. Peter Sykes, 1985, A Guidebook to Mechanism in Organic Chemistry, 6th edition, Longmann Scientific and Technical, Co published with John Wiley & Sons, Inc, New York.
6. James Clark & Duncan Macquarrie, 2002, Handbook of Green Chemistry and Technology, Blackwell Science Ltd
7. William M. Nelson, Green solvents for Chemistry: Perspectives and Practice, Oxford University Press
8. VK Ahluwalia & M Kidwai, 2004, New Trends in Green Chemistry, Kluwer Academic Publishers.
9. VK Ahluwalia & Renu Agarwal, 2006, Organic Synthesis-Special Techniques, Alpha Science International.
10. M. Lancaster, 2002, Green Chemistry: An Introductory Text, Royal Society of Chemistry.

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SEMESTER -I
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450103: Basic Physical Chemistry

Course Objectives:

The main aim of the paper is to develop the knowledge of pH, buffer, buffer capacity, solution behavior viscosity and thixotropy, Students should be able to understand preparation and utilization of buffer solution in the pharmaceutical industries. Students will make possible of knowledge

regarding effect of surface tension. Attain Knowledge of the suspension and emulsion and its behavior and utilization of various suspension and emulsion in the pharmaceutical and other chemical process industries.

Course Learning Outcomes: After the successful completion of the course, students should be able
1. To understand the knowledge of pH, buffer, buffer capacity etc.
2. To develop knowledge of solution behavior viscosity and thixotropy.
3. Ability to prepare different pH and buffer solutions.
4. To gain knowledge of utilization of buffer solution in the pharmaceutical industries.
5. To have knowledge of solid liquid and liquid-liquid interface.
6. To develop the knowledge regarding effect of surface tension.
7. Attain knowledge of the suspension and emulsion and its behaviour
8. To develop the ability for utilization of various suspension and emulsion in the pharmaceutical and other chemical process industries.

Contents:

UNIT -I

pH, Introduction of pH, pH scale.
Buffered and isotonic solution
Buffer capacity: Maximum buffer capacity, neutralization curves and buffer capacity.
Buffers in pharmaceutical and biological systems: In vivo biological buffer systems, pharmaceutical buffers, preparation of pharmaceutical buffer solution, influence of buffer capacity and pH on tissue irritation, stability vs optimum therapeutic response, pH and solubility.

UNIT -II

Physical properties of pharmaceutical liquid:
Viscosity: Introduction – Concepts of viscosity, factors influencing viscosity, Newtonian and Non – Newtonian systems,
Thixotropy: Measurement of Thixotropy bulges and spurs, negatives thixotropy, thixotropy in formulation.
Type & choice of Viscometer, Viscoelasticity, Pharmaceutical application.

UNIT -III

Physical properties of pharmaceutical liquid:
Surface and interfacial phenomena
Liquid interfaces: surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions method spreading co–efficient.
Adsorption of liquid interfaces: surface active agents, systems of hydrophile – lipophile classification.

UNIT -IV

Dispersion and Emulsion:
Coarse dispersion (Dispersion systems), Classification, purification and stability of pharmaceutical dispersion.
Suspensions: Classification of suspensions, Particle – particle interaction and behaviour, Interfacial properties of suspended particles (Brownian movement) factors affecting, formulation of suspension.
Emulsion: Emulsion types, pharmaceutical applications, Theories of emulsification. Mono molecular adsorption, multi molecular adsorption and film formation, solid particle adsorptions, Physical stability of emulsions (Preservation of emulsions), Microemulsions.

Basic text and Reference Books
1. Subramanyam C V S, Text book of Physical pharmaceutics, Vallabh prakashan, New Delhi; ISBN:81-85731-08-X.
2. Sinko Patrick J., Martin's Physical Pharmacy and Pharmaceutical Sciences, Publisher: Lippincott Williams & Wilkins; ISBN: 0-7817-6426-2.
3. Michael J Rosen, Milton J Rosen, Surfactants and Interfacial Phenomena, Publisher: Wiley-Interscience; ISBN-13: 9780471836513; ISBN: 0471836516.
4. Alfred N Martin, Physical Pharmacy: Physical Chemical Principles in the Pharmaceutical Sciences, ISBN-13: 9780812101638; ISBN: 0812101634.

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M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450104: Lab-I

Course Objectives:
The main objective of paper is make students enable to understand qualitative and quantitative analysis methods and develop the skill of separation and identification of inorganic and organic compounds and observe the differences. Students will understand qualitative and quantitative analysis methods and develop the skill of separation and identification of compounds and observe the differences.

Course learning Outcome: After the successful completion of the course students will be able :
To understand various analytical methods used in chemical analysis.
To understand various chemical reaction involved in Identification of organic compounds.
To develop the skill of separation and identification of inorganic and organic compounds.

Contents

Exercise –I

(a) Limit tests for following ions: Chlorides , Sulphates, Iron, Lead , Heavy metals and Arsenic.

(b) Quantitative analysis of Inorganic compounds: Estimation of Boric acid, Zinc oxide, Borax, Citric acid, Calcium gluconate, Ferrous sulphate, Ammonium chloride.

Exercise –II

Qualitative Analysis : Separation and Identification of binary mixture of Organic substance: 1. Salicylic acid, 2. Cinnamic acid, 3. Benzoic acid , 4. α-Naphthol, 5. β-Naphthol, 6. o-nitroaniline, 7. m-nitroaniline, 8. p-nitroaniline, 9. Naphthalene, 10. m-dinitrobenzene.

Basic text and Reference Books :

1. Mendham J., Denney R. C., Barnes J. D., Thomas M. J. K., *Vogel's textbook of quantitative chemical analysis*, 6th Edition.
2. Pandey, O. P., Bajpai, D. N., Giri, S., *Practical Chemistry*.
3. Ghoshal, Mahapatra , Nad , *An Advanced course in Practical Chemistry*.
4. A.I. Vogel, Text Book of Quantitative Inorganic analysis.

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M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21
101450105: Lab-II

Course Objectives:

The main objective of the paper is to make students understand physical properties and qualitative and quantitative analysis methods of compounds. Students should develop the skill of identification of Natural Products and observe the differences among different class of compounds.

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

1. Understanding various physical methods used in chemical analysis.
2. To understand various physical properties involved in Identification of compounds.
3. To develop the skill of identification of natural products.

Contents

Exercise – I

- Identification of Natural drugs by morphological characters.
- Physical and chemical tests for evaluation of drugs wherever applicable.
- Gross anatomical studies (T.S.) of the following drugs : Senna, Cinnamon, Coriander, clove, Ashwagandha.
- Identification of fibers and surgical dressing.

Exercise – II

Physical:

- Saponification value of Castor oil.
- Acid value of Oil and fats.
- Ester value of Oil and fats.
- Measurement of Surface tension and Interfacial tension.
- Measurement of Viscosity of liquid using Ostwald's Viscometer.
- Study the effect of concentration of Oxalic acid on Adsorption using activated charcoal.

Basic Text and Reference Books :

1. An Introduction to Practical Biochemistry by Plummer & T. David; Publisher: McGraw- Hill, London; ISBN-13: 9780070941625; ISBN: 0070941629.
2. Practical Physical Chemistry by Dr. H. N. More and Ashok Hajare Career Publications ISBN-10: 8188739464, ISBN-13: 978-8188739462
3. Comprehensive Practical physical Chemistry: Volume – I & II by Ahuluwalia, Universities Press (India) Pvt. Ltd.; ISBN-13: 9788173712739; ISBN: 8173712735
4. Practical Pharmaceutical Chemistry by A. H. Bakett and J.B. Stenlake, Volume I & II; CBS Publisher; ISBN: 81-239-0514-9.

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M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21
101450107: Chemistry of Natural Product-I

Course Objectives:

The Main Objective of paper is to generate ability to explain the origin, the role of drugs from natural sources, and students should attain knowledge of the important natural products, their origin, properties and biological activity. And should be able to Identify the common adulterations and substitutions.

Course learning Outcome: After the successful completion of the course, students will be

1. To understand sources and application of natural product.
2. To provide the knowledge of important natural product.
3. To explain properties and biological activity of natural drugs.
4. Identification of adulteration and substitution in natural product.

Contents

UNIT -I

Definition and scope of pharmacognosy, Various systems of classification of drugs of natural origin. Adulteration & drug evaluation; significance of Pharmacopoeial standards.

Brief outline of occurrence, distribution outline of isolation, identification tests, therapeutic effects & pharmaceutical applications of alkaloids, terpenoids, glycosides, volatile oils, tannins & resins.

Collection & preparation of crude drugs for the market as exemplified by Ergot, opium, Rauwolfia, Digitalis, Senna.

UNIT -II

Occurrence, distribution, Organoleptic evaluation, chemical constituents including tests & therapeutic efficacy of following categories of drugs:

Laxatives - Aloes, Castor oil, Ispaghula, Senna.

Cardiotonics - Digitalis, Arjuna. Carminatives & G.I. regulators - Coriander, Ajowan, Cardamom, Ginger, Black pepper, Cinnamon, Clove. Astringents - Catechu. Drugs acting on nervous system - Belladonna, Aconite, Ashwagandha, opium, Cannabis.

UNIT - III

Occurrence, distribution, Organo leptic evaluation, chemical constituents including tests wherever applicable & therapeutic efficacy of following categories of drugs:

Antihypertensives – Rauwolfia, Antitussives -Vasaka, Tolu balsam, Tulsi, Antirheumatics - Guggul, Colchicum, Antitumour – Vinca,

Antileprotics - Chaulmoogra oil, Antidiabetics - Pterocarpus, Gymnema, Diuretics - Gokhru, Punarnava.

UNIT -IV

Occurrence, distribution, Organoleptic evaluation, chemical constituents including tests wherever applicable & therapeutic efficacy of following categories of drugs:

Antidysenterics – Ipecacuanha, Antiseptics & disinfectants - Benzoin, Myrrh, Nim, Curcuma, Antimalarials – Cinchona.

Oxytocics - Ergot, Vitamines –Amla, Perfumes & flavouring agents - Lemon Oil, Orange Oil, lemon grass Oil, Sandalwood.

