

**Pt. B. D. SHARMA UNIVERSITY OF HEALTH SCIENCES,  
ROHTAK  
SCHEME OF EXAMINATION  
B. Pharmacy - First Year**

S. No.	Code BPH :	Subject (Theory Course)	Hrs/week	External Assessment	Internal Assessment	Total
1.	101	Pharm. Chem. – I (Inorganic Chemistry)	2	80	20	100
2.	102	Pharm. Chem. – II (Organic Chemistry)	3	80	20	100
3.	103	Pharmaceutics – I (Introduction to Dosage Forms)	2	80	20	100
4.	104	Pharmaceutics-II (Forensic Pharmacy)	2	80	20	100
5.	105	Pharmacognosy-I	2	80	20	100
6.	106	Pharmacology-I (Anatomy, Physiology & Health Education)	3	80	20	100
7.	107	Pharmaceutics – III (Drug Store and Hospital Pharmacy)	2	80	20	100
8.	108	Pharmaceutical Biology	2	80	20	100

S. No.	Code BPH :	Subject (Practical Course)	Hrs/week	External Assessment	Internal Assessment	Total
9.	109	Pharm. Chem. – I (Inorganic Chemistry)	3	80	20	100
10.	110	Pharm. Chem. – II (Organic Chemistry)	3	80	20	100
11.	111	Pharmaceutics – I (Introduction to Dosage Forms)	3	80	20	100
12.	112	Pharmacognosy-I	3	80	20	100
13.	113	Pharmacology-I (Anatomy, Physiology & Health Education)	3	80	20	100
14.	114	Pharmaceutical Biology	3	80	20	100

**Pt. B. D. SHARMA UNIVERSITY OF HEALTH SCIENCES,  
ROHTAK  
SCHEME OF EXAMINATION  
B. Pharmacy – Second Year**

S. No.	Code BPH :	Subject (Theory Course)	Hrs/week	External Assessment	Internal Assessment	Total
1.	201	Pharm. Chem. – III (Physical Chemistry)	2	80	20	100
2.	202	Pharm. Chem. – IV (Pharmaceutical Analysis-I)	3	80	20	100
3.	203	Pharm. Chem. – V (Pharmaceutical Biochemistry)	2	80	20	100
4.	204	Pharmaceutics – IV (Pharmaceutical Microbiology)	2	80	20	100
5.	205	Pharmaceutics – V (Pharmaceutical Engineering-I)	2	80	20	100
6.	206	Pharmacognosy-II	2	80	20	100
7.	207	Computers in Pharmacy	2	80	20	100
8.	208	Pharmaceutical Mathematics	3	80	20	100

S. No.	Code BPH :	Subject (Practical Course)	Hrs/week	External Assessment	Internal Assessment	Total
9.	209	Pharm. Chem. – III (Physical Chemistry)	3	80	20	100
10.	210	Pharm. Chem. – IV (Pharmaceutical Analysis-I)	3	80	20	100
11.	211	Pharm. Chem. – V (Pharmaceutical Biochemistry)	3	80	20	100
12.	212	Pharmaceutics – IV (Pharmaceutical Microbiology)	3	80	20	100
13.	213	Pharmaceutics – VI (Engineering Drawing)	3	80	20	100
14.	214	Pharmacognosy-II	3	80	20	100
15.	215	Computers in Pharmacy	3	80	20	100

**Pt. B. D. SHARMA UNIVERSITY OF HEALTH SCIENCES,  
ROHTAK  
SCHEME OF EXAMINATION  
B. Pharmacy - Third Year**

S. No.	Code BPH :	Subject (Theory Course)	Hrs/week	External Assessment	Internal Assessment	Total
1.	301	PHARMACEUTICAL CHEM.-VI (Medicinal chemistry-I)	2	80	20	100
2.	302	PHARMACEUTICAL CHEMISTRY-VII (Heterocyclics, Carbohydrates, Proteins and Nucleic acids)	2	80	20	100
3.	303	PHARMACEUTICS -VII (Physical Pharmacy)	2	80	20	100
4.	304	PHARMACEUTICS-VIII (Pharmaceutical Engineering-II)	2	80	20	100
5.	305	PHARMACEUTICS-IX (Pharmaceutical Technology-I)	2	80	20	100
6.	306	PHARMACOLOGY- II	3	80	20	100
7.	307	PHARMACOGNOSY-III	2	80	20	100
8.	308	PHARMACOLOGY- III (Pharmaceutical Animal Biotechnology)	2	80	20	100
9.	309	Environmental Sciences	2	80	20	100

S. No.	Code BPH :	Subject (Practical Course)	Hrs/week	External Assessment	Internal Assessment	Total
10.	310	PHARMACEUTICAL CHEM.-VI (Medicinal chemistry-I)	3	80	20	100
11.	311	PHARMACEUTICS -VII (Physical Pharmacy)	3	80	20	100
12.	312	PHARMACEUTICS-VIII (Pharmaceutical Engineering-II)	3	80	20	100
13.	313	PHARMACEUTICS-IX (Pharmaceutical Technology-I)	3	80	20	100
14.	314	PHARMACOLOGY- II	3	80	20	100
15.	315	PHARMACOGNOSY-III	3	80	20	100

**Pt. B. D. SHARMA UNIVERSITY OF HEALTH SCIENCES,  
ROHTAK**

**SCHEME OF EXAMINATION**

**B. Pharmacy – Fourth Year**

S. No.	Code BPH	Subject (Theory Course)	Hrs/week	External Assessment	Internal Assessment	Total
1.	401	PHARMACEUTICAL CHEMISTRY-VIII (Medicinal Chemistry-II)	2	80	20	100
2.	402	PHARMACEUTICAL CHEMISTRY-IX (Pharmaceutical Analysis-II)	3	80	20	100
3.	403	PHARMACEUTICS-X (Pharmaceutical Technology-II)	2	80	20	100
4.	404	PHARMACEUTICAL MANAGEMENT & PSYCHOLOGY	2	80	20	100
5.	405	PHARMACEUTICS-XI (Pharmaceutical Packaging Technology)	2	80	20	100
6.	406	PHARMACOLOGY- IV	3	80	20	100
7.	407	PHARMACEUTICS-XII (Biopharmaceutics and Pharmacokinetics)	2	80	20	100
8.	408	PHARMACOGNOSY- IV (Pharmaceutical Plant Biotechnology)	2	80	20	100

S. No.	Code BPH	Subject (Practical Course)	Hrs/week	External Assessment	Internal Assessment	Total
9.	409	PHARMACEUTICAL CHEMISTRY-VIII (Medicinal Chemistry-II)	3	80	20	100
10.	410	PHARMACEUTICAL CHEMISTRY-IX (Pharmaceutical Analysis-II)	3	80	20	100
11.	411	PHARMACEUTICS-X (Pharmaceutical Technology-II)	3	80	20	100
12.	412	PHARMACOLOGY- IV	3	80	20	100
13.	413	PHARMACEUTICS-XII (Biopharmaceutics and Pharmacokinetics)	3	80	20	100
14.	414	PHARMACOGNOSY- IV (Pharmaceutical Biotechnology)	3	80	20	100

**BPH-101: PHARMACEUTICAL CHEMISTRY – I**  
**(INORGANIC CHEMISTRY)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. Review of electronic structure of atom, periodic classification and group properties of elements. (2)
2. An outline of methods of preparation, uses, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any, of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia.
  - i. **Acids and Bases:** Buffers, Water.
  - ii. **Gastrointestinal Agents:** Acidifying agents (Dil HCl), Antacids (Aluminum hydroxide gel, Aluminum phosphate, Magnesium carbonate, Magnesium trisilicate, combination preparations), Protectives and Adsorbents, Cathartics (Magnesium sulphate), Emetics (Copper sulphate, Sodium potassium tartrate and antimony potassium tartrate). (14)
3. **Essential and Trace Elements:** Transition elements and their compounds of pharmaceutical importance, Iron and haematinics, mineral supplements. Cationic and anionic components of inorganic drugs useful for systemic effects. (4)
4. **Topical Agents :** Protectives (Calamine, Zinc oxide, Talc, Titanium dioxide), Astringents (Alum, Zinc sulphate) and Anti-infective (Iodine, Povidone iodine Hydrogen peroxide, Chlorinated lime, Potassium permanganate, Silver nitrate, Boric acid ). (4)
5. **Gases and Vapours:** Oxygen, Anaesthetics and Respiratory stimulants (ammonium carbonate). (4)
6. **Dental Products:** Dentifrices, Anti-caries agents (Stannous fluoride, sodium fluoride). (4)
7. **Major Intra and Extra-cellular Electrolytes:** Physiological ions, electrolytes used for replacement therapy, acid-base balance and combination therapy. (3)
8. **Miscellaneous Agents:** Sclerosing agents (Morrhuate sodium injection, sodium tetradecyl sulfate injection), expectorants (Ammonium chloride and potassium iodide), poisons and antidotes (heavy metal and cyanide poisoning: sodium nitrite injection, sodium thiosulphate injection, ethylene diamine tetra acetate salts, dimercaprol, penicillamine), sedatives (potassium bromide and lithium carbonate), etc. **Pharmaceutical Aids:** Anti-Oxidants (sodium metabisulphide, hypophosphorus acid), preservatives (sulphur dioxide, nitrogen, sodium benzoate), filter aids (purified talc, keiselguhr, charcoal), adsorbents, diluents (calcium sulphate, colloidal silicon dioxide), suspending agents (sodium lauryl sulphate, bentonite), colorants (red ferric oxide, carbon black, natural colors) etc. (7)
9. **Inorganic radio-pharmaceuticals:** Nuclear composition, forces and stability, isotopes, radioactive determination, measurement of radioactivity, modes of decay, half- life period, artificial radioactivity, radiopharmaceuticals, its preparations and radiopaque contrast media, therapeutic applications of isotopes, diagnostic applications of isotopes, use of radioisotopes in basic research. (8)

**BPH-109: PHARMACEUTICAL CHEMISTRY – I**  
**(INORGANIC CHEMISTRY)**

**PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. The background and systematic qualitative analysis of inorganic mixtures containing up to 4 radicals.
2. Limit tests for impurities in Pharmaceutical compounds.
3. Identification and purification of selected Inorganic Pharmaceutical Substances.

**NOTE: ANY OTHER EXPERIMENT (S) MAY BE INCLUDED IN SUPPORT OF THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition):**

1. J.H. Block, E. Roche, T.O. Soine and C.O. Wilson, "Inorganic Medicinal and Pharmaceutical Chemistry", Lea & Febiger, Philadelphia.
2. L.M. Artherden, Bentley and Drivers, "Textbook of Pharmaceutical Chemistry", S& Ed., Oxford University Press, Delhi.
3. Pharmacopoeia of India, Govt. of India, Ministry of Health.
4. A.H. Beckett and J.B. Stenlake, "Practical Pharmaceutical Chemistry", Part I, 3rd edition.

**BPH-102: PHARMACEUTICAL CHEMISTRY – II**  
**(ORGANIC CHEMISTRY)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Structure and properties:** Covalent bonding. Hybridization, Multiple bonds. Electronegativity. Inductive and field effects. Bond lengths, bond angles and bond energies. Intermolecular forces, polarity of bonds, polarity of molecules, delocalized chemical bonding. Hyperconjugation. Tautomerism. (4)
2. Structure, Nomenclature, preparation and reactions of Alkane, alkene, alkyne, cycloalkanes, dienes, benzene, alkyl halides, alcohols, amines, phenols, aldehydes and ketones, carboxylic acids, functional derivatives of carboxylic acid. (30)
3. **Stereochemistry (Basic Concepts):** Isomerism, Optical activity, Chirality, Enantiomers, Diastereomers, Relative and absolute configuration. D/L and R/S nomenclature. Racemic mixture and resolution. Geometrical isomerism. E/Z system of nomenclature. Conformations in open chain systems. (8)
4. Electro cyclic reactions, sigmatropic reactions, neighbouring gp. effects. Catalysis by transition metal complexes, Stereoselective and Stereospecific reactions. (10)
5. **Addition to carbon/carbon and carbon/hetero multiple bonds:** Electrophilic, nucleophilic and free radicals addition to carbon-carbon multiple bonds, orientation and stereochemistry. Michael, Mannich, Grignard, Reformatsky, Wittig and Perkin reactions. Aldol, Knoevengal, Benzoin condensations and benzilic acid rearrangements. (19)
6. **Active methylene compounds:** Ethyl acetoacetate and diethyl malonate synthesis and applications in organic synthesis. (4)

**BPH-110: PHARMACEUTICAL CHEMISTRY – II**  
**(ORGANIC CHEMISTRY)**  
**PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Introduction to various laboratory techniques viz. recrystallization, distillation, sublimation, etc.
2. Simple organic preparations involving acetylation, benzylation, substitutions, sulphonation, oxidation and reduction reactions.
3. Identifications of simple organic compound and preparation of suitable derivatives.
4. Demonstration of Stereochemistry using Ball and stick model

**NOTE: ANY OTHER EXPERIMENT (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition):**

1. R.T. Morrison and R.N. Boyd. Organic Chemistry, Allyn and Bacon, Inc., Boston, USA.
2. Organic Chemistry: Vols.I-III, S.M. Mukherji, S.P. Singh, R.P. Kapoor and R. Dass, New Age International (P) Ltd. , Publishers, Ansari road, Second edition, New Delhi-110002.
3. I. L. Finar, Organic Chemistry, Vol. I and II, The English Language Book Society.
4. P.Sykes, A Guidebook to Mechanisms in Organic Chemistry, Orient Longman, New Delhi.
5. J. March, Advanced Organic Chemistry, Reaction, Mechanisms and Structure, Wiley Eastern : New Delhi.
6. S. Pine, Organic Chemistry, McGraw Hill, 1987.



**BPH-103: PHARMACEUTICS-I  
(INTRODUCTION TO DOSAGE FORMS)  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Introduction:** Importance and classification of Pharmaceutical dosage forms, Sources of information required for Pharmacists. (2)
2. **Prescription:** Definition, various parts of prescription and their functions, handling of prescription, sources of error and care required in dispensing prescriptions, special labelling instructions for different pharmaceutical dosage forms. Pharmaceutical Latin terms used in prescriptions and their translation into English. (4)
3. **Incompatibilities:** Definition, types of incompatibility-physical, chemical and therapeutic, study of examples of prescription containing incompatibility, their correction and dispensing methods. (4)
4. **Additives:** Colours, flavours, sweeteners, surfactants, hydrocolloids, vehicles, stabilizers and other additives used in prescriptions. (5)
5. **Solid dosage forms:** Powders-Definition, advantages, disadvantages, cachets, tablet triturates, preparation of different types and problems encountered in dispensing of powders, effervescent granules, lozenges. (5)
6. **Monophasic liquid dosage forms:** Definition, brief description and formulation of mixtures, syrups, elixirs, aromatic waters, linctuses, liniments, lotions, collodions, gargles, mouthwashes, throat paints, douches, enemas, ear drops, eye drops and nasal drops. (8)
7. **Biphasic liquid dosage forms:** Suspensions and emulsions: Definition, advantages, disadvantages, classification, formulation, methods of preparation, stability and evaluation. (5)
8. **Semisolid dosage forms:** Ointments, pastes, jellies, poultices, suppositories and pessaries: Definition, advantages, classification, types of ointment and suppository bases, factors governing selection of ideal ointment and suppository base, methods of preparation and evaluation. (7)
9. **Ophthalmic products:** Definition, classification, essential characteristics, administration and precautions while handling, formulation additives, preparation of eye drops, contact lenses and lens care products. (3)
10. **Posology:** Definition, factors affecting dose selection, calculation of children and infant doses. (2)
11. **Pharmaceutical Calculations:** Metric and imperial system of weights and measures, percentage calculations, enlarging and reducing recipes, isotonic solutions, alcohol dilutions, allegation methods, proof spirits, displacement value. (5)

**BPH-111: PHARMACEUTICS-I  
(INTRODUCTION TO DOSAGE FORMS)  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Dispensing of prescriptions covering following dosage forms:**

1. Solid dosage forms including simple powders, compound powders, dusting powders, bulk and divided powders for oral use.
2. Monophasic dosage forms including simple mixtures, mixtures containing diffusible and indiffusible solids, liniments, lotions, enemas syrups, elixirs, aromatic waters, gargles, mouthwashes, throat paints, ear drops.
3. Biphasic dosage forms including suspensions and emulsions for internal use.

