

**FIRST YEAR B.PHARMACY
FIRST SEMESTER**

R14PHS11 BIO STATISTICS AND COMPUTER APPLICATIONS- I
THEORY - I **(54 Hours)**

UNIT - I **(11 Hours)**
Application of Bio Statistics in Medicine and Pharmacy – Collection of data - Classification and Tabulation of Statistical Data – Diagrammatic and Graphical representation – Measure of Central Tendency - Mean – Median – Mode – Geometric Mean.

UNIT – II **(11 Hours)**
Purpose of Sampling – Methods of Sampling – Test of Significance – Null Hypothesis and Alternative Hypothesis – Standard Errors – One Tailed test and Two tailed test – T test.

UNIT – III **(10 Hours)**
Correlation analysis - Application of correlation analysis – Types of correlation – Scatter diagram - Karl Pearson's correlation coefficient - Spearman's rank correlation coefficient.

UNIT – IV **(11 Hours)**
Computer Application: Basic computer components of organization – Classification of computers - Binary number system conversion – Types of Memory device – Network Topology - Types of computer Networks – Internet search engine – Computer input and out put device –Multimedia – MS- Office Package advantages and application.

UNIT – V **(11 Hours)**
Types of Computer Software and Application – Types of Operating System - Statistical Software Tools – DBMS and RDBMS – Data Abstraction – E –R Diagram Concept – Client Server Process – Network layers – HTML Web pages.

TEXT BOOKS

1. Dr. Paradkar A.R. & M.G.Dhayagude., "*Introduction to Bio Statistics and Computer Science*", Y.I.Shah,.Six Edition 2006.
2. Sundar Rao P.S.S and Richard J., "*Introduction to Bio Statistics and Research Methods*", Fourth Edition.2009.
3. V.Rajaraman., "*Fundamentals of Computers*", Fourth Edition 2009.
4. Balagurusamy E., "*Fundamentals of computing and programming*", Second Edition. 2010.

REFERENCES

1. Gupta S.P., "*Statistical Methods*", Sultan Chand & Sons. Edition 2011.
2. Jerrold. H. Zar., "*Bio statistical Analysis*", Fourth Edition. 2008.
3. Micro Soft office 2010 In Simple Steps, Kogent Learning Solutions.Edition.2011.
4. Margaret Levine Young., "*Complete Reference Internet*", Second Edition. 2007.

**R14PHC12
THEORY**

PHARMACEUTICAL ORGANIC CHEMISTRY – I

(54 Hours)

UNIT – I

(11 Hours)

Structural Theory: Atomic and molecular orbitals, electronic configuration, hybrid orbitals, polarity, melting point, boiling point, composition of organic compound Empirical and molecular formula determination, determination of molecular weight. Electronic theory of Bonding, Reactive species-carbanion, carbonium ion, Free radicals. Fundamental aspects of Reaction Mechanism, Electron displacement effects. Classification and IUPAC nomenclature of organic compounds

UNIT-II

(11 Hours)

Alkanes: Nomenclature, physical properties, preparation and reactions with mechanism, Free radical reaction, Substitution reaction, Bond dissociation energy, Energy of activation Alicyclic Hydrocarbons: Preparation and Reactions, Bayer's strain theory, Preparation and reactions of carbene Alkenes: Nomenclature, preparation and reactions with mechanisms, Markovnikov's rule and peroxide effect, Electrophilic and Free radical addition reactions. Dienes: Preparation and Reactions, stability of conjugated dienes, 1, 2 – addition and 1, 4 – addition. Alkynes: Nomenclature, preparation and properties, Reactions with mechanism, Acidity of Alkynes, Tautomerism.

UNIT – III

(11 Hours)

Benzene: Nomenclature, stability, Resonance, Aromatic character, Huckle's $(4n+2)$ rule, Nomenclature of Benzene derivatives, Electrophilic aromatic substitution reaction with mechanism, Theory of reactivity and orientation effect of substituent groups, orientation of disubstituted benzene, and synthesis.

UNIT – IV

(10 Hours)

Nitroalkanes and Aromatic Nitro compounds: Nomenclature, structure, method of preparation, Physical and chemical properties.

UNIT – V

(11 Hours)

Alkyl Halides and Aryl Halides: Structure, classification and Nomenclature, physical properties, preparation reaction, mechanism and kinetics of Nucleophilic substitution reaction (SN_1 & SN_2), Elimination reactions (E_1 & E_2) excluding stereochemistry.

R14PHC13 PHARMACEUTICAL ORGANIC CHEMISTRY – I

PRACTICAL

(54 Hours)

1. Introduction to the various laboratory techniques through demonstrations involving synthesis of the following compounds:
 1. Acetanilide (Acetylation)
 2. Phenyl benzoate (Benzoylation)
 3. 2, 4, 6 – Tribromo aniline (Bromination)
 4. 1 – Phenyl azo -2-naphthol (Diazotization)
 5. Salicylic acid (Hydrolysis of ester)
 6. m–Dinitro benzene (nitration)
 7. Benzoic acid (side chain oxidation).
2. Identification of organic compounds belonging to the following class- (Systematic qualitative organic analysis)
 1. Phenols.
 2. Amides
 3. Amines
 4. Carboxylic acids.
 5. Dicarboxylic acid.
 6. Aldehydes.
 7. Ketones.
 8. Nitro compounds.
3. Determination of Melting point of organic compounds.
4. Determination of Boiling point of organic compounds.

TEXT BOOKS

1. Morrison and Boyd., “*Organic Chemistry*”, Pearson education, Delhi, India.6th edition, 2006,
2. Arun Bahl and Bahl B.S., “*Advanced Organic Chemistry*”, S. Chand and company Ltd, New Delhi, India. 1st edition, 2007

REFERENCES

1. I.L. Finar., “*Organic Chemistry*”, Vol I and II, 6th, Longman Publishers, Singapore edition, 1994.
2. Soni P.L., Chawla H.M., “*Text Book of Organic Chemistry*”, Sultanchand & sons Educational Publishers, New Delhi, India. 28th edition 2002
3. “*A Text Book of Organic Chemistry*”, S. Chand & Company Ltd, New Delhi, India. 18th edition 2006.
4. Reactions and Reagents by O.P Agarwal, Krishna Prakashan Media (p) Ltd, Meerut. 42nd edition, 2006.

5. Bentley and Driver "*Text book of Pharmaceutical Chemistry*", 8th edition, Manzarkhan, Oxford University Press, New Delhi, India.
6. "*Indian Pharmacopoeia-Vol I and II*", 2010, the Indian Pharmacopoeia Commission, Ghaziabad.
7. Practical Organic Chemistry by Vogel, Dorling Kindersley (India) Pvt Ltd. 5th edition, 2008.

**R14PHC14
THEORY**

PHARMACEUTICAL INORGANIC CHEMISTRY

(54 Hours)

UNIT –I

(11 Hours)

The Periodic table: Dobernier's triads, Newland's law of octaves, Mendeleef's periodic table, Modern Periodic Table, Periodic table and electronic configurations of element. Periodic trends in properties.

Radio activity and Radioisotopes: Introduction to Radioactivity Detection and measurement of radioactivity, Isotopes, Isobars, Radioisotopes. Biological effects of Radiation, Artificial Radioactivity storage and medicinal uses of Radioisotopes. Precaution in the use of Radioisotopes, units of Radioactivity.

Theory of co-ordination compounds with special reference to application in **Pharmacy and Pharmaceutical analysis:** EDTA, Dimercaprol, Penicillamine, 1,10-Phenanthroline

Method of preparation, assay (only those compounds that are superscribed by a), test for purity, storage conditions and uses of inorganic compounds in the following categories.

UNIT II - GASTRO INTESTINAL AGENTS AND RELATED COMPOUNDS

(11 Hours)

Acidifiers: Dilute hydrochloric acid

Antacid: Classification, Ideal qualities of antacid, side effects, advantages, combination therapy, acid neutralizing capacity, Magnesium trisilicate Aluminium hydroxide gel^a, Aluminium phosphate, Magnesium hydroxide, Magnesium carbonate, Calcium Carbonate^a, Dimethicone, Magaldrate. Saline Cathartics: Magnesium sulphate^a, Magnesium carbonate, Sodium phosphate.

UNIT - III

(10 Hours)

Topical Agents: Adsorbents and Protectives: Activated Charcoal, Bismuth subcarbonate^a. Talc, Zinc oxide^a, Calamine, Zinc stearate, Titanium dioxide^a, Kaolin, Silicon polymers.

Astringents: Alum, Zinc sulphate.

Antimicrobials: Hydrogen peroxide^a, Potassium permanganate, Chlorinated lime^a, Iodine^a, Boric acid^a, Silver nitrate, Povidone-Iodine, Selenium sulphide^a, Zinc undecenoate.

Anti-caries agents and Dentrifices: Role of fluorides as anti-caries agent Sodium fluoride.

Desensitising agents: Strontium chloride and Zinc chloride.

UNIT – IV

(11 Hours)

Major Intra and Extra Cellular Electrolytes: Physiological role of Chloride, Phosphate, Bicarbonate, Sodium, Potassium, Calcium and Magnesium. Electrolytes use for Replacement Therapy: Sodium chloride, Potassium chloride^a, Calcium lactate, Calcium gluconate, Dibasic calcium phosphate and Tribasic calcium phosphate.

Electrolytes used in the Acid–base Therapy: Sodium acetate, Potassium acetate, sodium citrate^a, Potassium citrate.

Electrolyte Combination Therapy: Sodium chloride solution, Sodium chloride injection, Oral rehydration salt, Compound Sodium lactate injection, Total Parenteral Nutrients.

UNIT – V

(11 Hours)

Medicinal Gases: Oxygen^a, Carbon dioxide^a, Helium, Nitrogen, Nitrous oxide. Essential and Trace ions: Definition, Physiological role of Iron, Copper, Zinc, Chromium, Manganese, Molybdenum, Selenium, Sulphur, Iodine. Haematinic: Ferrous fumarate, Ferrous gluconate, Ferrous sulphate^a, Iron and Ammonium citrate^a

Sclerosing Agent: Hypertonic saline, Sodium tetra decyl sulphate. Expectorants: Ammonium chloride^a, Potassium iodide.

Sedative: Potassium bromide

Antidotes: Sodium nitrite, Sodium thiosulphate^a

R14PHC15

PHARMACEUTICAL INORGANIC CHEMISTRY

PRACTICAL

(54 Hours)

1. Systematic qualitative analysis of inorganic mixtures of upto 4 radicals. Six mixtures to be analyzed, preferably by semi-micro methods. All identification tests for pharmacopoeia inorganic pharmaceuticals and qualitative tests for cations and anions should be covered.
2. Tests for purity for swelling power in Bentonite,
3. Tests for purity for Ammonium-salts in potash alum.
4. Adsorption power in Heavy Kaolin.
5. Presence of Iodates in KI
6. Preparation of Boric acid,
7. Preparation of Potash alum,
8. Preparation of Magnesium sulphate
9. Preparation of Sodium citrate

TEXT BOOKS

1. Rajasekaran V. N., "*Text Book of Pharmaceutical Inorganic Chemistry Theory and Practical*", Sun Publication, Chennai. 2nd edition, 2005.
2. L. M. Artherden Bentley and Driver' s., "*Text Book of Pharmaceutical Chemistry*", Oxford University Press, New Delhi. 8th edition, 2003.

REFERENCES

1. Indian Pharmacopoeia, The Indian Pharmacopoeia Commission, Ghaziabad. 2007
2. Remington "*The Science And Practice of Pharmacy Vol I and II*", Wolters Kluver (India) Pvt. Ltd., New Delhi. 21st edition, 2009
3. Block J. H., Roche E. B., Sonie T. O., Wilson C. O., "*Inorganic Medicinal and Pharmaceutical Chemistry*", Varghese Publishing House, Bombay. 1st edition, 1986.

THEORY**(54 Hours)****UNIT I - INTRODUCTION****(11 Hours)**

Introduction to qualitative and quantitative analysis, Control of errors in Analysis. Validation of analytical methods accuracy and precision, repeatability and reproducibility, specificity, sensitivity, detection limit, linearity and range, ruggedness, Stoichiometric calculation - Express concentration of solutions, expression of analytical results, volumetric calculation, primary, secondary standards, preparation and storage of standard solution.

UNIT II - TECHNIQUES OF QUANTITATIVE ANALYSIS**(10 Hours)**

Balances – Analytical - Care and use, use of riders, Electronic Balances, Calibration of Analytical weights, Methods of Sample weighing, Precautions for sample weighing. Volumetric apparatus- Calibration of burette, pipette, volumetric flask, Water for lab use.

UNIT III - LIMIT TESTS**(11 Hours)**

Introduction to Pharmacopoeia and Monograph. Quality control and test for purity: Swelling power, Acid neutralizing capacity, presence of iodates and ferric ion. Sources of impurities in pharmaceutical Substances. Limit test: Definition, importance, general procedure for limit test for chlorides, sulphate, Iron, arsenic, heavy metals, lead. Modified limit test for chlorides and sulphates in potassium permanganate and sodium bi carbonate.

UNIT IV - PHYSIO-CHEMICAL PROPERTIES**(11 Hours)**

Calculation of pH of aqueous solution of strong and weak acids and bases, acidic and basic strength and pKa, Henderson –Hassel balch equation, buffers, salt hydrolysis, ionic strength and detective constant – partition coefficient, solubility. Common ion effect, effect of solvents on solubility.

UNIT V - TITRIMETRIC METHODS OF ANALYSIS – I**(11 Hours)**

Neutralization Titration: Theory of indicators, neutralization curves, choice of indicators, titration of polyprotic system (mixture of acids), determination of carbonates and bicarbonates by titration.

Oxidation reduction methods: Theory of redox titration, redox indicators, permanganate titrations, dichromate titration, iodometry, iodimetry, standardization and titration involving ceric ammonium sulphate.

**R14PHA17 PHARMACEUTICAL ANALYSIS – I
PRACTICAL**

(54 Hours)

1. Standardization of analytical weights and calibration of volumetric apparatus.
2. Preparation and Standardization of volumetric solutions and assay of official compounds involving Acidimetry, Alkalimetry, Permanganometry, ceriometry, lodimetry and iodometry as per IP'96.
3. Acidimetry - Assay of Sodium bicarbonate.
4. Determination of Sodium carbonate content of washing soda.
5. Alkalimetry - Assay of benzoic acid Assay of Boric acid
6. Permanganometry - Assay of Potassium bromide
7. Ceriometry - Assay of dried ferrous sulphate
Assay of Ascorbic acid.
8. lodimetry - Assay of sodium thio sulphate
Assay of Sodium meta bisulphate
9. Iodometry - Assay of bleaching powder
Assay of Copper sulphate
10. Limit tests - Limit test for Chloride
Limit test for Sulphate
Limit test for iron
Limit test for arsenic
Limit test for heavy metals.

TEXT BOOK

1. Beckett A.M. and Stenlake J.B., "*Practical Pharmaceutical Chemistry*", Vol. I & II, CBS Publishers and Distributors, New Delhi 4th Edition, 2005.
2. Antherden L.M., Bentley and Drivers., "*Text book of Pharmaceutical Chemistry*", Oxford University Press, Delhi, 8th Edition, 1995.
3. Block J.H., Roche E, Soine T.O. and Wilson C.O. "*Inorganic Medicinal and Pharmaceutical Chemistry*", 1986, Varghese publishing House, Bombay.
4. Barnes J.D., Denny R C & Mendham J, Thomas M.J.K., "*Vogel's Text book of quantitative chemical analysis*", Pearson Education pvt Ltd. Delhi 6th Edition, 2003.
5. Napoleon A.A., "*Pharmaceutical Titrimetric Analysis–Theory and Practical*", Kalaimani publication and Distributors, Tamil Nadu 1st Edition, 2006.
6. Rajasekaran V.N., "*Textbook of Pharmaceutical Inorganic Chemistry–Theory and Practical*", Sun Publications, Chennai 2nd Edition, 2005

REFERENCES

1. Indian Pharmacopoeia, Government of India, "*Ministry of Health and Family welfare*", The controller of Publication, New Delhi 5th Edition, 2010.
2. Connors K.A., "*A text book of Pharmaceutical Analysis*", A Wiley interscience, Singapore 3rd Edition, 1999.
3. Knevel A.M. and Digangi F.E., "*Jenkin's Quantitative Pharmaceutical Chemistry*", Mc.Graw Hill Book Co. New York.
4. David G Watson "*Pharmaceutical Analysis*", Elsevier Limited, London. 2nd Edition, 2005.
5. Joachim ermer, McB.Miller J.H., "*Method validation in Pharmaceutical Analysis*", Wiley – VCH Verlag Gmbh nad Co.kGaA, Weirheim 2005.
6. Lee J.D. "*A new concise Inorganic Chemistry*", , 3rd Edition, 1989, English Language book society, London.

THEORY**(54 Hours)****UNIT I - SCOPE OF ANATOMY****(10 Hours)**

Physiology and basic terminology (Description of the body as such planes and terminologies). Structure and functions of cell components. Tissues: Epithelial tissue, connective tissue, Muscular tissue and Nervous tissues, their types and characteristics

UNIT II - BONES AND JOINTS**(11 Hours)**

Structure and functions of skeleton, classification of joints, types of movements of joints and their disorders, Skeletal muscles: Gross Anatomy, Histology, And Physiology of muscle contraction. Sports Physiology: Drugs used in athletics, doping.

UNIT III – BLOOD**(11 Hours)**

Composition and functions of blood including their disorders. Blood grouping and its significance, mechanism of coagulation, bleeding and clotting disorders. Reticulo-endothelial system and its functions. Lymph: Formation of lymph and its composition, spleen structure and functions and disorders.

UNIT IV - DIGESTIVE SYSTEM**(11 Hours)**

Gross anatomy of the G.I.T and its physiology with special reference to liver, pancreas and stomach, Digestion, absorption, various gastrointestinal secretion and its regulation, movements of intestine and disorders of digestive system.

UNIT V - ENDOCRINE SYSTEM AND SENSE ORGANS**(11 Hours)**

Basic Anatomy and Physiology of Pituitary, Thyroid, Thymus, Pineal gland, Parathyroid, Adrenal and Pancreas glands. Regulation of hormonal secretion and disorders like dwarfism, gigantism, acromegaly, diabetes insipidus, cretinism, myxoedema, goiter, Addison's disease, Cushing's syndrome, diabetes mellitus, pheochromocytoma, Physiology of vision, audition, olfaction, taste and skin.