Study of source, preparation & identification of fibres used in sutures & surgical dressings-cotton, silk, wool & regenerated fibres.

Basic Text and Reference Books :

1. Pharmacognosy by T.E. Wallis; CBS publisher, New Delhi. ISBN: 81-239-0886-5.
2. Pharmacognosy by Trease and Evans; Publisher: Saunder (Elsevier); ISBN: 10:81-31- 2-0087-6.
3. Quality control and of herbal drugs by Mukherjee, Budinrdd Horizons Limited, New Delhi.
4. Phytochmical methods by J. Harbone, Chapman and Hall, International Ed., London.
5. Indian Herbal Pharmacopoeia of India, Vol –I-II by SS, Handa, RRL, Jammu tawi and IDMA Mumbai.
6. The Ayurvedic Pharmacopoeia of India, 1999. Government of India. Ministry of Health and family Welfare, Department of Indian Systems of Medicine and Homeopath, New Delhi.
7. Pharmacognosy - IV by A. P. Purohit, C. K. Kokate, and Mr. S. B. Gokhale.Nirali Publication.
8. A text book of Pharmacognosy by C. K. Kokate. Nirali Publication.
9. Pharmacognosy by C. K. Kokate, A. P. Purohit, S. B. Gokhale. Nirali Publication.

CHARUTAR VIDYAMANDAL UNIVERSITY
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SEMESTER- I
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21
101450108: Fundamentals of Analytical Chemistry

Course Objectives: The main aim **of** the study of this paper, student will learnt about basic concept of instrumental techniques and various titration methods. This study should be l helpful them in further studies and in industries.

Course learning Outcome: After completion of paper students will be able
1. To understand basic theory and principals of pH, potentiometry and conductometry instruments.
2. To understand various methods used for analysis.
3. To understand basic theory and principals of Redox titrations.
4. To understand basic theory and principals of Complexometric Titration.

Contents

UNIT - I
pH metry- Introduction, types of indicator electrodes and reference electrodes, types of titrations.
Potentiometry- Introduction, types of titrations, graphical method for end point determination.
Conductometry- Introduction, types of conductance, effect of dilution, conductivity cells, types of titration.

UNIT - II
Titrimetric Methods In Analysis
Introduction, Definitions: Standard solutions, Equivalence Point, Indicators, End point, Titration General Aspects of: Primary standards, Desirable properties of standard solution. Volumetric calculations: Molarity, Normality, percentage concentration, parts per million.
Neutralization Titration
Standard solution and acid-base indicators. Titration curve for strong acid-strong base. Systematic equilibrium concentrations for SA-SB titration. Acid-Base indicators, colour change range of an indicator, Indicator error. Determination of Acetic acid in vinegar. Determination of Alkalinity of soda ash.

UNIT - III
Redox Titration

Introduction, Terms involved: oxidation, reduction. Single electrode potential, formal potential, Nernst Equation, Titration curve for Iron(II) and cerium (IV). Types of redox indicators and their selection. Structural chemistry of redox indicators. Numericals: Calculation based on emf of electrode/cell, end point calculations, equation constants.

UNIT - IV

Complexometric Titration

Introduction, terms involved in titration: complex, ligand, buffer solution, chelating agents, chelates, Some Chelating agents, Stability of complexes: stepwise formation constants. Complexometric titration curve. Equilibria involved in EDTA titration, Indicators for EDTA titrations. Hardness of water. Ca in Calcium Gluconate Sample. Numericals based on this titration.

Basic Text & Reference Books:-

1. Fundamentals of Analytical Chemistry, 7th Edition by skoog, west, Holler
2.Quantitative Analysis 6th Edition - R.A. Day, Jr., A.L. Underwood.
3.Analytical Chemistry –Dr. Alka Gupta, Pragati Prakashan.

Course Credit Scheme

Semester-II

Course Type	Course code	Course Title	T/P	Credit	Exam duration in hrs	Component of Marks		
						Internal	External	Total
						Total/ Passing	Total/ Passing	Total/ Passing
Core Course	101450201	Organic Chemistry-II	T	4	3	30/10	70/28	100/40
	101450202	Modern Analytical Techniques	T	4	3	30/10	70/28	100/40
	101450203	Chemistry of Natural Product – II	T	4	3	30/10	70/28	100/40
	101450204	Lab–I(Sub-IOrganic Chemistry Sub II Modern Analytical Techniques)	P	4	3	30/10	70/28	100/40
	101450205	Lab-II (Sub IChemistry of Natural Product Sub II Chemistry of Biomolecules)	P	4	3	30/10	70/28	100/40
	101450206	Comprehensive Viva Voce	-	1			50/20	50/20
Elective Courses (any one)	101450207	Chemistry of Biomolecules	T	4	3	30/10	70/28	100/40
	101450208	Polymer technology	T	4	3	30/10	70/28	100/40
Total Credits				**25**				**650**

Course Wise Content Details for M.Sc. (Pharmaceutical Chemistry) Programme

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR
SEMESTER-II
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450201 : Organic Chemistry-II

Course Objectives:
The objectives of this course is to make students enable to apply previous knowledge of organic chemistry to understand the various chemical reactions. The course will enable students to understand clarity about three dimension arrangement of compounds and structural isomerism, Students should be understand the concept the various reactions intermediate and their stability, Students should be enable to syntheses compounds using new synthetic approach.

Course Learning Outcomes: After the successful completion of the course, students will be able,
1. To put emphasis on the concept of stereochemistry, structure arrangement of organic compounds.
2. To understand various type of reactive intermediate and their stability and synthetic route of common organic reactions.
3. To provide knowledge of various common catalysts and their application in chemical reaction.
4. To provide knowledge about new synthetic approach and fundamental principle of organic synthesis and its application in organic synthesis.

Contents:

UNIT -I : Stereochemistry:
Stereochemical nomenclature & terminology. General concepts on: Chirality, Molecular dissymmetry, Elements of symmetry (plane, centre and axis with relevant examples), optical activity and specific rotation, enantiomers distereomers, Sequence rule - Relative and absolute configuration (D, L and R, S nomenclature), Projection formulae (Fischer, Howarth, Newman and Sawhorse). Stereochemistry of compounds with one, two stereogenic centre, properties of stereoisomers. Stereochemistry of alkenes. Racemic modification – properties, methods and resolution.

UNIT -II : Reaction Mechanism
Carbonium ions, carbanions, their generation, stability and fate. Wagner-Meerwein rearrangement and related reactions, pinacol-pinacolone rearrangement, Benzil-benzilic acid rearrangement, Hofmann rearrangement, Curtius rearrangement, Schmidt reaction, Beckmann rearrangement, Lossen rearrangement, Claisen rearrangement, Fries rearrangement, Witting reaction.

UNIT -III : Reagents Used in Synthesis

Reagents, Type of reagents mechanism and utility of following Reagents**:** Oxidizing agents : peracids, H_2O_2/–OH, OsO_4. Reducing agents: $LiAlH_4$, $NaBH_4$, Lindlar's catalyst. Alkylating agent:1,3–Dithiane, Grignard reagent, Gilmann's Reagent.

UNIT- IV : Synthon Approach and its Application:

Synthon Approach: Introduction, General terminology, disconnection, synthon, functional group inter conversion (FGI). Basic rules in Disconnection. One and Two group disconnections. Application: Use of synthon approach in synthesis of compounds, Ibuprofen, Propanolol, Ciprofloxacin, Cimetidine.

Basic Text & Reference Books:

1. J. March, 2005, *Advanced Organic Chemistry – Reaction, Mechanism and Structure*, 4th edition, A Wiley-Interscience Publication, John Wiley & Sons, New York.
2. E.L. Eliel- *Stereochemistry of Carbon Compounds*, Tata McGraw-Hill Publishing Company Ltd, New Delhi
3. E.L. Eliel and S.H. Wilen, *Stereochemistry of Organic Compounds*, A Wiley-Interscience Publication, John Wiley & Sons, New York.
4. Thomas Laue and Andreas Plagens (Eds), 2005, *Named Organic Reaction*, 2nd Ed, John Wiley & Sons Ltd, England. 35.
5. P.S. Kalsi, 2006, *Stereochemistry, Conformation and Mechanism*, 6th edition, New Age International (P) Limited, Publishers, New Delhi.
6. D. Nasipuri, 2003, *Stereochemistry of Organic Compounds – Principles and Applications*, 2nd edition, New Age International (P) Limited, Publishers, New Delhi.
7. Laszlo Kurti & Barbara Czako, *Strategic application of named reaction in organic synthesis*, Elsevier Academic Press.
8. Peter Sykes, 1985, *A Guidebook to Mechanism in Organic Chemistry*, 6th edition, Longmann Scientific and Technical, Co-published with John Wiley & Sons, Inc, New York.
9. G.R. Stephenson, 1996, *Advanced Asymmetric Synthesis*, 1st edition, Blackie Academic and Professional, London
10. Stuart Warren Designing Organic syntheses, Introduction to synthon approach jone wiley & sons; New York Brisbane Toronto.

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SEMESTER-II
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450202 : Modern Analytical Technique

Course Objectives:
The objectives of this course are to make students understand about fundamentals of analytical chemistry and basic concept of chromatography. The course will enable to students usage of various chromatographic techniques for chemical analysis. This study will helpful to students to apply the knowledge in identification and separation of compounds.

Course Outcomes: After the successful completion of the course of the paper, students will learnt
1. To understand basic theory and principals of analytical separation techniques.
2. To develop understanding of various chromatographic methods based on the mechanism of separation.
3. To understand basic theory and principals and application of Gas, HPLC techniques.
4. To understand basic theory and principals of SFC and uses of electrophoresis.

Content:

UNIT- I : Analytical Separation & Solvent Extraction:
Introduction of various separation techniques, Separation by precipitation, distillation, solvent extraction, Electro deposition, Membrane separation, and miscellaneous methods.
Principles, Classification, Mechanism of Extraction, Factors favoring solvent extraction, Quantitative treatment of solvent Extraction, Advantages, Applications, Synergistic Extraction, Extraction Reagents.