4. Semisolid dosage forms including ointments, pastes, poultices and suppositories.
5. Ophthalmic products including eye drops.
6. Prescriptions related to pharmaceutical incompatibilities.

**NOTE: ANY OTHER EXPERIMENT (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition):**

1. Remington, The Science and Practice of Pharmacy, Mack Publishing Co., U.S.A. (Latest Edition.).
2. J. W. Cooper and G. Gunn, Tutorial Pharmacy, 1st edition, 1956, Pitman Books Ltd., London, U.K.
3. S. J. Carter, Dispensing for Pharmaceutical Students, 11th and 12th edition, 1967 and 1975, Pitman Books Ltd., London, U.K.
4. E. W. Martin, Dispensing of Medication, 7th and 8th edition, 1971 and 1982, Marek Publishing Co., Pennsylvania, U.S.A.
5. L. Lachman, H.A. Liebennan and J.L. Kanig, The Theory and Practice of Industrial Pharmacy, Lea and Febiger, Philadelphia, U.S.A. (Latest Edition).
6. H. S. Ansel and N.G. Popovich, Pharmaceutical Dosage Forms and Drug Delivery Systems, Baltimore, Md: Lippincott Williams & Wilkins (Latest edition).
7. E.A. Rowlin, Bentley's Textbook of Pharmaceutics, Bailliere Tindall and Cox, London, Latest Edition.
8. J. B. Sprowls, Prescription Pharmacy, J. B. Lippincott Company, Philadelphia.

**BPH-104: PHARMACEUTICS –II  
(FORENSIC PHARMACY)  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Introduction:** (5)
  - i. Pharmaceutical legislation- a brief reviews.
  - ii. Drug and Pharmaceutical Industry- a brief reviews.
  - iii. Pharmaceutical education- a brief reviews.
2. **An elaborate (practical oriented) study of the following:** (15)
  - i. Pharmaceutical Ethics
  - ii. Pharmacy Act 1948
  - iii. Drug and cosmetics Act 1940 and rules 1945.
  - iv. Medicinal and Toilet preparations (Excise duties) Act 1955.
  - v. Narcotic Drugs and Psychotropic Substances Act 1985 and Rules.
  - vi. Price Control Act 1995.
3. **A brief study of the following with special reference to the main provisions (with amendments):** (25)
  - i. Poisons Act 1919.
  - ii. Drug and Magic remedies (objectionable advertisements) Act 1954.
  - iii. Medical termination of Pregnancy Act 1970 and Rules 1975.
  - iv. Prevention of cruelty to Animal Act 1960.
  - v. States shops and establishments Act and Rules.
  - vi. Insecticides Act 1968.
  - vii. AICTE Act 1987.
  - viii. Minimum Wages Act 1948 & Rules 1950.
  - ix. Patents Act 1970 and Rules 1972
4. **International documentation:** New drug application. Relevant information for marketing the Pharmaceutical products in other countries, IPR studies, Procedure of filling patent (National & International). (5)

**Books Recommended (Latest editions)**

1. Drugs and Cosmetics Act, 1940 and all amendments, Govt of India.
2. B. M. Mithal, Text Book of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta 700014.
3. Relevant Acts & Rules published by the Government of India.
4. Drug laws by P. L. Malik.

## BPH-105: PHARMACOGNOSY-I THEORY

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Introduction:** Definition, history, scope and development of Pharmacognosy. (2)
2. **Sources of drugs:** Biological, marine, geographical and plant tissue cultures. (4)
3. **Classification of drugs:** Alphabetical, morphological, taxonomical pharmacological, chemical and others with their merits and demerits. (3)
4. **Cultivation, collection, processing and storage of crude drugs:** factors influencing cultivation of medicinal plants. Types of soils and fertilizers of common use. Pest management and natural pest control agents. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants. (5)
5. **Extraction:** Various methods of extraction of crude drugs namely infusion, decoction, percolation (various types including processes for concentrated preparations, continuous hot percolation), maceration (various types including processes for organized and unorganized drugs, for concentrated preparations, double and triple maceration processes) and factors affecting choice of extraction process. (4)
6. **Quality control of crude drugs:** Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation. (3)
7. **An introduction to active constituents of drugs:** their isolation, classification and properties. (3)
8. **Systematic pharmacognostic study of the following:** (10)
  - (a) Carbohydrates and derived products: Agar, Guar gum, Gum Acacia, Honey, Isabgol, Pectin, Starch and Tragacanth.
  - (b) Lipids: Bees wax, castor oil, Cocoa butter, Cod-liver oil, kokum butter, Lard, Linseed oil, Rice bran oil, Shark liver oil and wool fat.
9. **Study of the drugs containing resins and resin combinations:** Colophony, Podophyllum, Cannabis, Myrrh, Asafoetida, Balsam of tolu, Balsam of peru, Benzoin, Turmeric, Ginger. (6)
10. **Volatile oils:** General methods of obtaining volatile oils from plants. Study of volatile oils of mentha, coriander, cinnamon, cassia, lemon peel, lemon grass, orange peel, citronella, caraway, cumin, clove fennel, nutmeg, eucalyptus, chenopodium, cardamom, valerian, musk and sandalwood. (7)
11. Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin, and natural colorants. (3)

## BPH-112: PHARMACOGNOSY-I PRACTICAL

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Morphological characteristics of plant families mentioned in the theory.
2. Microscopic measurements of cells and cell contents: starch grains, calcium oxalate crystals and phloem fibres.
3. Determination of leaf constants such as stomatal index, stomatal number, vein-islet number, vein termination number and palisade ratio.
4. Identification of crude drugs mentioned in theory.

**NOTE: ANY OTHER EXPERIMENT (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition):**

1. V. E. Tylor, L. R. Brady & J. E. Robbers, Pharmacognosy (9th Edition), K.M. Varghese Company, Bombay, India, 1988.
2. W. C. Evans, Trease and Evans Pharmacognosy (15th Ed.), W. B. Saunders Limited, 2002.
3. Trevor Robbinson, The Organic Constituent of Higher Plants, Burge Publishing Co., 1967.
4. G. E. Trease, A Textbook of Pharmacognosy (7th Edition), Bailliere Tindall, London, 1957.
5. B. P. Jackson & D. W. Snowdon, Powdered Vegetable Drugs, Stanley Thomes Ltd., London, 1974.
6. M. Hickey and C. King, 100 Families of Flowering Plants, 2nd Edn., Cambridge University Press, 1988.

**BPH-106: PHARMACOLOGY-I**  
**(ANATOMY, PHYSIOLOGY, AND HEALTH EDUCATION)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. Scope of Anatomy, Physiology and basic terminology. (2)
2. **Structure and functions of cell:** Ion channels, signal transduction, second messengers, electrophysiology of muscles, cell stimulation and neuronal functions. (4)
3. **Tissues:** Epithelial, Connective, Muscular and Nervous tissues, their types and characteristics. (5)
4. **Bones and Joints:** Structure and function of skeleton, types of joints and their disorders. (5)
5. **Blood and Lymph:** Composition and functions of blood including their disorders. Blood grouping and its significance, mechanism of coagulation, bleeding and clotting disorders. Formation of lymph and its composition. Reticulo-endothelial system and its function. (6)
6. **Cardiovascular system:** Anatomy and physiology of heart, blood circulation, cardiac cycle, heart rate, blood pressure, ECG and heart sounds. (5)
7. **Digestive system:** Gross anatomy of the G.I.T. and its physiology with special reference to liver, pancreas and stomach. Digestion, absorption, movements of intestine and disorders of digestive system. (6)
8. **Respiratory system:** Anatomy of respiratory tract, Mechanism of respiration, Lung volumes, Transport of oxygen and carbon dioxide. Disorders like Cyanosis, Mountain sickness and Caisson's disease. (4)
9. **Urinary System:** Structure and functions of Kidney and Urinary Tract. Physiology of urine formation and acid base balance. (4)
10. **Reproductive system:** Structure and function of Male and Female reproductive systems, Sex hormones, physiology of menstruation, coitus and fertilization. Spermatogenesis and Oogenesis, Pregnancy and parturition. (5)
11. Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenal and Pancreatic hormones and disorders of these glands. (4)
12. **Central Nervous System:** Structure and function of brain and spinal cord. Functions of cerebrum, cerebellum. Vital centers of medulla oblongata, cerebral ventricles, cranial nerves and their functions. (6)
13. **Autonomic Nervous System:** Anatomy, Physiology and Divisions of ANS. Motor and sensory pathways. (3)
14. **Sense organs:** Physiology of vision, audition, olfaction, taste and skin. (3)
15. **Health education:** Concepts of health and disease. Disease causing agents and prevention of disease. (2)
16. **Nutrition:** Balanced diet, Deficiency disorders of various nutrients, their prevention and treatment. (2)
17. **Communicable diseases:** The causative agents, modes of transmission and prevention of chicken pox, measles, diphtheria, tuberculosis, malaria, poliomyelitis, filariasis, rabies, tetanus, STD and AIDS. (6)
18. **First Aid:** Emergency treatment of shock, snakebite, burns, poisoning, fractures and resuscitation methods. (3)

**BPH-113: PHARMACOLOGY-I  
(ANATOMY, PHYSIOLOGY, AND HEALTH EDUCATION)  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Study of different systems with the help of models.
2. Microscopic study of different tissues.
3. Blood experiments: Enumeration of RBC and WBC, Haemoglobin estimation, ESR, blood group determination, bleeding and clotting time, heart rate and blood pressure recording.
4. Identification of bones and points of identification.
5. Health education – charts for various communicable diseases.
6. Determination of vital capacity.

**NOTE: ANY OTHER EXPERIMENT (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition):**

1. C. Guyton & J.E. Hall, Text Book of Medical Physiology published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, U. S. A.
2. A. Keele, E. Neil and N. Jools, Samson Wright's applied physiology, Thirteenth Edition, published by Oxford University Press, 1982.
3. W. F. Ganong, Review of Medical Physiology, Thirteenth Edition, published by Appleton & Lange, U. S. A.
4. J. Vander, J. H. Sherman and D. S. Luciano, Human Physiology.
5. Gray's Anatomy, edited by P.L. Williams & R. Warwick, 38th Edition, published by Churchill Livingstone, 1995.
6. Cunningham's Textbook of Anatomy, edited by G. J. Romanes, Eleventh Edition, published by Oxford University Press.
7. E. Braunwald, K.J. Isslbucher, J.B. Martin, A.S. Fauci, J.E. Wilson Harrison, D.L. Kasper,
8. Principles of Internal Medicine, 14th Ed., McGraw Hill International Book Company, 1998.
9. Text book of Anatomy and Physiology for Health professionals by Indu Khurana, CBS Publishers.
- 10.

**BPH-107: PHARMACEUTICS-III**  
**DRUG STORE MANAGEMENT & HOSPITAL PHARMACY**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

**DRUG STORE MANAGEMENT**

- 1) **Introduction:** Trade, Industry and Commerce, Functions and subdivision of Commerce, Introduction of Elements of Economics and Management. Forms of Business Organizations, Channels of Distribution. (4)
- 2) **Drug House Management:** Selection of Site, Space Lay-out and legal requirements. Importance and objectives of Purchasing, selection of suppliers, credit information, tenders, contracts and price determination and legal requirements thereto. Codification, handling of drug stores and other hospital supplies. (5)
- 3) **Inventory Control:** objects and importance, modern techniques like ABC, VED analysis, the lead time, inventory carrying cost, safety stock, minimum and maximum stock levels, economic order quantity, scrap and surplus disposal. (4)
- 4) Sales Promotion, Market Research, Salesmanship, qualities of a salesman, Advertising and Window Display. (4)
- 5) Recruitment, training, evaluation and compensation of the pharmacist. (3)

**HOSPITAL PHARMACY**

- 1) **Hospitals:** Definition, Function, Classifications based on various criteria, organization, Management and Health delivery system in India. (4)
- 2) **Hospital Pharmacy:** Definition, Functions and objectives of Hospital Pharmaceutical services, Location, Layout, Flow chart of material and men, Personnel and facilities requirements including equipments based on individual and basic needs, Requirements and abilities required for Hospital pharmacists. (4)
- 3) **Drug Distribution system in Hospitals:** (4)
  - i. Out –patient services
  - ii. In-patient services: types of services, detailed discussion of unit Dose system, Floor ward stock system, Satellite pharmacy services, Central sterile services, Bed Side Pharmacy.
- 4) **Manufacturing (Sterile and Non-Sterile):** Economical considerations, estimation of demand, Sterile manufacture-large and small volume parenterals, facilities, requirements, layout production planning, man-power requirements, Non-sterile manufacture –Liquid orals, externals-bulk concentrates, testing of raw materials. (10)
- 5) Procurement of stores, demand estimation. (2)
- 6) P.T.C (Pharmacy Therapeutic Committee), Hospital Formulary System and their organisation, functioning, composition. (2)
- 7) Drug Information service and Drug Information Bulletin. (2)
- 8) Long-term care facilities. (2)

**Books Recommended (Latest editions):**

1. Principles and methods of Pharmacy management, Harrg A. Smith Loa & Febiger, Philadelphia.
2. Materials Manegemnet by Gopalkrishna, Prentice Hall, India .
3. Hospital Pharmacy, Hassan Lippincott.



4. Remington Pharmaceutical Sciences, Lippincott.

**BPH-108: PHARMACEUTICAL BIOLOGY  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Methods of classification of plants:** Artificial, Natural and Phyllogenetic. (3)
2. Study of plant cell, its organelles, functions and cell inclusions. Mitosis and meiosis. (5)
3. **Study of tissues:** Meristematic and Permanent tissues. (3)
4. Anatomy of stem, root and leaf. (3)
5. Morphology of the stem, root and leaf and their modifications, flower, fruit and seed. (7)
6. **Plant taxonomy:** Families- Ranunculaceae, Leguminosae, Liliaceae, Solanaceae, Apocynaceae, Rutaceae, Umbelliferae, Rubiaceae, Graminae, Labiate, Cruciferae, Papavaraceae. (7)
7. **Knowledge of Physiological process:** Transpiration, Photosynthesis, Respiration, Growth and growth regulators. (3)
8. Classification and general characters of invertebrates and vertebrates up to class with important examples. (6)
9. Structure and life history of parasites as illustrated by amoeba, entamoeba, trypanosoma, plasmodium, taenia and ascaris. (5)
10. **Study of life history of insects:** Housefly, Mosquito and Silkworm. (4)
11. Knowledge of heredity and variation. Mendel's laws, chromosomal theory of inheritance. Evidence and theories of evolution. (4)

**BPH-114: PHARMACEUTICAL BIOLOGY  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Care, use and type of microscope.
2. Morphology of plant parts indicated in theory.
3. Description of flowers related to families mentioned in theory.
4. Gross identification of slides of structure and life cycle of lower plants/animals mentioned in theory.
5. Microscopic examination 'of stem, root and leaf of monocot and dicot plants.
6. Structure of human parasites mentioned in theory with the help of specimen.