**R14PHL19
PRACTICAL**

HUMAN ANATOMY AND PHYSIOLOGY – I

(54 Hours)

1. Determination of Hemoglobin content of human blood.
2. Determination of R.B.C content of human blood.
3. Determination of W.B.C content of human blood.
4. Determination of Blood groups.
5. Determination of Blood pressure.
6. Determination of Bleeding time and clotting time.
7. Determination of Erythrocyte sedimentation rate of human blood
8. Determination of Tonicity of human blood.
9. Study of histological slides of different tissues/organs.

TEXT BOOKS

1. Gerard J Tortora, Bryan Derrickson., "*Principles of Anatomy and Physiology*", Published by Wiley, USA 11th Edition.
2. Anne Waugh Ross and Wilson., "*Anatomy and Physiology in Health illness*" Published by Churchill Livingstone Elsevier, UK 10th Edition, 2006.
3. Cinnamon Van Putte, Seeley's., "*Fundamentals of Human Anatomy and Physiology*", Tata Mc Graw Hill, New Delhi 7th Edition 2009.
4. Chatterjee C.C., "*Human Physiology, Vol – I & II*", Medical Allied Agency, Calcutta. 11th Edition, 1997.

REFERENCES

1. Davidson's "*Principles and Practice of Medicine*", Churchill Living Stone, Elsevier, USA, 21st edition, 2010.
2. Guyton A, Hall J. E., "*Textbook of Medical Physiology*", Elsevier ,New Delhi, 11th Edition.

SECOND SEMESTER

R14PHS21 BIO STATISTICS AND COMPUTER APPLICATIONS-II
THEORY - II (54 Hours)

UNIT – I (11 Hours)

Introduction to Basic Concepts of Bio Statistics Population data – Sample and Variables – Frequency distribution – Bivariate Frequency distribution – Harmonic mean – Measure of dispersion - Range – Quartile Deviation – Mean Deviation - Standard Deviation - Variance – Skew ness and Kurtosis.

UNIT - II (10 Hours)

Chi Square test – Degrees of Freedom – F test - Analysis of Variance – Types of ANOVA – Non Parametric Sign test – Advantages of Non Parametric test.

UNIT – III (11 Hours)

Regression Analysis – Types of Regression Analysis- Utility of Regression Analysis – Comparison of Correlation and Regression – Regression Equations.

UNIT – IV (11 Hours)

Computer Application: Introduction to Unix / Linux Operating System and Advantages – Unix Architecture – File System – Basic Commands – Directors – File Permissions - Pipes - vi Editor.

UNIT – V (11 Hours)

Introduction to C language – Character Set – C key words – Scope of Variables – Relational and Logical Operators – Reading and Writing Character – Decision Making Control Statement – Controls Loops – Arrays - Functions – Developing C Programs.

TEXT BOOKS

1. Arora P.N. and Malhan P.K., “*Bio Statistics*” Edition 2008.
2. Pramod Chandra Bhatt P., “*Introduction to Operating System Concepts and Practice*” Second Edition.2008.

REFERENCES

1. Veer Bala, Rastogi., “*Fundamentals of Bio Statistical*”, Second Edition.2011.
2. Herbert C, Schildt., “*The Complete Reference*”, Fourth Edition 2011.
3. Graham Glass & King Ables “*UNIX for Programmers and Users*”, Third Edition, 2009.

THEORY**(54 Hours)****UNIT - I****(11 Hours)**

Solutions- Solubility- Functional group effect on solubility-Determination of solubility- Dissolution rate- Factors affecting solubility and dissolution rate. Dissolution study-Noyes Whitney equation- Theories of dissolution, isotonic solutions, Distribution law. Diffusion- Partition co-efficient- Fick's laws of diffusion- Factors affecting diffusion- Steady state diffusion- Sink conditions- Diffusion studies by various methods.

UNIT-II**(11 Hours)**

Surface and Interfacial tensions at liquid/liquid interface- Measurement of surface and interfacial tensions- Spreading co-efficient- Adsorption at solid/gas and solid/liquid interfaces- Surface active agents and their applications- HLB classification- Electrical properties at interfaces.

UNIT-III**(10 Hours)**

Rheology- Viscosity, Newtonian and non-Newtonian systems- Determination of viscosity- Thixotropy- Quantification of thixotropy.

UNIT-IV**(11 Hours)**

Colloidal Dispersions- Definition- Types and properties of colloids- Protective colloid- Purification of colloids- Application of colloids in Pharmacy- Gels and its application.

UNIT-V**(11 Hours)**

Emulsions- Types – Identification, Preparation, Theories of emulsification- Physical stability of emulsions- Formulation, Emulsifying agents- Applications, Computation of Ternary phase diagrams (09Hrs)

R14PHP23**PHYSICAL PHARMACEUTICS - I****(54 Hours)****PRACTICAL**

1. Determination of Surface tension by drop weight method
2. Determination of Surface tension by drop count method
3. Determination of critical micellar concentration
4. Determination of spreading coefficient
5. Determination of Viscosity of a given liquid using Ostwald viscometer
6. Determination of Viscosity of a given liquid using Brookfield viscometer
7. Preparation and evaluation of stability of sulphur colloids
8. Identification of an emulsion
9. Determination of a saturated solution
10. Determination of Partition coefficient
11. Determination of Adsorption Isotherms
12. Determination of sedimentation volume using Anderson's Pipette
13. Preparation of Colloids.

TEXT BOOK

1. Manavalan R. and Ramasamy C., "*Physical Pharmaceutics*", Vignesh publisher, Chennai 2nd revised edition, 2004.
2. Bahl and Arun Bahl., "*Essentials of Physical Chemistry*", S.Chand & Company Ltd, Ramnagar, New Delhi. 1st edition, 2007.
3. Alfred Martin., "*Physical Pharmacy*", Lippincott Williams and Wilkins, Philadelphia 4th edition, 2002.

REFERENCES

1. Remington., "*The Science and practice of Pharmacy*", Lippincott Williams and Wilkins, Philadelphia 21th edition, 2005.
2. Cooper and Gunn's., "*Dispensing Pharmacy*", CBS Publishers and Distributors, New Delhi. 6th edition, 2003.

THEORY**(54 Hours)****UNIT – I****(11 Hours)**

Alcohol and Ether: Classification, Nomenclature, physical properties including acidity and basicity, preparation and reactions. Structure and uses of Cetostearyl alcohol, Chlorobutanol, Glyceryl trinitrate, Mephenesin, Dimercaprol, Chloral hydrate and Sodium lauryl sulphate.

UNIT – II**(11 Hours)**

Aldehydes and Ketone: (Aliphatic and Aromatic) Physical properties, preparation and reaction with mechanism. Structure and uses of Paraldehyde, Vanillin and Ketoprofen.

UNIT – III**(10 Hours)**

Carboxylic Acid: (Aliphatic and Aromatic) Physical properties, preparations and reactions, ionization, acidity, structure of carboxylate ion, effect of substituents on acidity. Structure and uses of Lactic acid, Citric acid, Tartaric acid, Oxalic acid, Aspirin, Ibuprofen, Probenecid and Salicylic acid. Functional Derivatives of Carboxylic Acids: Nomenclature, physical properties, preparation and reactions of Acid Chloride, Acid amide, Acid anhydrides and esters. Structure and uses of Benzyl benzoate, Dimethyl phthalate and Saccharin.

UNIT – IV**(11 Hours)**

Amines: (Aliphatic and Aromatic) Classification, Nomenclature, physical properties, preparation and Reaction, structure and Basicity of amines, effect of substituents on Basicity of amines. Structure and uses of Ethylene diamine dihydrate, Amphetamine and Sulphanilamide. Synthetic uses of Active Methylene Compounds: Acetoacetic ester and Malonic ester, Diazonium salt and Grignard reagents.

UNIT – V**(11 Hours)**

Phenols: Nomenclature, Physical properties, salts of phenols, preparation and Reactions, Acidity of phenols. Structure and uses of Chlorocresol, Chloroxylenol, Paracetamol, Thymol, Sodium amino salicylate, Methyl salicylate, Butylated hydroxy anisole.

**R14PHC25
PRACTICAL**

PHARMACEUTICAL ORGANIC CHEMISTRY –II

(54 Hours)

1. Quantitative determination of the following organic compounds
 1. Citric acid.
 2. Tartaric acid.
 3. Hexamine.
 4. Benzoic acid.
 5. Lactic acid.
2. Synthesis of the following compounds,
 1. Preparation of Dibenzyl acetone from Benzaldehyde(Claisen-Schmidtreaction)
 2. Preparation of Benzanilide (Benzoylation).
 3. Preparation of Iodoform
 4. Preparation of Phthalimide.
 5. Preparation of Hippuric acid.
 6. Preparation of Picric acid from Phenol(Nitration)

TEXT BOOKS

1. Morrison and Boyd., "*Organic Chemistry*", Pearson education, Delhi, India 6th edition.
2. Arun Bahl and Bahl B.S., "*Advanced Organic Chemistry*", S. Chand and company Ltd, New Delhi, India 1st edition, 2007.

REFERENCES

1. Finar IL., "*Organic Chemistry*", Vol I and II, Longman Publishers, Singapore 6th edition, 1994.
2. Soni P.L. Chawla H.M., "*Text Book of Organic Chemistry*", Sultanchand & sons Educational Publishers, New Delhi, India 28th edition 2002.
3. Arun Bahl & Bahl B.S., "*A Text Book of Organic Chemistry*", S. Chand & company Ltd, New Delhi, India 18th edition, 2006.
4. Agarwal O.P., "*Reactions and Reagents*", Krishna Prakashan Media (p)Ltd, Meerut 42nd edition, 2006.
5. Bentley and Driver., "*Text book of Pharmaceutical Chemistry*", Manzarkhan, Oxford University press, New Delhi, India 8th edition.
6. "*Indian Pharmacopoeia*" Vol I and II, The Indian Pharmacopoeia Commission, Ghaziabad 2010.
7. Vogel "*Practical organic chemistry*", , Dorling Kindersley (India) pvt Ltd 5th edition, 2008.
8. Morrison and Boyd., "*Organic Chemistry*", Pearson Education 6th edition, 2006.

THEORY**(54 Hours)****UNIT I - TITRIMETRIC METHODS OF ANALYSIS - II****(10 Hours)**

Precipitation titration : Preparation and standardization of titrants like silver nitrate, ammonium thiocyanate; titrations according to Mohr's and Volhard's methods, ammonium and potassium thiocyanate titrations, indicators, applications in pharmaceutical analysis, Fajan's method and Gaylussac's method.

Diazotisation titrations: Different conditions involved in diazotisation of different amines, end point determination and pharmaceutical analytical applications such as in the assay of sulfonamides.

UNIT II - TITRIMETRIC METHODS OF ANALYSIS – III**(11 Hours)**

Non-aqueous titrations: Theoretical basis, scope and limitations, acid base equilibria in non-aqueous media, titration of weak bases, weak acids and indicators. Standardization of perchloric acid, lithium and sodium methoxide, tetrabutyl ammonium hydroxide.

Complexometric titrations: Complexation, chelation, Werner's co-ordination number, stability of complexes, titration curves, types of complexometric titration, methods of end point detection. pM indicator, masking and demasking agents, factors influencing the stability of complexes and applications – such as estimation of calcium gluconate, bismuth carbonate and determination of hardness of water.

UNIT III - ELECTROMETRIC METHODS**(11 Hours)**

Potentiometry: Electrical potential, electrochemical cell, reference electrodes, indicator electrodes, measurement of potential and pH, construction and working of electrodes, Potentiometric titrations, methods of detecting end point, Karl Fischer titration.

Polarography: Instrumentation, DME, residual current, diffusion current and limiting current, polarographic wave, Ilkovic's equation, Effect of oxygen on polarographic wave, Polarographic maxima and suppressors and applications.

Amperometric Titrations: Introduction, types of electrodes used, reference and indicator electrode, instrumentation, titration procedure, advantages and disadvantages of Amperometry. Pharmaceutical applications.

UNIT IV - MISCELLANEOUS METHODS OF ANALYSIS (11 Hours)

Conductometry: Introduction, Conductivity cell, Conductometric titrations and applications.

Gravimetric method: Gravimetric calculation, organic precipitates, Co-precipitation, Solvent extraction and extraction reagents. Karl Fischer titration, Kjeldhal method of nitrogen estimation, Oxygen Flask combustion and Gasometry – Assay of CO₂, N₂O, O₂.

UNIT V - INTRODUCTION TO CHROMATOGRAPHY (11 Hours)

Introduction, history, classification, separation techniques, choice of methods. principles and techniques of separation of drugs from excipients.

Paper Chromatography: Introduction, principle, types of paper chromatography, preparation techniques, development techniques, applications

Thin Layer Chromatography: Introduction, principle, techniques, R_f value and applications.

Column Chromatography: Adsorption column chromatography, Operational technique, frontal analysis and elution analysis. Factors affecting column efficiency, applications and partition chromatography.

R14PHA27 PHARMACEUTICAL ANALYSIS – II PRACTICAL (54 Hours)

1. Preparation and standardization of volumetric solution and Assay of official compounds involving
 - a. Precipitation titration - Assay of Potassium iodide
Assay of Sodium chloride
 - b. Diazotization titration - Assay of Sulphanilamide
 - c. Non-aqueous titrations - Assay of Glycine
Assay of Nicotinamide
Assay of Saccharin sodium
Assay of Sodium benzoate
 - d. Complexometric titrations - Assay of Calcium gluconate
Assay of Magnesium stearate
Assay of Zinc chloride
Hardness of water
 - e. Conductometric titration - Determination of water
conductivity Chemical
reaction of Weak acid Vs Weak
Base
 - f. Potentiometric titration - Assay of Ephedrine
Assay of Amoxicillin sodium

2. Identification of amino acids by ascending paper chromatography
3. Identification of organic substances by thin layer chromatography
4. Determination of water content using Karl – Fischers reagent

TEXT BOOK

1. Beckett A.M. and Stenlake J.B., “Practical Pharmaceutical Chemistry”, Vol. I & II, CBS Publishers and Distributors, New Delhi 4th Edition, 2005.
2. Antherden L.M., Bentleys and Drivers., “*Text book of Pharmaceutical Chemistry*”, Oxford University Press, Delhi 8th Edition, 1995.
3. Block J.H. Roche E, Soine T.O. and Wilson C.O., “*Inorganic Medicinal and Pharmaceutical Chemistry*”, Varghese publishing House, Bombay 1986.
4. Barnes J.D., Denny R C & Mendham J., Thomas M.J.K., “*Vogel’s Text book of quantitative chemical analysis*”, Pearson Education pvt Ltd. Delhi 6th Edition, 2003.
5. Napoleon A.A., “*Pharmaceutical Titrimetric Analysis– Theory and Practical*”, Kalaimani publication and Distributors, Tamil nadu 1st Edition, 2006.

REFERENCES

1. “*Indian Pharmacopoeia, Government of India, Ministry of Health and Family welfare*”, The controller of Publication, New Delhi 5th Edition, 2010.
2. Connors K.A., “*A text book of Pharmaceutical Analysis*”, A Wiley interscience, Singapore 3rd Edition, 1999.
3. Knevel A.M. and Digangi F.E., “*Jenkin’s Quantitative Pharmaceutical Chemistry*”, Mc.Graw Hill Book Co. New York.
4. David G Watson, “*Pharmaceutical Analysis*”, Elsevier Limited, London 2nd Edition, 2005.
5. Joachim ermer, McB J.H., Miller., “*Method validation in Pharmaceutical Analysis*”, Wiley – VCH Verlag GmbH nad Co.kGaA, Weirheim 2005.
6. Lee J.D., “*A new concise Inorganic Chemistry*”, English Language book society, London 3rd Edition, 1989.

R14PHL28**HUMAN ANATOMY AND PHYSIOLOGY – II****THEORY****(54 Hours)****UNIT I - CENTRAL NERVOUS SYSTEM****(11 Hours)**

Definition and classification of nervous system, Structure and functions of brain, Spinal cord, Thalamus, hypothalamus and basal ganglia. Functions of cerebrum, cerebellum. Vital centers of medulla oblongata, cerebral ventricles, cranial nerves and their functions, Neurotransmitters in Brain, EEG.

UNIT II - AUTONOMIC NERVOUS SYSTEM**(10 Hours)**

Definition and classification of autonomic nervous system. Anatomy, Physiology and Divisions of Autonomic Nervous System, Motor and Sensory Pathways.

UNIT III - CARDIOVASCULAR SYSTEM**(11 Hours)**

Anatomy and Physiology of heart, blood vessels, blood circulation(pulmonary, coronary and systemic circulation)Cardiac cycle, heart rate, blood pressure and its regulation, Electrocardiogram (ECG)and heart sounds. Definition of the following Disorders: Hypertension, Atherosclerosis, Myocardial infarction, Congestive heart failure, Angina, Cardiac arrhythmias.

UNIT IV - RESPIRATORY SYSTEM**(11 Hours)**

Anatomy of respiratory tract, mechanism of respiration and its regulation, Lung Volume, Lung capacity. Transport of oxygen and carbon dioxide. Disorders like cyanosis, Mountain sickness and Caisson's disease. Definition of Hypoxia, Asphyxia, Dysbarism, Oxygen therapy and Resuscitation.

UNIT V - GENITO URINARY SYSTEM AND REPRODUCTIVE SYSTEM (11 Hours)

Structure and functions of Kidney and Urinary Tract, Physiology of Urine formation and acid base balance and disorders, Structure and function of Male and Female reproductive system, Sex hormones, physiology of menstruation, coitus and fertilization, Spermatogenesis and Oogenesis, pregnancy parturition and disorders.

R14PHL29**HUMAN ANATOMY AND PHYSIOLOGY – II****PRACTICAL****(54 Hours)**

1. Determination of Differential count of human blood.
2. Determination of Blood Pressure.
3. Determination of ECG.
4. Determination of Packed cell Volume of human blood.
5. Determination of Respiratory Volumes.

6. Determination of Body temperature.
7. Study of Normal and Abnormal constituents of Urine by urine analysis.
8. Study of Human Systems and Models.
9. Study of different family planning appliances.
10. To perform pregnancy diagnosis tests.

TEXT BOOK

1. Gerard J Tortora, Bryan Derrickson., "*Principles of Anatomy and Physiology*", Published by Wiley,USA 11th Edition.
2. Anne Waugh Ross and Wilson., "*Anatomy and Physiology in Health illness*", Published by Churchill Livingstone Elsevier,UK 10th Edition, 2006.
3. Cinnamon Van Putte., "*Seeley's Fundamentals of Human Anatomy and Physiology*", Tata Mc Graw Hill, New Delhi 7th Edition 2009.
4. Chatterjee C.C., "*Human Physiology*", Vol – I & II, Medical Allied Agency, Calcutta 11th Edition,1997.