UNIT-II : Introduction to chromatography and classification of chromatographic methods based on the mechanism of separation:
Column Chromatography: Adsorption and partition, theory, preparation, procedure and methods of detection. Thin Layer Chromatography: Theory, preparation, procedures, detection of compounds. Paper Chromatography: Theory, different techniques employed, filter papers used, qualitative and quantitative detection, Counter – current extraction, solid phase extraction techniques, gel filtration

UNIT- III : Gas chromatography:

Introduction, fundamentals, instrumentation, columns: preparation and operation, detection, dramatization. HPLC : Principles and instrumentation, solvents and columns used, detection and applications. HPTLC : Theory and principle, instrumentation, elution techniques and pharmaceutical applications.

UNIT- IV : Miscellaneous separation methods:

Supercritical Fluid Chromatography:

Properties of supercritical Fluids, Principles of Supercritical Fluid Chromatography, Supercritical Fluid & Extraction. Electrophoresis: Principles of Electrophoresis, Experimental assembly, Reverse Osmosis, Electrodialysis, Overview of Electrophoresis, Capillary Electrophoresis, Applications, Packed column Electro chromatography.

Basic Text & Reference Books:

1. Holler, Skoog, *Principals of Instrumental Analysis*, 6th Edition, Crouch, India edition Reprint: 2007.ISBN: 81-315-0329-1.
2. Douglas A. Skoog, F. James Holler, and Timothy A. Nieman; *Principles of Instrumental Analysis*, Publisher: Brooks Cole, ISBN: 981-243-869-6.
3. Willard, Merritt, Dean, Settle; *Instrumental Methods of Analysis*, CBS Publisher and Distributors, ISBN: 81-239-0943-8.
4. Skoog, West, Holler & Crouch, *Fundamentals of Analytical Chemistry*, Publisher: Brooks Col, ISBN : 981-243-513-1, (2006).
5. Douglas A. Skoog, Donald M. West, F. James Holler, *Fundamentals of Analytical Chemistry* (Dryden Press Series in Management) ISBN-13: 9780030749223 ISBN: 0030749220.

CHARUTAR VIDYAMANDAL UNIVERSITY
VALLABH VIDHANAGAR
SEMESTER-II
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450203: Chemistry Of Natural Product-II

Course Objectives: The main aim of the course, is to make students enable to know regarding occurrence, properties, classification and therapeutic uses of some alkaloids, steroids, polypeptides, proteins. Also gain knowledge regarding structure, structure modification and therapeutic uses of naturally occurring compounds as therapeutic agents.

Course Learning outcomes: After successfully completion of the course students will be able to

1. develop knowledge about functions and classification of alkaloids, steroids and their therapeutic applications.
2. knowledge about polypeptide synthesis, nomenclature and methods of degradation.
3. understanding regarding protein classification, structure of proteins, diabetes and insulin.
4. understand structure, structural modification, mechanism of action and therapeutic uses of naturally occurring compounds.

Contents:

UNIT-I : Alkaloids and steroids

Introduction, occurrence, properties and therapeutic uses of morphine, rauwolfia and vinca. Introduction, sources, properties, classification, method of isolation and therapeutic uses of diosgenin Allium sativum. Introduction, origin and types, cultivation, properties and medicinal uses.

UNIT-II : Amino acid and Protiens

Introduction, definition ,classification, isolation, general properties and pharmaceutical importance of amino acids and their relationship to proteins and polypeptides. Chemistry of protein hormons : Insulin, oxytocin, thyroxin and anti thyroid drugs.

UNIT-III : Flavonoids and Terpinoids

Flavonoids : Sources, uses, chemistry and General methods of structural determination (chemical & spectral analysis) of Amygdalin, arbutin and quercetin. Terpenoids: Definition and Classification: Isoprene rule, Special Isoprene rule for terpenes, General methods of isolation. Chemistry and structure elucidation of citral, menthol and camphor.

UNIT-IV : Compounds of medicinal Interest

Structure, structural modifications, mechanism of action and therapeutic uses of: a) taxanes, b) camptothecin, c) artemisinin, e) ginkgolides and, f) gymnemi cacids.

Basic Text & Reference Books:

1. Agrawal O. P. Organic chemistry-natural products. 30th ed. vol 1-2. Meerut: Goel Publishing House; 2006.
2. Finar IL. Organic Chemistry-stereochemistry and the chemistry of natural products. 5th ed. vol Delhi: Dorling Kindersley (India) Pvt. Ltd., 2006.
3. Morrison RT, Boyd RN. Organic Chemistry. 6th ed. Delhi: Pearson education Pvt. Ltd., 2003.
4. Pelletier SW. Alkaloids-chemical & biological perspectives. vol 1-15. London: Pergamon; 2001.
5. Evans WC. Trease and evanspharmacognosy. 15th Ed. Edinburgh: Saunders. 2004.
6. Ataur Rahman, Chemistry of natural products.
7. Bhat S. V., Nagasampagi B A, Sivakumar M., Chemistry of Natural Products. New Delhi: Narosa Publishing House; 2005

CHARUTAR VIDYAMANDAL UNIVERSITY
VALLABH VIDHANAGAR
SEMESTER-II
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450204: Lab-I

Course Objectives :
The objectives of this course are to make students understand differences between qualitative and quantitative analysis and to developed the skill of separation and identification of organic compounds. Students will able to understand mechanism of organic reaction and will give hands on practice of chemical analysis.

C**ourse learning Outcomes**: After the successful completion of the course of the paper, student will learnt :
1. Identification and separation of organic compounds.
2. To understand various chemical reaction involved in Identification of organic compounds
3. To develop the synthetic skill of organic compounds.

Practical's-I:

Group – A:
I - Qualitative analysis of Solid Organic Mixture (Ternary)

Group – B:
Organic Preparations viz:
Dibenzalacetone, paranitro-acetanilide, methyl salicylate, 4-acetamido-3-bromo-toluene, paramethoxy-acetanilide, Eosin, Hydantoin

Basic Text & Reference Books:
1. Vogel's, Longman; *Organic Qualitative analysis,* ISBN-13: 9780582442504; ISBN: 0582442508.
2. Vogel's, Longman; *A Text book of Practical Organic Chemistry,* ISBN-13: 9780582442504; ISBN: 0582442508.

3. Vogel's, *Elementary Practical Organic Chemistry,* Part I, II, & III (ELBS); ISBN: 81-239-1033-9.
4. Mann and Saunders; *Practical Organic Chemistry,* Orient Logmann Publisher; OLBN: 0-00209- 058-9.
5. V. K. Ahuluwalia, *Comprehensive Practical Organic Chemistry*: *Volume – I & II,* Universities Press (India) Pvt. Ltd; ISBN-13: 9788173712739; ISBN: 8173712735.

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SEMESTER-II
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450205: Lab-II

Course Objectives :
The objectives of this course is to make students understand about differences between qualitative and quantitative analysis. The course enable students to developed the skill of identification of biomolecules. Students shouldl able to create understanding of pathway and functions of reagents for organic reaction and will develop the synthetic skill, work up procedure of organic compounds.

Course learning Outcomes: After the successful completion of the course of the paper, student will learnt :
1. Identification of biomolecules.
2. To understand various chemical reaction involved in Identification of biomolecules.
3. To develop the synthetic skill of organic compounds.

Practical's:

I. Group – A: Qualitative analysis of Biomolecule,
- Identification of Biomolecule – Carbohydrate, Protein and Lipid.
- Qualitative analysis of unknown biomolecule (viz. Glucose, Fructose, Lactose, Maltose,
- Sucrose, Starch, Protein, Lipid.
- Perform colour reaction of proteins.

II. Group – B:
To carry out the synthesis of heterocylic compounds (3 - 4 steps) (viz. Flavones,

Quinolines, Quniazolines, Coumarins, Thiadiazoles, Oxadiazoles, Triazoles etc)

Basic Text & Reference Books:

1. Vogel's, Longman; *Organic Qualitative analysis,* ISBN-13: 9780582442504; ISBN: 0582442508.
2. Vogel's, Longman; *A Text book of Practical Organic Chemistry,* ISBN-13: 9780582442504; ISBN: 0582442508.
3. Vogel's, *Elementary Practical Organic Chemistry,* Part I, II, & III (ELBS); ISBN: 81- 239-1033-9.
4. Mann and Saunders; *Practical Organic Chemistry,* Orient Logmann Publisher; OLBN: 0-00209- 058-9.
5. V. K. Ahuluwalia, *Comprehensive Practical Organic Chemistry*: *Volume – I & II,* Universities Press (India) Pvt. Ltd; ISBN-13: 9788173712739; ISBN: 8173712735.

CHARUTAR VIDYAMANDAL UNIVERSITY
VALLABH VIDHANAGAR
SEMESTER-II
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450207:Chemistry of Biomolecules

Course Objectives:

The major objective of this paper is to develop clear understanding of various aspects of biochemistry which includes structure, sources and properties of biomolecules. This course content enables students to better understand fundamentals and basic structure of biomolecules and its importance in cellular metabolism.

Course Learning Outcomes: After the successful completion of the course of the paper, student will learnt :

1: To learnt carbohydrates, their types and properties.

2: Develop knowledge of lipid, types structure properties and uses.

3: Understands types of amino acids and their properties. Moreover, students will gathered understanding of Classification of amino acid. Protein structure and functions

4: The students will be nucleic acids and composition. Moreover, gain in depth knowledge of structure and function of nucleic acids.

Contents:

UNIT-I : Carbohydrate:
Structure of monosaccharides. Stereoisomerism and optical isomerism of sugars. Reaction of aldehyde and ketone groups. Ring structure and anomeric forms, mutarotation. Reactions of sugar due to hydroxyl groups. Important derivatives of monosaccharides, disaccharides and trisaccharides (structure, occurrence and functions of important ones). Structure, occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides e.g. Cellulose, chitin, agar, algenic acids, pectins, proteoglycans, sialic acids, blood group polysaccharides, glycogen and starch. Bacterial cell wall polysaccharide, Glycoproteins.

