

Pharm-D Courses

(Through Department of Pharmaceutical Chemistry)

First Year					
1st Semester			2nd Semester		
Course No.	Title of Course	Cr. Hr.	Course No.	Title of Course	Cr. Hr.
PHC-303	Organic Chemistry	3	PHC-304	Organic Chemistry (practical)	3
PHC-313	Pharmaceutical Mathematics	3	PHC-306	Pharmaceutical Statistics	3
			-	-	-
Second Year					
PHC-405	Physical Chemistry I	3	PHC-406	Physical Chemistry I (Practical)	2
-	-	-	PHC-408	Physical Chemistry II	3
Third Year					
PHC-503	Physical Chemistry II (Practical)	3	PHC-506	Preparation And Quality Control (Practical)	3
PHC-505	Theoretical Basis of Quality Control	3	PHC-508	Pharmaceutical Analysis-1	3
Fourth Year					
PHC-607	Pharmaceutical Analysis-1 (Practical)	3	PHC-608	Pharmaceutical Analysis-II	3
-	-	-	PHC-610	Medicinal Chemistry-I	3
Fifth Year					
PHC-707	Pharmaceutical Analysis-II (Practical)	3	PHC-710	Medicinal Chemistry-III	3
PHC-709	Medicinal Chemistry-II	3	-	-	-
Total 17 Courses making 50 Credit Hours in five years.					

FIRST SEMESTER

First Professional

PHC-303

Organic Chemistry

Cr. Hrs. 3

1. Introduction to pharmaceutical chemistry, classification and nomenclature of organic pharmaceutical compounds. hyperconjugation, steric effects inductive effect and mesomeric effect,.
2. Nucleophilic and electrophilic substitution reaction in aromatic system. Theory of resonance.
3. Orientation in electrophilic substitution reactions on benzene ring.
4. Organic reactions: Baeyer-Villiger oxidation; Diels Alder reaction; Grignard's reaction, metal hydride reduction and Wolf Krishner reduction, Friedel Craft's reaction, Perkin reaction, Cannizzaro reaction.
5. Carbonium ion rearrangements; Pinacol-pinacolone, Wagner-Merrwein, Wolf, Hofmann and Beckmann rearrangements.
6. Carbanions; condensation reaction (Aldol condensation; Favorskiirearrangement; Wittig reaction).
7. Stereoisomerism, optical isomerism, geometrical isomerism, tautomerism of carbonyl compounds, resolution of racemic mixture and conformational analysis.
8. Free radicals: Introduction, structure and stability.
9. General methods of preparations, properties, identification test and pharmaceutical applications of the following classes and their analogs:
alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids, esters, amines and aniline.

Books Recommended

1. A Guide Book to Mechanisms in Organic Chemistry Peter Sykes. Fourth edition, Longman Group Ltd. (1978).
2. Introduction to Organic Chemistry By William H. Brown Saunders College Publishing 3rd edition (2002).
3. Organic Chemistry Graham Solomons T.W. Fifth edition, John Wiley & Sons, Inc. (1992).
4. Textbook of Organic Medicinal and Pharmaceutical Chemistry Wilson and Gisvold's. 10th edition, Lippincott-Raven Publisher (1998).
5. The Organic Chemistry of Drug Design and Drug Action, Richard B. Silver. Academic Press, Phn, Inc., USA (1992).

PHC-313

Pharmaceutical Mathematics

Cr. Hrs. 3

1. Algebra
Common and natural logarithm, solution of linear and quadratic equations. Equations reducible to Quadratic form, solution of simultaneous equations. Arithmetic. Geometric and harmonic progressions. Arithmetic, geometric and harmonic means, permutations and combinations. Binomial Theorem: Simple application.
2. **Trigonometry**
Measurement of angles in radian and degrees. Definitions of circular functions. Derivation of circular function for simple cases and trigonometry identities.
3. **Analytical Geometry**
Coordinates of point in a plane. Distance between two points in a plane. Locus. Equations of straight parallel and perpendicular lines. Equation of parabola, circle and ellipse.
4. Differential Calculus
Limit, concept of derivative. Rules of differentiation, examples on the evaluation of derivatives. Derivatives of algebraic, trigonometric, exponential and logarithmic functions, partial differentiation, higher order derivatives. Maxima and minima points of inflections.