REFERENCES

1. "*Davidson's Principles and practice of Medicine*", Churchill Living Stone, Elsevier, USA, 21st edition, 2010.
2. Guyton A Hall J.E., "*Textbook of Medical Physiology*", Elsevier,New Delhi 11th Edition.

**SECOND YEAR B.PHARMACY
THIRD SEMESTER**

R14PHP31 PHARMACEUTICAL MANAGEMENT & MARKETING

THEORY (54 Hours)

UNIT I - PHARMACEUTICAL MANAGEMENT (11 Hours)

Concept on management – Principles of management – Administrative and Operative management - Entrepreneurship development. Personnel management and Industrial Relations – Objectives and functions of personnel department – Employment and development of personnel. Materials Management: Basic principles of materials management- Purchasing organization – Inventory control- EOQ, ABC, VED, Safety stock.

UNIT II - PROJECT MANAGEMENT. (10 Hours)

Theory of constraints – Buffer management and charts – Project planning.

UNIT III - MARKETING MANAGEMENT (11 Hours)

Marketing functions- buying- selling- transportation- storage- finance- feedback information - Channels of distributions: Types of middlemen- wholesaler-functions- retailer- itinerant vendors- Fixed shop traders- Small scale- large scale- Departmental stores- Mail order business- Multiple shops- Co-operative stores- Supermarkets- Choice of channels of distribution.

MARKET DEMAND ANALYSIS: Measuring and forecasting market demands – Market Research. Salesmanship: Sales organization in business houses- factors governing sales- sales agencies and their control- sales promotion- salesmanship and personal selling- statistics, graphs and charts- their aid in sales control- Advertising.

UNIT IV – ECONOMICS (11 Hours)

Introduction- Definition and scope, principles of economics- Utility analysis- Law of diminishing marginal utility- Demand and supply- Law of demand- demand schedules and demand curves- Elasticity of demand- Documents used in external trade- Export and import trade procedures - GATT.

UNIT V – ACCOUNTANCY (11 Hours)

Introduction- Book keeping- Meaning, Definition and objectives- Accounting- Meaning, branches, limitations, basic terms- basic accounts- Accounting principles (concepts and conventions - Journal- Subsidiary books (or) sub-journals including cash books- Ledger- Trial balance- errors revealed and not revealed by trial balance. Final accounts- Trading and Profit and Loss Accounts- Balance sheet.

TEXT BOOK

1. Arun Monappa, Saiyadain M.S., "*Personnel Management*", Tata Mc-Grill Publishers Pvt Ltd, New Delhi 2nd edition.
2. Bhushan Y.K., "*Fundamentals of Business Organization and management*" Sultan Chand & Company New Delhi.
3. Gupta.R.L., "*Advanced Accountancy*", Vol.I and Vol.II, Sultanchand & Company New Delhi.
4. ArunBalaji N., "*Pharmaceutical Administration and Industrial Business Management*", Kanakambal Natrajan publishers, Erode.
5. Mohan Singhal & Jaidev "*Drug Store and Business Management*", Imprint of S.Vikas and Co, India.
6. Eli Goldratt "*Project management*", North River Press 1986.

REFERENCES

1. Mickey Smith., "*Principles of Pharmaceutical Marketing*", CBS Publishers & Distributors, New Delhi 3rd edition.
2. Philips Kotler "*Principles of Marketing*", Printice Hall of India Pvt.Ltd 13th Edition.
3. Agarwal N.P. Tailor R.K., "*Fundamentals of Pharmacy Practice*", Aavishkar Publishers, Jaipur.

THEORY**(54 Hours)****UNIT I - SUSPENSIONS-****(11 Hours)**

Definition- Interfacial properties of Suspended particles in suspensions- Flocculated and deflocculated suspensions- Sedimentation volume- Degree of sedimentation- Brownian movement Controlled flocculation- Flocculation in structured vehicle.

UNIT II - MICROMETRICS**(10 Hours)**

Particle size and distribution- Expression of particle size- Number and weight distribution- Particle shape- Methods to determine particle size and specific area- Derived properties of powders – bulk density – true density – porosity.

UNIT III - COMPLEXATION AND PROTEIN BINDING**(10 Hours)**

Definition and classification of complexes- Intermolecular forces in complexes- Applications in pharmacy- Methods of analysis- Drug-Protein binding- Determination of protein binding- competitive binding- Significance of protein binding.

UNIT IV - KINETICS**(11 Hours)**

Rate and order of reactions- Reaction kinetics (zero, first and second orders)- Complex reactions- Influence of temperature, humidity and light on the rate of reaction- Decomposition mechanisms (hydrolysis, oxidation, racemization, decarboxylation, photochemical) and stabilization methods- Accelerated stability study as per ICH guidelines and its limitations- Expiration dating- Overages- Simple calculations.

UNIT V – THERMODYNAMICS**(11 Hours)**

First, Second and third laws of thermodynamics- Internal energy- Open, closed and isolated systems- Isothermal, adiabatic and reversible processes- Enthalpy- Heat Capacity- Thermo chemistry and its applications- Entropy-free energy- Criteria of spontaneity and equilibrium- Chemical potential. Matter and Properties of Matter- States of Matter- Changes in the states of matter- Phase rule- One component system- Sublimation- Critical Point – Eutectic mixtures- Vapor Pressure and its application in aerosol- Inhalers- Relative humidity and its importance- Liquid complexes, Liquid crystals- Glassy states- Solids (crystalline, amorphous and polymorphism) Definition of cohesive and adhesive forces- Forces between atoms, ions and molecules.

R14PHC33 PHYSICAL PHARMACEUTICS II

PRACTICAL

(54 Hours)

1. Determination of Bulk density
2. Determination of True density
3. Determination of Percentage porosity
4. Determination of Angle of repose
5. Determination of the effect of glidant on the angle of repose
6. Determination of particle size using optical microscope
7. Determination of average particle size by sieving method
8. Preparation of suspension
9. Determination of flocculation
10. Determination of rate constant for pseudo first order reaction.
11. Determination of rate constant for first order reaction.

TEXT BOOK

1. Manavalan R. and Ramasamy C., "*Physical Pharmaceutics*", Vignesh publisher, Chennai 2nd revised edition, 2004.
2. Bahl and Arun Bahl., "*Essentials of Physical Chemistry*", S.Chand & Company Ltd, Ramnagar, New Delhi 1st edition, 2007.
3. Alfred Martin "*Physical Pharmacy*", Lippincott Williams and Wilkins, Philadelphia 4th edition, 2002.

REFERENCES

1. Remington., "*The Science and practice of pharmacy*", Lippincott Williams and Wilkins, Philadelphia 21th edition, 2005.

THEORY**(54 Hours)****UNIT I - HEAT TRANSFER****(11 Hours)**

Heat transfer mechanism, heat transfer by conduction, Fourier's law, natural and forced convection, surface and overall heat transfer co-efficient, heat transfer by radiation, heaters and heat exchangers. Fluid Flow: Fluid statics, manometers, types of flow, Reynold's number its significance and applications, concept of boundary layer, Bernoulli's theorem and its applications, measurement of fluid flow-flow meters and valves. Liquid Handling- Different types of pumps, Solid Handling - Conveyors.

UNIT II - MATERIALS OF PLANT CONSTRUCTION**(11 Hours)**

General study of composition- physical, chemical and mechanical properties and applications of materials of construction with special references to ferrous metals, copper, Aluminum, nickel, stainless steel, plastics and glass. Corrosion- types of corrosion- methods to prevent corrosion.

UNIT III – HUMIDITY**(10 Hours)**

Measurement of humidity- humidity chart- humidifier and dehumidifier-refrigerator and air conditioning: Principles- compression and absorption types-co-efficient of refrigeration- refrigeration load – brine system – room and industrial air conditioners – applications in pharmacy.

UNIT IV - SIZE REDUCTION**(11 Hours)**

Definition-objectives of size reduction-factors affecting size reductions, laws governing energy-equipments –study of various types of mill including ball mill, hammer mill, fluid energy mill, sieves and their usage in grading of powders. Size Separation – Standards of sieves as per official books, powder gradation, size distribution methods, techniques of size separation- separators-Hydraulic separator, air separator.

UNIT V – MIXING**(11 Hours)**

Theory-liquid/liquid, liquid/solid, solid/solid mixing, mechanism of powder mixing, factors affecting mixing- equipments- sigma and ribbon blender, paddle mixer, tumblers like cubes and double cone, propeller mixer, paddle, planetary mixer. Packaging of pharmaceutical products: Industrial hazards and safety precautions-mechanical, electrical, fire and dust hazards.

R14PHP35 PHARMACEUTICAL TECHNOLOGY- I**PRACTICAL****(54 Hours)**

1. Determination of Reynold's number.
2. Determination of humidity- use of dry bulb and wet bulb temperature.
3. Determination of humidity by dew point method.
4. Measurement of Dew point.
5. Size separation by sieving.
6. Effect of density on mixing.
7. Study of permeation through container materials.
8. Experiment to illustrate solid/solid mixing. Determination of mixing efficiency using different type of mixtures.
9. Determination of Ball mill efficiency using Rittinger's law.
10. Determination of effect of mixer on globular size of castor oil emulsion.
11. Determination of Particle size by sieving method.

TEXT BOOKS

1. Cooper and Gunn's., "*Tutorial Pharmacy*", CBS Publishers and Distributors, New Delhi 12th edition, 2008.
2. Sambamurthy K., "*Pharmaceutical engineering*", Nal (P) Ltd, Delhi 2nd edition, 2005.
3. Subramanyam C.V.S., "*Pharmaceutical Engineering: Principles and Practice*", Vallabh Prakashan, Delhi 2nd edition, 2006.
4. Walter L.Badger "*Introduction to Chemical Engineering*", JuliusT. Banchemo, Mc Graw-Hill book company, Singapore.

REFERENCES

1. Collette, Aulton., "*Pharmaceutics The Science of dosage form*", ELBS Publishers, London 3rd edition, 2009.
2. Achman L, Lieberman H.A & Kanjig J.L., "*The Theory and Practice of Industrial Pharmacy*"– L, Special Indian, CBS publishers Pvt Ltd. New Delhi edition, 2009.
3. Dr. Paradkar A.R., "*Pharmaceutical Engineering*", Nirali Prakashan, New Delhi 11th edition, 2009.

THEORY**(54 Hours)****UNIT I - POLYNUCLEAR HYDROCARBONS****(11 Hours)**

Preparation, properties, reactions and uses of Diphenylmethane, Triphenyl methane, Naphthalene, Anthracene, Phenanthrene. Structure and uses of Triphenyl methane derivatives-Brilliant green, Crystal violet, Phenolphthalein, Fluorescein and Phenol red.

UNIT II - OPTICAL ISOMERISM**(11 Hours)**

Stereoisomerism, Tetrahedral carbon atom, Optical activity, Chirality, Elements of symmetry, Conventions used in stereochemistry – Relative and absolute configuration, Sequence rule, Racemic modification, Resolution, Walden Inversion, Asymmetric synthesis, Stereospecific and Stereoselective synthesis.

UNIT III - GEOMETRICAL ISOMERISM**(11 Hours)**

Nature, Nomenclature, Cis-trans isomerism, E and Z notation, Modern theory of double bonds, Determination of configuration, Interconversions. Stereochemistry of Biphenyls, Allenes, Spirans, Tertiary amine and Oximes Conformational Analysis of Ethane, n-butane and Cyclohexane (Mono and Di substituted)

UNIT IV - SYNTHETIC TOOLS**(10 Hours)**

Reduction with hydrazine, Birch reduction, Clemmenson's reduction, MPV reduction, Beckmann rearrangement, Schimdt rearrangement, Darzen condensation, Oppenauer oxidation, Micheal's addition and Mannich reaction.

UNIT V - ORGANIC REAGENTS**(11 Hours)**

Preparation and applications of anhydrous Aluminum chloride, Periodic acid, N – Bromo succinimide, Ozone, Lead tetraacetate, Sodium azide, Thionyl chloride and Sodamide.

PRACTICAL**(54 Hours)**

1. Quantitative determination of functional group.
 1. Carboxyl group by acid – base method.
 2. Alcoholic group by acetylation method.
 3. Amino group by acetylation method.
 4. Phenolic group by bromination method.
 5. Acetyl group by hydrolysis with alkali.
 6. Determination of amide group.

2. Preparation of organic compounds involving more than one step.
 1. Preparation of P-nitro acetanilide from aniline
 2. Preparation of P-bromo acetanilide from aniline
 3. Preparation of Eosin from fluorescein
 4. Preparation of P-amino azo benzene from aniline
 5. Preparation of Anthranilic acid from phthalimide
 6. Preparation of Benzilic acid from benzyl

3. Determination of specific rotation value of optically active compound
Dextrose & Tartaric acid.

TEXT BOOKS

1. Agarwal O.P., "*Reactions and Reagents*", Goel Publishing House, Meerut 42nd edition, 2006.
2. Gurdeep Chatwal., "*Organic Chemistry of Natural Products*", Vol-I, Himalaya Publishing House, Mumbai 3rd edition, 2005.
3. Gurdeep Chatwal., "*Organic Chemistry of Natural Products*", Vol II, Himalaya Publishing House, Mumbai 3rd edition, 2005.

REFERENCES

1. Finar I.L. "*Organic Chemistry*" Vol I & II, Longman Singapore Publishers, Singapore 6th edition.
2. Morrison and Boyd., "*Organic Chemistry*", Pearson Education, Delhi 6th edition.
3. Jerry "*Advanced Organic Chemistry*", John Wiley & sons, Singapore March, 4th edition, 2004.
4. Ernest L.Eliel., "*Stereochemistry of carbon compounds*", Tata Mc Graw-Hill Publishing Company Limited, 1975.

R14PHC38 BIOCHEMISTRY AND BIOMOLECULES – I

THEORY **(54 Hours)**

UNIT I – CARBOHYDRATES **(10 Hours)**

Introduction, classification, chemistry of monosaccharides, disaccharides and polysaccharides, properties and reactions of sugars, glycolysis, citric acid cycle, gluconeogenesis, glycogen metabolism and HMP shunt pathway.

UNIT II – PROTEINS **(11 Hours)**

Introduction, classification and properties of proteins and Amino acids, transamination, deamination, metabolism of ammonia, urea cycle, metabolism of aromatic amino acid and sulphur containing amino acid. Structure of Haemoglobin and Immunoglobulin.

UNIT III – ENZYMES **(11 Hours)**

Introduction, Nomenclature and Classification, Factors affecting enzyme activity, Michaelis-Menten equation, Enzyme inhibition, Coenzymes, Mechanism of enzyme action, Diagnostic importance.

UNIT IV – NUTRITION **(11 Hours)**

Energy content and Respiratory quotient of foodstuffs, Utilization of energy in man (BMR, specific dynamic action, physical activity) nutritional importance of carbohydrates, lipids and proteins.

UNIT V – HORMONES **(11 Hours)**

Classification, mechanism of action of hormones, chemical nature, properties and biochemical functions of hormones, jaundice, liver function tests, Renal function tests.

R14PHC39 BIOCHEMISTRY AND BIOMOLECULES – I

PRACTICAL **(54 Hours)**

1. Identification of glucose.
2. Identification of lactose.
3. Identification of maltose.
4. Identification of sucrose.
5. Identification of starch.
6. Identification of albumin.
7. Identification of gelatin.
8. Identification of peptone.

9. Estimation of proteins by Biuret method.
10. Estimation of amino acids by Ninhydrin method.
11. Estimation of chlorides in urine by Volhard's method.
12. Estimation of blood sugar by ortho toulidene reagent method.
13. Estimation of urea by DAM method.
14. Analysis of milk.

TEXT BOOKS

1. Satyanarayanan U., "*Biochemistry*", Books and Allied (P) Ltd, Kolkata 2nd edition, 2004.
2. Deb A.C., "*Concepts of Biochemistry (Theory and Practical)*", Books and Allied (P) Ltd, Kolkata 1st edition, 1999.
3. Ambika Shanmugam., "*Fundamentals of Biochemistry for Medical Students*", Published by author, Chennai 7th edition, 2001.

REFERENCE

1. Donald Voet, Judith G. Voet, Charlotte W. Pratt., "*Fundamentals of Biochemistry*", John Wiley & Sons, Inc, New York 1st edition, 1999.
2. Jerry M. Berg, John L. Tymoczko, Lubert Stryer., "*Biochemistry*", , W. H. Freeman and Company, New York 6th edition, 2007.
3. Michael M. Cox, David L. Nelson., "*Lehninger Principles of Biochemistry*", W. H. Freeman and Company, New York 5th edition, 2010.
4. Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell., "*Harper's Illustrated Biochemistry*", TATA McGraw-hill Companies, Inc India 28th edition, 2006.
5. Rama Rao A. V. S. S., "*Text book of Biochemistry*", UBS Publisher's Distributors Ltd, New Delhi 6th edition, 1993.
6. Rodney Boyer., "*Modern Experimental Biochemistry*", Addison Wesley Longman (Singapore) Pvt. Ltd, New Delhi 3rd edition, 2000.
7. Alan H. Gowenlock., "*Varley's Practical Clinical Biochemistry*", CBS Publishers & Distributors, New Delhi 6th edition, 2006.
8. Harold Varley., "*Practical clinical biochemistry*", CBS Publishers & Distributors, New Delhi 4th edition, 1988.
9. Srinivas B. Rao., "*Practical Biochemistry for Medical Students*", Academic Publishers, Kolkata 1st edition, 1992.
10. Jayaraman J., "*Laboratory manual in Biochemistry*", New Age International (P) Ltd, Publishers, New Delhi 1st edition, 2002.

FOURTH SEMESTER

R14PHL41 PATHOPHYSIOLOGY AND HEALTH EDUCATION

THEORY (54 Hours)

UNIT – I (11 Hours)

Basic principles of Cell injury and Adaptation: Causes of cellular injury, Pathogenesis and morphology of cell injury, Intercellular alterations in lipids, proteins and carbohydrates, cellular adaptation, atrophy and hypertrophy.

UNIT – II (11 Hours)

Basic mechanism involved in the process of inflammation and repair: alteration in vascular permeability and blood flow, migration of WBC's, acute and chronic inflammation and mediators of inflammation, brief outline on the process of repair.

UNIT – III (11 Hours)

Pathophysiology and etiology of Rheumatoid arthritis, Gout, Epilepsy, Psychosis, Hypertension, Angina, Congestive heart failure (CHF), Myocardial infarction, Diabetes, Asthma.

UNIT – IV (10 Hours)

Pathophysiology and etiology of Peptic ulcer, hepatic disorders, acute and chronic renal failure, tuberculosis, urinary tract infections, sexually transmitted diseases, and common types of neoplasm.

