

NOWGONG COLLEGE (AUTONOMOUS)



SYLLABUS

DEPARTMENT OF B. Voc. COURSES

**Learning Outcomes-based Curriculum Framework (LOCF)
of
Undergraduate Programme**

BACHELOR OF VOCATION IN PHARMACEUTICAL CHEMISTRY

(Effective from Academic Year 2020-21)

Syllabus Approved in Academic Council Nowgong College (Autonomous)

Syllabus for B. Voc. (Regular) in Pharmaceutical Chemistry

Course and Credit Structure

Semester	Regular Core Course 12 × 6 = 72	Ability Enhancement Course 2 × 4 = 8	Skill Enhancement Course 4 × 4 = 16	Discipline Specific Elective Course 6 × 6 = 36
1 st	Course:1 PHCH-RCC-1016 Course:2 PHCH-RCC-1026 Course:3 PHCH-RCC-1036	Communicative English/Communicative MIL ENGL-AEC-1014 ASSA-AEC-1014 HIND-AEC-1014 BENG-AEC-1014		
2 nd	Course:1 PHCH-RCC-2016 Course:2 PHCH-RCC-2026 Course:3 PHCH-RCC-2036	ENST-AEC-2014		
3 rd	Course:1 PHCH-RCC-3016 Course:2 PHCH-RCC-3026 Course:3 PHCH-RCC-3036		XXXX-SEC-3014	
4 th	Course:1 PHCH-RCC-4016 Course:2 PHCH-RCC-4026 Course:3 PHCH-RCC-4036		XXXX-SEC-4014	
5 th			XXXX-SEC-5014	Course:1 PHCH-RDS-5016 Course:2 PHCH-RDS-5026 Course:3 PHCH-RDS-5036
6 th			XXXX-SEC-6014	Course:1 PHCH-RDS-6016 Course:2 PHCH-RDS-6026 Course:3 PHCH-RDS-6036

SEMESTER-I

PHARMACEUTICAL INORGANIC CHEMISTRY

PAPER CODE: PHCH-RCC-1016

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about buffers, units etc.

LEARNING OUTCOME:

Students will understand about buffers, units etc.

CONTENTS

THEORY

UNIT 1

a) Rational nos.

Proportional set of nos., Ratios, Fractions, Decimals, Percentage

b) Other nos.

Exponents and Logarithms, Variables, Constants and Parameters, Graphical presentation of data-Different types of graphs (Line graph, Bar graph, Pie chart, Histogram etc.) Slope and intercept.

c) Accuracy and measurements:

Rounding nos. significant figures, correcting nos., Accuracy in arithmetic calculations, Accuracy in weighing, measuring for assays, Limits and uniformity of content

UNIT 2

a) System and Units:

Mass and weights, Metric units, Conversions between systems, Temperature conversions and others.

b) Ratios, Proportions and percentage:

Percent calculations, Proportions, Concentration systems, Part per million, calculation of amount of ingredients required to make up percentage solutions, Conversion from one to another strength.

Alcohol calculations

UNIT 3

a) Dilutions:

Simple dilutions, Serial dilutions, concentrated solutions' strengths, multiple dilutions, mixing concentrations.

b) Density:

Determination of density, specific gravity

Determination of displacement value, displacement volumes-solid-solid, liquid-liquid systems

UNIT 4

a) Molecular Weight

Moles, millimoles, milliequivalents, milliosmoles, Molar concentrations

b) Parenteral solutions and isotonicity

Rate of flow of IV solutions, Isotonicity

UNIT 5

Diagnostic drugs, pharmaceutical necessities

Preservatives, complexation and chelation- application in pharmacy, sources of impurities and their control, limit test for iron, arsenic, lead, heavy metals, chloride and sulphate: Gastrointestinal agents (Acidifying agents: dilute hydrochloric acid; sodium bicarbonate, aluminium hydroxide gel, aluminium phosphate: Saline cathartics: sodium potassium tartarate and magnesium sulphate).

UNIT 6

Methods of preparation, uses, sources of impurities, tests of purity and identification and special tests

Following classes of inorganic pharmaceuticals included in IP 2018, gases and vapours- inhalants (oxygen), anaesthetics (nitrous oxide), topical agents-protective (calamine, titanium dioxide, talc, kaolin), astringent (zinc oxide, zinc sulphate) and anti- infective (boric acid, H_2O_2 , iodine, povidone iodine, potassium permanganate, silver nitrate.).

UNIT 7

a) Acids and bases-

Acid base theory, specification of acidity and basicity, official inorganic acid (boric acid HCL, HNO_3 , H_3PO_4), nonofficial inorganic acids (H_2SO_4), official inorganic bases (strong ammonia solution, calcium hydroxide, KOH, Na_2CO_3 , NaOH, soda lime).

b) Buffers

Theory and mechanism, pharmaceutical buffer selection, pharmaceutical buffer system, preparation of pharmaceutical buffer.

UNIT 8

a) Antioxidant

Basics of antioxidants: theory, the selection of antioxidants, official antioxidants (hypophosphorous acid, sodium bisulphite, sodium thiosulphate and sodium nitrite).

b) Pharmaceutical accepted glass

Chemistry of glass, types of test employed for glass.

c) Water

Official water (water, purified water, water of injection, bacteriostatic water for injection, sterile water for injection).

RACTICAL

1. To prepare Boric acid or calcium Lactate and report the yield.
2. To identify not more than 2 radicals in a mixture of the following : (minimum 5 samples to be performed)

Cation : Pb^{2+} , Cu^{2+} , $\text{Fe}^{2+}/\text{Fe}^{3+}$, Cr^{3+} , Al^{3+} , Ni^{2+} , Mn^{2+} , Zn^{2+} , Ba^{2+} , Ca^{2+} , Sr^{2+} , Mg^{2+}

Anions : Cl^- , Br^- , I^- , NO_2^- , NO_3^- , SO_4^{2-} , F^- , BO_3^{3-} , PO_4^{3-} ,

(Presence of Na^+ , K^+ , NH_4^+ and CO_3^{2-} radicals are to be ignored and not to be reported)

3. To perform the limit test for chloride and sulphate in the given sample of tap water.
4. To perform the limit tests for iron and lead in the given sample.
5. To perform the assay of hydrogen peroxide and its determination in unknown solutions.
6. To perform the assay of zinc oxide and its determination in unknown solutions.
7. To perform the assay of calcium gluconate and its determination in unknown solutions.