UNIT- II: Lipids
Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, prostaglandins. Triacylglycerols: nomenclature, physical properties, chemical properties and characterization of fats - hydrolysis, saponification value, rancidity of fats, Reichert-Meissel number and reaction of glycerol. Biological significance of fats. Glycerophospholipids (lecithins, Iysolecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, plasmalogens), sphingomyelins, glycolipids - cerebrosides, gangliosides. Properties and functions of phospholipids, isoprenoids and sterols.

UNIT- III : **Protein**s
Introduction, classification based on solubility, shape, composition and functions. Amino acids: common structural features, stereo-isomerism and RS system of designating optical isomers, classification and structures of standard amino acids as zwitter ion in aqueous solutions, physical and chemical properties, Essential amino acids. Peptides: structure of peptide bond, chemical synthesis of polypeptide, formation of peptide bonds, determination of the amino acid sequence of a polypeptide chain, Protein structure: levels of structure in protein architecture, primary structure of proteins, secondary structure of proteins - helix and pleated sheets, tertiary structure of proteins, and quaternary structure of proteins. Denaturation and renaturation of proteins. Structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (hemoglobin, myoglobin), lipoproteins, metalloproteins, glycoproteins and nucleoproteins.

UNIT-IV: Nucleic acids
Nature of genetic material; evidence that DNA is the genetic material, Composition of RNA and DNA, generalized structural plan of nucleic acids, nomenclature used in writing structure of nucleic acids, features of DNA double helix. Denaturation and annealing of DNA, structure and roles of different types of RNA. Size of DNA in procaryotic and eucaryotic cells, central dogma of molecular biology, Gene, genome, chromosome.

Basic Text & Reference Books:

1. David L. Nelson, Michael M. Cox Lehninger's, *Principles of Biochemistry Fourth Edition.*
2. C.C.Chatterjee, *Human Physiology*, (Vol: I & II); Medical Allied Agency, Kolkatta.
3. Tortora Derrickson, *Principles of Anatomy and Physiology*; Publsiher: Wiley International; ISBN- 13:978-0-471-68934-3
4. Trease and Evans, *Pharmacognosy* ; Publisher: Saunder (Elsevier); ISBN-13: 978-81- 312-0087-2; ISBN-10: 81-312-0087-6.
5. T. E. Wallis, *Pharmacognosy* ; CBS Publisher (New Delhi); ISBN:81-239-0886-5.

CHARUTAR VIDYAMANDAL UNIVERSITY
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SEMESTER-II
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

101450208: Polymer Technology

Course Objectives:
The major objective of this paper is to develop clear understanding of various aspects of polymer chemistry which includes structure, sources and properties and industrial applications of polymers. This course content enables students to better understand fundamentals and basic structure of polymers used for materials and its importance in pharmaceuticals.

Course Learning Outcomes: After the successful completion of the course of the paper, student will learnt:
1. To learnt polymers and cherecteristic properties of polymer.
2. Develop knowledge of speciality polymers and their properties and cherecterization methods.
3. Understands various type of commercial polymers synthesis and applications.
4. To develop the knowledge of polymers used in different fields.

Contents:

UNIT- I : Introduction:

Characteristics of polymers, States of orders in polymers, Macromolecules in solution, molten

state, electrometric state, glassy (amorphous) state and crystalline state. Correlation of structure and morphology with properties of polymers.

UNIT- II : **Industrial polymers**
Addition & Condensation polymers: Polyolefines and olefin copolymers, Acrylics and Vinyl polymers, Polyesters, Polyamides, Polycarbonates and Cellulosic polymers.

UNIT- III : **Speciality Polymers and its Characterization:**
Heat and fire resistance polymers, Liquid crystal polymers, Electroactive, Optical information polymers, degradable polymers, Polymers supporting in organic synthesis, Polymer supported catalysts. Characterization: Molecular weight determination, glass transition (Tg) determination, XRD, SEM, TEM.

UNIT-IV : Trends in polymer application:
Polymers in packaging, Automative, Aerospace, Electricals and Electronics, Medical and Biomedical, Sport, Marine, Agriculture, Domestic and Business appliances, Building and construction.

Basic Text & Reference Books:

1. Gowarikar, *Polymer Science*, 17th reprint.
2. Bill Mayer, *Polymer Chemistry*, McGraw Hill 3rd edition.
3. K. Gunther, Hanser, *Characterization of Plastics by physical methods*, pub. 1st edition.
4. J. Bridson, *Plastic Materials*, Bh pub, 6th edition.
5. Manaschanda & SK Roy, *Plastics Technology Hand Book*, Marcel Dekker Inc. 3rd edition.
6. D. Brown, *Polymer Synthesis, Theory and Practice*, Springer Pub. 4th edition.
7. RJ Crawford, *Plastic Engg*. BH Pub, 3rd edition. R.W. Dyson.
8. *Speciality Polymers*, Chapman & hall Publications

CVM UNIVERSITY

MASTER OF SCIENCE

(Pharmaceutical Chemistry)

PROGRAMME

Under Choice Based Credit Scheme

Structure with Effect from: 2020-21

M.Sc. Pharmaceutical Chemistry Program Details

Programme Objectives (POs):

At the end of the program, post graduates will developed the extensive knowledge of Pharmaceutical Chemistry. The program aims to develop interdisciplinary knowledge of Chemistry, Biology and Pharmacy among the students and to equip the students with excellence in the field of Pharmaceutical chemistry and to development the skills, thus enabling the student to pursue a career in Pharmaceutical Industry/Research Institute. Development through skill based, multi-dimensional education will provides self-confidence and self-reliance in the student. The student will be instilled with values of professional ethics and be made ready to contribute to society as responsible individuals.

Programme Specific Outcomes (PSOs):

At the end of the two-year program the student will understand and be able to explain different aspects of Pharmaceutical Chemistry. The student will be able to describe different techniques of organic synthesis, reaction mechanisms, and their application to process chemistry, method development and drug discovery. Designing new techniques of organic synthesis using green chemistry approach, retro synthesis and will be able to formulate new drug formulations and will be able to explain about mode of action of various classes of drugs. He/she will be able to Design and implement research projects independently. They will be able to execute a short research project incorporating techniques of synthetic, characterization, identification and analysis of pharmaceuticals entity. The student will be equipped to take up a suitable position in academia or Industry, and to pursue a career in research if so desired.

Program Structure:

The M.Sc. Pharmaceutical Chemistry program is a two-year course divided into four-semesters. A student is required to complete hundred credits for the completion of course and for the award of degree. A student has to accumulate twenty-five credits in each of the four semesters.

PART ONE	FIRST YEAR	SEMESTER I	SEMESTER II
PART TWO	SECOND YEAR	SEMESTER III	SEMESTER IV

Course Credit Scheme

Semester- III

Course Type	Course code	Course Title	T/P	Credit	Exam duration in hrs	Component of Marks		
						Internal	External	Total
						Total/ Passing	Total/ Passing	Total/ Passing
Core Course	101450301	Drug Design and Development	T	4	3	40/16	60/24	100/40
	101450302	Medicinal Chemistry	T	4	3	40/16	60/24	100/40
	101450303	Spectroscopic techniques for Quality Control	T	4	3	40/16	60/24	100/40
	101450304	Lab I (Practical's based on 101450301 & 101450302	P	4	6	40/16	60/24	100/40
	101450305	Lab II (Practical's based on 101450303 & 101450307)	P	4	6	40/16	60/24	100/40
	101450306	Comprehensive Viva Voce	-	1			50/20	50/20
Elective Courses (any One)	101450307	General Pharmacology	T	4	3	40/16	60/24	100/40
	101450308	Mechanical Operation	T	4	3	40/16	60/24	100/40
Total Credits				**25**				**650**

Course Wise Content Details for M.Sc. (Pharmaceutical Chemistry) Program

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER-III

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450301: Drug Design and Development

Course Objectives:

Objectives of the course are to get knowledge regarding preclinical and clinical trials of drug design and development. Students get the information regarding steps and approaches for drug design and development. Also, effects and role of enzymes in the drug target can be understood. Structure activity relationship awareness is also developed.

Course Learning Outcomes:

1. To understand drug design – optimization and access to drug target.
2. To get knowledge regarding drug target, receptor site and role of enzyme as catalyst.
3. To get information regarding development of lead molecules.
4. To provide knowledge of 2D and 3D QSAR.

Contents:

UNIT -I

Drug design – optimizing access to the target: Improve absorption, making drugs more resistant to chemical and enzymatic degradation, making drugs less resistant to drug metabolism, Targeting drugs, Reducing toxicity, and Pro-drug, Endogenous compounds as a drug.

Protein as – drug target:

Protein – drug interaction (viz. Inter-molecular bonding forces), Drug action at protein, Peptide or protein as drugs.

UNIT – II

Enzymes & Receptor as drug target:

Enzymes as drug target: Enzymes as catalyst, The active sites of enzymes, Substrate binding at active sites, Enzymes inhibitors: Mechanism based enzyme in activators, examples.

Receptor as – drug target: Introduction to receptor & receptors role.

UNIT - III

Drug Discovery: Introduction, Irrational approach, Rational approach, Antisense approach.

Principles of Drug design Finding a lead drug design – optimizing target interaction, Identify structure – activity relationship (SARs), Binding role of various functional groups, Identify the pharmacophore, Strategies in drug design, Computer aided drug design.

UNIT – IV

Quantitative Structure Activity Relationship (QSAR) & Drug Development: Introduction, Graphs and Equation, Physicochemical properties like Hydrophobicity, Electronic effects, stearic effects. Hansch equation, Craig plot, Topliss scheme, Bioisoteres, Planning QSAR studies,

3D – QSAR: Introduction, Definition of steric and electrostatic fields, Relating shape and electronic distribution with biological activity, Hydrophobic potential, Advantages of 3D – QSAR over 2D – QSAR, Case study.

Drug Development: Preclinical and clinical study, Patenting and regulatory affairs, Chemical and process development, Design a manufacturing process, Register and market the drug.