UNIT – V (11 Hours)

Communicable diseases: Brief outline, their causative agents, mode of transmission and prevention of chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea and AIDS. Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

TEXT BOOKS

1. Harsh Mohan "Text book of Pathology", Jaypee Publishers, New Delhi Fifth edition, 2005.
2. Robbins and Cotran., "*Pathologic basis of diseases*", Elsevier, New Delhi Eighth Edition, 2010.

3. Guyton A, Hall J.E., "*Textbook of Medical Physiology*", Elsevier, New Delhi Eleventh Edition, 2004.
4. Walter, Israel., "*General Pathology*", Churchill Living stone, USA Seventh Edition, 1996.

REFERENCES

1. Liang Cheng, David G.Bostwick., "*Essential of Anatomic Pathology*", Humana press Totowa, New Jersey Second Edition, 2006.
2. Roddie M.N.Macsween, Keith Whaley., "*Muir's Text book of Pathology*", Thomson press New Delhi Thirteenth Edition, 1992.
3. James Catron, Richard Duly., "*Clinical Pathology*", Oxford University Press, UK 1st Edition, 2007.
4. Khurana S., Suresh P., "*Health Education and Community Pharmacy*", Kalsi S.Vikas & Co, Jalandhar 1st Edition, 1993,
5. "*A Text Book of Pathophysiology*", Bhodhankar S.L, Arihant Printers, New Delhi Sixth Edition 2008.
6. Keyadesai, Mohit Bansal "*Pathophysiology for Pharmacy*", S.Vikas & Co Jhalandar 1st Edition, 2007.

R14PHP42 PHARMACEUTICAL TECHNOLOGY- II

THEORY (54 Hours)

UNIT I – EVAPORATION (11 Hours)

Factors affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators, short tube evaporator, forced circulation evaporator, evaporation under reduced pressure. Distillation: Raoult's law, phase diagrams, volatility, simple steam and flash distillation, principles of rectification, Azeotropic and extractive distillation.

UNIT II – CENTRIFUGATION (10 Hours)

Principles of centrifugation, industrial centrifugation- centrifugal filters, centrifugal sedimentors, advantages and disadvantages.

UNIT III – FILTRATION (11 Hours)

Theory of filtration, mechanism of filtration, types of filter media used, filter aids, plate and frame filter, leaf filter, rotary filter, membrane filter.

UNIT IV – DRYING (11 Hours)

Mechanism of drying, theory of drying, drying equipments. Crystallization: Definition, crystal form, crystal habit, super saturation, nucleation, crystal growth, crystallizers, caking of crystals, prevention of caking. Lyophilization and its applications.

UNIT V – EXTRACTION (11 Hours)

Theories of extraction of drugs, solid- liquid extraction, liquid-liquid extraction, battery extraction, soxhletion, podbielnaik extractor, continuous counter current extractor.

R14PHP43 PHARMACEUTICAL TECHNOLOGY- II

PRACTICAL (54 Hours)

1. Evaluation of filter media, determination of rate of filtration.
2. Determination of effect of filter aids on rate of filtration.
3. Determination of effect of viscosity on rate of filtration.
4. Experiments to demonstrate applications of centrifugation.
5. Determination of rate of evaporation.
6. Determination of rate of drying.
7. Determination of moisture content of granules by drying method.
8. Effect of mixers on globule size of castor oil emulsion.

9. Separation of oil by steam distillation.
10. Crystallization – methods to produce big and small crystals.
11. Separation by sedimentation techniques.

TEXT BOOK

1. Cooper and Gunn's., "*Tutorial Pharmacy*", CBS Publishers and Distributors, New Delhi 12th edition, 2008.
2. Sambamurthy K. "*Pharmaceutical Engineering*" Nal (P) Ltd, Delhi 2nd edition, 2005.
3. Subramanyam C.V.S., "*Pharmaceutical Engineering Principles and Practice*", Vallabh Prakashan, Delhi 2nd edition, 2006.
4. Walter L.Badger, Julius T. Banchero., "*Introduction to Chemical Engineering*" McGraw-Hill book company, Singapore.

REFERENCES

1. Collette, Aulton., "*Pharmaceutics The Science of dosage form*", ELBS Publishers, London 3rd edition, 2009.
2. Lachman L, Lieberman H.A & Kanjig J.L., "*The Theory and Practice of Industrial Pharmacy*", CBS publishers Pvt Ltd. New Delhi Special Indian edition, 2009.
3. Dr. Paradkar A.R. "*Pharmaceutical Engineering*", Nirali Prakashan, New Delhi 11th edition, 2009.
4. Remington., "*The Science and Practice of Pharmacy*", Vol.I & II Lippincott Williams & Wilkins, Philadelphia 21st edition, 2005.

6. Preparation of Zinc oxide and salicylic acid dusting powder.
7. Preparation of Kaolin powder.
8. Preparation of Compound Effervescent Powder.
9. Preparation of Atropine sulphate powder.
10. Preparation of Cold cream.
11. Preparation of Vanishing cream.
12. Preparation of Alkaline phenol mouth wash.
13. Preparation of Compound Sodium Chloride mouth wash.
14. Preparation of Potassium permanganate gargle.
15. Preparation of Calamine Lotion.
16. Preparation of Salicylic acid Lotion.
17. Preparation of Turpentine Liniment.
18. Preparation of Menthol Eucalyptus inhalation.
19. Preparation of Mandle's paint.
20. Preparation of Camphor liniment.
21. Preparation of Phenol – Glycerin paint.
22. Preparation of Iodoform suppositories.
23. Preparation of Tannic acid suppositories.
24. Percentage calculations.
25. Calculations based on Alligation method.

TEXT BOOK

1. Cooper and Gunn., "*Tutorial Pharmacy*", CBS Publishers and Distributors, New Delhi 6th edition, 2003.
2. Ansel H.C., "*Introduction to pharmaceutical dosage forms*", New Age International publications, New Delhi 8th edition, 2002.
3. Winfield., "*Pharmaceutical Practice*", Churchill Livingstone, Spain 4th edition, 2009.
4. Cooper and Gunn., "*Dispensing Pharmacy*", CBS Publishers and Distributors, New Delhi 6th edition, 2003.

REFERENCES

1. Remington., "*The Science and practice of Pharmacy*", Lippincott Williams and Wilkins, Philadelphia.
2. Collette, Aulton., "*Pharmaceutics The Science of dosage form*", ELBS Publishers, London 2nd edition, 1988.

THEORY**(54 Hours)****UNIT I - HETEROCYCLIC COMPOUNDS****(11 Hours)**

Definition, classification, nature and nomenclature of heterocyclic compounds. Preparation, properties and reactions of Pyrrole, Furan, Thiophene, Pyrazole, Imidazole, Oxazole, Isoxazole, Thiazole, Isothiazole, Triazole Pyridine, Pyrimidine, Pyridazine, Pyrazine.

UNIT – II**(10 Hours)**

Fused Ring Heterocyclic compounds Preparation, Properties and reactions of Indole, Quinoline, Isoquinoline, Acridine, Phenothiazine.

Types of sonochemical reactions, Synthetic applications Saponification, Oxidation, Reduction, Substitution reactions.

UNIT III - VITAMINS**(11 Hours)**

Structure, Chemistry, synthesis (for the compounds superscribed by (s)) and Assay principles of Vitamins VitaminA^(s), Vitamin D, Vitamin E, Vitamin K, Vitamin B₁^(s), Vitamin B₂^(s), Vitamin B₃^(s), VitaminB₆^(s) and Vitamin C^(s).

UNIT IV - PROTEINS AND AMINOACIDS**(11 Hours)**

Introduction, General methods for the preparation of aminoacids, General properties of amino acids, Essential amino acids, Isolation and analysis of aminoacids from Proteins. Classification of proteins, Primary structure, Secondary structure, tertiary structure and Quaternary structure of proteins, Isolation and purification of proteins, Determination of C- terminal amino acid and Determination of N- terminal amino acid.

UNIT V – GLYCOSIDES**(11 Hours)**

Introduction and classification of glycosides. Chemistry of Salicin, Amygdalin, Indican, Ruberythric acid, and Glucovanillin. A general study of the cardiac glycosides of Digitalis, Strophanthus and Squill. Study of Anthraquinone glycosides and Saponin glycoside.

Green Chemistry: Introduction and general aspects of green chemistry, Microwave Induced organic synthesis- Introduction, Esterification, Hydrolysis, Fries rearrangement.

1. Method of separation and analysis of binary organic mixture (Minimum five mixtures)
2. Preparation of organic compounds or intermediates involving more than 1 step.
 1. Preparation of Tribromoacetanilide from aniline.
 2. Preparation of Benzimidazole from o-Phenylenediamine.
 3. Preparation of Benztriazole from o-Phenylene diamine.
 4. Preparation of Biphenicacid from anthranilic acid.
 5. Preparation of 4- Benzilidene -2-Phenyl oxazol -5- one from Benzoyl chloride.
 6. Preparation of 5,5¹- Diphenyl hydantoin from Benzoin.
 7. Preparation of 3-Methyl – 1- phenylpyrazol- 5-one.

TEXT BOOKS

1. “*Reaction and Reagents*”. Agarwal O.P., 42nd edition, 2006, Goel Publishing House, Meerut.
2. Organic Chemistry of Natural products Vol I & II by Gurdeep Chatwal, 3rd edition, 2005, Himalaya Publishing House, Mumbai.

REFERENCES

1. Organic Chemistry, I.L.Finar Vol I & II, 6th edition, Longman Singapore Publishers, Singapore.
2. Heterocyclic Chemistry, Vol I by Suschnitky, 1980, The Royal Society of Chemistry, London.
3. The Logic of Chemical Synthesis, E.J. Corey & Xue-min Cheng, Wiley publishers, USA.
4. Designing Organic Synthesis, Stuart Warren, Wiley India Pvt. Ltd, New Delhi.
5. Wilson and Gisvold’s Textbook of Organic Medicinal and Pharmaceutical Chemistry, John H. Block & John.M. Beale, 11th edition, Lippincott Williams & Wilkins, USA.
6. Organic Synthesis Special Techniques by V.K. Ahluwalia & Renu Aggarwal, 2005, Narosa Publishing House, New Delhi.
7. Trease and Evans Pharmacognosy by William.C. Evans, 16th edition, 2009, Elsevier Ltd. China.

R14PHC48 BIOCHEMISTRY AND BIOMOLECULES – II

THEORY **(54 Hours)**

UNIT I – LIPIDS **(11 Hours):**

Introduction and classification of lipids, Fatty acids, essential fatty acids, phospholipids, sphingolipids, sterols, Biosynthesis of fatty acids, fatty acid oxidation, ketone bodies, metabolism of phospholipids

UNIT II - NUCLEIC ACID **(11 Hours)**

Introduction, structure and functions of DNA and RNA, nucleotides – structure and functions, Biosynthesis and Degradation of purine nucleotides and pyrimidine nucleotides.

UNIT III - NUCLEIC ACID **(10 Hours)**

Replication of DNA, Transcription, Translation, Mutation, Genetic code, Regulation of gene expression, AIDS and cancer.

UNIT IV – VITAMINS **(11 Hours)**

Classification, sources, properties, daily requirements, functions and deficiency manifestations of fat soluble and water soluble Vitamins.

UNIT V - BIOLOGICAL OXIDATION **(11 Hours)**

Transport across biological membranes, Bioenergetics, High energy compounds, Biological oxidation, Electron transport chain, Oxidative phosphorylation, Enzymes involved in biological oxidation.

R14PHC49 BIOCHEMISTRY AND BIOMOLECULES – II

PRACTICAL **(54 Hours)**

1. Identification of cholesterol
2. Analysis of normal constituents of urine.
3. Analysis of abnormal constituents of urine-1
4. Analysis of abnormal constituents of urine-2
5. Analysis of unknown abnormal constituents of urine (4 experiments).
6. Estimation of blood cholesterol by Liebermann-Burchard's method.
7. Estimation of creatinine in urine by Jaffe's method.
8. Estimation of DNA by Diphenyl amine method.
9. Estimation of RNA by Orcinol method.
10. Estimation of Titrable acidity and ammonia in urine.

TEXT BOOKS

1. Biochemistry, U. Satyanarayananana, 2nd edition, 2004, Books and Allied (P) Ltd, Kolkata.
2. Concepts of Biochemistry (Theory and Practical), A.C. Deb, 1st edition, 1999, Books and Allied (P) Ltd, Kolkata.
3. Fundamentals of Biochemistry for medical students, Ambika Shanmugam, 7th edition, 2001, Published by author, Chennai.

REFERENCES

1. Fundamentals of Biochemistry, Donald Voet, Judith G. Voet, Charlotte W. Pratt, 1st edition, 1999, John Wiley & Sons, Inc, New York.
2. Biochemistry, Jerry M. Berg, John L. Tymoczko, Lubert Stryer, 6th edition, 2007, W. H. Freeman and Company, New York.
3. Lehninger Principles of Biochemistry, Michael M. Cox, David L. Nelson, 5th edition, 2010, W. H. Freeman and Company, New York.
4. Harper's Illustrated Biochemistry, Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 28th edition, 2006, The McGraw-hill Companies, Inc , India.
5. Text book of Biochemistry, A. V. S. S. Rama Rao, 6th edition, 1993, UBS Publishers Distributors Ltd, New Delhi.
6. Modern experimental Biochemistry, Rodney Boyer, 3rd edition, 2000, Addison Wesley Longman (Singapore) Pte. Ltd, New Delhi.
7. Varley's Practical Clinical Biochemistry, Alan H. Gowenlock, 6th edition, 2006, CBS Publishers & Distributors, New Delhi.
8. Practical Clinical Biochemistry, Harold Varley, 4th edition, 1988, CBS Publishers & Distributors, New Delhi.
9. Practical biochemistry for Medical Students, Srinivas B. Rao, 1st edition, 1992, Acadaemic Publishers, Kolkata.
10. Laboratory Manual in Biochemistry, J. Jayaraman, 1st edition, 2002, New Age International (P) Ltd, Publishers, New Delhi.

**THIRD YEAR B.PHARMACY
FIFTH SEMESTER**

R14PHP51 HOSPITAL AND CLINICAL PHARMACY

THEORY **(54 Hours)**

UNIT I - ORGANIZATION AND STRUCTURE **(11 Hours)**

Organization of a hospital and hospital pharmacy, types of hospital. Responsibilities of hospital pharmacist, Pharmacy and Therapeutic committee, hospital formulary, contents and preparation of hospital formulary.

UNIT II - DRUG DISTRIBUTION SYSTEM IN HOSPITALS **(11 Hours):**

Outpatient dispensing, methods adopted for distribution of drugs to inpatients, charging policy, labeling, distribution of drugs to ambulatory patients, dispensing of controlled drugs.

UNIT III - DRUG INFORMATION **(10 Hours)**

Drug information service, drug information centre drug information resources and stepwise methodology in answering drug information queries.

UNIT IV - CONCEPT OF CLINICAL PHARMACY **(11 Hours)**

Roles and responsibilities of clinical pharmacist. Adverse drug reaction; classification-excessive pharmacological effect, secondary pharmacological effect, genetically determined toxicity, idiosyncrasy, allergic drug reaction, toxicity following drug withdrawal, monitoring of adverse drug reaction, drug interaction, beneficial and adverse interaction, pharmacokinetic drug interaction and pharmacodynamic drug interaction.

UNIT V - MANUFACTURE OF STERILE AND NON-STERILE PRODUCTS **(11 Hours)**

Various methods of sterilization and their equipments in hospital. Radiopharmaceuticals used in hospital.

TEXT BOOK

1. Text book of Pharmaceutics, Bentleys, 8th edition, 2003, All India Traveller Book Seller, New Delhi.
2. Hospital Pharmacy, Hassan WF, 5th Edition, Lec and Febiger Publication, Philadelphia.

3. Textbook of Clinical Pharmacy practice, G.Parthasarathy, 1st Edition, University PressLtd, New Delhi.
4. Textbook of Hospital Pharmacy, SH Merchant and Dr.JS Quadry, 6th Edition, Shah Publication, New Delhi.

REFERENCES

1. Clinical Pharmacy, Dr. H.P.Tipnis, Dr, Amirta Bajaj, 2nd Edition, 2006, Career Publication, New Delhi.
2. Avery's Drug treatment, 4th edition, 1997, Adis International limited

THEORY**(54 Hours)****UNIT – I****(10 Hours)**

Introduction to bio pharmaceuticals and pharmacokinetics and their roles in formulation development. Importance of partition coefficient and pH in absorption, membrane structure, membrane potential.

UNIT – II**(11 Hours)**

Drug disposition: Distribution of drug in the blood, volume of distribution, physiological barriers and factors affecting distribution. Tissue permeability, cellular distribution, protein binding, significance of Plasma protein and tissue binding, factors affecting protein binding and applications.

UNIT – III**(11 Hours)**

Sampling of biological specimens in blood, plasma or serum, collection and storage condition until assay. Basic considerations of typical concentration time profile showing pharmacokinetic and pharmacodynamic parameters. Compartment modeling: One compartmental open model (i.v bolus, extra vascular administration) Wagner-Nelson method and Loo-Riegelman method. Two compartment open model (i.v bolus, extra vascular administration) and parameters involved. Clearance concept- Renal and hepatic clearance. Determination of K_E by rate excretion and sigma minus method

UNIT – IV**(11 Hours)**

Non linear pharmacokinetics with reference to one compartment model after i.v. drug administration. Michael's menten equation. Non-compartmental analysis- AUC, AUMC, MRT. Advantages of Non compartmental analysis.

UNIT – V**(11 Hours)**

Bio availability and Bioequivalence - Therapeutic window and significance, Measurement of bioavailability- C_{max} , T_{max} and AUC. Design of single dose bioequivalence, *in vivo* and *in vitro* correlation. Study of relevant statistics.

R14PHP53**BIOPHARMACEUTICS AND PHARMACOKINETICS****PRACTICAL****(54 Hours)**

1. Determination of partition coefficient of Oxalic acid between ether and water.
2. Determination of partition coefficient of Iodine between carbon tetrachloride and water.
3. Determination of partition coefficient of Benzoic acid between benzene and water.
4. Disintegration test for tablets.
5. Disintegration test for capsules.
6. Assessment of area under curve (AUC).
7. Determination of pharmacokinetic parameters after IV bolus administration following one compartment model.
8. Determination of pharmacokinetic parameters after IV bolus administration following two compartment models.
9. Determination of absolute bioavailability.
10. Determination of Relative bioavailability.
11. Determination of Bioavailability.

TEXT BOOK

1. Biopharmaceutics and Clinical pharmacokinetics, M. Gibaldi, 4th edition, 2006, Lea and Febiger, Philadelphia.
2. Biopharmaceutics and pharmacokinetics, Brahmanekar and Jaiswal, 2nd edition, 2009, Vallabh Prakashan, New Delhi
3. Biopharmaceutics and pharmacokinetics, 1974, Wolfgang A. Ritschel, Drug Intelligence Publications, USA.