SEMESTER-I

FUNDAMENTALS OF ORGANIC CHEMISTRY

PAPER CODE: PHCH-RCC-1026

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about stereochemistry, bonding etc.

LEARNING OUTCOME:

Students will understand about stereochemistry, bonding etc.

CONTENTS

THEORY

UNIT 1

Molecular orbitals, Bonding and Antibonding orbitals

Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces. Bond dissociation energy, Polarity of bonds, Polarity of molecules, structure and physical properties, Intermolecular forces, Acids and bases, general nomenclature.

UNIT 2

Stereochemistry

Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations, stereochemistry of specific reactions and intermediates, Stereoselective and stereospecific reactions.

UNIT 3

Structure, Nomenclature, Preparation and Reactions

Alkanes, Alkenes, Alkynes; Cycloalkanes, Dienses, Benzene, Polynuclear aromatic compounds, Arenes.

UNIT 4

Functional derivatives

Alkyl halides, Alcohol, Ethers, Epoxides, Amines, Phenols, Aldehydes and Ketones, Carboxylic acids, Functional derivatives of carboxylic acids, Reactive intermediates-carbocations, cabanions, carbenes, nitrene and nitrenium ions.

PRACTICAL

1. Qualitative Organic Analysis:

To analyze and identify organic compound by

- a) Detection of N, S, Halogens
- b) Test for functional groups
- c) Solubility, melting point, boiling point

2. To determine the equivalent mass of a carboxylic acid by direct titration method.

3. Estimation of urea by hypobromite method.

Suggested Readings:

1. Morrison & Boyd, Organic Chemistry, Prentice-Hall, 6th Ed. 2001.
2. March J. Advanced Organic Chemistry, MacGraw-Hill, 3rd Ed., 1985.
3. Solomon & Fryhle, Organic Chemistry, Wiley, 8th 2004.
4. Shriner & Morill, The systematic Identification of Organic Compounds, Wiley, 8th 2004.

SEMESTER-I

HUMAN ANATOMY AND PHYSIOLOGY

PAPER CODE: PHCH-RCC-4026

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about human anatomy and physiology.

LEARNING OUTCOME:

Students will understand about human anatomy and physiology.

CONTENTS

THEORY

UNIT 1

a) Introduction & Scope of Human Anatomy & Physiology

Sense Organs: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

b) Elementary tissues of the human body

Epithelial, connective muscular and nervous tissues, their sub- type and characteristics.

c) Structural & functional organization of cell

Structural & functional organization of cell, its components and functions: Body fluids & its composition, transport mechanisms across the cell membrane, Cell cycle.

UNIT 2

a) Support & Movement

Osseous system: structure, composition and functions of skeleton, classification of joints, types of movements at joints, Disorders of joints. Skeletal muscles: Their gross anatomy, physiology of muscle contraction, physiological properties

b) Nervous System

Central Nervous System: Functions of different parts of brain and spinal cord, Neurohumoral transmission in the Central Nervous System, reflex action, electroencephalogram, cranial nerves and their functions.

Autonomic Nervous System: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S

UNIT 3

a) Maintenance of Human body – I
Haemopoietic system

Composition and function of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.

b) Lymph and Lymphatic system

Composition, formation and circulation of lymph, disorders of lymph and lymphatic system. Basic physiology and functions of spleen.

c) Cardiovascular system

Basic outline of cardiovascular disorders like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmia.

d) Respiratory system

Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiration, respiratory volumes and capacity.

UNIT 4

a) Maintenance of Human body-II

Digestive system

Gross anatomy of the gastrointestinal tract functions of its different parts including those of liver, pancreas and gallbladder. Various gastro-intestinal secretions and their role in the absorption and digestion of food, disorders of digestive system.

b) Urinary system

Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid base balance. Diseases of the urinary system

c) Reproductive system

Male and Female reproductive system and their hormones. Physiology of menstruation, coitus and fertilization

PRACTICAL

1. To study the simple and compound microscopes
2. To study the various animal tissues through permanent slide (part I)
3. To study the various animal tissues through permanent slide (part II)
4. Estimation of haemoglobin
5. To study the effect of isotonic, hypertonic and hypotonic solution, acid and alkali on RBC

SEMESTER-II

PHARMACEUTICS (BASIC PRINCIPLES)

PAPER CODE: PHCH-RCC-2016

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES: To learn about different dosage forms, introduction to various process in pharmaceutical manufacturing units.

LEARNING OUTCOME: Students will understand about different dosage forms, introduction to various process in pharmaceutical manufacturing units.

CONTENTS

THEORY

UNIT 1

Introduction to Different dosage forms

Introduction to Different dosage forms, Routes of administration and their comparisons, Environment control in Pharmaceutical industry and its importance, Importance of air, water, Humidity, Temperature in drug manufacturing giving some examples

UNIT 2

a) Introduction to various process in pharmaceutical manufacturing Units

Principles of heat transfer: Modes of Heat transfer- Conduction, Convection, Radiation, Induction, Sources of heat – Steam and Electricity.

Factors affecting: Rate of evaporation, Differentiations between Evaporation, Distillation, Rectification, Precipitation, Crystallization.

Brief introduction: Solvent distillation and its application. Different types of heat reactions-Heats of relations and formations, Heat of melting, vaporization and sublimation, Differential and integral heat of hydration and salvation.

b) Introduction to dispensed products

Classification of dispensed products: Brief description and applications of each product. Difference between extemporaneous preparations and Non extemporaneous preparations.

Classification as per physical state – Solids, Liquids, Semisolids, Inhalations.

Classification as per route of administration, Classification as Sterile and non-sterile preparations,

Classification as Galenicals and non-galenicals.

Packaging of dispensed products: Containers and closures, Labelling of dispensed products.

UNIT 3

a) States of matter

Different states of matter-solid, liquid, Gas, Crystalline and Amorphous, Hygroscopic-Efflorescent-Deliquescent, Modified states of matter-Glassy state, Glass transition temperature, Liquid Crystals, Liquid- solid compact, Solid dispersions.

Two component system containing solid-solid liquid phases, Eutectic mixtures

b) Polymorphism

What is Polymorphism, Pseudo polymorphism, Solvates and Hydrates, Meta-stable forms? Examples of polymorphic drugs and effect on physicochemical properties

c) Principles of fluid flow

Reynold's no., and its importance. Types of flow- Laminar flow, Intermediate flow, turbulent flow. Importance of types of flow in pharmaceutical processing.

