

Department of Pharmaceutical Sciences

TEACHING LOAD and SCHEME OF EXAMINATIONS FOR THEORY AND PRACTICAL PAPERS FOR B.PHARMACY COURSE w.e.f. 2014-15

B. Pharm. VII th Semester

S. No.	Name of the subject	Theory (hrs)	Marks 80(Main)+ 20 (Int.Asst.)	Practicals (hrs)	Marks 80(Main)+ 20 (Int.Asst.)
BPH-7.1	Pharmaceutics X (Pharmaceutical Technology)	6	100	6	100
BPH-7.2	Pharmaceutical Chemistry VIII (Anal. Chem. II)	6	100	6	100
BPH-7.3	Pharmacognosy IV	5	100	6	100
BPH-7.4	Pharmacology IV (Pharmaceutical Biotechnology)	5	100	--	--
	Total =	22	400	18	300

Total = 40 hrs / week in VII th Semester; Total marks in VIIth Semester = 700

B. Pharm. VIII th Semester

S. No.	Name of the subject	Theory (hrs)	Marks 80(Main)+ 20 (Int.Asst.)	Practicals (hrs)	Marks 80(Main)+ 20 (Int.Asst.)
BPH-8.1	Pharmaceutical Chemistry IX (Medicinal chemistry II)	6	100	6	100
BPH-8.2	Pharmacology V	6	100	6	100
BPH-8.3	Pharmaceutics XII (Biopharmaceutics)	6	100	6	100
BPH-8.4	Pharmaceutics XIII (Pharmaceutical Packaging)	4	100	--	--
	Total =	22	400	18	300

Total = 40 hrs / week in VIII th Semester; Total marks in VIIIth Semester = 700

Note:

1. There shall be 80 marks for Main Theory / Practical Examinations and 20 marks for Internal Assessment, in all theory / practical papers. For Internal Assessment, the "Rules for award of Internal Assessment for UG courses", as applicable from time to time, shall be implemented.
2. The distribution of marks for Main Theory Examination (80 marks) shall be as follows:

Each Question shall be of 16 marks ; Total Marks = 80		
Question One	Covering the entire syllabus	Short answer type questions
Question Two	Covering the Unit One	Any one question, out of two questions, need to be answered
Question Three		
Question Four	Covering the Unit Two	Any one question, out of two questions, need to be answered
Question Five		
Question Six	Covering the Unit Three	Any one question, out of two questions, need to be answered
Question Seven		
Question Eight	Covering the Unit Four	Any one question, out of two questions, need to be answered
Question Nine		

B.PHARM. 7TH SEMESTER

BPH – 7.1 PHARMACEUTICS X (Pharmaceutical Technology)

THEORY

Lectures: 6 hrs / week

Unit - I

1. **Tablets:** Types of tablets, formulation of tablets, various granulation techniques including slugging, chilsonator, extractor, Day-Nauta granulator, double cone granulator, spray granulator. Tableting machinery for production of single layer, multilayer and compression coated tablets.
Tablet coating: sugar coating, film coating and compression coating, coating processes i.e. air suspension coating and pan coating (using conventional, rear vented and perforated pans).
Quality Control of Tablets.

Unit - II

2. **Capsules:** Types, material, machinery, manufacture, sizes and other pharmacopoeial requirements of capsule shells Formulation, large-scale production and quality control of *Hard* and *Soft* capsules. Applications, advantages and disadvantages of capsule dosage form.
3. **Microencapsulation:** Terminology, advantages and applications. 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.
4. **Aerosols:** Definitions, advantages and applications, liquified-gas system, compressed gas system, propellants, containers, valves, cold-filling process, pressure filling process and quality control of aerosols.

Unit - III

5. **Parenterals:** Types of parenteral products and formulation considerations. *Types and Quality of Water* used in Parenterals and requirement of Clean room.
Production facilities, methods of production, containers and packaging of Small Volume and Large Volume Parenterals and their *quality control*.
Large scale production of Injectable Grade Water
Quality control of parenterals.
6. **Controlled and Novel Drug Delivery:** Classification, design, development, production and evaluation of Oral and Controlled Drug Delivery Systems.

Unit - IV

7. **Process Validation:** Process validation methods for operations involved in the production of Tablets.
8. **Scale up Techniques :** Basic Concepts, Scale up of Tablets.
9. **Radiopharmaceuticals:** Fundamentals of Radio-pharmacy, therapeutic applications of isotopes, diagnostic applications of isotopes, use of radioisotopes in basic research, product development, product production, process control and quality control.