5. Integral Calculus

Concept of integration. Rules of integration's. Integration's of algebraic, exponential, logarithmic and trigonometric functions by using different techniques and numerical integration.

Books Recommended

1. Edwards, C.H. Jr. and David E. Penney. Calculus and Analytical Geometry (1995).
2. Text Book of Algebra and Trigonometry for Class XI and XII (New edition).

Second Professional

PHC-405

Physical Chemistry I

Cr. Hrs. 3

1. Physical Properties and Molecular Constitution

Surface and interfacial tension, dielectric constant, dipole moment, refractive index, optical rotation, density, specific gravity, viscosity, molar refraction, parachor.

2. Colloids and Colloidal System

Characteristics features of colloids, type of colloidal system, properties of colloids and colloidal systems. Preparation and purification of colloidal solutions, stability of colloids, pharmaceutical applications.

3. Solutions

Definition types and properties, concentration, solubility and solubilization, factors affecting solubility, solvents used in pharmacy, solutions of electrolytes and non-electrolytes, isotonic solutions, dissolution and dissolution rates, distribution phenomena, theory of distillation, molecular weight determination.

4. Ionic Equilibria

Modern theory of acids, bases and salts, acid-base equilibria, pH and acidity constants, theory of indicators, buffers and buffered system.

5. Phase Equilibria

Phase rule and its applications to one and two component system.

Books Recommended

1. British Pharmacopoeia, Stationary Press, Royal Society of Pharmaceutical Press, London (2005).
2. Physical Pharmacy Martir A.N., 4th Edition, Lea and Febiger, Philadelphia (1993).
3. Practical Pharmaceutical Chemistry Backet and Stenlake., Royal Press, London (1998).
4. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Eston, Pennsylvania, USA.
5. United State Pharmacopoeia, United State Pharmacopoeial Convention, Inc., 12601. Twinbrook Parkway, Rockyville M.D. 20852 USA. 2008

Third Professional

PHC-503

Physical Chemistry II (Practical)

Cr. Hrs. 3

1. Conductometric determination of the ionization constant of a weak acid.

2. Conductometric determination of the solubility of sparingly soluble salt.
3. U. V. absorption spectra of aromatic compounds and geometric isomers.
4. Determination of the wavelength of maximum absorbance and molar extinction coefficient of a given sample.
5. Determination of the first-order rate constant for acid catalysed hydrolysis of a given sample.
6. Determination of the first-order rate constant for the decomposition of a given sample.
7. Determination of effect of change of temperature in the rate of reaction.
8. To study the stability of a drug subjected to various stress conditions
9. Determination of heat of neutralization of HCl and NaOH.
10. Determination of heat of vapourization / transition of a given sample.
11. Determination of heat of solution from solubility.
12. Determination of an equilibrium constant by distribution method.

Books Recommended

1. Pharmaceutical Analysis, Higuchi T. and BrochmannHanssen E., Interscience, New York.
2. Physical Chemistry Barrow G.M... McGraw-Hill, London (1973).
3. Physical chemistry by Fazal I Hussain, 3rd Edition (1991).
4. Physical Chemistry, Barrow G.M... McGraw-Hill, London (1973).
5. Text Book of Physical Chemistry by SameulGlasstone 2nd Edition MC Millan& Company Ltd. (1946).

PHC-505

Theoretical Basis of Quality Control

Cr. Hrs. 3

1. Pharmaceutical chemistry and its relation to other sciences.
2. Brief historical outline.
3. Raw material for drugs
4. Sources of impurities in pharmaceuticals.
5. Purity and its control.
6. Testing and determination of water.
7. Survey of analytical methods
8. Quantitative and qualitative analysis (general information)
9. Pharmacopoeial tests and specifications.
10. Standardization of pharmaceuticals and formulated products.
11. Quality control system for drugs and pharmaceuticals
12. Causes of poor quality and general requirements.
13. Total quality management, a new approach.
14. Sampling techniques, validation and statistical treatment of analytical data.

Books Recommended

1. Pharmaceutical Analysis – A Textbook of Pharmacy, Student and Pharmaceutical Chemistry Watson D.G. Churchill Livingston (1999).
2. Quantitative Analysis, Theory and Practice by Lawrence W. Pott Harper and raw Publisher New York (1987).
3. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Eston, Pennsylvania, USA.
4. United State Pharmacopoeia, United State Pharmacopoeial Convention, Inc., 12601. Twinbrook Parkway, Rockyville M.D. 20852 USA. 2008
5. Vogel's Text Book of Quantitative Organic Chemistry, Longman, London.6th Edition (2006).