UNIT 4

a) Solubility and solubilization

Definitions and expressions, Physical properties of different solvents and solutes and their effects on solubility, Major pharmaceutical solvents – brief discussions. Liquid-liquid systems-solubility and Miscibility, Partitioning between immiscible solvents and partition co-efficient, Effect of pH on solubility – Dissociation constant, Solubilization Techniques-Brief discussion.

b) Complexation

Classification of complexes and its applications.
Concept of Filtration of filtration techniques

PRACTICAL

1. To prepare the list of market products as per physical form
2. To prepare the list of market products as per route of administration
3. To study two component system-Preparation of eutectic mixture
4. To study the solubility relationship of 3-component system containing benzene, water and acetic acid
5. To study the mutual solubility of given liquids (phenol, water) and find out upper consolute temperature.
6. To determine Reynold's no. in given system
7. To prepare different pharmaceutical buffers.
8. To study the effect of pH on solubility of given drugs.

Suggested Readings:

1. C.V.S, S. Pharmaceutical engineering, Principles and Practice, Vallabh Prakashan.
2. K.S. Pharmaceutical Engineering New age International publisher.
3. P., M. Elementary Chemical engineering, Tata MacGraw Hill.
4. Physical Pharmacy By Alfred Martin
5. Physical pharmaceutics, E. Shotton, Indian edition, oxford press.
6. Physicochemical principles of pharmacy, 5th edition, Alexander T. Florence and David Attwood., Pharmaceutical press

SEMESTER-II

ADVANCED ANALYTICAL CHEMISTRY

PAPER CODE: PHCH-RCC-2026

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES: To learn about gaseous and solid-state chemistry, liquid state, zeroth law etc.

LEARNING OUTCOME: Students will understand about gaseous and solid-state chemistry, liquid state, zeroth law etc.

CONTENTS

THEORY

UNIT 1
Gaseous and Solid State Chemistry

Behaviour of Gases: Kinetic theory of gases, deviation from behaviours and explanation.
Solid State: Crystalline structures, lattices, physical properties, Bragg's law, Miller indices
Adsorption: Freundlich and Gibbs adsorption isotherms, Langmuir theory of adsorption.

UNIT 2
The Liquid State

The Liquid State: Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents).
Solutions: Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement, Debye Huckel theory

UNIT 3

Zeroth Law

First, second and third laws, Zeroth law, absolute temperature scale, thermo, chemical equations, phase

equilibria and phase rule.

UNIT 4 Chemical Kinetics

Chemical Kinetics: Zero, first and second order reactions, complex reactions, theories of reaction Kinetics, characteristics of homogeneous and heterogeneous catalysts, acid base and enzyme catalysis. Photochemistry Consequences of light absorption, Jablenski diagram, Lambert-Beer Law, Quantum efficiency.

UNIT 5 Errors and statistics

Types of error, Precision and accuracy, Mean and Standard deviation, Confidence interval, of results and means of two samples, Paired T-test, Q-test, Correlation and linear regression, comparison of more than two means, Significant figures, Rule for retaining significant digits.

UNIT 6

Basis of sampling
Basis of sampling, sampling procedure and selection of sample, factors affecting sampling: sampling and physical state, crushing, grinding and hazards in sampling

UNIT 7

Introduction to titrimetric analysis

Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.

UNIT 8

Errors and Statistical Data Treatment of Analytical results

Introduction to Analytical Chemistry, Classification of Classical and Electro-analytical Techniques, Literature of Analytical Chemistry (Names of Author and Publishers for any Ten Books, Journals and Reviews), Criterion for selection of analytical Techniques, Analytical Data Treatment, Error, Types of errors, Accuracy and Precision, Statistical Terms: Mode, Average, Median, Deviation, Average Deviation, Relative Average Deviation, Standard Deviation & Coefficient of variance, Q-test for the rejection of result and related numerical.

Suggested Readings:

1. G. Raj, Advance Physical Chemistry, 20th Edition, Goel Publishing House, Merrut, 1996-97
2. Dr. J.N. Gurtu, Dr. Hemant Snehi, Advance Physical Chemistry, 7th Revised and Enlarged Edition, Pragati Prakashan, Merrut, 2000.
3. P.L. Soni, O.P Dharmartha, U.N. Dash, Textbook of Physical Chemistry, 22nd Edition, Sultan Chand and Sons, New Delhi, 2001.
4. P.W. Atkins, Physical Chemistry, 5th Edition, Oxford University Press, UK, 1994.

PRACTICAL

1. Determinations of the concentrations of sodium hydroxide in a given solution.
2. Determinations of the concentrations of Hydrochloric acid in a given solution.
3. To determine Normality, Molarity, %w/v and gm/liter of the given solution
4. Standardization of analytical weights and calibration of volumetric apparatus.
5. Estimation of Fe (II)- by standard KMnO_4 solution
6. Non-aqueous titrations: preparation and standardization of perchloric acid

SEMESTER-II

FUNDAMENTALS OF BIOCHEMISTRY

PAPER CODE: PHCH-RCC-2036

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES: To learn about lipids, protein, nucleic acids etc.

LEARNING OUTCOME: Students will understand about lipids, protein, nucleic acids etc.

CONTENTS

THEORY

UNIT 1

Biological macromolecules: carbohydrates

Introduction to carbohydrates, Nomenclature, definition and classification of carbohydrates. Monosaccharides, classification, structural aspect and biological significance Disaccharides, Oligosaccharides, Polysaccharides

UNIT 2

Introduction to lipids

Structure and function diversity of lipids, Definition and classification, Fatty acids, Triacylglycerols, glycerophospholipids, Sphingolipids, steroids and other biologically important lipids (Terpenes, Steroids, cholesterol etc.)

UNIT 3

Proteins and Nucleic acids

Proteins, structure and function, General structure of Amino Acids, Classification of Amino acids, Peptide bond link amino acids in proteins, Composition of amino acid in protein and determining sequence of amino acid residue. Structure of protein, Types of protein structure, Primary structure, Secondary structure, Tertiary structure. Quaternary structure, Various other biologically important protein. Basic studies of nucleic acids.