**NOTE: ANY OTHER EXPERIMENT (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended:**

1. A. C. Datta, Botany
2. Dhama & Dhama. Invertebrates.
3. K. N. Bhatia, Botany

**BPH-201: PHARMACEUTICAL CHEMISTRY – III  
(PHYSICAL CHEMISTRY)  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **States of Matter:** (12)
  - (a) **Gaseous:** Brief introduction to the behavior of gases, ideal and real gases, equations of state, Deviation from ideal behavior, critical phenomena, critical constant and its determination, coefficient of thermal expansion and compressibility.
  - (b) **Liquids:** Intensive and extensive properties, Additive and constitutive properties, molar volume, molar refraction, surface tension, parachor, optical activity and their importance in structure elucidation.
  - (c) **Solids:** Amorphous and crystalline solids, geometry and symmetry of crystals, point defects, Miller indices, types of crystals, physical properties of crystals, Crystal diffraction, Bragg's equation, application in mol. wt. determination, liquid crystalline state, smectic and nematic liquid crystals. Swarm theory of liquid crystals.
2. **Solutions:** (8)
  - (a) **Non- Electrolyte Solutions:** Concentration scales, ideal and real solutions, colligative properties, Mol. wt. determination, Donnan- Membrane Equilibrium and drug absorption, Solution of gases in liquids, solutes distributing in immiscible solvents, partition- coefficient and its importance.
  - (b) **Electrolyte Solutions:** Arrhenius theory of electrolytic dissociation, Debye-Huckel theory and its use in protein purification, Ionic equilibrium in blood, applications.
3. **Thermodynamics:** (13)
  - (a) **Energy and First Law of Thermodynamics:** Preliminaries and definitions, reversibility, energy and enthalpy changes, heat capacities and their relationship for ideal gas, isothermal and adiabatic processes involving ideal gases. Applications, Thermo- chemical equations. Heats of reaction, effect of temperature, state etc. Kirchhoff's equation and numericals for exercises.
  - (b) **Second and Third Law of Thermodynamics:** Carnot Cycle, irreversible process, molecular interpretation of entropy, entropy calculations for ideal gas systems, absolute entropy, entropy changes for phase changes and chemical reactions.
  - (c) **Free Energy and Equilibrium:** Helmholtz and Gibb's free energy, concept of spontaneity, chemical equilibrium, expressions for equilibrium constant, effect of volume, temperature and pressure.
4. **Phase Equilibrium:** Phase component, degrees of freedom, deduction of phase rule, equilibrium between phases and cooling curves. Phase diagrams for one component system, for two component systems involving eutectics. Three-component systems, triangular plots and partially miscible three liquid systems (formation of one, two and three miscible pairs). (6)
5. **Kinetics and Adsorption:** (11)
  - a) **Reaction Rates:** Rate and rate constant, order and molecularity, zero, first, second and third order reactions, half- life time, determination of rate and order, consecutive, parallel and opposing reactions, ionic and free-radical

reactions. Theories and reaction Kinetics, (Collision, Lindman and Transition state Theory)

- b) **Catalysis:** Characteristics of catalysed reactions, homogeneous and heterogeneous catalysis, acid base catalysis, enzyme catalysis, theory of catalysis.
- c) **Adsorption:** Physiosorption and Chemisorptions, adsorption isotherms, Freundlich and Langmuir adsorption isotherms, Gibbs adsorption isotherm, BET equation and its use in surface area determination.

**BPH-209: PHARMACEUTICAL CHEMISTRY – III  
(PHYSICAL CHEMISTRY)  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**SUGGESTED EXPERIMENTS**

1. To determine the molecular mass of naphthalene by Rast's method.
2. To determine the specific reaction rate of the acid catalysed hydrolysis of ethyl acetate.
3. To determine the specific reaction rate of the hydrolysis of ethyl acetate by sodium hydroxide.
4. To determine the partition coefficient of Iodine between  $CCl_4$  and water.
5. To study the molecular state of benzoic acid in benzene by partition method.
6. To study the phase-diagram of a two component system having eutectic temperature (diphenylamine-naphthalene).
7. To draw the mutual solubility curve of phenol water system.
8. To measure the surface tension of solutions of any alcohol in water at different concentrations.
9. To study the adsorption of acetic acid on activated charcoal.
10. To determine the heat of neutralization of HCl and NaOH.
11. To determine the heat of combustion of naphthalene at constant pressure and temperature.
12. Structural determination using Atomic parachors.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions):**

1. K. J. Laidler, Physical Chemistry with Biological Applications, Henjman, 1980.
2. W. S. Brey, Physical Chemistry and its Biological Applications, Academic Press, 1978.
3. J. R. Barrante, Physical Chemistry of the Life Sciences, Printell (Latest Edition).
4. R. Puri, L. R. Sharma and M. S. Pathania, Principles of Physical Chemistry, Shoban Lal, Nagin Chand & Co., 1998.

**BPH-202: PHARMACEUTICAL CHEMISTRY – IV**  
**(PHARMACEUTICAL ANALYSIS – I)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Introduction:** Importance of quality control, computation of analytical results, significant figure, concept of error, precision, accuracy, standard deviation, normal distribution curve, calibration of analytical equipments, fundamental of volumetric analysis, methods of expressing concentrations, primary and secondary standards. (3)
2. **Neutralization titrations:** Acid base concept, Acid base dissociation constant, Role of the solvent, Relative strength of acids, bases, Distribution of acid base species with pH, Buffer solution (Effect of dilution, added acids & bases upon buffer) Henderson Hasselbalch equation, neutralization curves, Acid base indicators, Mixed indicators, Acid base titrations (strong acid vs. strong base, weak acids-weak bases and mixtures of strong & weak acids) Polyprotic systems, phosphoric acid system, polyamine and amino acid systems. Titration of sodium carbonate. (7)
3. **Non-aqueous titrations:** Theoretical basis, types of solvents, indicators, scope, limitations, preparation and standardization of titrant solutions.. Titrations of weak acids and weak bases. Standardization of perchloric acid, lithium and sodium methoxide, tetrabutyl ammonium hydroxide. Pharmaceutical applications. (4)
4. **Precipitation titrations:** Principles of precipitation titrations, solubility product, effect of acids, temperature and solvent on the solubility of precipitate. Argentimetric titration, mercurimetric and titration involving ammonium or potassium thiocyanate, barium sulphate, adsorption indicators, Mohr's method, Volhard's method and Fajan's method. (5)
5. **Complexometric titrations:** Concept of complexation and chelation, Warner's coordination number and electronic structure of complex ions, stability constants, titration curves, masking and demasking agents, types of complexometric titration, metal ion indicators, factors influencing the stability of complexes, EDTA-metal ion complexes, Determination of hardness of water. (5)
6. **Oxidation – reduction titrations:** Concepts of oxidation–reduction, standard oxidation potential, Nernst equation, theory of redox titrations, redox indicators, titrations involving ceric ammonium sulphate, potassium permanganate, titanous chloride, sodium–2,6–dichlorophenol–indophenol, iodimetry, iodometry, preparation, standardization and titration. (6)
7. **Gravimetric analysis:** Colloidal state, Supersaturation, Co-precipitation, Post-precipitation, Digestion, Washing of the precipitate, Filtration, Filter papers and crucibles, Ignition, thermogravimetric curves Specific examples like barium as barium sulphate aluminium as aluminium oxide: Calcium as calcium oxalate and Magnesium as Magnesium pyrophosphate: Organic precipitants. (4)
8. **Miscellaneous methods:** 1. Diazotisation, 2. Kjeldhal method of nitrogen estimation, 3. Oxygen Flask combustion 4. Karl fischer titration 5. Analysis of oils, fats and waxes. (7)
9. **Chromatography with Pharmaceutical applications of each category:** (20)
  - i. **Column chromatography:** Adsorption and Partition theory, preparation, procedure and methods of detection.
  - ii. **Thin layer chromatography:** Theoretical consideration, preparation, procedure and detection of compounds.
  - iii. **Paper chromatography:** Theory of partition, different techniques employed and different grades of papers used, quantitative and qualitative detection.
  - iv. **Gas Chromatography:** Introduction, fundamentals of column operation and detection.

- v. **Ion Exchangers:** Types of exchangers, mechanism of ion exchange and column operation.
- vi. **Size Exclusion Chromatography.**
- 10. **Potentiometric titrations:** Introduction, Electrochemical cells, half-cells, electrodes, measurement of potential and application in pharmaceutical analysis. (4)
- 11. **Conductometric titrations:** Basic concepts, different types of conductometric titrations, apparatus used and applications in Pharmaceutical Analysis. (4)
- 12. **Polarography:** Basic concept, theoretical considerations, Basic instrumentation, apparatus, principles, general polarography analysis and applications in pharmaceutical analysis. (3)
- 13. **Amperometry:** Amperometric titrations with one polarized electrode, general procedure, titration curves and applications. (3)

**BPH-210: PHARMACEUTICAL CHEMISTRY – IV  
(PHARMACEUTICAL ANALYSIS – I)  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Calibration 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, Iodimetry, Iodometry, Gravimetry and Complexometry.
3. Chromatographic analysis of some pharmaceutical products.
4. Analysis of pharmaceuticals using potentiometer, conductometer, amperometer, polarograph.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition)**

1. A.H. Beckett and J.B. Stenlake, Practical Pharmaceutical Chemistry, Vol. I & II, The Athlone Press of the University of London (Latest Edition).
2. J. Bassett, R.C. Denney, G.H. Jeffery & J. Medhan, Vogel's Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis.
3. H. H. Willard, L.L. Merritt: Jr., and J.A. Dean, Instrumental Methods of Analysis, Van Nostrand Reinhold, New York.
4. L. G. Chatten, Pharmaceutical Chemistry, Vols. I and II, Marcel Dekker, New York.
5. K.A. Connors, A Textbook of Pharmaceutical Analysis, Wiley-Interscience, New York.
6. A.M. Knevel and F.E. Digangi, Jenkin's Quantitative Pharmaceutical Chemistry, McGraw-Hill Book Co., New York.
7. Indian Pharmacopoeia 1996 and 2007, Govt. of India, Ministry of Health, Delhi.
8. Silverstein, Basseler, Morrill- Spectroscopic identification of organic compounds (John Wiley and Sons. N.Y).

**BPH-203: PHARMACEUTICAL CHEMISTRY – V**  
**(PHARMACEUTICAL BIOCHEMISTRY)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Introduction to biochemistry:** Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds: ATP, Cyclic AMP and their biological significance. (3)
2. **Biological oxidation:** Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture: regulation and inhibition): Uncouplers of ETC: Oxidative phosphorylation. (3)
3. **Enzymes:** Definition: Nomenclature, IUB classification, Factor affecting enzyme activity, Enzyme action, enzyme inhibition. Isoenzymes and their therapeutic and diagnostic applications, Coenzymes and their biochemical role and deficiency diseases. (5)
4. **Carbohydrate metabolism:** Glycolysis, Citric acid cycle (TCA cycle), HMP shunt, Glycogenolysis, gluconeogenesis, glycogenesis. Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases): Glucose, Galactose tolerance test and their significance, hormonal regulation of carbohydrate metabolism. (8)
5. **Lipid metabolism:** Oxidation of saturated ( $\beta$ -oxidation): Ketogenesis and ketolysis, biosynthesis of fatty acids, lipids, metabolism of cholesterol, Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atherosclerosis, fatty liver, hypercholesterolemia). (8)
6. **Protein and amino acid metabolism:** protein turn over, nitrogen balance, Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders, production of bile pigments, hyperbilirubinemia, porphoria, jaundice. Metabolic disorder of Amino acids. (8)
7. **Nucleic acid metabolism:** Metabolism of purine and pyrimidine nucleotides, Protein synthesis, Genetic code: inhibition of protein synthesis: mutation and repair mechanism, DNA replication (semiconservative /onion peel models) and DNA repair mechanism. (8)
8. **Introduction to clinical chemistry:** (7)
  - a) Urine analysis (macroscopic and physical examination, quantitative and semi quantitative tests).
  - b) Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid).
  - c) Test for hepatic dysfunction-Bile pigments metabolism.
  - d) Test for hepatic function: test- Serum bilirubin, urine bilirubin and urine urobilinogen.
  - e) Lipid profile tests: Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.

**BPH-211: PHARMACEUTICAL CHEMISTRY – V**  
**(PHARMACEUTICAL BIOCHEMISTRY)**  
**PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

- 1) Preparation of standard buffer (nitrate, phosphate, carbonate and measurement of pH).
- 2) Separation of lipids by TLC.
- 3) Quantitative estimation of amino acids.
- 4) Quantitative estimation of proteins.
- 5) Identification of C-terminal amino acids of proteins.
- 6) Estimation of blood glucose, blood cholesterol, SGPT and SGOT activity.
- 7) Enzymatic hydrolysis of glycogen by  $\alpha$  and  $\beta$  amylase.
- 8) Acid hydrolysis and action of salivary amylase on starch.
- 9) Estimation of chloride, glucose, ammonia and creatinine in urine.
- 10) Identification of carbohydrates, proteins and fats.
- 11) Identification of abnormal constituents of urine.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition):**

1. D.W. Martin, PA Mays & V.M. Redwell, Harpers Review of Biochemistry, Lange Medical Publication (Latest Edition).
2. RE. Conn & P.K. Stumpf, Outlines of Biochemistry, John Wiley & Sons, New York (Latest Edition).
3. A.L. Lehninger, Biochemistry, Worth Publisher, Inc. (Latest Edition).
4. A.L. Lehninger, Principles of Biochemistry, CBS Publishers and Distributors (Latest Edition).
5. L. Stryer, Biochemistry, W.H. Freeman & Company, San Francisco (Latest Edition).
6. Harrow & A. Mazur, Textbook of Biochemistry, W.B. Saunders Co., Philadelphia. (Latest Edition).
7. M.N. Chatterjea & Rana Schinde, Textbook of Medical Biochemistry, Jintender P. Vij, New Delhi (Latest Edition).