Fourth Professional

PHC-607**Pharmaceutical Analysis – I (Practical)****Cr. Hrs. 3**

- 1. Assay of pharmaceutical compounds based on chemical methods**
Acid base titration, oxidation-reduction titration, complexometric titration, gravimetric, solvent extraction, and gasometric methods.
Potentiometric determination
pH of a solution and titration of an acid
Strength of unknown solution of HCl with NaOH.
Strength of each acid in a mixture of HCl and CH₃COOH using standard alkali.
Conductometric determination
Equivalent point of titration of HCl with NaOH
- 2. Polarographic determination**
Amount of nitrobenzene in solutions.
Quinhydrone.
- 3. Determination of refractive index of liquids by Abbe-refractometer.**
Determination of the composition of unknown mixture of two liquids
Determination of the concentration of alcohol in solutions.
Determination of a 10% solution of calcium chloride.
- 4. Polarometric determination of:**
Concentration of sugar in a given solution.
Percentage of two optically active substances in a given solution.
- 5. Fluorimetric determination of a standard drug in a given sample.**

Books Recommended

1. British Pharmacopoeia, Stationary Press, Royal Society of Pharmaceutical Press, London
2. United State Pharmacopoeia, United State Pharmacopoeial Convention, Inc., 12601. Twinbrook Parkway, Rockyville M.D. 20852 USA. 2008
3. Practical Pharmaceutical Chemistry Backet and Stenlake., Royal Press, London (1998).
4. Quantitative Analysis, Theory and Practice by Lawrence W. Pott Harper and raw Publisher New York (1987).
5. Vogel's Textbook of Quantitative Inorganic Analysis including Elementary Instrumental Analysis, Longman, 6th Edition, London (2006).

*Fifth Professional***PHC-707****Pharmaceutical Analysis – II (Practical)****Cr. Hrs. 3**

1. Assay of pharmaceutical compounds based on spectrophotometric methods.
2. Separation, identification and quantitation of a drug substance by chromatographic methods such as TLC, GLC, HPLC.
3. To study the methods development procedure of a drug substance by UV-Visible spectroscopy/TLC/GLC/HPLC.
4. To study the experimental methodology of validation of a drug substance by UV-Visible spectroscopy/TLC/GLC/HPLC.

Books Recommended

1. British Pharmacopoeia, Stationary Press, Royal Society of Pharmaceutical Press, London (2005).
2. Instrumental Methods of Chemical Analysis by Golden W. Evings, McGraw Hill London 5th Edition (1985).
3. Principle of Instrumental Analysis, Skoog Holter and Nieman 5th Edition (2000).

4. United State Pharmacopoeia, United State Pharmacopoeial Convention, Inc., 12601. Twinbrook Parkway, Rockyville M.D. 20852 USA. 2008
5. Vogel's Text Book of Quantitative Organic Chemistry, Longman, London.6th Edition (2006).

PHC-709

Medicinal Chemistry-II

Cr. Hrs. 3

To study the chemistry, structure, mechanism of action, structure activity relationship and therapeutic applications of the following:

1. Analgesic and Antipyretics

Paracetamol, salicylic acid analogues, quinolines derivatives pyrazolone and pyrazolodines, N-arylanthranilic acids, aryl and heteroaryl acetic acid derivatives.

2. Local Anaesthetics

Benzoic acid derivatives, lidocaine derivatives (anilides), amino benzoic acid, miscellaneous compounds such as: Procaine, lignocaine, eucaine, cocaine and benzocaine.

3. Central Nervous System Depressants

General anesthetics, inhalation anesthetics, ultrashort acting barbiturates, dissociative anesthetics such as cyclopropane, halothane, nitrous oxide, chloroform, thiopental sodium, ketamine, methohexital, thioamylal sodium, fentanyl citrate, tribromo ethanol.

Anxiolytics, sedative, hypnotics, such as benzodiazepines, barbiturates, paraldehyde, glutethimide, chloral hydrate and alcohols.

Anti-convulsants such as barbiturates, hydantoins, oxazolinediones, succinimides, benzodiazepines.