UNIT 4

Enzymes and co-enzymes

Structure and function of enzyme, Classification of enzyme, Enzyme kinetics and its mechanism of action Enzyme inhibition. Types of enzyme inhibition, Reversible enzyme inhibition, Irreversible enzyme inhibition, Regulation of enzyme activity, Enzymes and iso enzymes in clinical diagnosis. Coenzyme classification, Role of vitamin as coenzyme, Biological significance, Metal as coenzyme and its biological significance.

Suggested Readings:

1. Albert L. Lehninger, David L. Nelson, and Michael M. Cox, *Lehninger Principles of Biochemistry*, 8th Edition, MacMillan Learning Pvt. Ltd., 2021
2. U Satyanarayana, Biochemistry, 2nd edition, Books and allied (P). 2004.
3. A. White Philip Handler, E.L. Smith, R.L. Hill Lehman, Principles of Biochemistry, 6th Edition, Tata McGraw Hill Publishing Company Ltd.,2004.
4. D.L. Nelson, M.M. Cox, Lehninger Principles of Biochemistry, 4th edition, W.H, Freeman &Company,2005.
5. P.C. Champe, R.A. Harvey, Biochemistry, 2nd edition, Lippincott-Raven Publishers, 1994

PRACTICAL

1. To determine the viscosity and specific gravity of the given liquids.
2. To determine the surface tension of the given liquids.
3. To study the effect of temperature on viscosity and surface tension of the given liquids.
4. Qualitative and quantitative tests of carbohydrates.
5. Qualitative and quantitative tests of proteins.
6. Qualitative and quantitative tests of fats
7. Blood sugar tests

SEMESTER-III

ADVANCED ORGANIC CHEMISTRY

PAPER CODE: PHCH-RCC-3016

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES: To learn about structure of molecule etc.

LEARNING OUTCOME: Students will understand about structure of molecule etc.

CONTENTS

THEORY

UNIT 1

Structure of molecule:

Atomic orbital, Hybridization, Sigma and pi bonds, Intermolecular forces and related properties, conjugation, Bond length and bond energies, polarity of Bonds and molecules.

UNIT 2

Electro availability effects

Inductive effects, Resonance effects, hyper conjugation, steric effects, application of these factors on the strength of acids and bases bond length, tautomerism.

UNIT 3

Conservation of orbital symmetry and rules

Conservation of orbital symmetry and rules, electrocyclic, cycloaddition and sigmatropic reaction; neighbouring group effect, transition metal complexes as catalyst for organic reactions

UNIT 4

a. Nucleophilic and electrophilic aromatic reactions

Relation between Kinetics and mechanism of SN1 and SN2 reactions, stereochemical implications

Factors affecting nucleophilic substitution reactions: -

- Effects of solvent.

- Effect of structure.
- Effect of nucleophile.
- Effect of leaving group.
- Application of these in preparation and reactions of alkyl halides, alcohols
- Nucleophilic substitutions at aryl carbon atom

b. Elimination reactions

- Elimination reaction & factors effecting it
- E1, E2 and E1 (cb) mechanism.
- Orientation in E1 and E2 (Saytzeff and Hoffmann elimination)

Suggested Readings:

1. Miller J, Aromatic nucleophilic Substitution, Elsevier, 7th, 1968.
2. Furniss, Vogel's textbook of practical Organic chemistry, Pearson education, 5th, 2004
3. Norman R, Principles of Organic synthesis, Wiley, 4th, 1981.
4. Sykes P, A guide to mechanism in organic Chemistry, longman, 3rd, 1981.

PRACTICAL

1. To perform the assay of aspirin.
2. To determine water content in fruit juices by Karl Fischer method.
3. To determine the content of sulfamethizole (from table) by potentiometer.
4. To determine the dissociation constant of given acetic acid solution pH metry.
5. Preparation of paracetamol from 4-aminophenol
6. Preparation of aspirin from salicylic acid.
7. Preparation of benzyl from benzoin.
8. Preparation of benzanilide from aniline

SEMESTER-III

ADVANCED ANALYTICAL CHEMISTRY-I

PAPER CODE: PHCH-RCC-3026

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES: To learn about solid- liquid extraction, chromatography, titration methods etc.

LEARNING OUTCOME: Students will understand about solid- liquid extraction, chromatography, titration methods etc.

CONTENTS

THEORY

UNIT 1

Introduction to solid –liquid Extraction

Simple extraction, multiple extractions, separation of drugs in multicomponent system. Effect of pH on extractability of drugs, continuous extractions.

UNIT 2

Classification, theories, retention mechanism, separation efficiency

Classification, theories, retention mechanism, separation efficiency, methodology and pharmacopoeial applications of column, paper and thin layer chromatography

UNIT 3

Electro-analytical methods: Basics of electro analytical methods

a) Potentiometric and pH metric methods

Standard reduction potentials, various electrodes and cell potential, applications of potentiometry and pH metry.

b) Conductometry

Conductance, factors affecting conductance, Kohlrausch law, conductivity cells, application.

UNIT 4

Titration Methods

Kjeldahl's method, Karl Fischer Titration.

PRACTICAL

1. Potentiometric titration of HCl vs NaOH, Oxalic acid vs NaOH, Acetic acid vs NaOH.
2. To study the heating and cooling methods, distillation, reaction work-up, filtration, extraction, purification, identification.
3. To study the use of stereo models.
4. Conductometric titration of HCl vs NaOH, Oxalic acid vs NaOH, Acetic acid vs NaOH.

SEMESTER-III

PHYTOCHEMISTRY

PAPER CODE: PHCH-RCC-3036

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES: To study about tannins, resins, phytochemical screening etc.

LEARNING OUTCOME: Students will understand about tannins, resins, phytochemical screening etc.

CONTENTS

THEORY

UNIT 1

Study of drugs containing resins combinations

Introduction, classification, general properties, chemical tests of resins. Pharmacognostic Studies of the following resin containing drugs: Colophony, Podophyllum, Jalap, Cannabis, Capsicus, myrrh, Asafoetida, balsam of Tolu, balsam of Peru, Benzoin, turmeric and Ginger.

UNIT 2

Study of tannins and tannin containing drugs

Introduction, classification, general properties, chemical tests. Drugs: Black catechu, pale catechu and Myrobalans.