Basic Text & Reference Books:

1. G. L. Patrick, *An Introduction to Medicinal Chemistry; 3rd Ed.*, Oxford University Press, ISBN 978-0-19-568508-4 (2006).

2. David A. Williams, ThomasL. Lemke, Lippincott Williams & Wilkins, *Foye's Principles of Medicinal Chemistry, 5th Edition*, publisher- Walter Kluwer business, ISBN: 978-81-89836- 02-3 (2007).
3. John H. Block, John M. Beale, Jr., Lippincott Williams & Wilkins *Wilson and Gisvold's, Textbook of Organic Medicinal and Pharmaceutical Chemistry, 11th Edition*, ISBN– 0-7817-3481-9 (2004).
4. T. Nogradyedey, *Medicinal Chemistry –A biochemical Approach*, 3rd Edition, Oxford University Press, New York, Oxford, ISBN: 978-0-19-568213-7-4 (2005).
5. Richard B. Silverman, *The Organic Chemistry of Drug Design and Drug Action*; 2nd Edition, Academic Press, ISBN: 978-81-8147-450-6 (2010).

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER-III

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450302: Medicinal Chemistry

Course Objectives:

The objectives of this course is to make students enable to understand medicinal Chemistry to understand the synthesis mode of action of chemical compounds and their usage as drug. The course will enable students to understand the difference in chemical compounds and drugs, Students shall understand the concept of the various chemotherapeutic agents and their Structure activity relationship.

Course Learning Outcomes:

1. To provide knowledge about different classes of drug and their uses.
2. To understand the characterization, symptoms sources and treatment of various classes of drugs.
3. To emphasize the importance of SAR study of drugs.
4. To describe typical therapeutic classes of drug and their synthesis methods.

Contents:

UNIT -I

Antibacterial agents and Antibiotics: Introduction, General introduction to bacteria and bacterial cell wall, antibiotics, microbial resistance, classification of antibiotics, structure activity relationship, mode of action, adverse effect of following class of antibiotics: β– lactam

anitibiotics, Cephalosporins, Aminoglycoside antibiotics, Tetracycline antibiotics, Macrolide antibiotics, Polypeptide antibiotics, Unclassified antibiotics.

Synthesis: Methicillin, Oxacillin, Cloxacillin, Dicloxacillin, Ampicillin, Amoxycillin, Carbenicillin, Cephalexin, chloramphenicol, Cycloserine, Trimethoprim, etc.

UNIT –II

Sulphonamides and Antineoplastic Agents:

Sulphonamides: Introduction, Nomenclature, classification, mode of action, adverse effects. Synthesis: Sulphanilamide, Sulphathiazole, Sulphadiazine, Sulphamethoxazole, Nitrofurazone etc.

Antineoplastic Agents (Cancer Therapy): Introduction to cancer, Types, Causes & Treatment of cancer, Cell cycle kinetics – cancerous cell, Classification of antineoplastic agent, mode of action, structure activity relationship and adverse effect. Synthesis of Mechloromethamine hydrochloride, Melphalan, 6-mercaptopurine, Methotrexate, Chlorambucil, Cyclophosphamide, Thiotepa.

UNIT –III

Anti – mycobacterial and Antimalarial agents:

Anti – mycobacterial agents: Introduction, classification, Treatment, Mode of action, adverse effect of Anti–TB agents & Anti–leprotic agents, MDR TB & XDR TB. Synthesis : Isoniazid, para-aminosalicylic acid, pyrazinamide, ethambutol, Ethionamide, Prothionamide, Dapsone etc.

Antimalarial agents: Introduction, Life cycle of plasmodium, Antimalarial Agents for Chemotherapy and Prophylaxis: Classification, SAR and mode of action of Anti – malarial drugs. Synthesis of Mefloquine, Chloroquine, Primaquine, Quinacrine, Amodiaquine, pyrimethamine etc.

UNIT –IV

Antifungal agents, Antiviral agents:

Anti Viral : General Introduction, Types of viruses, Classification of antiviral agents, mechanism of action, Antiviral Compounds for DNA Viruses & Selected RNA Virus Infections other than HIV (viz. for Influenza A and B Viruses, Hepatitis C Virus).

Anti fungal : Introduction to Fungal Diseases and Pathogens,

Antifungal Chemical Classes, Synthesis of Ketoconazole, Nystatin etc.

Basic Text & Reference Books:

1. S. Alagarsamy, Text book of Medicinal Chemistry, Vol – I/II, Elsevier, Rajkamal Electric Press, Kundli, Haryana, ISBN – 978 – 81- 312 – 2189 – 1 (2010).
2. Ashutosh Kar, Medicinal Chemistry, 4th Edition, New age international publisher, ISBN – 81- 224-1970- 4 (2007).
3. David A. Williams, Thomas L. Lemke, Lippincott Williams & Wilkins, *Foye's Principles of Medicinal Chemistry, 5th Edition,* publisher- Walter Kluwer business, ISBN–: 978-81-89836- 02-3 (2007).
4. John H. Block, John M. Beale, Jr., Lippincott Williams & Wilkins *Wilson and Gisvold's, Textbook of Organic Medicinal and Pharmaceutical Chemistry, 11th Edition,* ISBN– 0-7817-3481-9 (2004).
5. Dr. S. S. Kadam, Dr. K. R. Mahadik, Dr. K. G. Bothara, Principles of Medicinal Chemistry, Volume – I & II, 19th Edition, Nirali Prakashan, ISBN : 978-81-85790-04-6 (2010).
6. Harkishan Singh, V. K. Kapoor, Medicinal and Pharmaceutical chemistry, 2nd Edition, Vallabh Prakashan, ISBN – 81-85731-00-4, (2007).
7. Donald J. Abraham, Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th Edition, A John Wiley and Sons, Inc., Publication, ISBN 0-471-27090- 3 (2007).

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER- III

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450303: Spectroscopic techniques for Quality Control

Course Objectives:

Students get awareness regarding modern instrumental analysis techniques for quality control. Through these course students gets knowledge regarding principles, instrumentation and application of UV-Vis, IR, NMR, Mass and thermal analytical techniques.

Course Learning Outcomes:

1. To understand concept, application and interpretation of UV- Vis spectroscopy.
2. To get knowledge regarding sample preparation and interpretation of IR spectroscopy.
3. To aware chemical shift, shielding effects, instrumentation of NMR spectroscopy.
4. To understand the importance of mass spectra in structure determination and get knowledge regarding thermal methods.

Contents:

UNIT -I

UV-Visible Spectroscopy:

Basic principles, Instrumentation, Electronic transitions, Concept of chromophore and auxochrome, Effect of conjugation, solvent and pH, Instrumentation, Multicomponent analysis, Woodward-Fieser rules for calculating absorption maximum for unsaturated hydrocarbons, Difference and derivative spectra, Interpretation of spectra, Qualitative and quantitative analysis of drug molecules.

UNIT – II

Infra-Red Spectroscopy:

Basic principles. Interaction of infrared radiation with organic molecules and its effect on bonds. Instrumentation-Dispersive IR and FT-IR spectrophotometers. Sample preparation & Sample handling in IR spectroscopy, Interpretation of IR spectra. Fermi resonance, Brief note on Attenuated, Total Reflectance. Qualitative and quantitative applications of IR.

UNIT – III

Nuclear Magnetic Resonance Spectroscopy:

Fundamental principles of NMR, Instrumentation, Chemical shift concept, spin-spin coupling and decoupling, shielding and deshielding, solvents, Pascal triangle, signal multiplicity in PMR, Spin-spin and spin-lattice relaxation, Nuclear overhauser effect, Interpretation of PMR, ^{13}C NMR.

UNIT - IV

Mass Spectrometry:

Basic principles and instrumentation. Ionization techniques, mass spectrum and its characteristics, molecular ion, metastable ions, fragment ions; fragmentation processes, fragmentation patterns and fragment characteristics in relation to parent structure and functional groups. Relative abundances of isotopes and their contribution to characteristic peaks.

Thermal Methods:

Thermogravimetric analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC).

Basic Text & Reference Books:

1. Robert M Silverstein, *Spectrometric Identification of Organic compounds* – 6th Edition, Wiley India, ISBN : 978-81-265-0972-0 (2010).
2. Doglas A Skoog, F. James Holler, Timothy A. Nieman, *Principles of Instrumental Analysis - 5th Edition*, Harcourt Brace College Publishers, ISBN : 9780030020780 (1998).
3. Willards, *Instrumental methods of analysis–7th Edition*, CBS publishers, ISBN : 9788123909431 (2004).
4. Beckett and Stenlake, *Practical Pharmaceutical Chemistry– Vol II, 4th Edition*, CBS Publishers, New Delhi, ISBN : 81-239-0514-9 (2005).
5. William Kemp, *Organic Spectroscopy*, 3rd Edition, Palgrave Macmillan, ISBN : 978-0333519530 (1991).
6. P. D. Sethi, *Quantitative Analysis of Drugs in Pharmaceutical formulation - 3rd Edition*, CBS Publishers, New Delhi, ISBN : 81-239-0560-2 (2005).

7. J. W. Munson, *Pharmaceutical Analysis- Modern methods – Part B - Volume 11*, Marcel Dekker Series, ISBN : 978-0824772512 (1984).

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER- III

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450304: Lab-I

Course Objectives:

The main objective of paper is to make students enable to understand qualitative and quantitative analysis methods and develop the skill of separation and identification of inorganic and organic compounds and observe the differences. Students will understand qualitative and quantitative analysis methods and develop the skill of separation and identification of compounds and observe the differences.

Course learning Outcome: After the successful completion of the course students will be able :

To understand various analytical methods used in chemical analysis

To understand various chemical reactions involved in Identification of organic compounds.

To develop the skill of separation and identification of inorganic and organic compounds

Contents

Exercise –I

Effect of pH and solvent on UV Spectrum of certain drugs.

Water analysis (COD, Total Hardness CD). Determination of pK value.

Exercise –II

Preparation and evaluation of different Pharmaceutical dosage forms (Tablet, Capsule & Parenteral viz.): Introduction & operations of various tablet machines. Preparation and evaluation of paracetamol, calcium lactate, ferrous sulphate.

