

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-semester. 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	PS01CPCH01	Inorganic Chemistry	T	4	3	30/10	70/28	100/40
	PS01CPCH02	Organic Chemistry-I	T	4	3	30/10	70/28	100/40
	PS01CPCH03	Basic Physical Chemistry	T	4	3	30/10	70/28	100/40
	PS01CPCH04	Practical's -I	P	4	3	30/10	70/28	100/40
	PS01CPCH05	Practical's-II	P	4	3	30/10	70/28	100/40
	PS01CPCH06	Viva-Voce	-	1			50/20	50/20
Elective Courses	PS01EPCH01	Chemistry of Natural Product -I	T	4	3	30/10	70/28	100/40
	PS01EPCH02	Fundamentals of Analytical Chemistry	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-I

M.Sc. PHARMACEUTICAL CHEMISTRY

SYLLABUS EFFECTIVE FROM: JUNE-2020-21

PS01CPCH01: Inorganic Chemistry

Course Objectives:

The main objective of the paper is to make students enable to understand inorganic drug chemistry and students will be able to explain the effects of impurities in pharmaceuticals and should be 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, Pharmacopoeia, History of Pharmacopoeia, 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 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

PS01CPCH02: 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 understand 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

Heterocyclic 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-Ponndorf-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, Longman 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.

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

PS01CPCH03 : 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.

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

PS01CPCH04 : Practical's-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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VALLABH VIDHANAGAR
SEMESTER- I
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21
PS01CPCH05 : Practical's-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 Ahluwalia, 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.

CHARUTAR VIDYAMANDAL UNIVERSITY
VALLABH VIDHANAGAR
SEMESTER- I
M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21
PS01EPCH01 : 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. Phytochemical 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
PS01EPCH02 : Fundamentals of Analytical Chemistry

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

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

1. To understand basic theory and principles of pH, potentiometry and conductometry instruments.
2. To understand various methods used for analysis.
3. To understand basic theory and principles of Redox titrations.
4. To understand basic theory and principles of Complexometric Titration.

Contents

UNIT - I

pHmetry- 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, equilibrium 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	PS02CPCH01	Organic Chemistry-II	T	4	3	30/10	70/28	100/40
	PS02CPCH02	Modern Analytical Techniques	T	4	3	30/10	70/28	100/40
	PS02CPCH03	Chemistry of Natural Product – II	T	4	3	30/10	70/28	100/40
	PS02CPCH04	Practicals –I	P	4	3	30/10	70/28	100/40
	PS02CPCH05	Practicals-II	P	4	3	30/10	70/28	100/40
	PS02CPCH06	Viva Voce	-	1			50/20	50/20
Elective Courses	PS02EPCH01	Chemistry of Biomolecules	T	4	3	30/10	70/28	100/40
	PS02EPCH02	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

PS02CIGB01 : 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, Wittig reaction.

UNIT -III : Reagents Used in Synthesis

Reagents, Type of reagents mechanism and utility of following Reagents: Oxidizing agents : peracids, $\text{H}_2\text{O}_2/-\text{OH}$, OsO_4 . Reducing agents: LiAlH_4 , NaBH_4 , Lindlar's catalyst. Alkylating agent: 1,3-Dithiane, Grignard reagent, Gilman's Reagent.

UNIT- IV : Synthons 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, Longman 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* John Wiley & Sons; New York Brisbane Toronto.

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

PS02CPCH02 : 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
PS02CPCH03 : 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 Proteins

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

UNIT-III : Flavonoids and Terpenoids

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) gymnemic acids.

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

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PS02CPCH04 : Practical's-I

Course Objectives :

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

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

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. Ahluwalia, *Comprehensive Practical Organic Chemistry: Volume – I & II*, Universities Press (India) Pvt. Ltd; ISBN-13: 9788173712739; ISBN: 8173712735.

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SYLLABUS EFFECTIVE FROM: JUNE-2020-21

PS02CPCH05 : Practical's-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 heterocyclic compounds (3 - 4 steps) (viz. Flavones, Quinolines, Quinazolines, 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. Ahluwalia, *Comprehensive Practical Organic Chemistry: Volume – I & II*, Universities Press (India) Pvt. Ltd; ISBN-13: 9788173712739; ISBN: 8173712735.

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PS02EPCH01: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, lysolecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, plasmalogens), sphingomyelins, glycolipids - cerebrosides, gangliosides. Properties and functions of phospholipids, isoprenoids

and sterols.

UNIT- III : Proteins

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.

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M.Sc. PHARMACEUTICAL CHEMISTRY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21
PS02EPCH02 : 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 (T_g) 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