UNIT 3

Study of Volatile oil containing drugs

Introduction, classification, general properties, chemical tests and general methods of obtaining volatile oils from plants. Pharmacognostic studies of the following drugs, containing volatile oils: Mentha, coriander, caraway, dill, fennel, cinnamon, lemon peel, lemon grass, clove, nutmeg, eucalyptus, chenopodium, cardamom, valerian, sandalwood.

UNIT 4

Phytochemical Screening

Basic idea of extraction, isolation and separation of active constituents from medicinal plants and Phytochemical Screening:

Basic principle of extraction. The factors which may affect the extraction process. Different type of extracts and their preparations. The comparative studies of different methods employed for extraction of phytoconstituents. Phyto chemical screening of alkaloids, saponins, cardenolides, bufadienolides, flavonoids, tannins, anthraquinones, cyanogenetic glycosides and amino acids in different extracts.

Suggested Readings:

1. Pharmacognosy and phytochemistry, part I and II, Vinod D. Rangari, Carrier Publications, 1st edition, Reprint, 2007.
2. Pharmacognosy V.E. Tylar, L.R. Brady, J.E. Habbers, Lea and Febiger Philadelphia, 8th edition, 1981.
3. Cultivation and utilization of Aromatic Plants, handa S.S and Kaul, M.K, regional Research Laboratory, Jammu, 1st edition, 1997.
4. Mukherji P.K, Quality control of Herbal Drugs, Business Horizon Pharma, Publishers, 1st edition, 2002.
5. Herbal drug technology, S.S. Agrawal and M. Paridhavi, Universities Press, 1st edition, 2007.

PRACTICAL

1. Separation of a mixture of two sugars by ascending paper chromatography
2. Separation of a mixture of o- and p-nitrophenol or o- and p-aminophenol by thin layer chromatography (TLC)
3. Extraction of lycopene from tomato.
4. Extraction of caffeine from tea.
5. Extraction of carotenoids from carrots.
6. Determination of amount of glucose by titration with Fehling solution.
7. To estimate nitrogen content by kjeldahl's method.

SEMESTER-IV

MICROBIOLOGY

PAPER CODE: PHCH-RCC-4016

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about microbiology, various types of microorganisms and the diseases caused, various types of viruses and their transmission, lab diagnosis, sterilization and disinfection etc.

LEARNING OUTCOME:

Students will learn about microbiology, various types of microorganisms and the diseases caused, various types of viruses and their transmission, lab diagnosis, sterilization and disinfection etc. Further the students will be able to identify different microbes by staining techniques.

CONTENTS

THEORY

UNIT 1:

Introduction to microbiology: Scope of microbiology, type of microorganisms, classification of microbes, actinomycetes, bacteria, rickettsia, spirochetes, and viruses. Identification of microbe's types and methods of staining techniques, electron microscopy, nutrition, cultivation, isolation and identification of bacteria, actinomycetes, fungi, viruses.

UNIT 2:

Control of microbes by physical and chemical methods:

- A. Disinfection and disinfectants, factors influencing action of disinfectants, dynamics of disinfection, antiseptics, and their evaluation.

- B. Sterilization: different methods, validation of sterilization methods and equipment, sterility testing of pharmaceutical products.
Clean area classification. Validation of aseptic room

UNIT 3:

Preservative efficacy, Microbial assay of antibiotics and vitamin B12

UNIT 4:

Immunology and immunological preparations: Principles, antigens and haptens, immune system, cellular and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, Hypersensitivity, active and passive immunization products, their preparation, standardization and storage.

PRACTICAL:

1. Date collection: Sample slides of microorganisms (bacteria, virus, spirochaetes, Rickettsia, Fungi).
2. Preparation of various growth media.
3. Identification of microbes by staining techniques.

SUGGESTED READINGS

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Pepler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, VallabhPrakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

SEMESTER-IV

ADVANCED ANALYTICAL CHEMISTRY-II

PAPER CODE: PHCH-RCC-4026

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about various types of chromatography, classification and principle of HPLC, HPTLC, Gas Chromatography.

LEARNING OUTCOME:

Students will understand about various types of chromatography, classification and principle of HPLC, HPTLC, Gas Chromatography. Further the students will be able to learn about analytical method development & validation protocol preparation.

CONTENTS

THEORY

UNIT 1:

High Performance Liquid chromatography (HPLC)

Introduction, theory-migration equation, theoretical plate, columns and stationary phases, measurement of column performance and its optimization, instruments for liquid chromatography including column packing for various types of chromatography, classification and principle of HPLC, mobile phase characteristics for normal and reversed phases, polarity and selectivity of the solvents, Instrumentation qualitative and quantitative applications.

UNIT 2:

HPTLC

Introduction to HPTLC, characteristic features, evaluation methods: visual comparison, area management, densitometry and thermal method, qualitative and quantitative applications.

UNIT 3:

Gas Chromatography

Introduction, principles of Gas- Chromatography, instrumentation, columns and stationary phases, qualitative and quantitative applications in pharmaceuticals.

UNIT 4:

Analytical method development & Validation protocol preparation

Method of Optimization, Accuracy, precision, linearity, specificity, system suitability, robustness.

PRACTICAL:

1. To demonstrate GC as analytical tool.
2. To demonstrate HPLC as analytical tool.
3. To demonstrate HPTLC as analytical technique

Reference books:

1. Advanced Analytical Chemistry, by Jessica Carol (Editor)
2. Advanced Analytical Chemistry by KiranSuryavanshi
3. Practical NMR Spectroscopy. M.L Martin, J.J. Delpuchand G.J Marin,Heyden.
4. Kemp. W.Organic spectroscopy 3rded. W.H. Freeman &Co
5. Introduction to NRM spectroscopy. R.J. Abraham, J. Fisher and P. Loftus,Wiley.
6. Application of Spectroscopy of Organic Compounds, J. R. Dyer, prenticeHall.
7. Spectroscopy Methods in organic Chemistry. D.H. Williams, I.Fleming,Tata McGrow Hills.
8. Instrumental Methods of Analysis, Willard Merritt, Dean and Settle, CBS publishers and Distributers, Delhi.
9. Introduction to high Performance liquid chromatography, RJ Hamilton, Chapman hall,London
10. Instrumental Methods of Chemical analysis, BK Sharma, Goel publication House. Meerut, India.
11. Instrumental Methods of chemical Analysis,3rdEd, GW Ewing, McGrew Hill book.
12. Introduction of Instrumental Analysis, Robert Braun, McGrew Hill; NewYork.