Antipsychotics, such as phenothiazines, fluorobutyrophenones, β -aminoketones, CNS depressants with skeletal muscle relaxant properties.

4. Central Nervous System Stimulants

Analeptics, picrotoxin, methylxanthines, monoamine oxidase inhibitors, tricyclic compounds. Indolethylamines, 2-phenylethylamines.

5. Diuretics

Carbonic anhydrase inhibitors, thiazide and thiazide like diuretics, high ceiling or loop diuretics, potassium sparing diuretics and miscellaneous compounds such as mercaptomerin, meralluride, Thiazides, spironolactone, theophylline, furosemide, acetazolamide, ethacrynic acid, triamterene.

6. Antiviral agents such as acyclovir, tromantadine hydrochloride, ribavirin

7. Immunosuppressive agents such as azathioprine, cyclosporine

8. Anti-Neoplastic Agents

Alkylating agents, antimetabolites, antibiotics, plant products, miscellaneous compounds, hormones, immunotherapy, such as methotrexate, 5-fluorouracil, actinomycines, anthracyclines, vincristine, tamoxifen.

9. Anti-Histamines

H₁-antagonists, H₂-antagonists, aminoalkyl ethers, ethylenediamines, propylamine derivatives, phenothiazine derivatives, piperazine derivatives, such as diphenhydramine, pyrilamine, promethazine, cyclizine, terfenadine, sucralfate, cimetidine, ranitidine, omeprazole.

Books Recommended

1. Principles of Medicinal Chemistry, William O. Foye, Thomas L. Lemke and David A. Williams, Wolters Kluwer, Lippincott Williams & Wilkins 7th edition, (2013).
2. Textbook of Organic Medicinal and Pharmaceutical Chemistry, Wilson and Gisvold's.. 12th edition, Wolters Kluwer, Lippincott Williams & Wilkins (2011).
3. Introduction to Medicinal Chemistry: How Drugs Act and Why, Alex. Gringuaz, John Wiley & Sons Inc. (1997).
4. Burger's Medicinal Chemistry and Drug Discovery edited by E. Wolf, 6th edition, Wiley-Inter Science, New York (2003).
5. The Organic Chemistry of Drug Design and Drug Action, Richard B. Silver. Academic Press, Plenum, Inc., USA (1992).

SECOND SEMESTER

First Professional

PHC-304 Organic and Inorganic Chemistry (Practical) Cr. Hrs. 3

1. Identification of unknown simple organic compounds containing acidic, basic and neutral functional groups.
2. Estimation of functional groups in the following drugs.
Sulpha drugs, aspirin, paracetamol, benzyl penicillin, bromisoval, methenamine.
3. Determination of iodine and saponification value, and ash content.
4. Preparation of some organic and inorganic compounds
Acetanilide, iodoform, nitrophenol, 3-nitrophthalic acid, benhydrol, 2, 4-dinitro-chlorbenzene, ferrous sulfate, aluminum hydroxide, magnesium carbonate, sodium carbonate.

Books Recommended

1. A Guide Book to Mechanisms in Organic Chemistry Peter Sykes.. Fourth edition, Longman Group Ltd. (1978).
2. Pharmaceutical Analysis – A Textbook of Pharmacy, Student and Pharmaceutical Chemistry Watson D.G., Churchill Livingstone (1999).
3. Introduction to Organic Chemistry By William H. Brown Saunders College Publishing 3rd edition (2002).
4. Organic Chemistry Graham Solomons T.W. Fifth edition, John Wiley & Sons, Inc. (1992).
5. Practical Pharmaceutical Chemistry Backet and Stenlake, Royal Press, London (1998).