Basic text and Reference Books :

1. Mendham J., Denney R. C., Barnes J. D., Thomas M. J. K., *Vogel's textbook of quantitative chemical analysis*, 6th Edition, ISBN: 0582226287 (2000).
2. Pandey, O. P., Bajpai, D. N., Giri, S., *Practical Chemistry*, 1st Edition, S. Chand & Company Pvt. Ltd. ISBN : 9788121908122 (2016).
3. Ghoshal, Mahapatra, Nad, *An Advanced course in Practical Chemistry*, 3rd Edition, New Central Book Agency, ISBN : 978-8173813023 (2011).
4. A. I. Vogel, A Text Book of Quantitative Inorganic analysis, 5th Edition Longman, ISBN : 0-582-44693-7 (1989).

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER- III

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450305: Lab-II

Course Objectives:

The main objective of the paper is to make students understand physical properties and qualitative and quantitative analysis methods of compounds. Students should develop the skill of identification of API and pharmaceutical formulations and observe the differences among different class of compounds.

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

1. Understanding various physical methods used in chemical analysis.
2. To understand various physical properties involved in identification of compounds.
3. To develop the skill for operation of tablet testing instruments.

Contents

Exercise – I

Estimation and analysis of various commercial drugs and drug intermediates,

Using conventional and instrumental techniques viz: Aspirin, Analgin, Isoniazid, Iron tablet, Anta acid, Sulpha drug.

Exercise – II

Prepare and supply of ascorbic acid injection, calcium gluconate injections, Preparation of cetrimide cream.

Determination of tapped and bulk densities of granules, Carr's Index, Hausner ratio, Angle of repose

Various testing of commercial tablets viz. disintegration time, hardness, friability etc.

Tablet dissolution study (paracetamol, aspirin etc.).

Basic Text and Reference Books :

1. Longman; Textbook of practical organic chemistry including *Organic Qualitative analysis by Vogel's*, ISBN: 9780582442504, (1978).
2. Longman; *A Text book of Practical Organic Chemistry by Vogel's*, 5th Edition, ISBN: 0-582-46236-3 (1989).
3. Longman; *Elementary Practical Organic Chemistry by Vogel's*, Part-I, II, & III (ELBS), 2nd edition; ISBN: 81-239-1033-9 (2002).
4. Mann and Saunders; *Practical Organic Chemistry*,4th Edition, Orient Logmann Publisher; ISBN – 81-250-1380-6 (2003).
5. V. K. Ahuluwalia, *Comprehensive Practical Organic Chemistry: Volume–I & II;* Universities Press (India) Pvt. Ltd; ISBN: 8173712735 (2008).

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER- III

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450307: General Pharmacology

Course Objectives:

The main objective of the course is to have knowledge of pharmacokinetic and pharmacodynamics, its importance and role in drug design and development. Through this course students is aware regarding various terminology used in pharmacology. To have knowledge regarding clinical pharmacology, factors modifying the drug action.

Course learning Outcome:

After the successful completion of the course, students will be aware of :

1. Phamacology and its general terminology
2. To understand pharmacokinetic effect
3. To have knowledge of pharmacodynamics
4. To get information of clinical pharmacology and adverse drug effect

Contents

UNIT -I

General terminology and scope Pharmacology: Clinical pharmacy, Clinical Pharmacology, Pharmacokinetics, Pharmacodynamics, Pharmacoepidemiology, Pharmacoeconomics, Pharmacogenomics, Therapeutics, Toxicology, Chemotherapy.

Nature and source of drugs, Drug nomenclature, Routes of drug administration.

UNIT -II

Pharmacokinetics: Biological membrane, mechanism of drug transportation, Absorption, Factors affecting absorption, Distribution, volume of distribution, Redistribution, Penetration into brain, passage across placenta, plasma protein binding, tissue storage, Metabolism/biotransformation, Phase-I and Phase-II reactions, microsomal enzymes and their induction, Excretion, mechanism of renal excretion, enterohepatic circulation. Area under curve (for single dose and repeated dose),

Bioavailability and bioequivalence, Plasma half-life and Clearance, Loading dose and maintenance dose, Therapeutic drug monitoring (TDM) and its significance.

UNIT - III

Pharmacodynamics: Principle of drug action, Target of drug action– receptors, ion channels, enzymes, transport proteins, Introduction to various types of receptor- ligand gated ion channel, G-protein coupled receptor, kinase linked receptor, nuclear receptor.

Introduction to various types of ion channels- open channels and gated channels, Dose response relationship, Agonist and antagonist, Combined effects of drugs (potentiation, addition, synergism and antagonism), Drug antagonism.

UNIT -IV

Clinical Pharmacology and adverse drug effects Drug dosage, Fixed dose ratio combination preparations, Factors Modifying Drug Action, Placebo, Tolerance, Cross Tolerance, Rational use of Medicines, Expiry date of Pharmaceuticals, Evidence Based Medicine, Meta-Analysis. Adverse Drug Effects: Introduction, Predictable (Type A Or Augmented) reaction, Unpredictable (Type B Or Bizarre) reactions, Pharmacovigilance, Prevention of Adverse Effects of Drugs, Adverse Drug Effects Categorization.

Basic Text and Reference Books:

1. K. D. Tripathi; *Essentials of Medical Pharmacology*, 5th Edition, Jaypee Brothers, ISBN : 81-80-61-187-6 (2005).
2. Roger Walker and Cate Whittlesea; *Clinical pharmacy and therapeutics*, 5th Edition, Churchill Livingstone, ISBN : 978-0702042935 (2011).
3. Satoskar, R. S. and Bhadarkar, S. D.; *Pharmacology and pharmacotherapeutics*, 12th Edition, Popular prakashan, ISBN : 978-81-1-991-385-7 (2007).
4. Rang, H. P. & Dale, M. M.; *Pharmacology*, 6th Edition, Elsevier, ISBN : 9780443069116 (2007).
5. Goodman & Gilman, Laurence L. Brunton; *The pharmacological Basis of therapeutics*, 12th Edition, ISBN : 978-0-07-176939-6 (2011).
6. Katzung, B. G. *Basic and Clinical Pharmacology*, 11th Edition, Tata McGrow hill, ISBN : 978-0-07-067725-8 (2010).

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER- III

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450308: Mechanical Operation

Course Objectives: The main objective of the paper is to make students aware regarding various classes of operation techniques as mixing, agitation, separation techniques, Settling and Fluidization etc.

Course learning Outcome: After completion of paper students will be able :

1. To understand basic principles of mechanical operations.
2. To understand various methods used for mixing and separations.
3. To understand basic theory and principals of different techniques.
4. To understand processes like settling mixing agitation etc.

Contents

UNIT - I

Size Reductions & Separation: Size reductions. Type of Crushers, Grinder and Disintegrators for coarse, intermediate and fine grinding, Power requirements, close and open circuit grindings, Laws of Crushing.

Introduction to size enlargement and agglomeration.

Size separation: Particle size analysis, Screening, Industrial screening, Equipments, Elutriation. Settling, Classification, Floatation, Electrostatic and Magnetic separation, Centrifugal separation.

UNIT – II

Mixing, Agitation and Conveying: Mixing and Agitation: Fundamentals of Mixing, Characteristics of Mixing equipments, Power consumption and equipments.

Conveying: Introduction, Type, Mechanical and pneumatic conveying, elevators, storage of solids.

UNIT – III

Settling and Fluidization:

Settling and sedimentation: Free and hindered settling, Type of thickness –Batch and Continuous, Settling Chambers, Cyclones and their design, ducts and fumes, flow of solids through fluids, settling velocities, stoke's law, terminal velocity Fluidization: Aggregate and particulate fluidization, incipient fluidization velocity, expansion of fluidized beds.

UNIT – IV

Drying and Evaporation:

Drying: Introduction, Objective of Drying, Definitions, Equilibrium moisture content, Type of Moisture, Mechanism of drying, rate of drying, drying curves, Driers, Type of driers, Tray drier, Truck drier, Tunnel drier, Rotary drier, Spray drier, Freeze drier, Radiation drying– Microwave drier, driers for solutions and suspensions – drum drier.

Evaporation : Introduction, General principles of Evaporation, factors effecting evaporation -time, temperature, moisture, type of product and concentration. Evaporators, Type of Evaporators – Pan Evaporators, Evaporating stills, short tube evaporators, forced circulation evaporators, film evaporators, long tube/ climbing film evaporators, falling film evaporator, wiped film evaporators, multiple effect evaporator.

Basic Text & Reference Books:-

1. W. L. McCabeand, J. C. Smith; *Unit Operations in Chemical Engineering*, 5th Edition, McGraw Hill and Kogakusha, ISBN : 0-07-044844-2 (1993).
2. K. Sambamurthy, *Pharmaceutical Engineering*, 1st Edition, New Age International, ISBN : 9788122411690 (2007).
3. S. J. Carter; *Cooper and Gunn's Tutorial Pharmacy*, 12th Edition, CBS Publishers, ISBN : 978-8123909028 (2008).
4. J. M. Caoulson and J. F. Richardson. *Chemical Engineering, Vol – I and II*, 5th Edition, Butterworth-Heinemann. ISBN : 0 7506 4445 1 (2002).
5. Perry and Chilton, *Chemical Engineer's Handbook*, 2nd Edition, McGraw Hill, ISBN : 978-0071154482 (1997).