SEMESTER-IV

MEDICINAL CHEMISTRY-I

PAPER CODE: PHCH-RCC-4036

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about steroids, anesthetics and their mechanism of action, different enzymes and elevated levels in various disease conditions.

LEARNING OUTCOME:

Students will learn about steroids, anesthetics and their mechanism of action, different enzymes and elevated levels in various disease conditions; further the students will know about the functions of liver, kidney, heart, thyroid and tests to evaluate these organs.

CONTENTS

THEORY

UNIT 1:

Steroids: Introduction, Nomenclature, Stereochemistry, simple reactions of cholesterol, classification of sterols, sex hormones, cardiac glycosides, Bile acids, sapogenins.

UNIT 2:

Anesthetic

Chemical naming, structure activity relationship, physicochemical and steric, aspects, mode of action and use of the drugs under the following therapeutic classes:

- a. **General anaesthetic agents:** Introduction, medicinal aspects of anaesthetics, mode of action, gases and volatile liquid anaesthetics, intravenous anaesthetics, toxicity of general anaesthetics (divinely ether, ethyl chloride, cyclopropane, thiopentalsodium, ketamine).
- b. **Local anaesthetic agents:** Introduction, SAR, benzoic acid derivatives, aminobenzoic acid derivatives. Lidocaine derivatives, miscellaneous, toxicity, mode of action (benzocaine, procaine hydrochloride, mepivacaine, lidocaine, cinchocaine hydrochloride).
- c. **Sedatives-hypnotics:** Introduction, classification, SAR, barbiturates, amides and imides, alcohols and their carbamate derivatives, aldehydes and their derivatives, mode of action, non barbiturates (official drugs).

UNIT 3:

Chemical naming, structure activity relationship, physicochemical and steric aspects, mode of action and uses of the drugs under the following therapeutic classes:

- a. **CNS stimulants:** CNS stimulants of natural origin, synthetic CNS stimulants (nikethamide, methylxanthines and modified methylxanthines (theophylline))
- b. **Psychopharmacological agents:** antipsychotics, phenothiazines(chlorpromazine, trifluoperazine, butyrophenones, miscellaneous), antidepressants- TCA (amitriptyline),MAO inhibitors, atypical antidepressants, antianxiety drugs-meprobamate and related drugs, benzodiazepines (diazepam)
- c. **Hallucinogens:** Hallucinogenic agents related to indoles, phenethylamines, cannabinoids.

UNIT 4:**CVS agents**

Cardiac glycosides, SAR, mechanism of action , toxic effects, antihypertensive agents-introduction, etiology, ganglion blocking agents, antiadrenergic agents, drugs acting directly on smooth muscles, drugs acting in CNS (propranolol) antianginals and vasodilators introduction, mechanism of smooth muscle vasodilatation, esters of nitrous and nitric acid, side effects (nitroglycetine), antiarrhythmic and antifibrillic drugs classification of antiarrhythmic drugs, mechanism of action, side effects antilipemic drugs, promethazine).

PRACTICAL:

- 1.To synthesize sulphanilamide from acetanilide.
2. To synthesize phthalimide from phthalic anhydride.
3. To synthesize anthranilic acid from phthalimide.
4. To synthesize N-phenylanthranilic acid from o-chlorobenzoic acid.
5. To synthesize barbituric acid.
6. To synthesize iodoform.
7. To synthesize oxalic acid.
8. To synthesize phenytoin.
9. To synthesize hydantoin.
10. To synthesize paracetamol.

Suggested Books:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia. 10. Text book of practical organic chemistry- A.I.Vogel.

SEMESTER-V**ADVANCED ANALYTICAL CHEMISTRY-III****PAPER CODE: PHCH-RDS-5016****PAPER CREDIT: 06 (4T+2P)**

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about electromagnetic radiation- its properties and absorption by molecules, factors affecting absorption of radiant energy, dispersive IR spectrometer and Fourier Transform Infrared (FTIR) spectrometer, Molecular Luminescence spectroscopy, basic instrumentation and components, interpretation of spectra.

LEARNING OUTCOME:

Students will understand about electromagnetic radiation- its properties and absorption by molecules, factors affecting absorption of radiation. Along with the basic instrumentation and components, interpretation of spectra.

CONTENTS**THEORY****UNIT 1:****Ultraviolet/Visible molecular Absorption Spectroscopy**

Introduction, its properties and absorption by molecules, factors affecting absorption of radiation by molecules of Ultraviolet UV, Beer's Law and its deviations, Beer's & Lambert's Law, instrumentation, sample handling techniques and pharmaceutical application.

UNIT 2:**Infrared spectroscopy**

Introduction, instrumentation sample handling techniques of Infrared (IR), Fourier Transform Infrared (FTIR) and pharmaceutical applications.

UNIT 3:**Molecular Luminescence spectroscopy**

Theory of fluorescence and phosphorescence, factors affecting the intensity of chemiluminescence's, instrumentation and analytical applications.

UNIT 4:**Molecular Absorption spectroscopy**

Interpretation of spectra and applications of Absorption spectroscopy.

PRACTICAL:

1. To determine dissociation constant (pK_a) of indicator by using UV-visible spectrophotometer.
2. Detection and identification test of proteins & amino acid.
3. Detection and identification test of sodium chloride.
4. Detection and identification of carbohydrates.
5. Detection and identification of Lipids.
6. Analysis of normal and abnormal constituents of urine.
7. To perform the assay of Mefenemic acid.
8. To perform the assay of Calcium gluconate.
9. To perform the assay of Isoniazide tablet,
11. To perform the assay of active ingredient for Riboflavin tablet.
12. To perform content uniformity test for paracetamol.

Suggested Books:

1. Advanced Analytical Chemistry by Jessica Carol (Editor)
2. Advanced Analytical Chemistry by KiranSuryavanshi
3. Practical NMR Spectroscopy. M.L Martin, J.J. Delpuchand G.J Marin,Heyden.
4. Kemp. W.Organic spectroscopy 3rded. W.H. Freeman &Co
5. Introduction to NRM spectroscopy. R.J. Abraham, J. Fisher and P. Loftus,Wiley.
6. Application of Spectroscopy of Organic Compounds, J. R. Dyer, prenticeHall.
7. Spectroscopy Methods in organic Chemistry. D.H. Williams, I.Fleming,TataMcGrow Hill.
8. Instrumental Methods of Analysis, Willard Merritt, Dean and Settle, CBS publishers and Distributers, Delhi.
9. Introduction to high Performance liquid chromatography, RJ Hamilton, Chapman Hall,London
10. Instrumental Methods of Chemical analysis, BK Sharma, Goel publication House. Meerut, India.
11. Instrumental Methods of chemical Analysis,3rdEd, GW Ewing, McGrew Hill.
12. Introduction of Instrumental Analysis, Robert Braun, McGrew Hill; NewYork.