PHC-306 Pharmaceutical Statistics Cr. Hrs. 3

1. What is statistics? Importance's of statistics. What is biostatistics? Application of statistics in biological and pharmaceutical sciences. How samples are selected.
2. Organizing and displaying data: Variables, quantitative and qualitative variables, univariate data, bivariate data. Frequency table, diagrams, pictograms, simple bar charts, multiple bar charts, histograms.
3. Summarizing data and variation: The mean, the median, the mode, the variance and standard deviation, coefficient of variation and skewness.
4. Probability: Definitions of probability, rules of probability. Distributions (binomial poisson and normal probability distributions)

- 5 Test of hypothesis and significance: Statistical hypothesis, level of significance, test of significance. Confidence intervals. Test involving binomial and normal distributions. Student “t” and Chi-square distribution test of significance based on “t” and chi square distributions
- 6 Curve Fitting: Fitting a straight line, fitting of parabolic or high degree curve.
7. Regression and correlation: simple linear regression model. Correlation co-efficient
8. Analysis of variance: One-way classification, partitioning of suen of squares and degrees of freedom. Multiple compression tests such as LSD. The analysis of variance models

Books Recommended

1. Beth Dawson-Saunders. Basic and Clinical Biostatistics, 3rd Edition, A Lange Medical Book. London.
2. Biostatistics, A Foundation Analysis in the Health Sciences, Dannel, W.W., 4th edition Bernard Rosner (1987).
3. Fundamentals of Biostatistics, 4th Edition Wadsworth Publishing Company, USA (1995).
4. Introduction to Statistics, Ronald Walpole, 3rd edition (1990).
5. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Eston, Pennsylvania, USA.

Second Professional

PHC-406

Physical Chemistry – I (Practical)

Cr. Hrs. 2

1. Determination of specific gravity of liquids/syrups using an Ostwald pycnometer.
2. Determination of the viscosity of a liquid by Ostwald viscometer.
3. Determination of the percent composition of a mixture of ethanol and water by viscometric method.
4. Determination of the parachor value of an organic liquid.
5. Determination of the surface tension of a pure liquid by the drop count method.
6. Determination of the percentage composition of mixture of ethanol and water by surface tension method.
7. Determination of interfacial tension between benzene and water by the drop count method.
8. Determination of solubility of benzoic acid over a range of temperatures and calculation of its heat of solution.
9. Determination of the mutual solubility curve of phenol and water.
10. Preparation of buffer solutions and measurement of pH.
11. Determination of variation of miscibility with temperature.
12. Determination of the partition coefficient of I₂ between CCl₄ and H₂O.

Books Recommended

1. Pharmaceutical Analysis, Higuchi T. and Brochmann Hanssen E., Interscience, New York.
2. Physical Chemistry Barrow G.M., McGraw-Hill, London (1973).
3. Physical chemistry by Fazal I Hussain, 3rd Edition (1991).
4. Physical Chemistry, Barrow G.M., McGraw-Hill, London (1973).
5. Text Book of Physical Chemistry by Sameul Glasstone 2nd Edition MC Millan & Company Ltd. (1946).

PHC-408

Physical Chemistry – II

Cr. Hrs. 3

1. **Electrochemistry**
Definition, resistance, conductance, specific conductance, conductivity and its measurement, conductometric titrations, electrochemical cells, determination of pH and redox potentials, electrophoresis and electro dialysis.
2. **Photochemistry**
Definition light absorption and excitation of organic compounds, photophysical and photochemical processes, photochemical reactions, photosensitisation and photocatalysis, photolysis of medicinal compounds and photostabilization, high energy radiations.

3. Solid and Crystalline State

Formation of solids, types of solids, nature of amorphous and crystalline solids, crystal systems, determination of crystal structure, polymorphism.

4. Chemical Kinetics

Rates and order of reactions, influence of temperature and other factors on reaction rates, acid-base catalysis, decomposition of medicinal compounds, accelerated stability analysis, kinetics of enzyme catalysed reactions.

5. Thermodynamics

First and second law of thermodynamics, thermochemistry, relationship between free energy, entropy and equilibrium constant, free energy functions and applications.

Books Recommended

1. Physical Chemistry P.W. Atkins 5th edition W.H. Freeman and company New York 2000
2. Physical Pharmacy Martin A.N., 4th Edition, Lea and Febiger, Philadelphia (1993).
3. Practical Pharmaceutical Chemistry Backet and Stenlake., Royal Press, London (1998).
4. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Easton, Pennsylvania, USA.