Course Credit Scheme

Semester-IV

Course Type	Course code	Course Title	T/P	Credit	Exam duration in hrs	Component of Marks		
						Internal	External	Total
						Total/ Passing	Total/ Passing	Total/ Passing
Core Course	101450401	Dissertation	T	25	-	200/80	450/180	650/260
		OR						
	101450402	Novel Drug Delivery system	T	4	3	40/16	60/24	100/40
	101450403	Pharmaceutical Formulation Development	T	4	3	40/16	60/24	100/40
	101450404	Validation and cGMP	T	4	3	40/16	60/24	100/40
	101450405	Lab I (Practical's based on (101450402 & 101450403)	P	4	6	40/16	60/24	100/40
	101450406	Lab II (Practical's based on 101450404 & 101450408)	P	4	6	40/16	60/24	100/40
Elective Courses (any one)	101450407	Comprehensive Viva Voce	T	1	--	--	50/20	50/20
	101450408	Advance Pharmaceutical Chemistry	T	4	3	40/16	60/24	100/40
	101450409	Quality Assurance of Pharmaceuticals	T	4	3	40/16	60/24	100/40
Total Credits				**25**				**650**

Course Wise Content Details for M.Sc. (Pharmaceutical Chemistry) Programme

CHARUTAR VIDYAMANDAL UNIVERSITY

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SEMESTER-IV

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450402 : Novel Drug Delivery system

Course Objectives:

The main objective of the paper is to make students enable to know the fundamentals of drug delivery systems. The students will be able to understand the knowledge and idea of conventional drug delivery system, oral drug delivery system, parenteral control drug delivery system, site specific drug delivery system and transdermal drug delivery system.

Course Learning Outcomes: After the successful completion of the course, students will be able:

1. To accentuate the nature of Novel drug delivery system.
2. To understand the conventional method and new method for drug delivery system.
3. To get the knowledge about pharmacokinetic / pharmacodynamic basis of controlled drug delivery system.
4. To know the various routes for the delivery of drugs and their applications.
5. To understand the different method of sterilization techniques and targeted drug delivery system.

Contents:

UNIT -I :

Fundamentals of controlled release drug delivery systems :

Fundamentals and Rationale of Sustained / controlled drug delivery, factors influencing the design & performance of sustained / Controlled release products, Drug Targeting, Use of polymers in controlled release of active agents, Pharmacokinetic / Pharmacodynamic basis of controlled drug delivery systems, regulatory requirements.

UNIT -II :

Oral drug delivery: Formulation, fabrication and evaluation of various oral controlled drug delivery systems including dissolution and diffusion controlled delivery systems, gastro retentive, colon targeted and pulsatile drug delivery. TIMERx, MASSRx & COSRx, Procise technology, RingCap technology, Theriform Technology, Accudep Technology, THREEFORM Technology, DissoCube IDD Technology, Zydis Technology for poorly soluble drugs, Orasolv & Durasolv technology, Egalet Technology, Buccal Mucoadhesives, Periochips.

UNIT -III :

Parenteral controlled release system:

Scope, Parenteral routes of administration: Intravenous Route, Intramuscular Route, Subcutaneous Route, Intradermal Route, Specialized Access, injectable controlled release, formulation.

Injections:

Types of Injections, Solvents and Vehicles for injections, Nonaqueous Vehicles, Sterilization of Parenteral Product: Steam, Dry Heat, Filtration, Gas, Ionizing Radiation. Implantable drug delivery, microspheres, liposomes & their quality control.

UNIT- IV :

Site specific drug delivery system:

Active & passive targeting, resealed erythrocyte, monoclonal antibodies, drug targeting by particulate carrier system, drug targeting to brain, lung & colon.

Transdermal drug delivery system:

Permeation through skin including mechanism, permeation enhances, *In-vitro* skin permeation, technologies for developing transdermal drug delivery system, mechanism of release kinetics, evaluation of transdermal drug delivery systems.

Basic Text & Reference Books:

1. Wiilliams and Willkins Remington's pharmaceuticals sciences. 21st Edition, Lippincott - Vol. I & II , ISBN : 978-0781782784 (2005).
2. Yie W. Chien, Novel drug delivery system – Marcel Dekker N.Y. 2nd Edition, Vol. – 50, ISBN : 0824785207 (1992).
3. J. R. Robinson and Vincent H. L. Lee; Controlled drug delivery system; Marcel Dekker 2nd Edition, Revised and Expanded. Vol- 29, ISBN : 0-8247-7588-0 (1987).

4. N. K. Jain; Novel and controlled drug delivery systems, C.B.S. publishers and Distributors, New Delhi. ISBN : 9788123905174 (2008).
5. N. K. Jain; Advances in Novel and Controlled Drug Delivery, 1st Edition. C.B.S. publishers and Distributors, New Delhi, ISBN : 978-8123905174 (2011).
6. Kim. C., Controlled Release Dosage form Design, India special edition, Taylor & Francis Inc, ISBN : 9781566768108 (2000).
7. James Swarbrick, James C. Boylan, *Encyclopedia by pharmaceutical technology*, 3rd edition, Informa Healthcare, ISBN: 100‑8493‑9399‑X (2007).
8. L. Xiaoling, B. R. Jasti, "Design of Controlled Release Drug Delivery Systems" 1st Edition, McGraw-Hill Education, ISBN : 978-0071417594 (2005).

CHARUTAR VIDYAMANDAL UNIVERSITY

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SEMESTER-IV

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450403 : Pharmaceutical Formulation Development

Course Objectives:

The main objective of the paper is to make students enable to know about basics of pharmaceutical development and the fundamental principles of biopharmaceutics that include various type of preformulation study methods and effect of various factors onto pharmaceutical development, Students will be able to understands the concept of formulation design.

Course Outcomes: After the successful completion of the course of the paper, students will learnt:

1. To understand need of preformulation study.
2. To develop understanding of properties and Characterization of drug and excipients.
3. To understand basic theory and principals and application of dissolution study and stability study.
4. To understand basic theory and principals of biopharamceutics.

Content:

UNIT- I : Preformulation studies:

General terminology, factors influencing formulation, Characterization, Like: Crystallinity, hygroscopicity, Particle size and particle size distribution, compaction properties, Crystalline and polymorphism and its evaluation. Rationale for selecting the preferred polymorph/crystalline form, preformulation study of formulation like thermal analysis, Differential scanning

calorimetry, X-Ray diffraction, Drug-excipients compatibility study, Traces of organic volatile impurities (OVIs) and their regulatory limits.

UNIT-II :

Dissolution study: General introduction, objectives, equipments, and significance on dissolution study and its application in dosage form development. Selection of dissolution media and conditions. Comparison of dissolution profile by model independent (similarity and dissimilarity factor) and dependent methods.

UNIT- III :

Stability Study: Basic concept and objectives of stability study, Order of reaction and their applications in predicting shelf-life and half-life of pharmaceutical formulations, Importance of accelerated stability study, Effect of various environmental/ processing factors like light, pH, temperature, etc. on stability of the formulation, impurities in stability study, Applications of stability study test.

UNIT- IV :

Biopharmaceutical properties: The concept of bioavailability, biopharmaceutics, Release of drug from its dosage form into solution, Stability in physiological fluids, Perfusion studies, Presystemic metabolism, Assessment of Bioavailability: Plasma concentration-time curves, cumulative urinary drug excretion curves, Absolute and relative bioavailability, Bioequivalence. Assessment of site of release in vivo.

Basic Text & Reference Books:

1. Robert A. Nash, Alfred H. Wachter, *Pharmaceutical Process Validation*, Vol. 129, Marcel Dekker Inc., ISBN : 9780824708382 (2008).
2. Sidney H. Willing and Murray M. Tuckerman, *Good Manufacturing Practices for Pharmaceuticals*, Vol. 16, Marcel Dekker Inc. (2000).
3. James Swarbrick, James C. Boylan, *Encyclopedia by pharmaceutical technology*, 3rd Edition, Informa Healthcare, ISBN: 100-8493-9399-X (2007).

4. Sharma P. P., *How to practice GMPs,* 5th Edition, Vandana Publication, ISBN : 978-81-905957-2-8 (2014).
5. *Drug and Cosmetic Act and Rules* (Government of India).
6. Potdar M. A., *Current Good Manufacturing Practices* Pharma-Med Press, Hyderabad, ISBN : 978-81-88449-78-4 (2009).
7. Potdar M. A., *Pharmaceutical Quality Assurance*, 2nd Edition, Nirali Prakashan, Pune, ISBN : 978-8185790596 (2007).

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER-IV

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450404: Validation and cGMP

Course Objectives: The main objective of the paper is to make students enable to get awareness regarding importance, scope and need of validation and cGMP in the pharmaceutical as well as chemical process industries. Students can get knowledge regarding plant design and plant layout as well as norms for building and facilities.

Course Learning outcomes: After successfully completion of the course students will be able :

1. To aware regarding government regulations, scope and advantages of validation.
2. To get awareness regarding HVAC, Sterile and non-sterile area, septic and aseptic conditions and different types of water used in pharmaceutical industries.
3. To get knowledge about cGMP in manufacturing, processing, packaging and storage of drugs as well as needs, responsibilities and facilities given to person working in pharma industries.
4. To provide knowledge regarding plant location, plant layout and maintenance. Also aware regarding utilities used in industries and vendor related matters.

Contents:

UNIT-I : Definition, Government regulation, scope and advantage of validation, relationship between validation and qualification, validation master plan, FDA 21 CFR Part 11, qualifications of utilities and process equipments (protocols & reports for DQ, IQ, OQ, PQ).

UNIT-II :

Validation of medical devices, biotechnology processes, pharmaceutical ingredients, air handling and HVAC systems, sterile and non-sterile areas, aseptic processes and sterilization methods, purified water system, distilled water and water for injection.

UNIT-III :

Concepts and Philosophy of cGMP in manufacturing, processing, packaging, and holding of Drugs. Organization and Personnel: Responsibilities, qualification, experience, training, personal hygiene and clothing.

UNIT-IV :

Buildings and Facilities: Location, design, plant layout, maintenance and sanitation, environmental control, utilities and services like gas, water, control of contamination and maintenance of sterile areas.

Raw materials: Purchase specifications, selection of vendors, control on raw materials and finished dosage forms.