SEMESTER-V

PHARMACOLOGY-I

PAPER CODE: PHCH-RDS-5026

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about pharmacology, absorption, distribution, metabolism and excretion of drugs. Along with the Clinical trials.

LEARNING OUTCOME:

Students will understand about the pharmacology, absorption, distribution, metabolism and excretion of drugs. Principles of pharmacokinetics, bioavailability and bioequivalence, pharmacogenetics, adverse drug reaction, drug interactions, bioassays & preclinical studies. Further the students will be able to learn about Clinical trials.

CONTENTS

THEORY

UNIT 1: Pharmacology

- **General pharmacology:** Introduction to pharmacology, sources of drugs, dosage forms and routes of administration.
- **Pharmacodynamics:** General principles of drug action. Molecular basis of drug Targets.

Pharmacokinetics: Absorption, distribution, Metabolism and excretion of drugs. Principles of pharmacokinetics, Bioavailability and Bioequivalence, pharmacogenetics, Adverse drug reaction, drug interactions, Bioassays & Preclinical studies. Clinical trials.

UNIT 2:

Pharmacology of Peripheral Nervous system

Neurohumoral transmission (autonomic and somatic), Parasympathomimetic, parasympatholytic, sympathomimetics, adrenergic receptor and neuron, blocking agents, ganglionic stimulants and blocking agents, neuromuscular blocking agents, basics of ANS disorders.

UNIT 3:

Pharmacology of Respiratory System

Drugs used in treatment of Bronchial asthma, Dry cough, COPD, Mucolytics, Expectorants, Antitussives).

UNIT 4:**Pharmacology of Nitric oxide**

Pharmacology of Nitric oxide, endothelin's, ANP, purines.

PRACTICAL:

1. Introduction to Experimental Pharmacology.
2. To study basic instruments used for isolated tissue experiments
3. To study different laboratory animals.
4. Introduction to CPCSEA, its constitution and functions (CPCSEA guidelines)
5. To study various methods of anesthesia & method of disposal of animals.
6. Demonstration of mounting of isolated rat ileum.
7. To find out nature of unknown drug using rat ileum using simulation software.
8. To study the effect of various drugs acting on neuromuscular junction using simulation software (Computer Assisted Experiment).

Reference Books:

1. K.D Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
2. Fundamentals of Experimental Pharmacology by M.N. Ghosh.
3. Handbook of Experimental Pharmacology by S.K. Kulkarni
4. Pharmacology by V.J. Sharma
5. Lippincot's Pharmacology by Heavy & Champ.
6. Practicals in Pharmacology by Dr. Goyal.
7. Medical Pharmacology by Goth.
8. Pharmacology by Gaddum
9. Principles of Drug Action by Goldstein Aronow&Kalaman.
10. Lewis Pharmacology by Crossland.
11. Elements of Pharmacology by Dr. Derasari& Dr. Gandhi.

SEMESTER-V

MEDICINAL CHEMISTRY-II

PAPER CODE: PHCH-RDS-5036

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about chemical classification, Chemical nomenclature, mechanism of action, structure activity relationship & therapeutic uses of various drugs.

LEARNING OUTCOME:

Students will understand about basic information of Chemical classification. Chemical nomenclature, Mechanism of action, Synthesis of the agent, Structure activity relationship & therapeutic uses of various drugs.

CONTENTS

THEORY

UNIT 1:

Introduction, Chemical classification (if any). Chemical nomenclature, Mechanism of action, Synthesis of the agent (mentioned in the bracket), Structure activity relationship & therapeutic uses.

- a. Sulphonamides and fluoroquinolones (sulphanilamide, sulphaguanidine, sulphathiazole, sulphafurazolesulphamerizine, sulphamethoxazole).
- b. Antimalarials (chloroquine, primaquine, mepacrine hydrochloride, pyrimethamine).
- c. Antimycobacterial (Antileprotic&Antitubercle agents) (isoniazid, para-aminosalicylicacid).
- d. Antifungal/ Antiemetic agents (metronidazole,fluconazole).

UNIT 2:

Introduction, Chemical classification (if any), Chemical nomenclature, Mechanism of action, Synthesis of the agent (mentioned in the bracket), Structure activity relationship & Therapeutic uses.

- a. Antiviral drugs including Anti- HIV drugs(amantadine).
- b. Antineoplastic agents (methotrexate, chlorambucil, mustine, thiotepa, cyclophosphomide, 6-mercaptopurinehydroxylurea).

Antiseptics and Disinfectants

UNIT 3:**Antibiotics**

Introduction, Chemical classification (if any), Chemical nomenclature, Mechanism of action, Synthesis of the agent (mention in the bracket), Structure activity relationship & Therapeutic uses of Antibiotics.: Beta-lactams, aminoglycosides, tetracyclines, macrolides, polyene & polypeptide antibiotics, chloramphenicol, ampicillin, carbenicillin, cephalixin, penicillin-V.

UNIT 4:**Combinatorial chemistry**

Introduction, principle, importance of new drug discovery, various synthetic approaches and library preparations, High throughput screening (HTS).

PRACTICAL:

1. Synthesis of aspirin from salicylic acid.
2. Synthesis of N-acetyl glycine from glycine.
3. Synthesis of benzoic acid from benzyl alcohol.
4. Synthesis of benzyl from benzoin.
5. Synthesis of benzaldehyde phenyl hydroxide from benzaldehyde.
6. Synthesis of Iodoform from ethyl alcohol.