REFERENCES

1. The Science and Pharmacy by Remington 21st edition, 2005, Vol.I & II, Lippincott Williams & Wilkins, Philadelphia.
2. Biopharmaceutics and Relevant pharmacokinetics, Wagner J.E, Drug Intelligence publications, Washington DC.
3. Applied Biopharmaceutics and pharmacokinetics, Shargel. L, Yu AB, 5th Ed, 1993, McGraw Hill publication New York.
4. Biopharmaceutics and Clinical pharmacokinetics, Notari R.E, 4th edition, 2005, Marcel Dekker, Inc, New York.

THEORY**(54 Hours)****UNIT I – TERPENOIDS****(11 Hours)**

Introduction, isolation, classification, isoprene rule, General methods of determining structure, chemistry and synthesis of Citral, Menthol, Thymol, Camphor, α – terpineol, α – pinene, Linalool. Inter relationship of Limonene, Dipentene, Terpineol, Terpinhydrate, Cineole and Carvone.

UNIT II – PURINES**(10 Hours)**

Introduction, classification, structural elucidation of Uric acid, Caffeine, Theophylline, Theobromine and it's inter relationship.

UNIT III – ANTIBIOTICS**(11 Hours)**

Introduction, chemical classification, structure of Natural and semi synthetic penicillin, Degradation of penicillin, synthesis of Phenoxy methyl penicillin, chemistry and uses of Streptomycin, Tetracyclines, Chloramphenicol, Cephalosporin. Structures of Antifungal, Anticancer, Macrolide and polypeptide antibiotics.

UNIT IV – ALKALOIDS**(11 Hours)**

Introduction, classification, isolation, properties, General methods for determining structures, chemistry and pharmacological activity of Atropine, Cocaine, Quinine, Reserpine, Morphine, Codeine, Papaverine, Ephedrine, Ergotamine and Nicotine.

UNIT V – CARBOHYDRATES**(11 Hours)**

Introduction, Ring structure of glucose, Determination of size of the ring. Chemistry of Fructose, Maltose, Lactose, Sucrose and Starch.

Natural Pigments: Introduction, chemistry, reactions, synthesis and interrelationship of flavones, Isoflavone and Xanthone, Chemistry and synthesis of Quercetin.

Carotenoids: Introduction, Geometrical isomerism, classification, structure, isolation, properties and conversion of β – carotene to Vitamin A.

1. Assay of Thiamine hydrochloride.
2. Assay of Riboflavin powder.
3. Assay of Chloramphenicol capsule.
4. Assay of Ascorbic acid.
5. Assay of Quinine sulphate.
6. Assay of Pyridoxine HCl.
7. Assay of Codeine phosphate syrup.
8. Estimation of Citral in lemon oil .
9. Qualitative analysis of Alkaloids.
10. Degradation Study of Caffeine.
11. Degradation Study of Atropine.
12. Qualitative analysis of Vitamins.
13. Assay of Benzyl penicillin injection.
14. Estimation of Theophylline in Theophylline elixir.

TEXT BOOKS

1. Organic Chemistry of Natural products Vol I &II, Gurdeep Chatwal, 3rd edition, 2005, Himalaya, Publishing House, Mumbai.
2. Chemistry of Organic Natural products Vol I & II, O.P. Agarwal, 34th edition, 2007, Goel Publishing House, Meerut.

REFERENCES

1. Organic Chemistry, Vol I & II, I.L. Finar, sixth edition, 1994, Longman Singapore publishers, Singapore.
2. Trease and Evans Pharmacognosy by William. C – Evans, 16th edition, 2009, Elsevier, Ltd. China.
3. Chemistry of Natural products, V.K. Ahluwalia, Lalita S.Kumar, sanjiv kumar, 2006, Gopsons printers, Noida.
4. Phytochemical Techniques, N. Raaman, 2006, New India publishing Agency, Delhi.
5. Natural products, A laboratory guide, 2nd edition, Raphael I Kan, 2005, Elsevier, New Delhi.
6. Natural Products, James. R, Hanson, 2003, Royal Society of Chemistry, UK.
7. Phytochemical Methods by J.B. Harbone.

THEORY**(54 Hours)****UNIT I – INTRODUCTION****(11 Hours)**

Definition, History, Present status and future scope of pharmacognosy. Structure of plant cell and its non-living inclusions, different types of plant tissues and their functions. Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed. Modifications of root and stem.

Classification of crude drugs: Alphabetical, biological, chemical, pharmacological, taxonomical, chemotaxonomical and serotaxonomical classification of drugs.

UNIT II - CULTIVATION AND COLLECTION**(10 Hours)**

Advantages and factors influencing cultivation and their application, general methods of cultivation, collection, processing and storage of crude drugs, plant growth regulators, polyploidy, mutation and hybridization with reference to medicinal plants.

UNIT III - QUALITY CONTROL OF CRUDE DRUGS**(11 Hours)**

Adulteration of crude drugs. Brief introduction to evaluation of crude drugs by organoleptic, microscopic, physical, chemical and biological methods.

Introduction to phytoconstituents of drugs: Definition, classification, properties and identification tests of carbohydrates, tannins, alkaloids, glycosides, lipids, resins, volatile oils, terpenoids, steroids, flavonoids.

UNIT IV - BIOLOGICAL SOURCES**(11 Hours)**

Geographical distribution, preparation, description/macroscopy, chemical constituents, substitutes, adulterants, uses, and specific chemical tests of the following:

Carbohydrates and related products: agar, gum acacia, tracaganth, sterculia gum, honey, Isapgol, pectin, starch

Tannin containing drugs: gambier, black catechu, gall, myrobalan.

UNIT V – ALKALOIDS**(11 Hours)**

Sources, cultivation, collection, processing, commercial varieties, preparation, chemical constituents, substitutes, adulterants, uses, diagnostic (macroscopic & microscopic) features and specific chemical tests of the following: pyridine-piperidine: lobelia; tropane: belladonna, coca; quinoline and isoquinoline: cinchona, ipecac, opium; indole: ergot, rauwolfia, catharanthus, nux-vomica; imidazole: pilocarpus; steroidal: kurchi; alkaloidal amine: ephedra; glycoalkaloid: solanum; purines: tea.

R14PHG57**PHARMACOGNOSY – I****PRACTICAL****(54 Hours)**

1. Macroscopy of crude drugs: Isapgol, gall, myrobalan, cinchona, ipecac, rauwolfia, vinca, nuxvomica, kurchi, ephedra .
2. Microscopy and powder characteristics of Isapgol
3. Microscopy and powder characteristics of cinchona
4. Microscopy and powder characteristics of ipecac
5. Microscopy and powder characteristics of vinca
6. Microscopy and powder characteristics of nuxvomica
7. Microscopy and powder characteristics of ephedra
8. Morphological characters and chemical tests of agar
9. Morphological characters and chemical tests of acacia
10. Morphological characters and chemical tests of tracaganth
11. Morphological characters and chemical tests of honey
12. Morphological characters and chemical tests of starch
13. Morphological characters and chemical tests of black catechu
14. Morphological characters and chemical tests of pale catechu
15. Determination of length and width of phloem fibres.
16. Determination of swelling factor
17. Microchemical analysis of atropine
18. Microchemical analysis of caffeine
19. Microchemical analysis of quinine
20. Quantitative microscopy-lycopodium spore method.

TEXT BOOKS

1. Pharmacognosy, GE Trease and WC Evans, 16th edition, 2009, Saunders Elsevier limited, China
2. A Text book of pharmaceutical biology, SB Gokhale, CK Kokate, DS Bidarkar, 1st edition, 1998, Nirali Prakashan, Pune
3. Text book of pharmacognosy, CK Kokate, AP Purohit and SB Gokhale, 45th edition, 2010, Nirali Prakashan, Pune.
4. Text book of pharmacognosy and phytochemistry, Vinod K Rangari, 2nd edition, 2009, Nishad Deshmukh for career publications, Maharashtra
5. Practical pharmacognosy, CK Kokate, AP Purohit and SB Gokhale, 4th edition, 2005, Vallabh Prakashan, New Delhi

REFERENCES

1. Cultivation of medicinal plants, CK Kokate, AS Gokhale and SB Gokhale, 5th edition, 2003, Nirali Prakashan, Pune

2. Pharmacognosy, SS Honda and VK Kapoor, 2nd edition, 2000, Vallabh Prakashan, New Delhi
3. Text book of Industrial pharmacognosy, AK Kalia, 2005, CBS publishers, New Delhi
4. Text book of pharmacognosy, TE Wallis, 5th edition, 2005, CBS publishers & Distributors, New Delhi
5. Text book of pharmacognosy, Shah and Quardy, 13th edition, 2007-08, BS Shan Prakashan, Ahmedabad
6. Anatomy of crude drugs, MA Iyengar and SGK Nayak, 10th edition, 2006, published by MA Iyengar, Manipal
7. Practical pharmacognosy, Rasheeduz Zafar, 1st edition, 1994, published by CBS publisher, New Delhi
8. Pharmacognosy of powdered crude drugs, MA Iyengar, 7th edition, 2005, Published by MA Iyengar, Manipal
9. Evaluation of crude drugs, a laboratory guide, Madhu C. Divakar, 2nd edition, 2002, published by M/S CD remedies, Kerala
10. Indian Herbal Pharmacopoeia, Volume I and II, 2002, A Joint publication of Regional Research Laboratory, Jammu Tawi and Indian Drug Manufacturer's Association, Mumbai.

R14PHL58**PHARMACOLOGY AND THERAPEUTICS – I****THEORY****(48 Hours)****UNIT I - INTRODUCTION TO PHARMACOLOGY****(10 Hours)**

Definitions, sources of drugs, dosage forms, various routes of drug administration, Bioassay of drugs, Dose Response Relationship, Prodrug concept, Orphan drugs, Pharmacogenomics, Pharmacoepidemiology.

UNIT II - PHARMACOKINETICS AND PHARMACODYNAMICS**(11 Hours)**

Absorption, Distribution, Metabolism and Excretion of drugs, Principles of basic and clinical pharmacokinetics. Mechanism of action of drugs, combined effect of drugs, Factors modifying drug action, Tolerance and dependence, Tachyphylaxis, Drug addiction and abuse.

UNIT III –**(11Hours)**

Various steps involved in Neurohumoral transmission in Autonomic and Somatic nervous system, cholinergic receptors. Mechanism of action, Pharmacological actions, adverse effects, drug interactions and therapeutic uses of Cholinergic agonists, Anti - cholinesterases, Anti-cholinergic drugs, Ganglionic stimulants and blocking agents, Skeletal muscle relaxants.

UNIT IV - CLASSIFICATIONS OF ADRENOCEPTORS**(11Hours)**

Mechanism of action, Pharmacological actions, adverse effects, drug interactions and therapeutic uses of Adrenergic drugs, Anti- adrenergic drugs, Dale's vasomotor reversal phenomena, Mydriatics, Miotics, Drugs for Glaucoma, Local anesthetic agents.

UNIT V –**(11 Hours)**

Mechanism of action, Pharmacological actions, adverse effects, drug interactions and therapeutic uses of autacoids like Histamine and their antagonists, 5-HT and their antagonists, Prostaglandins, Thromboxanes and Leukotrienes, Pentagastrin, Cholecystokinin, Angiotensin, Bradykinin and Substance P, Drugs used in migraine.

R14PHL59**PHARMACOLOGY AND THERAPEUTICS - I****PRACTICAL****(54 Hours)**

1. Common laboratory animals and anesthetics used in animal studies.
Commonly used instruments in Experimental Pharmacology.
2. Some common and standard techniques - Bleeding and intravenous injection, intra-gastric administration.
3. Procedures for rendering animal unconscious and chemical euthanasia.

4. To study the different routes of administration of drugs in mice/rats.
5. To study the effect of hepatic microsomal enzyme inhibitors and inducers on the Phenobarbitone sleeping time in mice.
6. To study the effect of autonomic drugs on rabbit's eye.
7. To study the effect of Local anesthetics on Guinea pigs and Rabbit.
8. Estimation of bioavailability parameters viz AUC, T_{max} , K_{el} from blood and urine samples in human volunteers or in laboratory animals.
9. Statistical calculations used in Experimental Pharmacology.
 - i Student's - t test
 - ii ANOVA
10. Experiments based on computer models like Expharm for isolated smooth and skeletal muscle preparations.

TEXT BOOKS

1. Pharmacology and Pharmacotherapeutics, R.S. Satoskar, S.D. Bhandarkar, Nirmala.N. Rege, 19th Edition, 2005, Popular Prakashan, Mumbai.
2. Essentials of Medical Pharmacology, K.D. Tripathi, sixth edition, 2008, Jaypee Publishers, NewDelhi.
3. Pharmacology, Rang M.P, Dale M.M, Reter J.M., R.J. Flower, sixth edition, 2007, Elsevier, USA.
4. Pharmacology, Lippincott's Illustrated reviews, Fourth edition, 2009, Wolters Kluwer(India) Private Ltd., New Delhi.

REFERENCES

1. The Pharmacological basis of therapeutics –Goodman and Gilman's, Eleventh Edition, 2010, The McGraw – Hill, USA.
2. Hand book of Experimental Pharmacology, S.K. Kulkarni, Third Edition, 1999, M.K. Jain Vallabh Prakashan, New Delhi.
3. Essentials of Pharmacotherapeutics, F.S.K. Barar, Fourth Edition, 2009, S. Chand & Company, New Delhi.
4. Clinical Pharmacology, Laurence, D.R. and Bennet P.N, Seventh Edition,1994, Churchill Livingstone, UK.
5. Katzung, B.G., Susan B Masters, Anthony J Trever, Basic and Clinical Pharmacology, Eleventh edition, 2010, The McGraw - Hill Companies Ltd.USA.

SIXTH SEMESTER

R14PHP61 PHARMACY ACT AND DRUG RULES

THEORY (54 Hours)

UNIT – I (11Hours)

Origin and nature of pharmaceutical legislation in India, its scope and objectives. Evolution of the “concept of Pharmacy” as an integral part of the Health care system. Professional ethics in pharmacy practices, legal and ethical responsibilities of pharmacists.

UNIT – II (11 Hours)

Pharmacy Act - Drugs and Cosmetics act 1940 and rules 1945. Recent amendments to be considered.

UNIT – III (11 Hours)

Narcotics and Psychotropic substances Act, Drugs and Magic remedies (Objectionable advertisement) Act 1954, Poisons act 1919 – Patent Act – Intellectual Property Rights.

UNIT – IV (10 Hours)

Medicinal and Toilet preparations (Excise duties) Act and rules, Drugs Price control order, Shops & Establishments Act, Sales promotion employees (conditions of service) Act.

UNIT – V (11 Hours)

Medical Termination of Pregnancy Act, Prevention of cruelty to Animals act, Insecticides Act. Consumer protection Act 1986 - The Factories Act 1948 and the Amendment (salient features.)

TEXT BOOK

1. Forensic Pharmacy, B.M. Mithal, 6th edition, 2005, Vallabh Prakashan, New Delhi.
2. Forensic Pharmacy, Dr. B.S. Kuchekar, A.M. Khadatare and Sachin C. Itkar, Nirali Prakashan, Pune.
3. Forensic Pharmacy, by N.K.Jain, 6th edition CBS Publishers. Delhi.
4. Forensic Pharmacy, B.Suresh, 12th edition, CBS Publishers. Delhi.
5. Forensic Pharmacy and Pharmaceutical Business Management, K.Ram Kumar, 1st edition, 2006.

REFERENCES

1. Drugs and Cosmetics Act 1940, Vijay Malik, Eastern Book Company, Lucknow.
2. Forensic Pharmacy, G.Vidyasagar & T.V.Narayana, Kalyani Publishers, New Delhi.

THEORY**(54 Hours)****UNIT – I****(11 Hours)**

Introduction to microorganisms, structure, organization and reproduction and economic importance of bacteria, algae, fungi and virus- Growth identification (staining, morphological) cultivation of bacteria, fungi and virus in different culture media, their nutritional requirements and environmental factors affecting their growth.

UNIT – II**(11 Hours)**

Sterilization- Introduction, Classification of sterilization including its merits and demerits. Sterilization methods of all pharmaceutical products. Biological indicators, test for sterility. Disinfectants- Classification, Mechanism, Factors affecting their action. Evaluation of bactericidal, bacteriostatic, fungicidal and virucidal activities. Evaluation of preservatives in pharmaceutical preparations.

UNIT – III**(11 Hours)**

Immunology- Introduction, types of immunity, antigen, haptens, B cell, T cell, complements activation, MHC complex, structure of antibody. Microbial assay- Including antibiotics and vitamins. Antibiotic sensitivity testing. Vaccines- Definition, classification, immunization schedule, preparation, standardization, containerization, storage and stability of toxoids, bacterial and viral vaccines. Hybridoma technology in the production of Monoclonal antibodies and its applications.

UNIT – IV**(10 Hours)**

Fermentation- basic principle of fermentation. Study, design and operation of fermenter and study of different parameters like pH, dissolved oxygen concentration, temperature etc., Isolation and screening of industrially important microbes. Bioprocess of metabolites like Penicillin, Streptomycin, Riboflavin, Cyanocobalamin, Alcohol, Citric acid.

UNIT – V**(11 Hours)**

Microbial genetics-Structure of DNA, RNA and its types, replication, transcription and translation. Genetic engineering- cloning strategies in rDNA technology. Restriction endonucleases, vectors. rDNA application in the production of Insulin, Hepatitis B Vaccine, Interferon, Interleukins. Blood Products- storage, Plasma substitutes.

R14PHP63 PHARMACEUTICAL BIOTECHNOLOGY**PRACTICAL****(54 Hours)**

1. Staining technique- simple staining.
2. Gram staining.
3. Sterility testing for Pharmaceutical compounds.
4. Preparation of nutrient broth.
5. Preparation of nutrient agar slant.
6. Preparation and inoculation of differential and selective media.
7. Isolation of pure culture.
8. Determination of motility of micro organism by hanging drop method.
9. Protein estimation by – Lowry's, Bradford's, Biuret method.
10. Estimation of nucleic acids- DNA, RNA.
11. Antimicrobial sensitivity test.
12. Identification of fungi.