**BPH-204: PHARMACEUTICS – IV  
(PHARMACEUTICAL MICROBIOLOGY)  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. Introduction to the science of microbiology. Major divisions of microbial world and relationship among them. (2)
2. Nutritional requirements, growth and cultivation of bacteria and virus. Study of different important media required for the growth of aerobic and anaerobic bacteria & fungi. Differential media, enriched media and selective media, maintenance of lab cultures. (5)
3. Different methods used in isolation and identification of bacteria with emphasis to different staining techniques and biochemical reactions. Counting of bacteria -Total and Viable counting techniques. (6)
4. Detailed study of different methods of sterilization including their merits and demerits. Sterilization methods for all pharmaceutical products. Detailed study of sterility testing of different pharmaceutical preparations. (7)
5. Disinfectants- Study of disinfectants, antiseptics, fungicidal and virucidal agents factors affecting their activation and mechanism of action. Evaluation of bactericidal, bacteristatic, virucidal activities, evaluation of preservatives in pharmaceutical preparations. (5)
6. Microbial culture sensitivity testing: Interpretation of results, Principles and methods of different microbiological assays, microbiological assay of Penicillin, Streptomycin and vitamin B<sub>2</sub> and B<sub>12</sub>. Standardization of vaccines and sera. (6)
7. Fermentation and its design, control of different parameters in fermentation process, Use of mutagenic agents, Isolation of mutants, factors influencing rate of mutation, Preparation and isolation of fermentation products with special reference to penicillins, streptomycins, tetracyclines, alcohol, citric acid and vitamin B<sub>12</sub> (cyanocobalamin). (11)
8. Immunology: General introduction, infection, factors influencing infection, kinds of immunity, vaccines (i.e. Tetanus vaccine, Diphtheria vaccine, BCG vaccine), virus immunity, official viral vaccines (small pox vaccine, rabies vaccine, yellow fever vaccine, influenza vaccine, poliomyelitis vaccine, measles vaccine, typhus vaccine), toxoids (FT, TAF, APT, PTAP), diagnostic preparation, sera, antitoxins (i.e. Diphtheria antitoxins, Botulinum, Gas gangrene, Staphylococcus and Tetanus antitoxins) Brief control of immunological products-identification tests, toxicity tests, sterility tests, potency tests and storage of immunological products. (08)

**BPH-212: PHARMACEUTICS – IV  
(PHARMACEUTICAL MICROBIOLOGY)  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**SUGGESTED EXPERIMENTS**

1. Preparation and sterilization of aerobic and anaerobic media.
2. Aerobic and anaerobic cultivation of bacteria.
3. Gram's staining, acid fast staining and hanging drop preparation.

4. Separation of mixed cultures and maintenance of pure cultures.
5. Microbial viable count in Pharmaceutical Formulations.
6. Particle count in water for injection.
7. Thermal death time studies.
8. Morphological characteristics of moulds and Yeasts.
9. Turbidimetric assay of at least one drug using microbial culture.
10. Bio-Chemistry reactions:
  - (a) Starch Hydrolysis
  - (b) Gelatin liquification and
  - (c) Haemolysis of blood
11. Phenol coefficient test for disinfectant.
12. Production of at least one product by fermentation.
13. Biological assay of tetracycline and cyanocobalamin.
14. Test for limit of alkalinity of glass.
15. Test for sterility. (Rabbit method and LAL method)
16. Test for Pyrogens.
17. Preparation of injections of water, dextrose, normal saline and oily phenol. Carrying out quality control tests.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition):**

1. J. Woodward (Editor), Immobilized Cells and Enzymes, A Practical Approach, IRL Press.
2. L.M. Prescott, J.P. Harley and D.A. Klein, Microbiology, Wm. C. Brown Publishers, England.
3. S. J. Carter, Cooper and Gunn's Tutorial Pharmacy. Sixth Edition, Pitman publishing Co, London.
4. M. Furbisher, Fundamentals of Microbiology, 8<sup>th</sup> Edition, W. B. Saunders Company, Philadelphia, USA.
5. W. B. Hugo and A. D. Russell, Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford.
6. Prescott & Donn, Industrial Microbiology, CBS. Publishers, Delhi.
7. K. K. Kieslich (Editor). Biotechnology, Vol 6a, Verlag chemie, Basel, Switzerland.
8. M. J. Pcelzar, Reid and Chan, Microbiology, TATA Mc-Graw Hill publishing, Co. Ltd. New Delhi.
9. S. J. Carter, Cooper and Gunn's dispensing for Pharmaceutical students, 12<sup>th</sup> Edition, CBS Publishers & Distributors, 485, Bhole Nath Nager, Shahdara, Delhi-32.
10. Osal, Remington's Pharmaceutical Sciences, Mack publishing company, Pennsylvania, U. S. A.

**BPH-205: PHARMACEUTICS – V**  
**(PHARMACEUTICAL ENGINEERING-I)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. Flow of fluids: Introduction, mechanism of fluid flow, Reynolds number and its Significance, Bernoulli's theorem, manometers and friction losses in pipes, measurement of flow rate using headmeters, displacement meters and dilution methods. Regulation of flow using valves, pumps and common problems like water hammer. (12)
2. Heat Transfer: Modes of heat transfer, Different laws of heat transfer, overall heat transfer coefficient, single pass heater, multipass heater, liquid-liquid heat interchanger/ exchanger and finned tubes heat exchangers. (6)
3. Evaporation: Principle, Factors affecting evaporation, natural circulation evaporators, forced circulation evaporators, film evaporators, multiple effect evaporation, material and energy balance of evaporators. (8)
4. Drying: Theory, definitions, behavior of solids during drying, static bed dryers, moving bed dryers, fluidizes bed dryer and pneumatic bed dryers. (3)
5. Centrifugation: theory, industrial centrifuges. (4)
6. Filtration: Theory, filter aids, filter media, industrial filters i.e. sand filter, filter presses, rotary drum filter, leaf filters, edge filter. Ultrafiltration. (8)
7. Humidification, dehumidification and air conditioning: Definitions, Principles of Humidification, dehumidification and air conditioning, psychrometry, humidity measurement, large scale equipment for humidification and dehumidification, cooling towers. (5)
8. Refrigeration: Principle and equipments employed for vapor compression, steam jet and absorption types of refrigeration cycles, applications in Pharmacy. (4)

**Books Recommended (Latest edition):**

1. McCabe and Smith, Unit Operations for Chemical Engineering, 6th edition, McGraw Hill, N.Y.
2. G. Gunn and S.J. Carter and Gunn's Tutorial Pharmacy, Pitman Medical Publishing Co., London, 1972.
3. L.A. Lachman, H.A. Liberman and J.L. Kanig, The Theory and Practice of Industrial Pharmacy, 3rd edition, Lea and Febiger, Philadelphia, U.S.A.
4. Badger, Introduction to Chemical Engineering, McGraw Hill Co., International Student edition (Latest edition).
5. E.A. Rowlinson, Bentley's Text Book of Pharmaceutics, Bailliere Tindall and Cox, London (Latest Edition).
6. K. Sambamurthy, Pharmaceutical Engineering, New Age Int. Publishers, New Delhi, 2003.

**BPH-206: PHARMACOGNOSY-II**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. Phytochemical screening (3)
  - i. Preparation of extracts.
  - ii. Screening for alkaloids, saponins, sterols, cardenolides, bufadenolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthraquinones, cyanogenetic glycosides, amino acids in plant extract.
2. Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substituents, adulterants used, diagnostic microscopic and macroscopic features and specific chemical tests of following group of drugs containing glycosides: (11)
  - i. Saponins: liquorice, ginseng, dioscorea, sarsaparilla and senega.
  - ii. Cardio-active sterols: digitalis, squill, strophanthus and thevetia.
  - iii. Anthraquinones cathartics: aloe, senna, rhubarb and cascara.
  - iv. Others: Psoralea, ammi, gentian, saffron, chirata, quassia
3. Study of tannins and tannin containing drugs like gambir, black catechu, gall, and myrobalan. (3)
4. Studies of traditional drugs, common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs:  
Amla, Kantkari, Satavari, Tylophora, Bhilava, Kalajira, Bach, Rasna, Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Gaduchi, Brahmi, Adusa, Arjuna, Ashoka, Methi, Lehsun, Palash, Guggal, Gymnema, Shilajit, Nagarmotha and Neem. (8)
5. Holistic concepts of Drugs administration in traditional systems of medicine. Introduction to ayurvedic preparations like arishtas, asavas, gutikas, tailas, churnas, lehas and bhasmas. (3)
6. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid containing drugs: (13)
  - i. Pyridine-piperidine: tobacco, areca and lobelia.
  - ii. Tropane: belladonna, hyoscyamus, datura, duboisia, coca and withania.
  - iii. Quinoline and isoquinoline : Cinchona, ipecac, opium.
  - iv. Indole: ergot, rauwolfia, catharanthus, nux-vomica and physostigma.
  - v. Imidazoles: pilocarpus.
  - vi. Steroidal: vertrum, kuruchi.
  - vii. Alkaloidal amines: ephedra and colchicum.
  - viii. Glycoalkaloids: solanum.
  - ix. Purines: Coffee, tea and cola.
7. Biological sources, preparation, identification test and uses of the following enzymes: Diastase, papain, pepsin, trypsin and pancreatin. (2)
8. Study of fibers used in pharmacy such as cotton, silk, wool, polyester and asbestos. (2)
9. Plant bitters and sweeteners. (1)

10. World wide trade in plant and plant derived products with special reference to dioscoreas (Diosgenin), Digitalis. Tropane alkaloid containing plants. Carica papaya Rauwolfia, Cinchona (quinine and quinidine). Ipeacac (emetine) Glycyrrhiza, Gineng, plants containing laxatives and valerine. (4)

**BPH-214: PHARMACOGNOSY-II  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

- 1) Identification of crude drugs listed in theory.
- 2) Microscopic study of some important crude drugs as underlined above.
- 3) Standardization of some traditional drug formulations.
- 4) Studies of microscopic characters of some important drugs in entire and powdered form.
- 5) Chemical evaluation of powdered drugs and enzymes.
- 6) Processing, extraction, isolation and characterization of natural products.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT  
OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition):**

1. V. E. Tylor, L. R. Brady & J. E. Robbers, Pharmacognosy (9th Edition), K.M. Varghese Company, Bombay, India, 1988.
2. W. C. Evans, Trease and Evans Pharmacognosy (15th Ed.), W. B. Saunders Limited, 2002.
3. Trevor Robbinson, The Organic Constituent of Higher Plants, Burge Publishing Co., 1967.
4. G. E. Trease, A Textbook of Pharmacognosy (7th Edition), Bailliere Tindall, London, 1957.
5. B. P. Jackson & D. W. Snowdon, Powdered Vegetable Drugs, Stanley Thomes Ltd., London, 1974.
6. M. Hickey and C. King, 100 Families of Flowering Plants, 2nd Edn., Cambridge University Press, 1988.

**BPH-207: COMPUTERS IN PHARMACY  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **History:** Introduction to Computer, Computer classifications (According to generation, size and use). (2)
2. **Hardware:** Introduction to hardware, CPU, Mother board, various ports and slots available with motherboard. Input devices, Output devices, Storage Devices and Memory. (3)
3. **Networking:** Introduction to networking, Classification of networking like LAN, WAN, MAN. Hardware of networking – Modem, Hub, Cables. Power devices like UPS. (2)
4. **Number systems:** Decimal, Binary, Octal, Hexadecimal and their uses in computer. (3)
5. **Software:** Introduction to software, use of Machine language, Assembly language and Higher-level languages. (2)
6. **Application of computers in pharmacy:** Introduction to various uses of computer in pharmaceutical research and development, industries, authorities, education and in hospitals in maintenance of records, inventory control, medication monitoring, drug information and drug storage and retrieval in retail pharmacy establishments. (5)
7. **Operating systems:** Introduction to Operating system, classification, use of operating system like DOS, WINDOWS (98 & XP) & LINUX. (6)
8. **File manipulations:** Directories / folder / files searching, creating, copying, moving, deleting, renaming etc. (2)
9. **Computer Package:** MS Word, MS PowerPoint, MS Excel. (10)
10. **Maintenance:** Checking, Scanning and formatting a floppy disk, CD Writing. (1)
11. **Internet:** History, Introduction to Internet Browsers, URL. Introduction to email and how to check and compose an email? Important websites related to pharmaceutical information – like sites for information regarding drugs, medical literature, plants, adverse effects, clinical data, patent sites, FDA, WHO, etc. (3)
12. **Programming Language (Programming with C):** Introduction to programming; Problem analysis, algorithm, flow chart, coding, execution, debugging and testing, program documentation. Introduction to C: Programming rules. C-Declarations: C-Character set, Key words, identifiers, constants, variables, defining variables, data type, declaring variables, initializing variables, conversion types etc. Operators and expression, input and output statement in C.  
Decision statements: **If ....., if.... Else, Nested if else....., Go to, Switch ( ) .... Case, break**, default statement, loop control statement: **While, Do .....,While, for, nested for**. Arrays: One dimensional, Two dimensional. The **scanf ( )** and **printf ( )** functions. Preprocessor directives: **# include, # define**. (11)

**BPH-215: COMPUTERS IN PHARMACY  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Demonstration of hardware.
2. Operating system: DOS, WINDOWS & LINUX
3. Searching directories or folders

4. Creating and deleting files and folders
5. Copying and Moving files and folders / directories
6. Saving in floppies and CD Writing.
7. Formatting and checking by floppy disks and Bootable CD.
8. Simple programming in C or C++: at least five programs.
9. Create and save a document in a word processor program like MS WORD. Type few paragraphs, format them, and paste an image.
10. Create and save presentations in POWERPOINT
11. Create and save a work sheet using MS EXCEL. Input data in cells, copy and move the data, make calculations, plot a graph from X and Y sets of data.
12. Internet (Search Engine, email, groups)

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition)**

1. Computer and common sense, Hunt & Shelly, Prentice-Hall India, 4th Ed.
2. DOS 6 & 6.22: An Introduction with computer fundamentals. Pradeep Nair, Payal Lotia, BPB Publications.
3. Windows 98 Instant Reference, Peter Dyson, BPB Publications.
4. ABCs of Windows 98, Sharon Crawford & Neil J. Salkin, BPB Publications.
5. Programming in C++, TMH, New Delhi, John R.Hubbard, 2nd Ed.
6. Fundamentals of Computer, P.K.Sinha, BPB, Latest Ed.
7. DOS 6 & 6.22 Instant Reference, Robert M.Thomas, BPB Publications, 2nd Ed.
8. Programming in ANSI C, E.Balguruswamy, TMH, New Delhi, 3rd Ed.
9. Complete Reference MS- Office
10. Complete Reference Windows XP.
11. Complete Reference Internet

**BPH-208: PHARMACEUTICAL MATHEMATICS  
THEORY**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. Algebra: Solution of linear equation up to two variables only, solution of quadratic equation. Determinants and their six important properties, solutions of simultaneous equations by Cramer's rule. Definition of various matrices up to upper triangular matrices, arithmetic operations on matrices, transpose, adjoint reciprocal and inverse of a matrix, solution of simultaneous equations using matrix methods. Partial fractions and resolution of linear and quadratic (non-repeated) partial functions. (20)
2. Trigonometry: revision on angle measurement and T-ratios, addition, subtraction and transformation formulae. T- ratio of multiple, sub multiple and allied angles, solution of simple trigonometric identities based on above concepts. Pharmaceutical application of logarithms. (5)
3. Analytical plane geometry: Cartesian co-ordinates, distance between two points, area of triangle, locus of a point, straight line, slope and intercept form, general equation of first degree. (4)
4. Calculus:
5. Differential: Limits and functions, differential coefficient, differentiation of standard functions, including function of a function (chain rule), differentiation of implicit functions, logarithmic differentiation, parametric differentiation, elements of successive differentiation. (6)
6. Integral: Integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, by partial fractions and by substitution, formal evaluation of definite integrals. (5)
7. Differential equations: definition and formation of ordinary differential equations, equations of first order and first degree, variable separable, homogeneous equations, linear equations (Liebnitz form) and differential equations reducible to these types. Linear differential equations of order greater than one with constant coefficients, complementary function and particular integrals of  $e^x$ ,  $x^m$ ,  $\sin(ax + b)$  or  $\cos(ax + b)$  types of functions, solution of simple simultaneous linear differential equations. Pharmaceutical transforms. (8)
8. Laplace transforms: definition, properties of linearity and shifting, transforms of elementary function (without proof) and inverse laplace transforms not involving Euler's theorem, transforms of derivatives, solutions of ordinary and simultaneous differential equations. (6)
9. Collection of primary and secondary data through experiments or surveys sampling and complete enumeration survey, merits and limitations of various random and non-random sampling methods, data organization including frequency distributions and tabulation, diagrammatic representation of data, simple, multiple, sub-divided and floating bar diagrams, pie diagrams. 2-D and 3-D pictographic representation, graphs of frequency distributions. (6)
10. Measures of central tendency, ideal characteristics, mean, median, mode, GM, HM and weighted arithmetic mean from discrete and continuous frequency distributions, quartiles, measures of dispersion, range, quartile deviation, mean deviation, standard deviation, calculation of standard deviation from discrete and continuous frequency distributions, standard error of means, coefficient of variation. (4)
11. Probability and events, Bayes theorem, probability theorems, probability distributions, elements of binomial and Poisson distributions, normal distribution, normal distribution curve, and properties, calculation of areas under normal curve and standard normal curve (Z statistic), confidence limits, deviations from normality, Kurtosis and skewness, elements of central limit theorem. (5)



12. Linear correlation and regression analysis, scatter plots, method of least squares, Pearsonian coefficients of correlation and determination, definitions, of amount of explained variance, standard error of estimate and significance of regression(F). (3)
13. Statistical inference, type I and II errors, t-test (paired and unpaired). (3)

**Books Recommended (Latest edition):**

1. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi (Latest Edition).
2. Schaum, Differeptial Equations, McGraw-Hill, Singapore, 1982.