Suggested Books:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Ladu, B.N., Mandel H.G & E.L Way, Fundamentals of drug metabolism & disposition, William & Wilkins Co. Baltimore.
4. Indian Pharmacopoeia
5. Text book of practical organic chemistry. A.I Vogel
6. Remington's Pharmaceutical Chemistry
7. Burger's Medicinal Chemistry, Vol I to IV
8. Walter Sneader's drug Discovery-A history, John Willy & Sons, Ltd. UK.
9. Vogel's Text book of principal Organic Chemistry, ELBS/ Longman, London.
10. Practical Organic chemistry by Mann & Saunderson, Orient Longman, London.
11. Spectrometric identification of Organic compounds by R.M. Silverstein, G. Clayton Bassel's and T.C. Movvill, John Wiley & sons, USA.

SEMESTER-VI**ADVANCED ANALYTICAL CHEMISTRY-IV****PAPER CODE: PHCH-RDS-6016****PAPER CREDIT: 06 (4T+2P)**

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about the basic fundamental of NMR Spectroscopy, Mass Spectroscopy, Gravimetric analysis and GC-MS.

LEARNING OUTCOME:

Students will understand about the basic fundamentals of various Spectroscopy.

CONTENTS**THEORY****UNIT 1:****Fundamental of NMR spectroscopy:**

Principle, basics of NMR technique, NMR spectra, instrumentation and applications, criteria for a compound to be NMR active. Shielding-deshielding, splitting. Resolution and multiplicity.

UNIT 2:**Mass Spectrometry:**

Principle, Basic introduction of MS, unit mass and molecular ions, important terms-singly and doubly charged ions, meta stable peak, base peak, isotopic mass peaks and relative intensity.

UNIT 3:**Gravimetric analysis:**

Principle, Basic introduction of gravimetric analysis. Advantages, disadvantages and its applications. Precipitation techniques, solubility products: The colloidal state. Supersaturation co-precipitation, post-precipitation. Digestional washing of the precipitate, Filtration, Filter papers and

crucibles, ignition. Thermogravimetric curves, specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants.

UNIT 4:

GC-MS

Principle, Basic introduction of GC-MS, advantages, disadvantages and its applications.

Reference Books:

1. Advanced Analytical Chemistry by Jessica Carol (Editor)
2. Advanced Analytical Chemistry by Kiran Suryavanshi
3. Practical NMR Spectroscopy. M.L Martin, J.J. Delpuchand G.J Marin, Heyden.
4. Kemp. W. Organic spectroscopy 3rded. W.H. Freeman & Co
5. Introduction to NRM spectroscopy. R.J. Abraham, J. Fisher and P. Loftus, Wiley.
6. Application of Spectroscopy of Organic Compounds, J. R. Dyer, prenticeHall.
7. Spectroscopy Methods in organic Chemistry. D.H. Williams, I. Fleming, Tata McGrew Hill book.
8. Instrumental Methods of Analysis, Willard Merritt, Dean and Settle, CBS publishers and Distributers, Delhi.
9. Introduction to high Performance liquid chromatography, RJ Hamilton, Chapman hall, London
10. Instrumental Methods of Chemical analysis, BK Sharma, Goel publication House. Meerut, India.
11. Instrumental Methods of chemical Analysis, 3rdEd, GW Ewing, McGrew Hill book.
12. Introduction of Instrumental Analysis, Robert Braun, McGrew Hill; New York.

SEMESTER-VI
PHARMACOLOGY-II

PAPER CODE: PHCH-RDS-6026

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about the pathophysiology and drugs acting on Urinary System, Pharmacology of Gastrointestinal Tract and RIA.

LEARNING OUTCOME:

Students will understand about pathophysiology and drugs acting on various systems in human body along with detailed Pharmacology.

CONTENTS

THEORY

UNIT 1:

Pathophysiology and Drugs used in Congestive Cardiac Failure, Angina, Myocardial Infraction, Cardiac Arrhythmias, hypertension, Hyperlipidaemia and Atherosclerosis, Anaemia, Coagulation disorders, Shock.

UNIT 2:

Drugs Acting on Urinary System:

Fluid and electrolyte balance, Diuretics, Anti diuretics, Urine acidifying and alkalinizing agents.

UNIT 3:

Pharmacology of Gastrointestinal Tract

Antacid, antiemetics, antidiarrheal, laxatives, appetizer, demulcents, mucolytics, Adsorbents, Astringents, Digestants Pathophysiology, and drugs used in peptic ulcer & inflammatory

Bowel Disease.

UNIT 4:

Immunochemical techniques; Radial Immuno assay (RIA), Radioligand Studies, Enzyme Linked Immuno Sorbent Assay (ELISA).

Reference Books:

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-Hill.
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A.K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology.
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig & Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan

SEMESTER-VI

MEDICINAL CHEMISTRY-III

PAPER CODE: PHCH-RDS-6036

PAPER CREDIT: 06 (4T+2P)

T: Theory P: Practical

Total no. of Lectures: 60+30(L+P) Total Marks: 100 (T60+IA20+P20)

L: Lecture, T: Tutorial, P: Practical

T: Theory, IA: Internal Assessment, P: Practical

OBJECTIVES:

To learn about the drug design, Physiochemical properties of drug molecules molecular modelling and drug design.

LEARNING OUTCOME:

Students will understand about physiochemical properties of drug molecules, molecular modelling and drug design.

CONTENTS

THEORY

UNIT 1:

Drug design

Analogues and prodrug concept, Concept of lead, Rational approach to drug design, Overview of drug design and development, Tailoring of drug.

UNIT 2:

Molecular modelling and drug design:

Basic Principle and Introduction of molecular modelling and drug design. De novo Drug Design, Molecular modelling (MM), Computer Aided Drug Design (CADD), methods of lead discovery, identification and Optimization of Lead, Docking study.

UNIT 3:

QSAR study: Lipophilic parameters, electronic and steric parameters, model of QSAR.

Reference Books:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Ladu, B.N., Mandel H.G & E.L Way, Fundamentals of drug metabolism & disposition, William & Wilkins Co. Baltimore.
4. Indian Pharmacopoeia
5. Text book of practical organic chemistry. A.I Vogel
6. Remington's Pharmaceutical Chemistry
7. Burger's Medicinal Chemistry, Vol I to IV
8. Walter Sneader's drug Discovery-A history, John Willy & Sons, Ltd. UK.
9. Vogel's Text book of principal Organic Chemistry, ELBS/ Longman, London.
10. Practical Organic chemistry by Mann & Saunderson, Orient Longman, London.
11. Spectrometric identification of Organic compounds by R.M. Silverstein, G. Clayton Bassel's and T.C. Movvill, John Wiley & sons, USA.