TEXT BOOKS

1. Text book of Pharmaceutics, Bentleys, 8th edition, 2003, All India Traveller Book Seller, New Delhi.
2. Microbiology, Prescott, 7th edition, 2008, Mc Graw Hill, Asia.
3. Text book of Microbiology, Arora D.R, 2nd edition, 2003, CBS Publishers and distributors, New Delhi.
4. Microbiology, Pelczar, 5th edition, 1993, Tata Mc Graw Hill, New Delhi.
5. Textbook of Biotechnology , R.C Dubey, 1st edition, 2007, S.Chand & Company Ltd, Ramnagar, New Delhi
6. Principles of Fermentation technology, P.F Stanbury,A. Whitaker and S.J. Hall. 2nd edition, 1997. Aditya book, New Delhi.
7. Pharmaceutical Biotechnology: Fundamentals and application, M.A.Halkari, 1st edition, 2003, Vallabh Prakashan, New Delhi.
8. Tutorial Pharmacy, S.J.Carter, 6th edition, 2005, CBS Publishers and distributors, New Delhi.
9. Pharmaceutical Biotechnology, W. B. Hugo and A.D. Russell, 6th edition, 1998, Black well science, USA.

THEORY**(54 Hours)****UNIT-1****(11 Hours)**

Physico Chemical Parameters of Drug Molecules in Relation to Biological activity; Solubility, Partition co-efficient, Hydrogen bonding, Ionisation, Protein binding, Chelation, Redox Potential, Surface activity, Optical and Geometrical isomers, Receptors, Theories of drug - receptor interaction.

Drug Metabolism: General pathway of Drug metabolism, oxidative, Reductive, hydrolytic and conjugation reaction. Discussion on phase - I and II pathway will be restricted to the following representative model drugs. Phenobarbitone, Diazepam, Isoniazid, Paracetamol, Ibuprofen, Valproic acid, Chlorpromazine and Acebutol. Factors affecting drug metabolism.

UNIT-II**(11 Hours)**

Modern Concept of Rational Drug Design: Lead discovery, pharmacophore identification, Functional group optimization, structural activity relationship (SAR) studies, Bioisoterism. A brief introduction on QSAR, combinatorial chemistry and computer aided drug design. Prodrug: Basis concept of pro drug, types of Prodrugs-Carrier linked Prodrug and Bioprecursor with examples, Utility of Prodrug in drug design.

Classification, Mode of action, Structure, chemical name, Synthesis (only those compounds that are superscribed by s) and uses of the following category of the drugs (UNIT-III, IV & V).

UNIT-III**(11 Hours)**

General Anaesthetics: Halothane^s, Methoxyflurane^s, Enflurane, Methohexital sodium^s, Thiopental^s, Ketamine hydrochloride^s and Thiamylal sodium^s. Anxiolytics, Sedatives and Hypnotics: Chlordiazepoxide^s, Diazepam^s, Oxazepam, Lorazepam, Halozepam, Alprazolam^s, Flurazepam, Barbitol^s, Triazolam, Tolbutal, Glutethimide^s, Methaqualone, Meprobamate^s, Triclofos sodium, SAR of Benzodiazepine.

UNIT-IV**(10 Hours)**

Drugs acting on CNS Antipsychotics: ChlorpromazineHCl^s, Triflupromazines, Thioridazine^s, Mesoridazine HCl, Prochlorperazine, Thiothixene^s, Loxapine succinate, Haloperidol^s, Droperidol, Risperidone, SAR of Phenothiazines. Anticonvulsant: Phenytoin, Phenobarbitone^s, Mephenytoin, Ethoin^s, Trimethadione^s, Phensuximide, Ethosuximides, Metho suximide, Carbamazepine^s, Primidone^s, Valproic acid^s and Clonazepam. SAR of Barbiturates.

UNIT – V

(11 Hours)

Drugs acting on CNS: CNS Stimulant: Nikethamide, DoxapramHCl^s, Dextroamphetamine sulphate^s, Benzamphetamine HCl, Methyphenidate, Pentylentetrazole, Modafinil.

Antidepressant: Phenelzine sulphates, Trancylpromines, Imipramine HCl^s, Desipramine HCl^s, Amitriptyline HCl^s, Protriptyline HCl^s, Doxepine HCl^s, Fluoxetine, Sertaline, Venlafaxine, Trazadone HCl^s, Psilocybin and Psilocin, Phencyclidine, Transtetrahydro cannabinol.

R14PHC65 MEDICINAL CHEMISTRY – I

PRACTICAL

(54 Hours)

1. Determination of Partition Coefficient of Ibuprofen.
2. Determination of Partition Coefficient of Paracetamol.
3. Construction of Stereo model of Epinephrine.
4. Construction of Stereo model of Ephedrine.
5. Construction of Stereo model of Ibuprofen .
6. Construction of Stereo model of Diethyl stilboesterol.
7. Construction of Stereo model of Methyl dopa.
8. Construction of Stereo model of Propranolol.
9. Assay of Aspirin powder.
10. Assay of Methyl salicylate.
11. Assay of Salicylic acid powder.
12. Assay of Saccharin powder.
13. Assay of Chlorpheniramine maleate powder.
14. Test for Purity of salicylic acid.
15. Test for Purity of Aspirin.
16. Test for Purity of Methyl salicylate.
17. Test for Purity of Nicotinic acid.

TEXT BOOKS

1. Text Book of Medicinal Chemistry, Vol I & II, K. Ilango, P. Valentina, 1st edition, 2007, Keerthi Publishers, Chennai.
2. Principles of Medicinal Chemistry , Vol I & II, Kadam, Mahadik, Bothara, 5th edition, 1997,Niraliprakashan, Pune.
3. Medicinal chemistry, Ashutoshkar, 3rd edition, 2005, Ashutoshkar, New age International publishers, New Delhi.

REFERENCES

1. Burger's Medicinal chemistry & Drug Discovery. Vol I to IV edited by Donald J. Abraham, 6th edn, 2007 Wiley interscience publication, New Jersey.
2. The Science and Practice of Pharmacy, Vol I, Remington, 20th edn, 2004, Lippincott Williams and Wilkins, Philadelphia
3. Foye's principle of Medicinal Chemistry, David. A. Williams, Thomas. L. Lenke, 5th edition, 2005, Lippincott Williams and Wilkins, Philadelphia.
4. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 11th ed, 2004, Lippincott Williams & Wilkins, Philadelphia.
5. Text Book of Medicinal Chemistry, S.N.Pandeya, 3rd edition, 2006, SG publisher, Varanasi.
6. Principles of Organic Medicinal Chemistry, Ramarao Nadendla, 2005, New age International publisher, New Delhi.
7. Indian Pharmacopoeia – Vol I & II, 2010, The Indian Pharmacopoeia Commission, Ghaziabad.

UNIT I - GLYCOSIDES CONTAINING DRUGS

(11 Hours)

Study of the biological sources, cultivation, collection, commercial varieties, preparation, chemical constituents, substitutes, adulterants, uses, diagnostic characters (macroscopy and microscopy) and specific chemical tests of the following: Saponin group includes liquorice, ginseng, dioscorea; Cardioactive glycosides include digitalis, squill, strophanthus; Anthraquinone cathartics include aloe, senna, rhubarb, cascara; Bitter glycosides include gentian, quassia; Cyanogenetic glycosides: linseed.

UNIT II

(11 Hours)

Biological sources, geographical distribution, preparation, description/macroscopy, chemical constituents, substitutes, adulterants, uses, and specific chemical tests of the following:

Lipids: bees wax, castor oil, cod-liver oil, hydnocarpus oil, lard, linseed oil, rice-bran oil, shark liver oil wool fat.

Resins and resin combinations: podophyllum, colophony, benzoin, asafoetida, ginger, balsam of tolu, peru balsam, storax.

Volatile oils: General methods of isolation of volatile oil from plants. Brief study of crude drugs containing volatile oils : mentha, coriander, lemon peel, chenopodium, valerian, cinnamon, cassia, caraway, dill, clove, fennel, cardamom, sandalwood, eucalyptus, nutmeg.

UNIT – III

(10 Hours)

Biological sources, geographical distribution, preparation, description, chemical constituents, uses, and identification tests of the following:

Fibres: Cotton, jute, silk, wool, rayon, nylon, alginate fibre, gelatin sponge, oxidised cellulose.

Pharmaceutical aids: Talc, kaolin, bentonite, natural colorants.

UNIT IV - ALTERNATIVE SYSTEM OF MEDICINE

(11 Hours)

Basic principles involved in ayurveda, siddha and unani. Preparation and standardization of arishtas, asavas, churnas, lehyas and bhasmas. Worldwide trade, commercial potential and demand of crude drugs with reference to phytochemical industry in India.

UNIT V – NUTRACEUTICALS

(11 Hours)

Definition, classification and examples. Proteins and enzymes: Biological sources, preparation, identification test and uses of following: gelatin, diastase, papain, pepsin, trypsin, maltase, pectinase.

Natural pesticides: Biological sources, macroscopy, chemical constituents and uses of following: pyrethrum, neem, sabadilla, strychnine, rotenone, tobacco.

R14PHG67

PHARMACOGNOSY – II

PRACTICAL

(54 Hours)

1. Macroscopy of crude drugs: liquorice, squill, senna, rhubarb, quassia, linseed, shark liver oil, wool fat, ginger, mentha, lemon peel, coriander, cinnamon, cassia, caraway, dill, clove, fennel, cardamom, sandal wood, eucalyptus, nutmeg, neem.
2. Microscopy and powder characteristics of senna.
3. Microscopy and powder characteristics of quassia.
4. Microscopy and powder characteristics of ginger.
5. Microscopy and powder characteristics of coriander.
6. Microscopy and powder characteristics of cinnamon.
7. Microscopy and powder characteristics of clove.
8. Microscopy and powder characteristics of fennel.
9. Microscopy and powder characteristics of cardamom.
10. Description and identification tests of aloes.
11. Description and identification tests of bees wax.
12. Description and identification tests of castor oil.
13. Description and identification tests of colophony.
14. Description and identification tests of benzoin.
15. Description and identification tests of asafetida.
16. Description and identification tests of fibres.
17. Description and identification tests of gelatin.
18. Determination of ash values.
19. Determination of extractive values.
20. Determination of loss on drying.
21. Determination of alcohol content.
22. Determination of weight per ml .

TEXT BOOKS

1. Pharmacognosy, GE Trease and WC Evans, 16th edition, 2009, Saunders Elsevier limited, China
2. Text book of pharmacognosy, CK Kokate, AP Purohit and SB Gokhale, 45th edition, 2010, Nirali Prakashan, Pune.
3. Text book of pharmacognosy and phytochemistry, Vinod K Rangari, 2nd edition, 2009, Nishad Deshmukh for career publications, Maharashtra
4. Practical pharmacognosy, CK Kokate, AP Purohit and SB Gokhale, 4th edition, 2005, Vallabh Prakashan, New Delhi

REFERENCES

1. Text book of Industrial pharmacognosy, AK Kalia, 2005, CBS publishers, New Delhi
2. Text book of pharmacognosy, TE Wallis, 5th edition, 2005, CBS publishers & Distributors, New Delhi
3. Text book of pharmacognosy, Shah and Quardy, 13th edition, 2007-08, BS Shan Prakashan, Ahmedabad
4. Anatomy of crude drugs, MA Iyengar and SGK, Nayak, 10th edition, 2006, published by MA Iyengar, Manipal
5. Practical pharmacognosy, Rasheeduz Zafar, 1st edition, 1994, CBS publishers, New Delhi
6. Pharmacognosy of powdered crude drugs, MA Iyengar, 7th edition, 2005, Published by MA Iyengar, Manipal
7. Evaluation of crude drugs, a laboratory guide, Madhu C Divaka, 2nd edition, 2002, published by M/S CD remedies, Kerala

**R14PHL68
THEORY**

PHARMACOLOGY AND THERAPEUTICS – II

(54 Hours)

UNIT – I

(11 Hours)

Neurohumoral transmission in the Central nervous system, Mechanism of action, Pharmacological actions, adverse effects, drug interactions, therapeutic uses and toxicities of General anesthetics, Alcohol, Sedatives and Hypnotics, Anti-anxiety agents, Anti-epileptic drugs, C.N.S. stimulants.

UNIT – II

(11 Hours)

Mechanism of action, Pharmacological actions, adverse effects, drug interactions and therapeutic uses of Anti-psychotics, antidepressants, Anti-manics and hallucinogens, Anti-parkinsonism drugs, Drugs for Alzheimer's Disease, Nootropic agents, Narcotic analgesics and their antagonists, Non steroidal anti-inflammatory and anti-gout drugs.

UNIT – III

(10 Hours)

Electrophysiology of heart, Cardiac glycosides and drugs for Congestive heart failure, Anti-arrhythmic drugs, Anti-hypertensive drugs- Drugs acting on renin angiotensin system, Fluid and electrolyte balance, Diuretics and Anti-diuretics.

UNIT – IV

(11 Hours)

Anti-hyperlipidemic drugs, Drugs used in the therapy of shock, Anti-anginal drugs, Drugs for Myocardial infarction and vasodilator drugs including calcium channel blockers, Potassium channel openers and beta adrenergic antagonists.

UNIT – V

(11 Hours)

Etiology of Allergic asthma, Anti-asthmatic drugs including Bronchodilators, Pharyngeal demulcents, Expectorants, Anti-tussives, Nasal decongestants, Respiratory stimulants.

R14PHL69 PHARMACOLOGY AND THERAPEUTICS - II

PRACTICAL

(54 Hours)

1. To study the Spontaneous motor activity and Stereotype activity using actophotometer and open field apparatus.
2. To study the Analgesic activity by Physical, chemical and thermal methods.
3. To study the Anticonvulsant activity using Electro convulsimeter.
4. To study the Anti-inflammatory activity using Digital Plethysmograph.
5. To study the Muscle relaxant activity by Rota rod and Traction method.
6. To study the Anti anxiety activity using Elevated plus maze apparatus.
7. To study the Cognitive effect using Rectangular or Y - maze.
8. To study the diuretic effect using metabolic cages.
9. Experiments based on computer models like Expharm for isolated heart experiments.

TEXT BOOKS

1. Pharmacology and Pharmacotherapeutics, R.S. Satoskar, S.D. Bhandarkar, Nirmala.N. Rege, 19th Edition, 2005, Popular Prakashan, Mumbai.
2. Essentials of Medical Pharmacology, K.D. Tripathi, Sixth edition, 2008, Jaypee Publishers, NewDelhi.
3. Pharmacology, Rang M.P, Dale M.M, Reter J.M., R.J. Flower, Sixth edition, 2007, Elsevier, USA.
4. Pharmacology, Lippincott's Illustrated reviews, Fourth edition, 2009, Wolters Kluwer(India) Private Ltd., New Delhi.

REFERENCES

1. The Pharmacological basis of Therapeutics –Goodman and Gilman's, Eleventh Edition, 2010, The McGraw – Hill, USA.
2. Hand book of Experimental Pharmacology, S.K. Kulkarni, Third Edition, 1999, M.K. Jain Vallabh Prakashan, NewDelhi.
3. Essentials of Pharmacotherapeutics, F.S.K. Barar, Fourth Edition, 2009, S. Chand & Company, NewDelhi.
4. Clinical Pharmacology, Laurence, D.R. and Bennet P.N, Seventh Edition,1994, Churchill Livingstone, UK.
5. Katzung, B.G., Susan B Masters, Anthony J Trever, Basic and Clinical Pharmacology, Eleventh edition, 2010, The McGraw - Hill Companies Ltd., USA.

**FINAL YEAR B.PHARMACY
SEVENTH SEMESTER**

R14PHS71 SOCIAL AND BEHAVIOURAL SCIENCES

THEORY **(54 Hours)**

UNIT – I **(11 Hours)**

Professional communication- Communication with health care professionals- written communication, formulary communications. Writing manuscripts for publications. Written professional communication, personal communications. Communicating with administrators, communicating with media.

UNIT – II **(10 Hours)**

Development of a pharmacy care plan and patient problem solving community pharmacy- Definition, establishment and organization

UNIT – III **(11 Hours)**

Community Pharmacy- Economics and management: Role of management, material and human resources, planning and controlling operation, money, inventory, facilities, personnel, selection orientation and training, credit, risk, insurance and records.

UNIT – IV **(11 Hours)**

Social interaction- general: Non verbal communication, self knowledge learning groups. Transactional analysis, Assertiveness, leadership skills, motivation, counselling, bargaining and negotiation, Interviews, rating.

UNIT – V **(11 Hours)**

Marketing pharmaceutical care services: Marketing management process, planning of marketing, implementing and controlling marketing activities.

TEXT BOOK

1. The Science and Practice of Pharmacy by Remington 21st Edn.Vol.I&II Lippincott Williams& Willkins,Philadelphia.
2. Behavioral Sciences for Managers, A.G.Cowling, 2nd edition, Harwal Publishers.
3. Pharmacy Practice, Patritious Ston & Stephen Curtis, 3rd edition, 2002, Viva books Pvt Ltd, New Delhi.
4. Dynamics of behavioral sciences in Industry, P.C. Rihar, 2001, H.G.Publication, New Delhi.

REFERENCES

1. Pharmaceutical Practice, Winfield, 3rd edition, 2004, Churchill Livingstone, Spain.
2. Clinical Pharmacy, Dr. H.P. Tipnis, Dr. Amrita Bajaj, 2nd Edition, 2006, Career Publication, New Delhi.

R14PHP 72 INDUSTRIAL PHARMACY-I

THEORY **(54 Hours)**

UNIT I - PRE-FORMULATION STUDIES **(11 Hours)**

Study of physical properties of drug like physical form, particle size, shape, density, wetting, solubility, dissolution, organoleptic properties and their effect on formulation and stability, study of chemical properties of drugs like hydrolysis, oxidation-reduction, racemization and their influence on formulation and stability of products. Study of Prodrug in solving problem related to stability, bioavailability, elegance of formulations.

UNIT II - HARD AND SOFT GELATIN CAPSULES **(11 Hours)**

Advantages and disadvantages of capsule dosage forms- production of hard gelatin capsules- size of capsules- soft gelatin capsules- manufacture of soft gelatin capsules- quality control- stability and storage of capsule dosage forms- packaging.

UNIT III – TABLETS **(11 Hours)**

Different types of formulations- granulation processes- stages with production of tablets- types of tablets making machines- defects in the production of tablets- methods to overcome- quality control tests for tablets- packaging.

UNIT IV - COATING PROCESSES **(11 Hours)**

Sugar coating- film coating- enteric coating- materials and polymers used- different techniques of coating processes and their advantages and disadvantages. Micro-encapsulation- techniques of microencapsulation- evaluation of coated tablets and microcapsules.

UNIT V – COSMETICS **(10 Hours)**

Fundamentals of cosmetic science. Structure and functions of skin and hair. Formulation, evaluation, packaging of cosmetics for skin, hair, dentifrices and manicure preparations, nail polish, lipsticks, eye lashes, baby care products. Introduction of basics in packaging for tablets, capsules, liquid orals. Primary, secondary and tertiary packaging- Importance of packaging in preventing counterfeit medicines.