Basic Text & Reference Books:

1. Robert A. Nash, Alfred H. Wachter, *Pharmaceutical Process Validation*, Vol. 129, Marcel Dekker Inc., ISBN : 9780824708382 (2008).
2. Sidney H. Willing and Murray M. Tuckerman, *Good Manufacturing Practices for Pharmaceuticals*, Vol. 16, Marcel Dekker Inc. (2000)
3. James Swarbrick, James C. Boylan, *Encyclopedia by pharmaceutical technology*, 3rd Edition, Informa Healthcare, ISBN- 10: 0‑8493‑9399‑X (2007)
4. Sharma P. P., *How to practice GMPs*, 5th Edition, Vandana Publication, ISBN : 978-81-905957-2-8.
5. *Drug and Cosmetic Act and Rules* (Government of India).
6. Potdar M. A., *Current Good Manufacturing Practices* Pharma-Med Press, Hyderabad, ISBN : 978-81-88449-78-4 (2009).

7. Potdar M. A., *Pharmaceutical Quality Assurance*, 2nd Edition, Nirali Prakashan, Pune, ISBN : 978-8185790596 (2007).

CHARUTAR VIDYAMANDAL UNIVERSITY

VALLABH VIDHANAGAR

SEMESTER-IV

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450405: Lab-I

Course Objectives :

The objectives of this course are to make students understand differences between qualitative and quantitative analysis and to developed the skill of separation and identification of organic compounds. Students will able to understand preparation and evaluation methods of drugs mechanism of organic reaction and will give hands on practice of chemical analysis.

C**ourse learning Outcomes**: After the successful completion of the course of the paper, student will learnt :

1. Identification and separation of organic compounds.
2. To understand various chemical reaction involved in Identification of organic compounds.
3. To develop the synthetic skill of organic compounds.

Exercise : I

Qualitative analysis of Solid + Liquid Organic Mixture (Ternary).

Exercise :II

Preparation and evaluation of aspirin, amoxicillin capsules and other commercial drugs. Tablet dissolution study ibuprofen, diclofenac sodium.

Basic Text & Reference Books:

1. Vogel's, Longman; *Organic Qualitative analysis*, ISBN-13: 9780582442504; ISBN: 0582442508.

2. Vogel's, Longman; *A Text book of Practical Organic Chemistry,* 5th Edition, Pearson education, ISBN : 9788177589573 (2006).
3. Vogel's, *Elementary Practical Organic Chemistry,* Part-I, II, & III (ELBS); ISBN: 81- 239-1033-9.
4. Mann and Saunders; *Practical Organic Chemistry,*4th edition, Orient Logmann Publisher; ISBN : 81-250-1380-6 (2003).
5. V. K. Ahuluwalia, *Comprehensive Practical Organic Chemistry: Volume–I & II;* Universities Press (India) Pvt. Ltd; ISBN: 8173712735 (2008).

CHARUTAR VIDYAMANDAL UNIVERSITY

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SEMESTER-IV

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450406: Lab-II

Course Objectives :

The objectives of this course are to make students understand about differences between qualitative analysis of inorganic compounds and preparation of organic compounds. The course enable students to developed the skill of identification of Inorganic compounds. Students should able to create understanding of pathway and functions of reagents for organic reaction and will develop the synthetic skill, work up procedure of organic compounds.

Course learning Outcomes: After the successful completion of the course of the paper, student will learnt :

1. Identification of Inorganic molecules.
2. To understand various chemical reaction involved in Identification of compounds.
3. To develop the synthetic skill of organic compounds.

Practical's:

Exercise - I:

Qualitative analysis of Inorganic mixture (Two positive and Two negative radicals)

Exercise - II

Organic Preparation:

Benzoic acid, Iodoform, Methyl orange, m-nitroaniline, p-nitroaniline, mordant yellow etc.

Basic Text & Reference Books:

1. Vogel's, Longman; *Organic Qualitative analysis,* ISBN-13: 9780582442504; ISBN: 0582442508.
2. Vogel's, Longman; *A Text book of Practical Organic Chemistry,* ISBN-13: 9780582442504; ISBN: 0582442508.
3. Vogel's, *Elementary Practical Organic Chemistry,* Part-I, II, & III (ELBS); ISBN: 81- 239-1033-9.
4. Mann and Saunders; *Practical Organic Chemistry*,4th Edition, Orient Logmann Publisher; ISBN : 81-250-1380-6 (2003).
5. V. K. Ahuluwalia, *Comprehensive Practical Organic Chemistry: Volume– I & II;* Universities Press (India) Pvt. Ltd; ISBN: 8173712735 (2008).

CHARUTAR VIDYAMANDAL UNIVERSITY

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SEMESTER-IV

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450408: Advance Pharmaceutical Chemistry

Course Objectives:

The main objective of the paper is to make students aware regarding advance drug design and development techniques like combinatorial synthesis, parallel synthesis etc. Students shall get knowledge regarding chirality concept and role of chiral molecule in pharmaceutical industries. Also students can gain information regarding whole blood and blood substituents, neurodegenerative diseases, HIV.

Course Learning Outcomes: After the successful completion of the course of the paper, student will learnt :

1. To get awareness regarding basic principles, concepts and rules for combinatorial synthesis, parallel synthesis, mix and split methods.
2. To get knowledge regarding chirality and techniques used in synthesis of asymmetrical synthesis of drugs.
3. To get knowledge about whole blood, blood constituents, blood substituent's, Blood clotting factors etc.
4. To gain knowledge of Alzheimer's, Parkinson diseases, AIDS and agents used in the treatments of these disease. Also gain information regarding protein and peptide drugs.

Contents:

UNIT-I : Combinatorial Chemistry

Introduction, Combinatorial synthesis for drug optimization, Combinatorial chemistry for drug discovery, Combichem – solid phase techniques, Methods of parallel synthesis, Methods in mixed combinatorial synthesis: General principles, The mix and split method, Mix and split in the production of positional scanning libraries, Isolation of active component in a mixture – DE convolution, Structure determination of Active compound, Limitation of Combinatorial synthesis.

UNIT- II Chiral Technology:

Introduction to Chirality and Techniques used asymmetric synthesis of Diltiazem, Timolol, Vitamin C, Ampicillin, Dextrapropoxyphen, Thienamycin, Citrenalol, Propranolol, Atenolol, and Naproxen.

UNIT- III : **Biopharmaceuticals from Blood:**

Whole blood, Platelets and red blood cells. Blood substitutes: Dextrans, Albumin, Gelatin, Oxygen-carrying blood substitutes. Blood clotting: Factor VIII and haemophilia, Production of factor VIII, Factors IX, VIIa and XIII. Anticoagulants, Antithrombin, Thrombolytic agents, Tissue plasminogen activator (tPA), Enzymes of therapeutic value, Digestive aids. Liposome mediated drug delivery. Drug delivery methods for therapeutic proteins.

UNIT-IV: Agents used in Neurodegenerative diseases:

Alzheimer's and Parkinsonism. Agents used in treatment of AIDS: Life cycle of HIV and Drugs used. Proteins and Peptide drugs: Chemistry, structure and stability, Reactivity of proteins and peptides. Different ways to synthesize these drugs - study of Insulin, Relaxin, Somatostatin, DNAse Interferon.

Basic Text & Reference Books:

1. Donald J. Abraham, Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th Edition, A John Wiley and Sons, Inc., Publication, ISBN 0-471-27090- 3 (2007)

2. David A. Williams, Thomas L. Lemke, Lippincott Williams & Wilkins, *Foye's Principles of Medicinal Chemistry*, *5th Edition*, publisher- Walter Kluwer business, ISBN: 978-81-89836- 02-3 (2007).
3. Ledinicer: *Organic Drug synthesis.* Vol.- 1,2,3,4 (John Wiley &. Sons N.Y.).
4. Ariens : *Medicinal Chemistry Series.*
5. John H. Block, John M. Beale, Jr., Lippincott Williams & Wilkins *Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 11th edition,*, ISBN– 0-7817-3481-9 (2004).
6. G. L. Patrick, *An Introduction to Medicinal Chemistry; 3rd Ed.*, Oxford University Press, ISBN 978-0-19-568508-4 (2006).
7. Gary Walsh, Biopharmaceuticals Biochemistry and biotechnology 2nd Edition, Wiley-Blackwell, ISBN : 978-1-118-68738-3 (2013).

CHARUTAR VIDYAMANDAL UNIVERSITY

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SEMESTER-IV

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2021-22

101450409: Quality Assurance of Pharmaceuticals

Course Objectives: The main Objective of paper is to prepare students for functioning of quality assurance department in pharmaceutical industry. This course paper helps students to understand and implement measures effectively for particular operation during drug development in pharmaceutical industry.

Course Learning Outcomes: After the successful completion of the course of the paper, student will learnt:

1. The students will impart knowledge of understanding of various physical and chemical properties influences formulation design.
2. The students will gain the knowledge of quality assurance guidance GMP, GLP and ICH in all areas that impact drug quality.
3. Students will get knowledge about quality system and Good Documentation Practices (GDPs), SOPs and principles of product complaints, product recall, returned goods, change control and CAPA.
4. The course equips students to manage GMP and quality related issues as well as various regulatory requirements.

Contents:

UNIT- I :

Introduction of Quality Control: Main Principal of Pharmaceutical products, quality Management in drug industry, Philosophy, and essential elements, Active Ingredient, Pharmaceutical Excipients, specific Pharmaceutical Products, Hazards and Risk analysis in pharmaceutical products.

UNIT- II :

Water Treatment & Sterilization Process: Techniques and maintenance – RO, DM, ultra – filtration, WFI. Sterilization and sterility testing: Principle, validation of different sterilization processes, methods, industrial sterilizer, air handling unit and sterility testing of different types of dosage form.

UNIT- III :

Pilot plant design and Large scale synthesis: Basic requirements for design, facility, equipment selection for tablets, capsules, liquid orals, parenterals and semisolid preparations. Large-scale Synthesis: Introduction, scale-up: synthetic strategy, bench-scale, experimentation, and scale-up from Bench to Pilot.

UNIT-IV :

Quality Assurance:

Basic concept of quality assurance, functions, source of variation, control of quality– Raw materials, APIs, packing materials, finished products and environment. For materials production, facilities & equipment, packaging & labeling. In-process quality control – importance, inspection, IPQC tests.

Basic Text & Reference Books:

1. Robert A. Nash, Alfred H. Wachter, *Pharmaceutical Process Validation*, Vol. 129, Marcel Dekker Inc.

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