**BPH-213: PHARMACEUTICS- VI**  
**(PHARMACEUTICAL ENGINEERING DRAWING)**  
**PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Introduction: Significance of Engineering Drawing in pharmaceutical industry, drawing instruments and their uses, lines, lettering and dimensioning
2. Scales: Construction of plain scales, vernier scale, diagonal scale, comparative scale and isometric scale
3. Isometric projections: Theory, isometric views and projections, construction of isometric projections/views of two dimensional figures(i.e. circles, triangles, rectangles, quadrilateral pentagon, hexagon), three dimensional solids(i.e. cylinder, prism, pyramids, cones )
4. Orthographic projections: Theory, types, construction of drawing in both first angle and third angle. Various methods of sectioning i. e. full section, half section, removed section, partial section, offset section
5. Conversion of orthographic projections into isometric projections/views
6. Drawing of machine parts and simple pharmaceutical equipment
7. Methods of depicting layouts of various sections of a pharmaceutical unit.

**Books Recommended (Latest editions):**

1. A Manual of Engineering drawing for students and Draftsmen, Frechand Viorck.
2. Engineering Drawing, N. D. Bhatt.
3. Technical Drawing ciesocke Mitchell and sponcer.
4. Machine Drawing N. D. Bhatt.

**BPH-301: PHARMACEUTICAL CHEMISTRY – VI**  
**(MEDICINAL CHEMISTRY-I)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Basic Principles of Medical Chemistry:** Physico-chemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action: Drug receptor interaction including transduction mechanisms. Principles of drug design (Theoretical aspects). Traditional analog (QSAR) and mechanism based approaches (Applications of Quantum mechanics, computer aided drug designing (CADD) and molecular modeling. (8)
2. Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only mentioned against each class. (42)
  - i. **Drugs acting on autonomic nervous system:**
    - Cholinergics and Anticholinergics: Acetylcholine, Carbachol, Bethanechol, methacholine and Neostigmine. Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrogen bromide, Tropicamide.
    - Adrenergic drugs and adrenergic blocking agents: Adrenaline, Salbutamol, Terbutaline, Phenylephrine, Naphazoline, Prazosin, Atenolol
    - Antispasmodic and anti ulcer drugs: Homatropine, Cyclopentolate, Diclomine, Tropicamide.
    - Neuromuscular blocking agents: Gallamine, succinylcholine
  - ii. **Drugs acting on central nervous system:**
    - General anesthetics: Desflurane, Nitrous oxide, Propofol, Ketamine
    - Sedatives and hypnotics: Flurazepam, Triazolam, Phenobarbotol, Secobarbital, Diphenhydramine, Diazepam.
    - Antidepressants: Protriptyline, Maprotiline, Paroxetine, Amitriptyline, Imipramine.
    - Psychotherapeutic drugs: Clozapine, Risperidone, Zolpidem
    - Hallucinogens: Mescaline, Tryptamine.
    - Stimulants: Ephedrine, Fenfluramine
  - iii. **Autacoids:**
    - Antihistamines: Diphenhydramine, Mepyramine, Chlorpheniramine, Promethazine, Chlorcyclizine, Cimetidine, Ranitidine.
    - Eicosanoids: Occurrences, Chemical nature, Medicinal applications
    - Analgesic, antipyretics, anti-inflammatory (non-steroidal) agents: Aspirin, Paracetamol, Ibuprofen, Phenylbutazone, Naproxan, Diclofenac sodium.
  - iv. **Drugs affecting uterine motility:** Oxytocics (including oxytocin, ergot alkaloids and prostaglandins) Their Occurrence, Chemical nature, Medicinal applications.
  - v. **Steroids and Related Drugs:** General study on Steroidal nomenclature and stereochemistry, Androgens and anabolic agents, Estrogens and progestational agents, synthesis of Progesterone from diosgenin, Diethyl satilboestrol, Synthesis of Testosterone from Cholesterol, General study of structural formula and therapeutic uses of steroidal antiinflammatory agents.
  - vi. **Diuretics:** Acetazolamide, Dichlorphenamide, Chlorthiazide, Hydrochlorthiazide, Furosemide, Spironolactone, Triamterene and Amiloride.

**BPH-310: PHARMACEUTICAL CHEMISTRY – VI**  
**(MEDICINAL CHEMISTRY-I)**

## PRACTICAL

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Synthesis of selected drugs and intermediates from the course content.
2. Monographs of selected official drugs including identification tests and tests for purity.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

### **Books Recommended (Latest edition)**

1. Text Book of Organic Medicinal & Pharmaceutical Chemistry, Wilson & Grisvold,
2. Lippincott Williams & Wilkins.
3. Principles of Medicinal Chemistry, William Foye, Lippincott Williams & Wilkins.
4. A Text Book of Medicinal Chemistry, S.N.Pandeya, SG Publisher, Varanshi.
5. Medicinal Chemistry, Ashutosh Kar, New Age International Publishers, New Delhi.
6. Text Book of Pharmaceutical Chemistry, Bentley & Driver, Oxford University Press, New Delhi.

**BPH-302: PHARMACEUTICAL CHEMISTRY – VII**  
**(HETEROCYCLICS, CARBOHYDRATES, PROTEINS AND NUCLEIC ACIDS)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Chemistry of Heterocyclic Compounds:** Nomenclature of heterocyclic compounds, five and six membered heterocycles, aromatic characteristic of heterocyclic compounds. Structure, synthesis and reactions of pyrrole, furan and thiophene, pyridine and piperidine.

Condensed five and six membered heterocyclics. Synthesis and reactions of indole, quinoline and isoquinoline (Fischer-Indole Synthesis, Skraup Synthesis and Bischler-Napieralski Synthesis).

Heterocyclic ring systems containing up to two hetero atoms. Chemistry of pyrazole, imidazole, oxazole, thiazole, azines, pyridazines, pyrazine, oxazine, Purines and Pyrimidines, preparation and reactions of adenine, guanine, cytosine, uracil, thymine, Tautomerism. (20)

2. **Carbohydrates:** Occurrence, classification, interrelationship amongst monosaccharides. Constitution and reactions of glucose and fructose, Osazone formation, mutarotation, Cyclic structures, determination of ring size. Configuration and conformation of monosaccharides, epimerization, Chain lengthening and shortening in aldoses, interconversions of aldoses and ketoses.

Chemistry of ascorbic acid, ribose and 2-deoxyribose. Disaccharides and polysaccharides- Maltose, lactose, sucrose, cellulose, starch and gums. Glycosides. (15)

3. **Amino acids, Peptides, proteins:** Classification, source, essential and non-essential amino acids. Synthesis, physical properties, zwitterion structure, isoelectric point, chemical reactions and configuration of amino acids. Peptides and polypeptides. Geometry of peptide linkage, peptide synthesis. Structure determination of polypeptides and group analysis.

Classification and general characteristics of proteins- primary, secondary, tertiary and quaternary structure of proteins, helical and sheet structures. (10)

4. **Nucleic Acids:** Nucleotides, RNA and DNA. General methods for the synthesis of oligonucleotides. (5)

**Books Recommended (Latest editions)**

1. I. L. Finar, Organic chemistry, vol. I and II, The English Language Book Society, London.
2. Organic Chemistry: Vols. I-III, S.M. Mukherji, S.P. Singh, R.P. Kapoor and R. Dass, New Age International (P) Ltd., Publishers, Ansari road, Second edition, New Delhi-110002
3. R. T. Morrison and R. N. Boyd, Organic Chemistry 4<sup>th</sup> Ed. Allyn and Bacon, Inc. Boston.
4. R. N. Acheon, An Introduction to the chemistry of Heterocyclic Compounds, Interscience Publishers, New York.
5. L. Stryer, Biochemistry, W. H. Freeman and Company, San Francisco.

**BPH-303: PHARMACEUTICS –VII  
(PHYSICAL PHARMACY)  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Micromeretic and Powder Rheology:** Applications of micromeritics in pharmacy, particle size and distribution, average particle size, number and weight distribution, particle number, method of determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods of determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness, flow properties and compression properties. (7)
2. **Surface and Interfacial Phenomenon:** Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents and its applications, HLB classification, solubilisation, detergency, adsorption at solid interfaces, solid gas and solid-liquid interfaces, wetting phenomena, electric properties of interface. (7)
3. **Viscosity and Rheology:** Newtonian systems, laws of flow, kinematic viscosity, effect of temperature, Non Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity. Single point and multipoint, capillary, falling ball, rotational viscometers. (6)
4. **Dispersion system**
  - i. **Colloidal dispersions:** Definition, types, optical, electrical and kinetic properties of colloids, protective colloidal action, purification of colloidal dispersions, applications of colloid in pharmacy. (7)
  - ii. **Suspensions and Emulsions:** Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations. Emulsions: types, theories and physical stability. Application of HLB in emulsions, physical mechanisms behind micro-emulsions. (6)
5. **Complexation and protein binding:** Classification of complexes, method of preparation and analysis, kinetics of protein binding, applications of complexation and protein binding in pharmacy. (6)
6. **Kinetics and drug stability:** Half-life determination, physical degradation of pharmaceutical products, chemical decomposition of drugs, influence of temperature, light, solvent, catalytic species on drug decomposition, accelerated stability study, storage conditions. (6)
7. **Buffers:** Buffer equation and buffer capacity in general, buffer in pharmaceutical systems- preparation, stability, buffered isotonic solutions, measurement of tonicity, methods of adjusting isotonicity. (5)

**BPH-311: PHARMACEUTICS –VII  
(PHYSICAL PHARMACY)**

**PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Determination of particle size, particle size distribution and surface areas using various methods of particle size analysis.
2. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
3. Determination of surface/interfacial tension, HLB values and critical micellar concentration of surfactants.
4. Study of rheological properties of various types of systems using different viscometers.
5. Studies of different types of colloid and their properties.
6. Preparation of various types of suspensions and determination of their sedimentation parameters.
7. Preparation and stability studies of emulsions.
8. Studies on different types of complexes and determination of their stability constants.
9. Determinations of half-life rate constant and order of reaction.
10. To study the influence of various factors on the rate of reaction.
11. Accelerated stability testing, shelf life determination and expiration dating of pharmaceuticals.
12. Preparation of pharmaceutical buffers and determination of buffer capacity.
13. Experiments involving tonicity adjustments

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT  
OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**

1. Alfred Martin et. al., Physical Pharmacy, B. I. Waberly Pvt. Ltd., New Delhi.
2. H. S. Beans, A. H. Beckett and J. E. Careless, Advances in Pharmaceutical Sciences, Vol I to 4.
3. Remington's Pharmaceutical Sciences, Mack Publishing Co, Easten Ponnsylvania,, U. S. A.

**BPH-304: PHARMACEUTICS –VIII**  
**(PHARMACEUTICAL ENGINEERING-II)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

**Max. Marks: 80**

**Total Hours: 50**

1. **Distillation:** Raoult's law, volatility, boiling point diagrams, azeotropic mixtures, equilibrium diagrams, types of distillation, rectification, rectifying columns, material and energy balance of a rectifying column, reflux ratio, determination of number of theory plates, H.E.T.P. and steam distillation. (7)
2. **Extraction:** Factors affecting, equipment for extraction of solids i.e. fixed bed diffusion battery, continuous diffusion battery, basket extractor, Rotocel extractor and Dorr agitator. Equipment for liquid-liquid extraction i.e. extraction towers and Podbielniak extractor. (6)
3. **Mixing:** Theory, uniformity index, factors influencing selection of suitable mixer equipment for solid-solid, liquid-liquid and solid-liquid mixing. Emulsification equipment. (6)
4. **Size reduction:** Mechanism, Laws and factors influencing, energy requirements, applications in pharmacy, different mills i.e. fluid energy mill, hammer mill, ball mill and its variants, centrifugal mill, attrition mill, edge runner mill, squirrel cage disintegrator, Buhrstone mill. (9)
5. **Size separation:** Screening, Screening effectiveness, Screening equipment i.e. stationary and vibrating types. Air suspension methods i.e. air separator and cyclone separators, Sedimentation and hydraulic separation i.e. elutriation and doublecone emulsifier. (4)
6. **Crystallization:** Crystal forms and habits, Hole theory, Mier's supersaturation theory, Nucleation, Crystal growth theories, Crystallizers based on supersaturation, by cooling (i.e. tank crystallizers, agitated batch crystallizers and Swenson-Walker), adiabatic cooling (i.e. vacuum crystallizers) and evaporation (i.e. Krystal crystallizers). Mateial and energy balance of crystallizer. (6)
7. **Corrosion and its prevention:** Types of corrosion causes of corrosion and method for combating corrosion. (3)
8. **Materials for pharmaceutical plant construction:** factors affecting the selection of a material for pharmaceutical plant, ferrous metals (i.e. cast iron, steel and stainless steels), non-ferrous metals (i.e. Copper and its alloys, aluminium, tin sliver, nickel and alloys), non-metals i.e. glass, slate, asbestos, rubber, plastics and timber. (3)
9. **Industrial hazards and safety precautions:** Mechanical, Chemical, Electrical, Fire and Dust hazards, safety requirements, accident records etc. (3)
10. **Transportation of materials:**  
Gases: Ejectors, compressors, fans and blowers.  
Solids: Intermittent and continuous methods in vertical, horizontal and inclined plane. (3)



**BPH-312: PHARMACEUTICS-VII  
(PHARMACEUTICAL ENGINEERING)  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. To perform Reynold's experiment.
2. Determination of fanning factor.
3. Comparison of the sensitivity of various manometers.
4. Determination of flow rate using venturimeter.
5. Determination of flow rate using orificemeter.
6. Determination of overall heat transfer coefficient.
7. Effect of number of balls on the grinding rate in a ball mill.
8. Efficiency of a centrifugal pump.
9. Effect of thickness of cake on filtration rate in a filter press.
10. Effect of colour on radiation of heat.
11. Overall efficiency of steam distillation.
12. Use of psychrometric chart.
13. Flow rate using pitot tubes.
14. Classification by elutriation.
15. Determination of equilibrium moisture constant.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT  
OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**

1. Richardson and Coulson's Chemical Engineering (Vol. 1-6) Butterworth/ Mc Graw Hills.
2. Perry's Chemical Engineering, Mc Graw Hills.
  3. McCabe and Smith, Heat Transfer, Mc Graw Hill.