R14PHP73 INDUSTRIAL PHARMACY-I

PRACTICAL

(54 Hours)

1. Preparation of Calcium gluconate tablets by wet granulation method.
2. Preparation of Aspirin tablets by dry granulation method.
3. Preparation of Aspirin tablets by direct compression method.
4. Evaluation tests for tablets.
5. Preparation of loose face powder.
6. Preparation of compact face powder.
7. Preparation of lather shaving cream.
8. Preparation of brushless shaving cream.
9. Preparation of vanishing cream.
10. Preparation of cold cream.
11. Preparation of lipsticks.
12. Preparation of coconut oil shampoo.
13. Preparation of anti dandruff shampoo.
14. Preparation of tooth powder.
15. Preparation of cuticle remover.

TEXT BOOKS

1. The Theory and Practice of Industrial Pharmacy – Lachman L, Lieberman H.A & Kanjig J.L, Special Indian edition, 2009, CBS publishers Pvt Ltd. New Delhi.
2. Pharmaceutics The Science of dosage form, Collett, Aulton, 3rd edition, 2009, ELBS Publishers, London.
3. Introduction to pharmaceutical dosage forms, H.C.Ansel, 8th edition, 2002, New Age International publications, New Delhi.
4. Pharmaceutical Process Scae-up, second edition, Michael Levin, CRC press, Taylor & Francis group, Newyork, London, 2008.

REFERENCES

1. The Science and Practice of Pharmacy by Remington 21st edition, 2005, Vol.I&II Lippincott Williams & Willkins, Philadelphia
2. Modern Pharmaceutics, Banker G.S and Rhodes C.T, 4th edition, 2002, Mercel Dekker Inc. New York.

THEORY**(54 Hours)**

Classification, Mode of action, Structure, chemical name, Synthesis (only those compounds that are underlined and superscribed by s) and uses of the following category of the drugs.

UNIT I - ADRENERGIC NEUROTRANSMITTERS**(11 Hours)**

Function, Structure, biosynthesis and metabolism of Noradrenaline, α and β receptors. Sympathomimetic Agents: Phenylephrine^s, Naphazoline^s, Xylometazoline, Dobutamine, Terbutaline^s, Isoproterenol, Salbutamol^s. Adrenergic Blocking Agents: Tolazoline^s, Phentolamines, Phenoxybenzamine, Prazosine, Propranolol^s, Timolol, Nadolol, Atenolol^s, Metoprolol, Labetalol, Carvedilol. SAR of adrenergic blockers. Skeletal Muscle Relaxant: Chlorphensin^s, Methocarbamol^s, Pancuronium, Dantrolene.

UNIT II - OPIOID ANALGESICS**(11 Hours)**

Mepiridine HCl^s, Alpha Prodine HCl, Loperamide HCl, Fentanyl Citrate^s, Propoxyphene HCl, Levorphanol Tartarate, Methadone Nalorphine HCl, Levallorphan Tartarate, Pentazocine, Naloxone HCl.

Anti Inflammatory: Mefenamic acid^s, Indomethacin^s, Naproxen, Ibuprofen^s, Ketoprofen, Sulindac, Diclofenac sodium^s, Piroxicam, Celecoxib, Valdecoxib, Acetaminophen^s, Meloxicam. SAR of NSAIDs. Uricosuric Agent: Allopurinol, Sulfipyrazone, Probenecid, Colchicine.

Anti-Rheumatic Agents: Auranofin, Gold sodium thiomalate, Aurothioglucose Prostaglandins.

UNIT III - CHOLINERGIC NEUROTRANSMITTERS**(10Hours)**

Biosynthesis and metabolism of Acetylcholine, Cholinergic receptors.

Cholinergic: Methacholine, Carbachol^s, Bethanecol^s, Pilocarpine, Edrophonium Chloride, Pralidoxim, Pyridostigmine, Cholinergic Blocking Agent: Clindinium, Cyclopentolate HCl, Dicyclomine HCl, Bzotropine Mesylate, Orphenadrine, Biperiden^s, Isopropamide iodide, Trihexyl phenidyl. Discuss SAR of Cholinergic agents. Ganglionic Blocking Agent: Mecamylamine HCl, d-Tubocurarine chloride, Gallamine triethiodide^s, Pancuronium bromide. (09Hrs)

UNIT IV - H₁ AND H₂ ANTAGONIST**(11 Hours)**

Diphenhydramine HCl^s, Dimenhydrinate, Doxylamine Succinate, Tripeleminamine HCl^s, Antazoline Phosphate, Cyclizine HCl, Chlorpheniramine Maleate^s, Promethazine^s, Methdilazine, Cyproheptadine HCl^s, Cetrizine, Loratadine, Ketotifen

fumarate^s, Cimetidine, Famotidine, Ranitidine, Omeprazole, Lansoprazole, Rabeprazole Sodium, SAR of Phenothiazine. Local Anaesthetics: Procaine^s, Benzocaine^s, Mepivacaine, Bupivacaine^s, Amethocaine^s, Ropivacaine, Lignocaine^s, Prilocaine, Dibucaine HCl^s, Dimethisoquin.

UNIT V - DRUGS ACTING ON CARDIO VASCULAR SYSTEM (11 Hours)

Antianginal and antiarrhythmic Agent: Erythryltetranitrate, Isosorbide dinitrate, Verampamil^s, Diltiazem, Nifedipine^s, Amlodipine^s, Bepridil, Procainamide^s, Disopyramide Phosphate^s, Mexiletene HCl. SAR of Calcium channel blockers.

Antihypertensive Agents: Captopril^s, Enalapril maleate, Ramipril, Losartan, Hydralazine HCl^s, Minoxidil^s, Guanethidine^s, Methyl dopa^s Clonidine^s. SAR of ACE inhibitors. Anticoagulants, Antithrombolytic and Antihyperlipidemic: Dipyridamole, Ticlopidine, Warfarin^s, Dicoumarol^s, Clofibrate^s, Gemfibrozil, Dextrothyroxine, Colestipol, Nicotinic acid^s, Probucol. Diuretics: Acetazolamide^s, Chlorthiazide^s, Hydrochlorthiazide^s, Chlorthalidone, Furosemide^s, Bumetanide, Trifloxin, Ethacrynic acid^s, Triamhexine^s, Amiloride^s, Spironolactone, Discuss SAR of Thiazide diuretics.

R14PHC75 MEDICINAL CHEMISTRY – II

PRACTICAL

(54 Hours)

1. Assay of Nicotinic acid powder.
2. Assay of Dapsone tablet I.P
3. Assay of Furosemide tablet I.P
4. Assay of Paracetamol powder I.P
5. Assay of Ephedrine powder I.P
6. Assay of Methyl Salicylate Ointments
7. Assay of Ibuprofen Powder I.P
8. Preparation of Benzil from Benzoin
9. Preparation of 7-Hydroxy 4-methyl Couramin from resorcinol
10. Preparation of Phenolphthalein from Phenol
11. Preparation of Methyl orange from sulphanilic acid
12. Preparation of Diphenyl Quinoxaline from o-Phenylene diamine
13. Preparation of β-Dimethyl amino propiophenone by Mannich reaction
14. Preparation of Phenytoin from benzyl

TEXT BOOKS

1. Text Book of Medicinal chemistry, Vol I & II, K. Ilango, P. Valentina, 1st edition, 2007, Keerthi publishers, Chennai.
2. Principles of Medicinal chemistry, Vol I & II, Kadam, Mahadik, Bothara, 5th edition, 1997, Nirali prakashan, Pune.

3. Medicinal chemistry, Ashutoshkar, 3rd edition, 2005, Ashutoshkar, New age International publishers, New Delhi.

REFERENCES

1. Burger's Medicinal chemistry & Drug Discovery. Vol I to IV edited by Donald J. Abraham, 6th edn, 2007 Wiley interscience publication, New Jersey.
2. The Science and Practice of Pharmacy, Vol I, Remington, 20th edn, 2004, Lippincott Williams and Wilkins, Philadelphia.
3. Foye's principle of Medicinal chemistry, David. A. Williams, Thomas. L. Lenke, 5th edition, 2005, Lippincott Williams and Wilkins, Philadelphia.
4. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 11 th ed, 2004, Lippincott Williams & Wilkins, Philadelphia.
5. Text book of Medicinal chemistry, S.N.Pandeya, 3rd edition, 2006, SG publisher, Varanasi.
6. Principles of Organic Medicinal chemistry, Ramarao Nadendla, 2005, New age International publisher, New Delhi.
7. Indian Pharmacopoeia – Vol I & II, 2010, The Indian Pharmacopoeia Commission, Ghaziabad.
8. Comprehensive Medicinal Chemistry, Corwin Hansch, Elsevier Publications, 2005.

R14PHL76**PHARMACOLOGY AND THERAPEUTICS – III****THEORY****(54 Hours)****UNIT – I****(10 Hours)**

Antacids, Anti-secretory and Anti-ulcer drugs, Emetics and anti-emetics, Drugs for Gastro esophageal reflux disease, Carminatives, Digestants, Gall stone dissolving drugs, Laxatives and Anti- diarrhea drugs, Appetite stimulants and suppressants.

UNIT – II**(11 Hours)**

Haematinics and Haemopoietic growth factors, Blood coagulation- Coagulants and Anti-coagulants, Haemostatic agents, Fibrinolytic and anti-platelet drugs, Blood plasma volume expanders.

UNIT – III**(11 Hours)**

Hypothalamic and pituitary hormones, Thyroid hormones and anti-thyroid drugs, Parathormone, Calcitonin and Vitamin D, Insulin, Oral hypo glycaemic agents and glucagon.

UNIT – IV**(11 Hours)**

ACTH and corticosteroids, Androgens, anabolic steroids and drugs for erectile dysfunction, Estrogens, progesterone and oral contraceptives, Drugs acting on the uterus including Tocolytics.

UNIT – V**(11 Hours)**

Neurotransmitters, Receptors and signal transduction, G-protein coupled receptors, Ligand gated ion channels, Enzyme linked receptor, Cytoplasmic receptor and their mechanism of action, Definition of rhythms and cycles, Biological clock and their significance leading to chronotherapy.

R14PHL77**PHARMACOLOGY AND THERAPEUTICS – III****PRACTICAL****(54 Hours)**

1. To record the CRC of specific agonists on rat ileum preparation.
2. To record the CRC of specific agonists on rat fundus preparation.
3. To record the CRC of specific agonists on rat colon preparation
4. To record the CRC of nor-adrenaline on rat anococcygeus muscle preparation.
5. To record the CRC of Oxytocin on rat uterus preparation
6. To study the Anti-ulcer activity using pylorus ligated rats.

7. To determine the effect of anti-coagulants by subaqueous tail bleeding time in rodents.
8. To study the effect of Oral hypoglycemic agents in diabetic rodents.

TEXT BOOKS

1. Pharmacology and Pharmacotherapeutics, R.S. Satoskar, S.D. Bhandarkar, Nirmala.N. Rege, 19th Edition, 2005, Popular Prakashan, Mumbai.
2. Essentials of Medical Pharmacology, K.D. Tripathi, sixth edition, 2008, Jaypee Publishers, New Delhi.
3. Pharmacology, Rang M.P, Dale M.M, Reter J.M., R.J. Flower, sixth edition, 2007, Elsevier, USA.
4. Pharmacology, Lippincott's Illustrated reviews, Fourth edition, 2009, Wolters Kluwer(India) Private Ltd., New Delhi.
5. Chronopharmacology Cellular and Biochemical Interactions by B. Lemmer,2005, Second Edition, Marcel Dekker publishers, New York.

REFERENCES

1. The Pharmacological basis of therapeutics –Goodman and Gilman's, Eleventh Edition, 2010, The McGraw – Hill, USA.
2. Hand book of Experimental Pharmacology, S.K. Kulkarni, Third Edition, 1999, M.K. Jain Vallabh Prakashan, New Delhi.
3. Essentials of Pharmacotherapeutics, F.S.K. Barar, Fourth Edition, 2009, S. Chand & Company, New Delhi.
4. Clinical Pharmacology, Laurence, D.R. and Bennet P.N, Seventh Edition, 1994, Churchill Livingstone, UK.
5. Katzung, B.G., Susan B Masters, Anthony J Trever, Basic and Clinical Pharmacology, Eleventh edition, 2010, The McGraw - Hill Companies Ltd., USA.

THEORY**(54 Hours)****UNIT – I****(10 Hours)**

Studies of Traditional drugs Common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, common uses and marketed formulations of following indigenous drugs: Amla, Ashoka, Satavari, Punarnava, *Phyllanthus niruri*, Gymnema, Gokhru, Shankapushpi, Guggul, Garlic, Brahmi, Vasaka, Methi, Withania.

UNIT – II**(11 Hours)**

Extraction, isolation, separation, purification of plant metabolite
Modern methods of extraction, basic principles of various chromatographic techniques like column, TLC, Paper, HPTLC, GC, electrophoresis and spectroscopic methods and their application to natural products.

UNIT – III**(11 Hours)**

Plant tissue culture. Historical development, types of cultures, nutritional requirements, growth and their maintenance, production of secondary metabolites through tissue culture techniques, applications of plant tissue culture in pharmacognosy. Detailed study of callus culture, cell suspension culture, single cell culture, totipotency and application, clonal propagation, enzyme immobilization technique. Role of plant growth regulators for the production of secondary metabolites.

UNIT – IV**(11 Hours)**

Basic metabolic pathways leading to the formation of plant secondary metabolites. Calvin cycle, Kreb's cycle, Glycolysis, shikimic acid pathway, mevalonic acid pathway. Biogenesis and pharmaceutical application of the following phytoconstituents: Atropine, Morphine, Digoxin, Reserpine, Ergometrine, Quinine.

UNIT – V**(11 Hours)**

A brief account of plant based industries and institutions involved in work of medicinal and aromatic plants in India. Sources, Industrial production and pharmaceutical application of phytoconstituents such as Quinine, Sennosides, Podophyllotoxin, Digitoxin, Solasodin, Tropane alkaloids, Mentha oil, Vinca alkaloids, Taxol, Silymarin.

Herbal formulations: preparation and uses of tinctures, herbal syrups, herbal creams, herbal shampoos. WHO guidelines for the assessment of herbal medicines.

R14PHG79 PHARMACOGNOSY – III

PRACTICAL

(54 Hours)

1. Macroscopy of traditional drugs: amla, ashoka, satavari, punarnava, *Phyllanthus niruri*, gymnema, gokhru, guggul, garlic, brahmi, vasaka, methi, withania
2. Isolation of amino acids using paper chromatography.
3. TLC of caffeine.
4. TLC of cinchona.
5. TLC of sennosides.
6. TLC of menthol.
7. Isolation of starch from potato.
8. Isolation of casein from milk.
9. Isolation of calcium citrate from lemon.
10. Isolation of caffeine from tea dust.
11. Monographs of castor oil.
12. Monographs of turpentine oil.
13. Monographs of honey.
14. Monographs of shark liver oil.
15. Determination of acid value.
16. Determination of iodine value.
17. Determination of saponification value.
18. Determination of peroxide value.
19. Determination of refractive index.
20. Determination of caffeine content in tea dust.
21. Determination of aldehyde content in cinnamon oil/lemon oil.
22. Formulation and standardization of herbal syrups.
23. Formulation and standardization of herbal creams/herbal shampoos.
24. Isolation of phytoconstituents using column chromatography.

TEXT BOOKS

1. Pharmacognosy, GE Trease and WC Evans, 16th edition, 2009, Saunders Elsevier limited, China
2. Text book of pharmacognosy, CK Kokate, AP Purohit and SB Gokhale, 45th edition, 2010, Nirali Prakashan, Pune
3. Text book of pharmacognosy and phytochemistry, Vinod K Rangari, 2nd edition, 2009, Nishad Deshmukh for career publications, Maharashtra

4. Practical pharmacognosy, CK Kokate, AP Purohit and SB Gokhale, 4th edition, 2005, Vallabh Prakashan, New Delhi

REFERENCES

1. Text book of Industrial pharmacognosy, AK Kalia, 2005, CBS publishers, New Delhi
2. Text book of pharmacognosy, TE Wallis, 5th edition, 2005, CBS publishers & Distributors, New Delhi
3. Text book of pharmacognosy, CS Shah and JS Quardy, 13th edition, 2007-08, BS Shan Prakashan, Ahmedabad
4. Pharmacognosy, VE Tyler. LR Brady and JE Robbers, 1996, Lea and Febiger
5. Indian Herbal Pharmacopoeia, Volume I and II, 2002, A Joint publication of Regional Research Laboratory, Jammu Tawi and Indian Drug Manufacturer's Association, Mumbai
6. Phytochemical methods, JB Harborne, 3rd edition, 1998, Chapman & Hall, United Kingdom
7. Quality control of herbal drugs, Pulok K Mukherjee, 1st edition, 2005, Business Horizons, India
8. Standardisation of Botanicals, V Rajpal, 2006, Eastern publication, New Delhi
9. Evaluation of crude drugs, a laboratory guide, Madhu C Divakas, 2nd edition, 2002, M/S CD remedies, Kerala

EIGHTH SEMESTER

R14PHP82 INDUSTRIAL PHARMACY-II

THEORY (54 Hours)

UNIT I - OPHTHALMIC AND LIQUID ORAL PRODUCTS (10 Hours)

Eye drops, eye lotions, eye ointments, Ophthalmic inserts, - Formulation, Evaluation and production of syrups, suspensions and emulsions.

UNIT II - PARENTERAL PRODUCTS (11 Hours)

Water for injection, pyrogenicity, non-aqueous vehicles, isotonicity adjustment methods formulation: preparation of unit dose and multiple dose parenterals, infusion fluids and sterile powders, Quality control, Aseptic techniques- source of contamination and method of prevention, design of aseptic area, laminar flow bench service and maintenance, Concept of Total parenteral nutrition (TPN)

UNIT III - SUSTAINED RELEASE DRUG DELIVERY SYSTEMS (11 Hours)

Rationale for sustained release drug delivery systems, advantages and disadvantages- physic-chemical properties influencing design and performance. Controlled drug delivery modules osmotic pump system- density altered system- floating devices.

UNIT IV - TRANSDERMAL DRUG DELIVERY SYSTEM (11 Hours)

Targeted drug delivery Liposome, Resealed erythrocytes- Magnetic micro spheres- Pharmaceutical aerosols.

UNIT - V (11 Hours)

Good manufacturing practice of quality assurance, quality audit, personal requirements in manufacturing practice, master formula card- manufacturing records. Pilot scale up Techniques-concepts of pilot plant, scale up techniques in pharmaceutical industries. Design, development and process validation method for pharmaceutical operation involved in the production of pharmaceutical products with special reference to tablets, suspensions.