Third Professional

PHC-506 Preparation and Quality Control (Practical) Cr. Hrs. 3

1. Preparation/synthesis, identification and purity determination of the following important pharmaceutical compounds as mentioned in B. P and U. S. P.
Paracetamol, salicylic acid, methyl salicylate, azobenzene, benzoic acid, 5-Hydroxy-1, 3-benzoxazol-2-one, aspirin, p-nitrosophenol, 3-nitrophthalic acid, o-Chlorobenzoic acid.
2. Limit tests as mentioned in pharmacopoeias for lead, arsenic, chlorides, sulphates, iron and heavy metals

Books Recommended

1. Laboratory Techniques and Organic Preparations, Nousheen Mushtaq & Shamim Akhtar, Manual for PHC 506.
2. A Guide Book to Mechanisms in Organic Chemistry Peter Sykes. Fourth edition, Longman Group Ltd. (1978).
3. Analytical Application of Spectroscopy Greaser C.S. and Davies A.M.C. Royal Society of Chemistry, London (1988).
4. Introduction to organic chemistry By William H. Brown Saunders College Publishing 3rd edition (2002).
5. Remington Practical of the Science and Pharmacy, Mack Publishing Company, Easton, Pennsylvania, USA.

PHC-508 Pharmaceutical Analysis - I Cr. Hrs. 3

To study the principles and applications of the following methods in the drug analysis and development

1. **Chemical Methods**
Titrimetric methods, Gravimetric methods, Solvent extractions methods.
2. **Electro Chemical Methods**
Potentiometry, Polarography, Conductometry.
3. **Optical Methods**
Refractometry, Polarometry, Fluorimetry.
4. **Radiochemical Methods**
Introduction to Radiopharmaceuticals, Analysis, Quality Control, Stability, Applications.

Books Recommended

1. Instrumental Methods of Chemical Analysis by Golden W. Evings, McGraw Hill London 5th Edition (1985).
2. Pharmaceutical Analysis – A Textbook of Pharmacy, Student and Pharmaceutical Chemistry Watson D.G. Churchill Livingston (1999).
3. Principle of Instrumental Analysis, Skoog Holter and Nieman 5th Edition (2000).
4. Quantitative Analysis, Theory and Practice by Lawrence W. Pott Harper and Raw Publisher New York (1987).
5. Vogel's Text Book of Quantitative Organic Chemistry, Longman, London.6th Edition (2006).

Fourth Professional

PHC-608

Pharmaceutical Analysis – II

Cr. Hrs. 3

To study the principles and applications of the following methods in the drug analysis and development

1. Spectroscopic Methods

Spectrophotometry (UV, Visible and Infrared), atomic absorption spectroscopy, mass spectrometry, nuclear magnetic resonance spectrometry, x-ray spectroscopy.

2. Chromatographic Methods

Thin layer chromatography, column chromatography, gas-liquid chromatography, high performance liquid chromatography, ion-exchange chromatography, size exclusion or gel chromatography.

Books Recommended

1. Principle of Instrumental Analysis, Skoog Holter and Nieman 5th Edition (2000).
2. Chromatographic Methods, R-Stock and CBE Rice 2nd Edition, Chapman and Hall Ltd and Science (1966).
3. Instrumental Methods of Chemical Analysis by Golden W. Evings, McGraw Hill London 5th Edition (1985).
4. Modern Infra Red Spectroscopy, Barbara Stuart Publisher ACOI John Wily and Sons (1996).
5. Vogel's Text Book of Quantitative Organic Chemistry, Longman, London.6th Edition (2006).

PHC-610

Medicinal Chemistry- I

Cr. Hrs. 3

1. **Introduction to medicinal chemistry.**
2. **Classification of drugs** on the basis of sources, structure, site of action and mode of action.
3. **Preparation and properties of medicinally important heterocyclic compounds** such as: pyrrol, furan, thiophene, pyridine, pyrimidine and pyrazine. Five and six membered ring containing one heteroatom: indole, quinoline and Isoquinoline.
4. **Drug Discovery and designing:**
 - a. Introduction of lead : qualities and requirements
 - b. Finding "lead" compounds
5. **Drug Development: Lead Modification**
 - a. Pharmacophore and modifications in structure
 - b. Physicochemical parameters affecting to drug development
6. **Metabolism of Drug**
 - a. Introduction
 - b. Reactions involved in Metabolism
 - i. Phase-I transformation

ii. Phase-II transformation

7. **Structural features of Drugs**
 - a. Stereochemistry and drug action
 - b. Configuration and drug receptor interaction
 - c. Conformation and drug receptor interaction
8. **Forces involved in drug receptor interaction**
9. **Introduction and types of drug targets**
10. **Drug Receptor interaction; Theories**
11. **Structure activity relationship**
12. **Alkaloids** – atropine, morphine and related compounds (codeine, thebaine), ergotamine, reserpine, ephedrine.
13. **Hormones** (steroidal and proteinous): Testosterone, progesterone, estrogen, aldosteron, cortisol, insulin, glucagon, oxytocin and vasopressin.
14. **Modern concept of rational drug design**
 - a. Computational Chemistry
 - b. Combinatorial Chemistry
 - c. Biotechnology and drug discovery