**BPH-305: PHARMACEUTICS –IX**  
**(PHARMACEUTICAL TECHNOLOGY-I)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

**1. Preformulation studies:**

Study of physical properties of drug like physical form, particle size, shape, density, wetting dielectric constant, solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability.

Study of chemical properties of drug like hydrolysis, oxidation, reduction, recemization, polymerization etc., and their influence on formulation and stability of products. (10)

2. **Glandular, blood and related products:** Introduction, extraction methods and preparation of thyroid, liver, pancreas, pituitary gland, Whole human blood, concentrated human RBC, dried human plasma, dried human serum, human plasma protein fraction, human fibrinogen, human thrombin, plasma substitute, ideal plasma substitute properties, products i.e. PVP, Dextran, absorbable gelatin, sponge, oxidized cellulose, calcium gluconate. (9)
3. Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to liquid dosage forms. (7)
4. ICH Guidelines for stability testing protocol for various pharmaceutical products. (7)
5. GMP, Quality assurance, Quality audit. (5)
6. Specifications of the international standards organization: (5)
  - i) ISO 9001: Quality systems: Model for quality assurance in design, development production installation and servicing.
  - ii) ISO 9002: Quality systems: Model for quality assurance in production and installation.
  - iii) ISO 9003: Quality systems: Model for quality assurance in final inspection and test.
  - iv) ISO 9004: Quality management and quality system elements guidelines.
  - v) Latest amendments of ISO.
7. **Skin:** Structure and functions of skin, formulation, preparation and evaluation of cleansing creams, cold creams, cleansing lotions, foundation creams, moisturizing creams, skin tonics, hand and body lotion, sun preparations, face powders. (9)
8. Hairs, structure and functions, formulation, preparation and evaluation of shampoos, dandruff preparation, hair creams, and fixers, hair colorants, hair remover (depilatories), shaving sticks and after shave lotion. (7)
9. Nail, structure and functions, formulation, preparation and evaluation of nail lacquer. (5)
10. Formulation, preparation and evaluation of other cosmetics like, anti-perspirants and deodorants, tooth powders and tooth paste, lipsticks. (8)
11. Herbal Cosmetics. (4)

**BPH-313: PHARMACEUTICS-IX  
(PHARMACEUTICAL TECHNOLOGY-I)**

**PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Preparation and Evaluation of (a) cold cream (b) vanishing cream (c) Cleansing lotion and creams (d) moisturizing creams (e) skin tonics, (f) hair creams and hair conditioners (g) shampoos (h) hair colorant (i) depilatory (j) shaving creams and sticks (k) tooth powder (l) tooth pastes (m) after shave lotions and other cosmetics as studied in theory.
2. Preformulation studies including drug-excipient, compatibility studies, effect of stabilizers, preservatives etc. in dosage form design.
3. Stability evaluation of various dosage forms.
4. Dissolution testing and data evaluation for oral solid dosage forms.
5. GMP for various dosage forms.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT  
OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**

1. Lachman et. AlZ, Theory and practice of Industrial Pharmacy 2<sup>nd</sup> Ed. Fea & Febiger, Philadelphia, USA. 1976.
2. J. B. Wilkinson & R. J. Moore, Harry's Cosmeticology, Chemical publishing House, New York.
3. ISO Reports.
4. ICH Guidelines.
5. Pharmaceutics: The Science of Dosage form Design By: Aulton, Lippincott.
6. Remington's Pharmaceutical Sciences. Mack publication. Company, ponnsylvania,USA (Latest Edition).
7. IP/BP/USP.
8. Poucher's perfumes, Cosmetics and Soaps, Vol. 3 (Cosmetics), 9th edition.
9. M.S. Balsam and E. Sagarin, Cosmetics: Science and Technology, Vol. 1-3, 2nd edition, 1974, Wiley Interscience, N. Y.

**BPH-306: PHARMACOLOGY –II  
THEORY**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

**1. General pharmacology:**

- a. Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, combined effect of drugs, factors modifying drug action, tolerance and dependence, pharmacogenetics.
- b. Absorption, distribution, metabolism and excretion of drugs, principles of basic and clinical pharmacokinetics, adverse drug reactions and treatment of poisoning, ADME drug reactions, bioassay of drugs and biological standardization, discovery and development of new drugs.

**2. Pharmacology of autonomic nervous system:**

- a. Neurohumoral transmission (autonomic and somatic)
- b. Parasympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics, Ganglion blocking and Stimulating agents
- c. Neuromuscular blocking agents.
- d. Local anaesthetic agents.

**3. Pharmacology of Central Nervous System:**

- a. Neurohumoral transmission in the C.N.S.
- b. General anaesthetics
- c. Alcohols and Disulfiram
- d. Sedative and hypnotics
- e. Anti-anxiety agents and centrally acting muscle relaxants
- f. Psychopharmacological agents (Anti-psychotic, antidepressants, antimaniacs and hallucinogens)
- g. Anti-epileptic drugs
- h. Anti-parkinsonian drugs
- i. Analgesics, antipyretics and anti-inflammatory agents
- j. Narcotic analgesics and antagonists.
- k. CNS stimulants

**4. Pharmacology of Cardiovascular system:**

- a. Digitalis and cardiac glycosides
- b. Anti-hypertensive drugs
- c. Anti-anginal and vasodilator drugs
- d. Anti-arrhythmic drugs.
- e. Anti-hyperlipidemic drugs
- f. Drugs used in therapy of shock

**5. Drugs acting on the Haematopoietic system:**

- a. Haematinics
- b. Anticoagulants, vitamin K and haemostatic agents
- c. Fibrinolytic and Anti-platelet drugs
- d. Blood and plasma volume expanders

**6. Drugs acting on the urinary system:**

- a. Fluid and electrolytic balance
- b. Diuretics

**7. Autocoids:**

- a. Histamine, 5-HT and their antagonists
- b. Prostaglandins, thromboxane and Leukotrienes
- c. Pentagastrin, cholecystokinins, angiotensin, bradykinin and substance P.

**8. Drugs acting on the respiratory system:**

- a. Anti-asthmatic drugs including bronchodilators
- b. Anti-tussive and Expectorants
- c. Respiratory stimulants

**BPH-314: PHARMACOLOGY –II  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Introduction to Experimental Pharmacology.
2. Preparation of different solutions for experiments.
3. Common Laboratory animals and their maintenance.
4. Study of commonly used instruments in experimental pharmacology.
5. Procedures for rendering animals unconscious – stunning of rodents, pithing of frogs, chemical anaesthesia.
6. Experiments on intact preparations:
  - i. Study of different routes of administration of drugs in mice / rats. To study the effect of hepatic microsomal enzyme inhibitors and induction on the
  - ii. pentobarbitone/hexobarbitone/thiopental sodium sleeping time in mice.
7. Experiments on Central Nervous System:
  - i. Recording of spontaneous motor activity, stereotypy, analgesia, anticonvulsant activity and muscle relaxant activity of drugs using simple experiments.
  - ii. Effects of autonomic drugs on rabbit's eye.
8. Pharmacology of Cardiovascular System:
  - i. To study the inotropic and chronotropic effects of drugs on isolated frog heart.
  - ii. To study the effects of drugs on normal and hypo dynamic frog heart.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**

1. Essentials of Medical Pharmacology, K.D.Tripathy, JAYPEE.
2. Pharmacology & Pharmacotherapeutics, Satoshkar & Bhandarkar, Popular Publication.
3. Pharmacology, Prasun Kumar Das, S.K.Bhattacharya, Elsevier.
4. The Pharmacological Basis of Therapeutics, Goodman & Gilman, Mc Graw Hill.
5. Text book of Pharmacology, S.D. Sethi, BI Churchill Livingstone.
6. Pharmacology, Rang, Dale and Ritter, Churchill Living Stone.
7. Basic & Clinical Pharmacology, B.G.Katzung, Lange.
8. Pharmacology, Mary J, Mycer, Richard A, Lippincott William & Willans.

**BPH-307: PHARMACOGNOSY – III  
(NATURAL PRODUCTS)  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. General technique of biosynthetic studies and basic metabolic pathways. An introduction to biogenesis of secondary Metabolites of pharmaceutical importance. (4)
2. Plant allergens and allergenic substances. (2)
3. **Alkaloids:** Definition, isolation, general methods of determining structure, Structure elucidation and synthesis of the following groups: Phenylethylamine group (ephedrine, amphetamine), pyrrolidine group (hygrine), pyridine-piperidine group (Areca nut and Hamlock alkaloids, piperine), pyrrolidine-pyridine group (Tabacco and coca alkaloids), quinine group (conchona alkaloids), isoquinoline and phenanthrene groups (opium alkaloids) and indole group (mesembrine). (14)
4. **Volatile Oils:** General methods of obtaining volatile oils from plant, Knowledge of important volatile oils used as flavouring agents and in perfumery. Pharmacognostic study of the following drugs & yielding volatile oils: mentha, cinnamon, clove, nutmeg, eucalyptus, cardamom, fennel, dill, sandalwood, vetiver, rose, celery, geranium, pine, matricaria and cedarwood, Utilization of waste of essential oil industry. (12)
5. **Terpenoids:** classification, isolation, general methods of determining structure and chemistry of the following members: Monoterpenoids (citral, geraniol, terpinol, Limonene, menthol, pinene and camphor), Sesquiterpenoids (borneol, juvenile hormones, santonin), diterpenoids (phytol) and triterpenoids (squalene). (10)
6. **Flavonoids:** Structure, elucidation and synthesis of anthocyanins, flavones and isoflavones. (3)
7. Chemistry of medicinal important iridoids. (2)
8. Chemistry of penicillins, streptomycin and tetracyclines. (3)

**BPH-315: PHARMACOGNOSY –III  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75  
(3hrs/week)**

1. Microscopic examination of diagnostic tissues in powdered crude drugs.
2. Pharmacognostic identification of various crude drugs.
3. Processing, extraction, isolation and characterization of natural products.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**

1. G. R. Trease & W. C. Evans, Pharmacognosy (12 Edition), Tindall London 1983, Lea & Febiger, Philadelphia.

2. Organic Chemistry: Vols.I-III, S.M. Mukherji, S.P. Singh, R.P. Kapoor and R. Dass, New Age International (P) Ltd. , Publishers, Ansari road, Second edition, New Delhi-110002
3. V. E. Tylon Brady, H. E. Robbers, Pharmacognosy (9<sup>th</sup> Edition), Lea & Febiger, Philaephia, 1988.
4. J. E. Finar Organic chemistry, Vol. I and II, The English Language Book society, London.
5. T. Eorrison and B. N. Boyd, Organic chemistry, 4<sup>th</sup> Ed, Allya and Bacon, Ind, Boston.
6. T. E. Wallis, The Textbook of Pharmacognosy, J. & A Churchill, London.
7. Trover Robbinson, The Organia constituent of higher plants,Birgass publishing Co., 1967.
8. C.K. Atal & B.M. Kapur, cultivation & UIC Utilization or Medicinal Plants, CSTR, India, 1982.
9. G.V. Satyavati and M.K.Raina, Medicinal Plants of India Vol I & IC, ICMR,New Delhi, 1976 & 1987.

**BPH-308: PHARMACOLOGY – III**  
**(PHARMACEUTICAL ANIMAL BIOTECHNOLOGY)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Introduction to Biotechnology:** Definitions, history, branches and scope of biotechnology. Therapeutic and pharmaceutical applications of biotechnology. (5)
2. **DNA:** Structure and function; DNA replication, repair and recombination, isolation of DNA; RAPD, RFLP and AFLP analysis. (7)
3. **Genetic Engineering of Animal Cells:** (9)
  - i. Introduction, gene transfer techniques, host system and gene cloning.
  - ii. Transgenic animals and their applications, characterization of transfected cells; in vitro fertilization, embryo transfer and ethical issues of animal cloning.
4. **Enzymes:** (6)
  - i. Introduction, mechanism of action, isolation, purification, immobilized enzymes, methods of immobilization, applications of immobilized enzymes.
  - ii. Study of enzymes such as hyaluronidase, streptokinase, amylase and protease.
5. **Animal Tissue Culture:** (8)
  - i. History and scope of tissue culture, tissue culture media;
  - ii. Sterilization of materials for tissue culture.
  - iii. Types of tissue culture, primary cultures and culture of cell lines,
  - iv. Characterization and preservation of cell lines, 3D culture techniques.
6. **Stem cells and Gene Therapy:** (6)
  - i. History and introduction to stem cells and gene therapy
  - ii. Human stem cell culture (embryonic and germ cells); methods of gene therapy;
  - iii. Applications of stem cells and gene therapy in pharmaceuticals, ethical issues related to stem cells.
7. **Drug Delivery systems by Biotechnology:** (9)
  - i. Production of drugs from biotechnology- erythropoietins, interferons, vaccines, anticoagulant agents, monoclonal antibodies and human and follicle stimulating growth hormone.
  - ii. Cancer immunotherapy vaccines
  - iii. Design of drug delivery systems for biotechnological products.

**Books Recommended (Latest editions)**

1. Balasubramanian, Bryce, Dharmalingam, Green and Jayaraman (Eds.), Concepts in Biotechnology, University Press.
2. Hood L.E., Weissman I., Wood W.B. and Wilson J.H. Immunology, Benjamin Cummings.
3. Biotol Series – Butterworth and Heineman, Oxford, 1992.
4. Essential Immunology, Roitt, I.M., Blackwell Scientific, Oxford, UK.
5. Immunology, Kuby, J., Freeman, W.H., Oxford.
6. Biotechnology V, M. K. Sateesh.
7. Culture of Animal Cells- I.Freshrey (Willy).