R14PHP83 INDUSTRIAL PHARMACY-II

PRACTICAL

(54 Hours)

1. Formulation of sustained release oral dosage forms
2. Evaluation of sustained release dosage forms
3. Formulation of Parenterals
4. Formulation of Isotonic solutions
5. Quality control tests for Parenteral Leaker's test, Clarity test, etc
6. Formulation of eye drops
7. Formulation of eye ointments
8. Formulation of eye lotions
9. Formulation of microspheres
10. Filling of capsules
11. Evaluation of Ophthalmic preparations
12. Evaluation of microspheres
13. Evaluation of capsules.

TEXT BOOKS

1. The Theory and Practice of Industrial Pharmacy – Lachman L, Lieberman H.A & Kanjig J.L, Special Indian edition, 2009, CBS publishers Pvt Ltd. New Delhi.
2. Pharmaceutics The Science of dosage form, Collett, Aulton, 2nd edition, 2001, ELBS Publishers, London.
3. How to practice GMP's, P.P.Sharma, 5th edition, 2006, Vandhana Publications, New Delhi.
4. Cosmetics-Formulation,Manufacturing&Quality control, P.P.Sharma, 4th edition, 2010, Vandana publications Pvt Ltd, New Delhi.

REFERENCES

1. The Science and Practice of Pharmacy by Remington 21st edition,2005,Vol.I&II Lippincott Williams& Willkins,Philadelphia
2. Novel Drug Delivery System, Chien Y.W, 2nd edition, 2009 Marcel Dekker, Inc, New York
3. Controlled drug delivery system- Fundamentals and applications, Robinson J.R. and Lee V.H. 2nd edition, 2009, Marcel Dekker Inc, New York.
4. Modern Pharmaceutics, Banker G.S and Rhodes C.T, 4th edition, 2009, Informa Health Care,New York
5. Ansel's Pharmaceutical dosage forms and drug delivery systems, 8th edition, 2005, Lippincott Williams& Willkins, Philadelphia
6. Pharmaceutical dosage forms, Parenteral medications, Vol 1-3, 2nd edition,2008, Informa Health Care.New York

7. Pharmaceutical dosage forms, Tablets, Vol 1-3, 2nd edition, 2005, Marcel Dekker, Inc, New York

THEORY**(54 Hours)**

Classification, Mode of action, Structure, chemical name, Synthesis (only those compounds that are superscribed by s) and uses of the following category of the drugs.

UNIT I - STEROIDS AND RELATED DRUGS**(11 Hours)**

Structure and stereochemistry of steroids Androgens: Testosterone, Dihydrotestosterone, Methyltestosterone^s, SAR of Androgens Oestrogens: Oestradiol, Mestranol^s. Chemical relationship between Oestrone, Oestriol and Oestradiol, SAR of Oestrogenic derivatives, Diethyl Stilbesterol^s and Dienosterol. Gestagens: Progesterone, Norethindrone. Corticosteroids: Cortisone, Hydrocortisone, Prednisone, Dexamethasone, Betamethasone^s and Beclomethasone^s and Oral Contraceptives.

UNIT II - ANTIBACTERIAL AGENTS**(11 Hours)**

Sulphonamides and Sulphones: Sulfamethiazole^s Sulfacetamide^s Sulfapyridine, sulfamethoxazole, Sulfadiazine, Mafenide acetate, Sulfasalazine, Trimethoprim, Dapsone^s, Solapone. SAR of Sulphonamides. Synthetic Anti-Bacterial agents: Nalidixic acid, Norfloxacin, Ciprofloxacin, Gatifloxacin, Sparfloxacin, Moxifloxacin, Nitrofurazone^s and Furozolidone. Anti-Fungal Agents: Clotrimazole, Econazole nitrate, Sulconazolenitrate, Tioconazole, Ketoconazole^s, Miconazole, Fluconazole, Flucytosin. Local Anti-infective Agents: Hexachlorophen^s, Halazone^s, Benzalkonium chloride, Cetylpyridinium chloride, Chlorhexidinegluconate^s, Gentian violet, Methylene blue, Nitromersal, Thiomersal, Methyl paraben, Propyl paraben and Sodium benzoate^s.

UNIT III - ANTI PARASITIC AGENTS**(11 Hours)**

Anti-Protozoal Agent: Metronidazole^s, Diloxanide^s, Iodoquinol^s, Melarsoprol, Dimercaprol^s and Nifurtimox. Anthelmintics: Piperazine^s, Diethylcarbamazine citrate^s, Thiobendazole^s, Pyrantelpamoate, Mebendazole^s, Albendazole, Niclosamide and Praziquantel. Antimalarials: Chloroquine phosphate^s, AmodiaquineHCl, MefloquineHCl, Primaquine Phosphate^s, _____Pyrimethamine^s, Proguanil^s and Atovaquone.

UNIT IV - DRUGS AFFECTING HORMONAL SYSTEMS (11 Hours)

Oral Hypoglycemic Agents: Chlorpropamide^s, Glipizide^s, Glibenclamide, Metformin^s, Phenformin^s, Pioglitazone^s, Rosiglitazone, Repaglinide, Nateglinide, Tolrestat, Sorbil and Acarbose.

Anti-thyroid Drugs: Propyl thiouracil, Methimazole^s, Carbimazole, Goitrin and Phloretin.

Anti-Resorptive Agents: Tamoxifen, Raloxifene, Lasofoxifene, Ospemifene, Bazedoxifene, Clodronate and Zoledronic acid.

UNIT V - ANTIVIRAL AGENTS (10 Hours)

: Amantidine^s, Rimatidine, Idoxuridine^s, Acyclovir, Trifluridine, Ganciclovir, Zidovudine, Didanosine, Lamivudine, Zalcitabine, Ribavirin, Nevirapine and Amprenavir. Anti-Neoplastic Agents: Mechlorethamine HCl^s, Cyclophosphamide^s, Chlorambucil^s, Busulfan, Lomustine, Thiotepa^s, Dacarbazine^s, Mercaptopurine, Thiotepa, Thioguanine, Flurouracil, Floxuridine, Capecitabine, Azathioprine, Cisplatin, Carboplatin.

Anti-Mycobacterial Agents: Isoniazid^s, Pyrazinamide^s, Ethambutol^s, Aminosalicilic acid and Ethionamide.

R14PHC85 MEDICINAL CHEMISTRY – III

PRACTICAL (54 Hours)

1. Synthesis of medicinally useful compound. Monitoring progress of reaction by TLC and study spectral analysis of drug synthesized.
 1. Sulphanilic acid from Aniline
 2. Paracetamol from P-amino Phenol.
 3. Sulphacetamide from Sulphanilamide.
 4. Chlorbutanol from Acetone.
 5. Para amino Salicylic acid from sulphonyl chloride.
 6. Methylene blue from Dimethyl Aniline.
 7. Acridone from o-Chloro benzoic acid
 8. Cyclization of Schiff's base to form Heterocyclic rings.
2. Assay of medicinally useful compounds
 1. Sodium benzoate I.P.
 2. Isoniazid tablet I.P.
 3. Metronidazole tablet I.P.
 4. Methyl paraben I.P.
 5. Diethylcarbazine citrate tablet I.P.
 6. Metformin HCl tablet I.P.
 7. Nalidixic acid

TEXT BOOKS

1. Text book of Medicinal Chemistry, Vol I & II, K. Ilango, P. Valentina, 1st edition, 2007, Keerthi publishers, Chennai.
2. Principles of Medicinal Chemistry , Vol I&II, Kadam, Mahadik, Bothara, 5th edition, 1997,Niraliprakashan, Pune.
3. Medicinal Chemistry, Ashutoshkar, 3rd edition, 2005, Ashutoshkar, New age International publishers, New Delhi.

REFERENCES

1. Burger's Medicinal chemistry & Drug Discovery. Vol I to IV edited by Donald J. Abraham, 6th edn, 2007 Wiley interscience publication, New Jersey.
2. The Science and Practice of Pharmacy, Vol I, Remington, 20th edition, 2004, Lippincott Williams and Wilkins, Philadelphia
3. Foye's principle of Medicinal chemistry, David. A. Williams, Thomas. L. Lenke, 5th edition, 2005, Lippincott Williams and Wilkins, Philadelphia.
4. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 11 th edition, 2004, Lippincott Williams & Wilkins, Philadelphia.
5. Text book of Medicinal Chemistry, S.N.Pandeya, 3rd edition, 2006, SG publisher, Varanasi.
6. Principles of Organic Medicinal Chemistry, Ramarao Nadendla, 2005, New age International publisher, New Delhi.
7. Indian Pharmacopoeia – Vol I & II, 2010, The Indian Pharmacopoeia Commission, Ghaziabad.

UNIT I - ABSORPTION SPECTROSCOPY

(10 Hours)

Theory of electronic, atomic and molecular spectra. Fundamental laws of photometry, Beer – Lambert's law, application and its deviation. Spectra of isolated chromophores, auxochromes, batho chromic shift, hypsochromic, hyper and hypochromic shift. Instrumentation- Source, Monochromator, Sample cell, Detectors such as Photovoltaic cell, Photomultiplier tube, Photoemissive cell, Applications in Pharmacy

UNIT II - EMISSION SPECTROSCOPY

(11 Hours)

Fluorimetry: Theory, luminescence, factors affecting fluorescence, quenching, instrumentation, applications, fluorescent indicators, study of pharmaceutically important compounds such as Thiamine, Quinine sulphate, Riboflavine estimated by fluorimetry.

Flame photometry: Theory, nebulization, flame and flame temperature, interference, flame spectrometric techniques – internal standard, external standard and standard addition methods, instrumentation and pharmaceutical applications.

Nepheloturbidimetry: Theory, Instrumentation of Nephelometry and Turbidimetry. Pharmaceutical Applications.

UNIT III - INFRARED SPECTROSCOPY

(11 Hours)

Vibrational transitions, Theory, Types, Hook's law. Dispersive and Fourier Transform Instrumentation – source and detectors used, sample handling in IR spectroscopy. Applications of FT - IR in Pharmacy. Preliminary Study of IR frequencies for functional groups.

UNIT IV - ADVANCED SPECTROSCOPIC TECHNIQUES

(11 Hours)

Nuclear Magnetic Resonance – Introduction, Principle involved, Reference standard, chemical shift, factors affecting chemical shift, shielding, deshielding, Spin – spin interaction, Coupling constant, Instrumentation and its applications

Mass Spectroscopy – Introduction, Type of Ionization Techniques such as Electron impact, Chemical ionization, Fast atom bombardment, MALDI, ESI, Mass analyzers- Quadrapole, Time of Flight and Magnetic sector. Detectors – Photomultiplier tube and Faraday cup, fragmentation rules such as ring rule, nitrogen rule and McLafferty rearrangement. Instrumentation and applications.

UNIT V - ADVANCED CHROMATOGRAPHIC TECHNIQUES (11 Hours)

Introduction, Classification, Principle involved in separation, Components used such as Columns, Sample application, detectors, Sample preparation including Liquid - Liquid Extraction, Solid Phase Extraction and protein precipitation, theoretical aspects and applications of following chromatographic techniques High Performance Liquid Chromatography, High Performance Thin Layer Chromatography and Gas Chromatography.

R14PHA87 INSTRUMENTAL METHODS OF ANALYSIS

PRACTICAL

(54 Hours)

1. Determination of λ_{max} , Isobestic point, Effect of concentration on λ_{max}
2. Effect of Auxochromes on λ_{max}
3. Effect of pH on λ_{max}
4. Determination of Paracetamol tablet using UV spectrophotometer.
5. Assay of Metformin tablets using UV spectrophotometer
6. Assay of Frusemide tablets using UV spectrophotometer
7. Assay of Sulphanilamide powder using Bratton marshall reagent
8. Assay of Ciprofloxacin Hydrochloride using UV spectrophotometer.
9. Determination of Pyridoxine using Visible spectrophotometer.
10. Assay of Paracetamol injection using UV spectrophotometer.
11. Determination of Quinine sulphate by Fluorimetry
12. Quenching of Quinine fluorescence by iodide ions
13. Identification of Amino acid using Radial chromatography.
14. Identification of Drugs using Thin Layer chromatography
15. Demo on IR pellet preparation and interpretation of chemical compounds.
16. Demo on HPLC and HPTLC separation of Pharmaceutical formulation.

TEXT BOOK

1. Practical Pharmaceutical Chemistry, A.M.Beckett and J.B.Stenlake, Vol. I & II, 4th Edition, 2005, CBS Publishers and Distributors, New Delhi
2. Instrumental methods of Chemical Analysis, Chatwal & Anand, 13th Edition, 1997, Himalaya Publishing house, Bombay.
3. Instrumental Method Analysis, Hobard.L.Willard, Lynne.L.Merritt Jr, John.A.Dean & Frank.A.Settle, Jr, 7th Edition, 1986, CBS Publishers and Distributors, New Delhi
4. Elementary Organic Spectroscopy, Y.R.Sharma, 1st Edition, 1980, Rajendra Ravindra Printers, New Delhi
5. Pharmaceutical Analysis, Ashutosh kar, 2007, CBS Publishers and Disributors Pvt.Ltd, New delhi.

REFERENCES

1. Indian Pharmacopoeia, Government of India, Ministry of Health and Family welfare, 2010, The controller of Publication, New Delhi.
2. A text book of Pharmaceutical Analysis, K.A.Connors, 3rd Edition, 1999, A Wiley interscience, Singapore.
3. Pharmaceutical Analysis, David G Watson, 2nd Edition, 2005, Elsevier Limited, London.
4. Analytical Chemistry by Open Learning, Wiley India editions, John wiley & sons, Thames polytechnic, London

R14PHL88**PHARMACOLOGY AND THERAPEUTICS– IV****THEORY****(54 Hours)****UNIT – I****(11 Hours)**

General principles of chemotherapy, Sulfonamides and Co-trimoxazole, Penicillins, Cephalosporins, Quinolones and Fluoroquinolones, Chloramphenicol, Tetracyclines, Macrolides, Aminoglycosides, Miscellaneous antibiotics, Chemotherapy of tuberculosis and leprosy.

UNIT – II**(11 Hours)**

Anti malarial drugs, Anti fungal drugs, Anti - viral drugs, Anthelmintics, Anti protozoals, Anti - amoebic drugs, Drugs for urinary tract infections and sexually transmitted diseases, Chemotherapy of malignancy, Immunosuppressive agents.

UNIT – III**(11 Hours)**

Definition of poison, general principles of treatment of poisoning, Treatment of Barbiturate, organophosphorus, opioid and atropine poisoning, Heavy metals and heavy metal antagonists, Definition for acute, sub acute and chronic toxicity, genotoxicity, carcinogenicity, teratogenicity and mutagenicity.

UNIT – IV**(10 Hours)**

Discovery and development of new chemical entities, Clinical trials, design of clinical trials and testing of drugs in human, Gene Therapy – An introduction and its role in cancer treatment, High throughput screening techniques.

UNIT – V**(11 Hours)**

Individualization of Drug therapy, Adverse drug reactions, Drugs used during pregnancy, lactation, pediatrics and geriatrics, Drug interactions, Drug induced disease, Therapeutic Drug monitoring.

R14PHL89**PHARMACOLOGY AND THERAPEUTICS - IV****PRACTICAL****(54 Hours)**

1. To estimate the strength of the test sample of agonist / drug (e.g. Acetylcholine, Histamine, 5-HT, Oxytocin, etc) using a suitable isolated muscle preparation employing matching bioassay.
2. To estimate the strength of the test sample of agonist / drug (e.g. Acetylcholine, Histamine, 5-HT, Oxytocin, etc) using a suitable isolated muscle preparation employing interpolation bioassay.

3. To calculate the pA₂ value of Atropine using Acetylcholine as an agonist on rat ileum preparation.
4. To calculate the pA₂ value of Mepyramine or Chlorpheniramine using Histamine as agonist on guinea pig ileum.
5. To identify the given unknown poisons by performing chemical test and *invivo* methods.
6. To study the *invitro* pharmacokinetic drug interactions applied in clinical practice.
7. To explain the principle involved in the given charts of dose calculations, agonism, antagonism and drug interactions.
8. To perform the microbiological assay of antibiotics by cup plate method.

TEXT BOOKS

1. Pharmacology and Pharmacotherapeutics, R.S. Satoskar, S.D. Bhandarkar, Nirmala.N. Rege, 19th Edition, 2005, Popular Prakashan, Mumbai.
2. Essentials of Medical Pharmacology, K.D. Tripathi, sixth edition, 2008, Jaypee Publishers, NewDelhi.
3. Pharmacology, Rang M.P, Dale M.M, Reter J.M., R.J. Flower, sixth edition, 2007, Elsevier, USA.
4. Pharmacology, Lippincott's Illustrated reviews, Fourth edition, 2009, Wolters Kluwer(India) Private Ltd., New Delhi.
5. Clinical Pharmacy, Tipnis bajaj, First Edition, 2003 Career Publications, Nashik.
6. Frank Lu's Basic Toxicology; Second edition; Hemisphere Publishing Corporation, USA.

REFERENCES

1. The Pharmacological basis of Therapeutics – Goodman and Gilman's, Eleventh Edition, 2010, The McGraw – Hill, USA.
2. Hand book of Experimental Pharmacology, S.K. Kulkarni, Third Edition, 1999, M.K. Jain Vallabh Prakashan, New Delhi.
3. Essentials of Pharmacotherapeutics, F.S.K. Barar, Fourth Edition, 2009, S. Chand & Company, New Delhi.
4. Clinical Pharmacology, Laurence, D.R. and Bennet P.N, Seventh Edition, 1994, Churchill Livingstone, UK.
5. Katzung, B.G., Susan B Masters, Anthony J Trever, Basic and Clinical Pharmacology, Eleventh edition, 2010, The McGraw - Hill Companies Ltd., USA.
6. A Textbook of Clinical Pharmacy Practice; G Parthasarathi, Karin Nyfort Hansen, Milap C Nahata, 2007, University press, India.

APPENDIX – A

PUBLIC NOTICE

NO.14-2/2015-PCI (A)

Date: 30.7.2015

Sub: Eligibility of Open School education system of the Central Govt. / State Govts. institutions for admission in Pharmacy courses for the purpose of registration as a Pharmacist under the Pharmacy Act, 1948.

Ref.: Decision of 97th Central Council of the Pharmacy Council of India (June, 2015)

The Pharmacy Council of India in its 97th Central Council meeting held in June, 2015 has decided to approve a pass from Open School education system of the Central Govt. / State Govts. institutions for admission to various Pharmacy courses for the purpose of registration as a pharmacist.

(Registrar-cum-Secretary)