Books Recommended

1. An introduction to medicinal chemistry by Graham L. Patrik oxford university press 2nd edition (2000).
2. Principles of Medicinal Chemistry, William O. Foye, Thomas L. Lemke and David A. William, Wolters Kluwer, Lippincott Williams & Wilkins 7th edition, (2013).
3. Textbook of Organic Medicinal and Pharmaceutical Chemistry, Wilson and Gisvold's.. 12th edition, Wolters Kluwer, Lippincott Williams & Wilkins (2011).
4. Introduction to Medicinal Chemistry: How Drugs Act and Why, Alex. Gringuaz, John Wiley & Sons Inc. (1997).
5. Introduction to organic chemistry By William H. Brown Saunders College Publishing 3rd edition
6. The Organic Chemistry of Drug Design and Drug Action, Richard B. Silver. Academic Press, Pnen, Inc., USA (1992).

Fifth Professional

PHC-710

Medicinal Chemistry –III

Cr. Hrs. 3

1. **To study the chemistry, structure, mechanism of action, structure activity relationship and therapeutic applications of the following**
 - a. **Antibacterial / Antibiotics**
Sulphonamides such as sulfamethoxalor, sulfadiazine, sulfafurazole. Penicillines, Cephalosporine, Streptomycin, Chloramphenicol, Tetracyclines, Kamamycin and Erythromycin.
 - b. **Antimalarial agents** such as 4-aminoquinolines, 8-aminoquinolines, 9-amino acridine, biguanides, pyrimidine, analogues, mefloquine, cinchona alkaloids.

- c. **Anthelmintics** such as piperazine derivatives, thiabendazole, mebendazole, pyrantal.
 - d. **Antitubercular drugs** such as ethambutol, isonicotinic acid, hydrazid rifampicin, pyrizinamide, cycloserine, thambutol, ethionamide, streptomycin, kanamycin, para aminobanzoic acid, rifamycin, fluoroquinolones
 - e. **Hypoglycemic agents** such as sulfonylureas tolbutamide, chlorpropamide, acetohexamide, glipizide, glyburide
 - f. **Cardiovascular agents:** Antianginal agents and vasodilators, antiarrhythmic drugs, antihypertensive agents, angiotensin-converting enzymes inhibitors, antihyperlipidemic agents, anticoagulants
 - g. **Adrenergic and cholinergic agents neurotransmitters, receptors, agonists and antagonists**
 - h. **Vitamins** (water and fat soluble). B₁, B₂, B₆, B₁₂, folic acid, nicotinic acid, biotin, pantothenic acid, ascorbic acid A, D, E and K
2. **To study the Occurrence, properties, preparation and applications of the following medicinally active inorganic compounds.**

Aluminium Hydroxide, Ammonium Chloride, Sodium Carbonate, Magnesium Carbonate, Lithium Carbonate, Sodium Nitrite, Calcium Gluconate, Ferrous Fumarate, Ferrous Sulfate and Silver nitrate

Books Recommended

1. Principles of Medicinal Chemistry, William O. Foye, Thomas L. Lemke and David A. Williams, Wolters Kluwer, Lippincott Williams & Wilkins 7th edition, (2013).
2. Textbook of Organic Medicinal and Pharmaceutical Chemistry, Wilson and Gisvold's.. 12th edition, Wolters Kluwer, Lippincott Williams & Wilkins (2011).
3. Introduction to Medicinal Chemistry: How Drugs Act and Why, Alex. Gringuaz, John Wiley & Sons Inc. (1997).
4. Burger's Medicinal Chemistry and Drug Discovery edited by E. Wolf, 6th edition, Wiley-Inter Science, New York (2003).
5. The Organic Chemistry of Drug Design and Drug Action, Richard B. Silver. Academic Press, Pnen, Inc., USA (1992).