**BPH-309: ENVIRONMENTAL SCIENCES  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Environmental studies:** Definition, Scope and importance. Multidisciplinary nature of environmental studies. (2)
2. **Natural resources:** (8)
  - i. **Forest:** Benefits of forests. Use and over exploitation, Deforestation and timber extraction. Dams - their effects on forests and tribal people.
  - ii. **Water resources:** Global water resources distribution. Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water, Dams-benefits and problems.
  - iii. **Mineral resources:** Usage and exploitation, Environmental effects of extracting and using mineral resources.
  - iv. **Food:** World food problems, Changes caused by agriculture and overgrazing, Effects of modern agriculture, Fertilizer-pesticide problems, Water logging and salinity. Organic farming - Definition and advantages.
  - v. **Energy sources-**Conventional and non conventional / Renewable and non renewable.
    - a. **Fossil fuels:** Coal, Petroleum and natural gas -Availability, Dependency and environmental problems. Effect of global price of fossil fuel on nations.
    - b. **Alternatives to fossil fuels:** Hydro electric power, Bio energy, Nuclear, Wind, Solar, geothermal. Energy of future for transportation-Ethanol, Biodiesel and fuel cells.
  - vi. **Land resources:** Land as a resource, Land degradation, Man induced landslides, Soil erosion and desertification.  
Role of an individual in conservation of natural resources and equitable use of resources for sustainable life style.
3. **Ecosystem** – Structure and functional components of ecosystem. Producers, Consumers and decomposers. Food chain and food web. Energy flow and material cycling in ecosystem. Balanced eco system. (3)
4. **Biodiversity and its conservation:** Definition: Species and ecosystem diversity. Threats to biodiversity: Habitat loss, Poaching of wild life, Man wild life conflicts. Hot spots of biodiversity. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. (5)
5. **Environmental pollution:** Definition, Causes, Effects and control measures of: Water pollution (water quality standards and parameters, Assessment of water quality, Transformation process in water bodies, Oxygen transfer by water bodies, Turbulent mixing, Water quality in lakes and preservers, Ground water quality), Air pollution, Soil pollution and noise pollution), Air pollution, Soil pollution and noise pollution. (5)
6. **Current environmental issues:** Population Growth, Human health and urbanization. Global warming (greenhouse effect), Climate change, Acid rain, Ozone layer depletion, Industrial and nuclear accidents, Nosocomial diseases. (7)
7. **Environmental protection:** Salient features of Environmental Protection Act, Air & Water Acts, Wildlife and Forest Acts. Functions of Central and State Pollution Control Boards. Role of NGO'S. Environmental education. Role of information technology in environment and human health. (7)

8. **Waste management:** (8)
- i. **Water Treatment:** Water quality standards, Water sources and their quality, Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.
  - ii. **Waste Water Treatment:** Water flow rate and characteristics, Design of waste water network, Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion and its application.
  - iii. **Solid Waste Management:** Sources classification and composition of MSW ;properties and separation, storage and transportation, MSW Management, Waste minimization, Reuse and recycling, Biological treatment, Thermal treatment, Landfill, Integrated waste management. Hazardous Waste Management, Hazardous waste and their generation, Medical hazardous waste. Household waste, Transportation and treatment of hazardous waste: incinerators, Inorganic waste treatment, Treatment systems for hazardous waste, handling of treatment plant residue.
9. **Field work: equal to 5 lectures.**
- i. Visit to a local area to document environmental assets – river/forest/ grassland/hill/mountain etc.
  - ii. Visit to a local polluted site – urban/rural/industrial/agriculture
  - iii. Study of common plants, insects and birds.
  - iv. Study of simple ecosystems- pond, river, hill slopes etc.

**Books Recommended (Latest editions)**

1. Principles of Environmental Engineering and Sciences, K.L. Davis & S.J. Masen, McGraw Hill International Edition, 2004.
2. Principles of Environmental Science inquiring & applications, Cunningham & Cunningham (TMH, New Delhi)
3. Introduction to Environmental Science, Y.Anjaneyalu, B.S.Publication. Hyderabad
4. Environmental Engineering Irwin/McGraw Hill International Edition, 1997, G.Kiely,

**BPH-401: PHARMACEUTICAL CHEMISTRY – VIII**  
**(MEDICINAL CHEMISTRY-II)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Drug Metabolism:** Activation of oxygen and electron transport system. Role of cytochrome P-450 monooxygenases. Drug metabolising reactions: phase-I (Oxidative, reductive & hydrolytic) and phase-II (conjugative) reactions. Drug activation and consequences for human health. Factors effecting drug metabolism. Models mimicking drug metabolising enzymes. (4)
2. **Prodrug Approach:** Basic concept. Common pro-moietics. Reversal of prodrugs chemical & enzymatic. Applications of prodrug approach to alter taste and odour, reduction of pain at injection site, reduction of gastrointestinal irritability, alteration of drug stability, increasing chemical stability, prevention of presystemic metabolism, prolongation of drug action, site specific drug delivery, reduction in toxicity, and alternation of drug metabolism. (4)
3. Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Study of synthesis of compounds mentioned against each class.
  - i. **Sulphonamides:** Sulphadiazine, Sulphamethoxazole, Sulphacetamide Sodium, Sulpharguanidine, Sulphasalazine.
  - ii. **Antibiotics:** General study including classification, synthesis of Methicillin, Ampicillin, Amoxycillin and Chloramphenicol, Structure of cloxacilin, clavulanic acid, cephalexin, doxycyclin.
  - iii. **Antifungal agents:** Griseofulvin, Nystatin, Ketoconazole, Amphotericin B, Miconazole.
  - iv. **Anti Malarial Drugs:** Chloroquine, Primaquine, Mepacrine, Proguanil, Pyrimethamine.
  - v. **Antineoplastic agents:** Chlorambucil, Thiotepa, Busulfan, 5-Fluorouracil, Cyclophosphamide, Mephalan, Methotrexate.
  - vi. **Anti-TB and anti-leprosy Drugs:** Isoniazid, Ethambutrol, Pyrazinamide, Dapsone, Structure of clofazimine and streptomycin.
  - vii. **Antiamoebic agents:** Metronidazole, Tinidazole, Diloxanide furoate
  - viii. **Anthelmintics:** Thiabendazole, Mebendazole, Niclosamide, Piperazine, Albendazole.
  - ix. **Anti-viral including anti-HIV agents:** Acyclovir, Zidovudine
  - x. **Immunosuppressives and immunostimulants:** To study only the general concept
  - xi. **Diagnostic Agents:** Propyl iodone, Sodium diatrizoate, Fluorescein sodium.
  - xii. **Anticoagulants:** Heparin, Coumarins, Phenindione derivatives.
  - xiii. **Amino acids:** Peptide, nucleotides and related drugs.
  - xiv. **Thyroid and Anti thyroid drugs:** Thyroxine, Liothyronine, Propylthiouracil, Carbimazole
  - xv. **Insulin, Insulin preparations and oral hypoglycaemic agents:** Chlorpropamide, Tolbutamide, Glibenclamide, Phenformin, Metformin, Tolazamide.
  - xvi. **Cardiovascular Drugs:** Clonidine, Methyldopa, Procainamide, Nifedipine, Isosorbide dinitrate, Prazocin, clofibrate.

**BPH-409: PHARMACEUTICAL CHEMISTRY – VIII  
(MEDICINAL CHEMISTRY-II)  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Synthesis of selected drugs and intermediates from the course content.
2. Monographs of selected official drugs including identification tests and tests for purity.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT  
OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**

1. Text Book of Organic Medicinal & Pharmaceutical Chemistry, Wilson & Grisvold, Lippincott Williams & Wilkins.
2. Principles of Medicinal Chemistry, William Foye, Lippincott Williams & Wilkins.
3. Medicinal Chemistry, Ashutosh Kar, New Age International, New Delhi.
4. A Text Book of Medicinal Chemistry, Surendra N. Pandeya, SG Publisher.
5. Fundamentals of Medicinal Chemistry, G.Thomas, Wiley Publication.
6. Medicinal Chemistry, V.K.Ahluwalia, Madhu Chopra, Ane Books India.

**BPH-402: PHARMACEUTICAL CHEMISTRY – IX**  
**(PHARMACEUTICAL ANALYSIS – II)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Electrophoresis:** Principle, instrumentation and applications. (3)
2. **Turbidimetry and Nephelometry:** Theory of light scattering, Nephelometry, Turbidimetry for Practical Analysis of dispersions, study of the working principles of instrument used for analysis and applications in Pharmacy. (4)
3. **Theoretical aspects, basic instrumentation, elements of interpretation of spectra and applications of the following analytical techniques should be discussed.** (56)
  - i. UV and Visible Spectroscopy.
  - ii. Fluorimetry.
  - iii. Infrared Spectrophotometry.
  - iv. Nuclear Magnetic Resonance Spectroscopy including C<sup>13</sup>-NMR.
  - v. Mass Spectrometry.
  - vi. Flame Photometry.
  - vii. Emission Spectroscopy.
  - viii. Atomic Absorption Spectroscopy.
  - ix. X-ray diffraction.
  - x. HPLC and HPTLC.
4. **Quality Assurance** (12)
  - i. GLP, TQM, Quality Review, quality documentation and International Conference of Harmonization (ICH) on quality.
  - ii. ISO, NDA and Intellectual Property Rights including copy right, patents and trade marks.
  - iii. Validation, quality audit, quality of equipment, validation of equipment and validation of analytical procedures.

**BPH-410: PHARMACEUTICAL CHEMISTRY – IX**  
**PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Exercises involving Nephelo-turbidimeter, spectroscopy, fluorimetry, flame photometry.
2. IR of samples with different functional groups
3. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest edition)**

1. A.H. Beckett and J.B. Stenlake, Practical Pharmaceutical Chemistry, Vol. I & II, The Athlone Press of the University of London (Latest Edition).
2. J. Bassett, R.C. Denney, G.H. Jeffery & J. Medhan, Vogel's Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis.
3. H. H. Willard, L.L. Merritt: Jr., and J.A. Dean, Instrumental Methods of Analysis, Van Nostrand Reinhold, New York.

4. L. G. Chatten, Pharmaceutical Chemistry, Vols. I and II, Marcel Dekker, New York.
5. K.A. Connors, A Textbook of Pharmaceutical Analysis, Wiley-Interscience, New York.
6. A.M. Knevel and F.E. Digangi, Jenkin's Quantitative Pharmaceutical Chemistry, McGraw-Hill Book Co., New York.
7. Indian Pharmacopoeia 1996 and 2007, Govt. of India, Ministry of Health, Delhi.
8. Silverstein, Basseler, Morrill- Spectroscopic identification of organic compounds (John Wiley and Sons. N.Y).

**BPH-403: PHARMACEUTICS-X  
(PHARMACEUTICAL TECHNOLOGY-II)  
THEORY**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Tablets:** Advantages, disadvantages and various types of tablets, formulation of tablets, various granulation techniques including slugging and equipments i.e. chilsonator, extractor, Day-Nauta granulator, double cone granulator, spray granulator. Tableting machinery for production of single layer, multilayer and compression-coated tablets.  
Physics of tablet making: strain gauge, measurement of applied and transmitted pressure, distribution of forces during compression, effect of applied pressure on relative volume and factors affecting strength of tablet.  
Tablet coating: Tablet coating principles, sugar coating, film coating, materials used in film coating, Film defects and specialized coating, coating processes i.e. air suspension coating and pan coating (using conventional, rear vented and perforated pans).  
Quality control of tablets. (30)
2. **Capsules:** Advantages, applications, formulation, large scale production and quality control of hard and soft gelatin capsules. (10)
3. **Microencapsulation:** Study of various processes employed for microencapsulation i.e. coacervation phase separation, multiorifice centrifuge, electrostatic deposition, vacuum deposition, spray drying, spray congealing, polymerization, complex emulsion, air suspension technique and pan coating. (10)
4. **Aerosols:** Definitions, advantages and nomenclature of aerosols, components of aerosol package, propellants, containers, valves, actuators, formulation of aerosols, types of systems, manufacture of pharmaceutical aerosols and quality control of aerosols. (10)
5. **Parenterals:** Types of parenteral products, formulation, containers, pyrogens, production facilities, production procedures for small volume and large volume Parenterals, large scale production of injectable grade water and quality control of parenterals. (10)
6. Design, development, production and evaluation of controlled release preparations. (5)

**BPH-411: PHARMACEUTICS-X  
(PHARMACEUTICAL TECHNOLOGY-II)  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Microencapsulation by coacervation phase separation brought about by change of temperature.
2. Microencapsulation by coacervation phase separation brought about by addition of nonsolvent.
3. Formulation, preparation and evaluation of paediatric tablets.
4. Preparation and evaluation of aspirin tablets.
5. Coating of tablets.
6. Evaluation of coatings.
7. Granulation by slugging.
8. Determination of BA and M/G factor.
9. Formulation of hard capsules.

10. Quality control of soft and hard capsules.
11. Preparation of small volume parenterals.
12. Test for pyrogen.
13. Preparation and evaluation of large volume parenteral.
14. Formulation, preparation and evaluation of aerosol.
15. Microencapsulation by complex emulsion method.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**

1. L. Lachman et. al, Theory and Practice of Industrial Pharmacy, Varghese publishing House, Hind Rajasthan Building, Dodar, Bombay- 400014.
2. J. R. Robinson & Vincent Pel-Lee. Controlled drug delivery, Marcel Dekker, New York, 1987.
3. M. H. Rubinstein Pharmaceutical Technology, (Tabletting Technology), Volume-1, Ellis Horwood Limited, John Wiley & Sons, 1987.
4. Bentley's Text Book of Pharmaceutics, ELBS
5. Remington's Pharmaceutical Sciences, Mack publishing Company, Pennsylvania, USA.



**BPH-404: PHARMACEUTICAL MANAGEMENT AND PSYCHOLOGY  
THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **General Management:** Concept, functions and principles. Techniques of management of objectives management by exception, management by crisis, management by departmentation. Span of management, Delegation: Concept and significance, authority and power, centralization and decentralization, line and staff conflicts: Motivation: Need for recognizing motivating factors, hierarchy of human needs, theories X and Y: Communication: purpose, importance process, barriers and breakdown in communication, making communication effective. (6)
2. **Personnel Management:** Definition, importance and objectives, qualities and functions of personnel manager: Human resource planning: Meaning and need, job analysis, job description and job specification. Recruitment and selection process: Sources of manpower, recruitment policies, selection procedures. Promotion, demotion, transfer and separation. Employee training: Need, importance, principles of training, training methods. Performance appraisal: Meaning, objectives, approaches and methods. Nature definition and factors affecting personality development (7)
3. **Principles of Material Management:** Scope problems cost of item, vendor development, vendor audit (suppliers & quotations) and Ordering procedures. Procurement of raw material and packaging material as per warehouse system, inwarding of material and goods, statutory records vis-à-vis schedule M requirements, issue of materials to production department and documentation systems thereof. Central Excise Act: Chapters 28, 29, 30, records thereof CENVAT, record keeping and total documentation of central excise, filling of central excise papers, classification and price list, C. E. Tariff for AHC products, general exemption No. 1 C.E. Tariff, Dispatch of goods from Pharmaceutical manufacturing unit. (7)
4. **Introduction to Financial management:** Sources of finance, book keeping, loans and repayment (4)
5. **Marketing and Production Management:** Meaning, function and problems: functions of marketing executives. Product life cycle, product line policies and strategies. Concept and components of marketing information system. Ethical and unethical marketing of Pharmaceutical products. Pricing of Pharmaceutical formulations. DPCO considerations. Production planning & control, production process analysis, plant location and layout. (7)
6. **Psychology:** Nature, definition and scope, relation of psychology in pharmaceuticals. (3)
7. **The chemistry of behavior:** Drugs and behavior, Drug addiction. (4)
8. **Motivation:** Nature and definition, hunger, thrust. (2)
9. **Intelligence:** Nature, definition and measurement. (3)
10. **Mental disorders:** Nature, causes and psychological methods of treatment. (7)

**Books Recommended (Latest edition)**

1. Principles and methods of Pharmacy management, Harrg A. smith Loa & Febiger, Philadelphia.
2. Personnel Management by Edwin B. Flipppo.
3. Materials Managemnet by Gopalkrishna, Prentice Hall, India .
4. Marketing Management analysis, planning and control, Philips Kotler.
5. Central excise tariff, Govt. of India publication.
6. Relevant Acts & Rules published by the Government of India.
7. Principles and practices of management Koontz/o Donnal.
8. Marketing and managerial introductions, J. C. Gandhi.
9. Boren, R. A. (2007) Psychology (Fifth Edition), New Delhi: Pearson.
10. Thompson, R.E. (1975) Introduction to Physiological Psychology, New York: Harper & Row.
11. Carson, R. C., Butcher, J. N. and Mineka, S. (2004) Abnormal Psychology and Modern life, Naw Delhi: Pearson.

**BPH-405: PHARMACEUTICS-XI**  
**(PHARMACEUTICAL PACKAGING TECHNOLOGY)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Introduction:** Definition and objectives of packaging, hazards encountered by the package, selection of a suitable package, objectives, selection and different types of closures, child resistant packaging, tamper proof packaging, and cushioning design. (6)
2. **Packaging materials:** Detailed study with regard to materials employed for packaging of pharmaceuticals with main emphasis on glass, plastics, metals rubber, paper board, corrugated boards. Evaluation of various packaging materials. (7)
3. **Films for Flexible Packages:** Ideal characteristics, formulation and different types of films for flexible package, production of single layer and oriented films, production of laminates, evaluation of films. (5)
4. **Strip Packing:** Advantages of Strip Packing, Strip packaging machinery, strip package design and evaluation of strip package. (4)
5. **Blister Packaging:** Advantages of Blister packing, Blister packing materials, blister packing machinery, blister package design and evaluation of blister package. (4)
6. **Pouch packaging:** Advantages of Pouch packing, pouch packing machinery, types of pouch package, pouch package design and evaluation of pouch package. (4)
7. **Liquid Formulation Packaging:** Factors influencing selection of liquid filling machinery. Balanced and unbalanced constant level filling, volumetric, gravimetric, level sensing, time fill, peristaltic and overflow liquid filling machinery. (5)
8. **Dry products Filling machinery:** Factors influencing selection of solid filling machinery. Augers, vibrating feeders, gravity flow systems, belt feeders, screw feeders, cascade filling systems, vacuum filling systems, weighing systems. (5)
9. **Sterile Product Packaging:** Various types of containers used for sterile products like ampoules, vials, bottles for I.V. fluid, etc. Types of closures used for the sterile products. Sterile product filling and sealing machinery i.e. ampoule filling and sealing machine. Evaluation of the sterile product packages. (5)
10. **Labeling:** Objectives, legal requirements, packaging inserts, bar code, bar code symbologies, types of labels and labeling machinery. (5)

**Books Recommended (Latest editions)**

1. Wiley Encyclopedia of Packaging Technology. Aaron L Brody and Kenneth S Marsh, John Wiley and Sons, Inc.
2. Encyclopedia of Pharmaceutical Technology, James Swarbrick, James C. Boylan, Marcel Dekker, Inc.
3. Pharmacy Law and Practice. Jonathan Merrills and Jonathan Fisher. Blackwell Science.
4. What is packaging design. Giles Calvier. Rotovision SA.
5. International Pharmaceutical Product Registration: Aspects of Quality, Safety and Efficacy. Cartwright, A. C., Matthews, Brian. Taylor & Francis Routledge.

**BPH-406: PHARMACOLOGY –IV  
THEORY**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Drugs acting on the Gastrointestinal Tract:** (6)
  - i. Antacids, antisecretory and anti-ulcer drugs.
  - ii. Laxative and antidiarrhoeal drugs.
  - iii. Appetite stimulants and suppressants.
  - iv. Emetics and anti-emetics.
  - v. Miscellaneous: carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.
  
2. **Pharmacology of Endocrine system:** (8)
  - i. Hypothalamic and pituitary hormones
  - ii. Thyroid hormones and antithyroid drugs, parathormone calcitonin and vitamin D.
  - iii. Insulin, oral hypoglycemic agents and glucagon.
  - iv. ACTH and corticosteroids.
  - v. Androgens and anabolic steroids.
  - vi. Drugs acting on the uterus.
  
3. **Chemotherapy:** (15)
  - i. General principles of chemotherapy.
  - ii. Sulphonamides and co-trimoxazole.
  - iii. Antibiotics, penicillins, cephalosporins, betalactams, tetracyclines, aminoglycosides, chloramphenicol, erythromycin, quinolones and miscellaneous antibiotics.
  - iv. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.
  - v. Chemotherapy of malignancy and Immunosuppressive agents.
  
4. **Principles of Toxicology:** (4)
  - i. Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates opioids, organophosphorus and atropine poisoning.
  - ii. Heavy metals and heavy metal antagonists.
  
5. **Introduction to Clinical Pharmacy.** (3)
6. **Basic concepts of Pharmacotherapy:** (15)
  - i. Clinical Pharmacokinetics and individualisation of drug therapy.
  - ii. Drug delivery systems and their biopharmaceutic and therapeutic considerations.
  - iii. Drug use during infancy and in the elderly (Paediatrics & geriatrics).
  - iv. Drug use during pregnancy.
  - v. Drug induced disease.
  - vi. The basics of drug interactions.
  - vii. General principles of clinical toxicology.
  - viii. Interpretation of clinical laboratory tests.
7. **Important disorders of organ system and their management:** (20)
  - i. Cardiovascular disorders: hypertension, congestive heart failure, angina, acute myocardial infarction and cardiac arrhythmias.
  - ii. CNS disorders: epilepsy, parkinsonism, schizophrenia, depressions.
  - iii. Respiratory disease: asthma, COPD.

- iv. Gastrointestinal disorders: peptic ulcer disease, ulcerative colitis, hepatitis and cirrhosis.
  - v. Endocrine disorders: Diabetes Mellitus and thyroid disorders.
  - vi. Infections disease: tuberculosis, urinary tract infection, enteric infections, upper respiratory infections.
  - vii. Mematopoietic disorders: anemias.
  - viii. Joint and connective tissue disorders: rhematie disease gout and hypercurricemia.
  - ix. Neoplastic disease: acute leukaemias, hodkin's disease and Carcinoma of breast.
8. **Therapeutic drug monitoring.** (2)
9. **Concept of essential drugs and rationale drug use.** (2)

**BPH-412: PHARMACOLOGY –IV  
PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Experiments on isolated preparations:
2. To calculate the  $PA_2$  value of atropine using acetylcholine as an agonist on rat ileum preparation.
3. To calculate the  $PA_3$  value of mepyramine or chlorpheniramine using histamine as agonist on guinea pig ileum.
4. To find out the strength of the given sample on agonist (e.g. Acetylcholine, Histamine, 5-HT, Oxytocin etc.) using a suitable isolated muscle preparation by-
  - Matching Assay
  - Two Point Assay
  - Three Point Assay
5. Pharmacology of the Gastrointestinal Tract: To study the anti-secretory and anti-ulcer activity using pylorus ligated rats.
6. Clinical Pharmacology: To demonstrate the effects of certain clinically useful drugs on human volunteers like:-
  - i. Anti-histamines
  - ii. Anti-anxiety and sedative drugs
  - iii. Analgesics.
  - iv. Betablockers.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**

1. Essentials of Medical Pharmacology, K.D.Tripathy, JAYPEE.
2. Pharmacology & Parmacotherapeutics, Satoshkar & Bhandarkar, Popular Publication.
3. Pharmacology, Prasun Kumar Das, S.K.Bhattacharya, Elsevier.
4. The Pharmacological Basis of Therapeutics, Goodman & Gilman, Mc Graw Hill.
5. Text book of Pharmacology, S.D. Sethi, Elsevier.
6. Pharmacology, Rang, Dale and Ritter, Churchill Living Stone.
7. Basic & Clinical Pharmacology, B.G.Katzung, Lange.
8. Pharmacology, Mary J, Mycer, Richard A, Lippincott William & Willans.

**BPH-407: PHARMACEUTICS-XII**  
**(BIOPHARMACEUTICS AND PHARMACOKINETICS)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting. (3)
2. **Biopharmaceutics:** (7)
  - a. Passage of drug across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
  - b. Factors influencing absorption-physicochemical, physiological and pharmaceutical.
  - c. Drug distribution in the body, plasma protein binding.
3. **Pharmacokinetics:** (30)
  - i. Significance of plasma drug concentration measurement.
  - ii. Compartmental model: definition and scope.
  - iii. Pharmacokinetics of drug absorption-zero order and first order absorption rate constant using Wagner-Nelson and Loo-Riegelman method.
  - iv. Volume of distribution and distribution coefficient.
  - v. Compartmental kinetics-one compartment and two compartment models. Determination of pharmacokinetics parameters from plasma and urine data after drug administration by intravascular and oral route.
  - vi. Curve fitting (method of residuals), regression procedures.
  - vii. Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance.
  - viii. Hepatic elimination of drugs, first pass effect, extraction ratio, hepatic clearance, biliary excretion, enterohepatic circulation.
  - ix. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaels Menten equation, determination of non-linearity (saturation mechanism).
4. **Clinical pharmacokinetics:** (5)
  - a. Definition and scope.
  - b. Dosage adjustment in patients with and without renal and hepatic failure.
  - c. Dosage regimen adjustment for repeated therapy.
  - d. Introduction to Pharmacokinetics drug interactions and its significance in combination therapy.
5. **Bioavailability and bioequivalence:** (5)
  - a. Measures of bioavailability,  $C_{max}$ ,  $t_{max}$  and Area Under Curve (AUC).
  - b. Design of single dose bio-equivalence study and relevant statistics.
  - c. Overview of regulatory requirements for conduction of bio-equivalence study.

**BPH-413: PHARMACEUTICS-XII**  
**(BIOPHARMACEUTICS AND PHARMACOKINETICS)**  
**PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Intestinal transport of drugs including plotting of standard curve (salicylic acid, riboflavin).
2. Protein binding of drugs through diffusion cell.
3. Determination of dissolution rate constant using Noyes- Whitney equation.

4. Determination of effect of pH on dissolution rate constant.
5. Determination of urinary excretion of sulfonamides / any other drug.
6. Determination of partition coefficient of hydrophilic and hydrophobic drugs in water/ octanol system
7. In-vitro evaluation of sustained release versus traditional dosage forms (capsules and tablets).
8. In-situ absorption studies of paracetamol.
9. Study of release rate of drug through various ointment bases using agarplates/ dialysis membrane.
10. Study of effect of various additives on rate of release of drugs using dialysis method.
11. To study acid neutralizing capacity and rapidity of action of antacid tablets.
12. Determination of bioavailability of sulfonamides / any other drug.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**

1. W. A. Ritschel Handbook of Basic Pharmacokinetics, Drug Intelligence Publications, Hamilton.
2. J. G. Wagner, Fundamentals of Clinical Pharmacokinetics. Drug Intelligence publications, Hamilton.
3. Remington's Pharmaceutical Sciences, Chapter Bioavailability and Bioavailability Testing, Mack publishing Co, Easton, Pennsylvania, USA.
4. Rowland, Malcolm and Tozer, Thomas Ng, Clinical Pharmacokinetics, Lea Febiger, Philadelphia.
5. Biopharmaceutics & Pharmacokinetics,- A Treatise, D.M. Brahmankar & S.B.Jaiswal, Vallabh Prakashan, Delhi.
6. Pharmacokinetics, Gibaldi & D.Perrier, Marcel Dekker, New York.
7. Biopharmaceutics & Clinical Pharmacokinetics – An Introduction, R.E.Notari, Marcel Dekker, New York, 4th Ed. – 2008.

**BPH-408: PHARMACOGNOSY –IV**  
**(PHARMACEUTICAL PLANT BIOTECHNOLOGY)**  
**THEORY**

**Max. Marks: 80**

**Total Hours: 50 (2hrs/week)**

**Note: Examiner to set eight questions and the candidates are required to attempt any five.**

1. **Introduction:** Pharmaceutical Biotechnology, concepts and basic techniques in tissue culture and their application in Pharmaceutical Sciences. (3)
2. The Pharmacists' practitioner's role in Biotechnology, Introduction and various Biotechnological products. (4)
3. **Drug Delivery Aspects of Biotechnological Products:** Introduction, Stability of peptides and proteins, Non conventional Routes of Administration. (4)
4. **Micropropagation:** Organogenesis and somatic embryogenesis, clinical propagation of elite germplasm of Pharmaceutical importance. Technical problems in micropropagation such as vitrification, explant exudation etc. Effect of microenvironment on micropropagation. (6)
5. Production and application of synthetic seeds. (3)
6. The use of Non-classical techniques in the production of secondary metabolites by Plant Tissue Culture: Plant cell cultures as new alternative sources of secondary natural products. Production of Endogenous compounds and Transformation Involving Foreign Genes. (5)
7. Production of flavoring compounds through tissue culture. (3)
8. Antimicrobial agents from plant cell culture. (4)
9. Production of anti tumor compounds by plant cell culture. (3)
10. Increasing secondary metabolite production in plant cell culture with fungal elicitors. (3)
11. Immobilization of cell systems for the production of plant metabolites. (3)
12. Production of edible vaccines by successful expression of foreign antigens in genetically engineered plants. (3)
13. Application of Bioreactors in large scale production of useful Pharmaceutical products. (3)
14. Application of Biotechnology in Pharmacy and intellectual property rights. (3)

**BPH-414: PHARMACOGNOSY –IV**  
**PRACTICAL**

**Max. Marks: 80**

**Total Hours: 75 (3hrs/week)**

1. Laboratory design, Aseptic techniques, Media Preparation.
2. Initiation and maintenance of callus cultures.
3. Initiation and maintenance of plant cell suspension cultures.
4. Micro droplet and single cell nurse culture.
5. Culture organ explants and micro propagation by axillary bud proliferation and somatic embryogenesis.
6. Production of secondary metabolites Anthocyanin pigments and Aromatic compounds.
7. Synthesis of artificial seeds and study of their delivery system.

**NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended (Latest editions)**



1. Biotechnology and Pharmacy, John M. Pazzute, Michael E. Johnson, and Hanri R. Manasse, Jr.
2. An Introduction to plant Tissue culture by M. K. Razdan, 1994, Oxford & IEH.
3. Plant cell tissue and organ culture fundamental methods by O. L. Gambarg and G. C. Phillips, 1996, Narosa Publishing House.
4. Secondary metabolism in plnat cell cultures by phillip Marris, Alan H. Scragg, Angle Staff and Michael W. Fowlar 1986, Cambridge University Press.
5. Biotechnology in Agriculture and Forestry Vol. IV, Medicinal and arematic plants I by V. P. S. Bajaj 1988, Springer Verlag.
6. Biotechnological applications of plant cultures by peter D. Shargoel and That T. Ngo, 1994. CRC Press Inc.