PRACTICALS

(06 hrs per week)

Number of experiments based on aforementioned theory

Books Recommended

1. "Remington' Pharmaceutical Sciences", Mack Publishing Co., P.A.
2. Leon Lachman, H A Liberman and J L Kanig, "The Theory and Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia
3. "Bentley's Textbook of Pharmaceutics", ELBS Bacilliere Tindall
4. " Modern Pharmaceutics",ed G S Banker and Rhodes, Marcel Dekker Inc., NY
5. S Turco and R E king, " Sterile Dosage Forms", Lea & Febiger, Philadelphia
6. H A Liberman, L Lachman and J B Schwartz," Pharmaceutical Dosage Forms: Tablets", Vol. 1, Marcel Dekker Inc, NY
7. Encyclopedia of Pharmaceutical Technology by Swarbrick
8. Commercial's Hand book of Drug Laws
9. Pharmacopoeia of India.

BPH – 7.2 PHARMACEUTICAL CHEMISTRY VIII (Analytical Chemistry II)

THEORY

Lectures: 6 hrs / week

Unit - I

Quality Assurance: Philosophy of GLP, ISO-9000, TQM, quality Review and Quality documentation. Regulatory aspects: Legislation & regulatory control, regulatory drug analysis, interpretation of analytical data. Validation /Quality audit; Quality of equipment, Validation of equipment, Validation of analytical procedures.

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.

Unit - II

The theoretical aspects, basic instrumentation, elements of interpretation of spectra and applications of the following analytical techniques should be thoroughly studied

- a) Ultraviolet and Visible Spectrophotometry.
- b) Fluorimetry.
- c) Infrared spectrophotometry.

Unit - III

The theoretical aspects, basic instrumentation, elements of interpretation of spectra and applications of the following analytical techniques should be thoroughly studied

- a) Flame photometry.
- b) Atomic absorption spectroscopy
- c) Nuclear magnetic resonance spectroscopy including ^{13}C NMR.
- d) Mass spectroscopy.

Unit - IV

Fundamentals of Chromatography. Introduction and theory of underlying different types of chromatography techniques like- Column chromatography, thin layer chromatography, paper and circular chromatography, adsorbents and solvents used in these techniques. Gas chromatography: introduction, principles of gas chromatography, basic GLC apparatus, sample introduction, column, column efficiency, solid support, liquid phases, branches of gas chromatography, detectors, temperature effect, application of GLC in pharmaceutical analysis. HPLC: introduction and nomenclature, instrumentation, liquid solid chromatography, liquid liquid chromatography, exclusion chromatography, HPLC columns, solvent selection in HPLC, data handling in HPLC, applications of HPLC, HPTLC-instrumentation and applications..

PRACTICALS

(6 hrs / week)

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

List of Books Recommended

Text Books

1. William Kemp, "*Organic Spectroscopy*", Macmillan Press Ltd.
2. Willard, Merritt, Dean, Settle, "*Instrumental Method of Analysis*", CBS Publishers, New Delhi.
3. K. A. Connors, "*A Textbook of Pharmaceutical Analysis*", Wiley Interscience, New York.

Reference Books

4. Silverstein et al., "*Spectrometric Identification of Organic Compounds*".
5. Skoog, "*Fundamental of Analytical Chemistry*".
6. John R. Dyer, "*Applications of Absorption Spectroscopy of Organic Compounds*".

BPH – 7.3

PHARMACOGNOSY IV

THEORY

Lectures: 5 hrs / week

Unit - I

1. Role of medicinal and aromatic plants trade in national economy of a country and introduction of world-wide trade regulations of herbal products.
2. Current trade status and potential of some commercially important plants like diosgenin (dioscorea), taxol (taxus sps), digitalis, vinca, papain, cinchona, ginseng and laxative plants.

Unit - II

3. Govt and private institutions and industries working in the study, research and analysis of medicinal and aromatic plants in India.
4. Traditional and recent methods of extraction of bioactive compounds alongwith their merits and demerits.

Unit - III

5. Marine pharmacognosy: Novel medicinal agents from marine sources.
6. Introduction of standardization and quality control of herbal drugs and formulations. Process of preparation of standardized extracts.

Unit - IV

7. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Application of plant tissue culture in pharmacognosy.
8. Natural allergens and photosensitizing agents.

PRACTICALS

(6 hrs per week)

Number of experiments based on aforementioned theory and including the following:

1. Isolation and analysis of some selected phytoconstituents studied in theory.
2. Extraction of volatile oils and their chromatographic profiles.
3. Some experiments on basic techniques of plant tissue culture.

List of Recommended Books

1. Brain, K.R. and Turner, T.D., "The Practical Evaluation of Phytopharmaceuticals", Wright Sciencetechnica, Bristol.
2. "Export Potential of Selected Medicinal Plants", Prepared by Basic Chemicals, Pharmaceuticals and Cosmetic export Promotion Council, Bombay, and other reports.
3. "Herbal Drug Industry", Eastern Publishers.
4. Pridham, J.B. and Swain, T., "Biosynthetic Pathways in Higher Plants", Academic Press, New York
5. Wealth of India. Council of Scientific & Industrial Research, India.
6. "Supplement to Cultivation and Utilization of Medicinal Plants", RRL, Jammu.
7. Chopra, R.N., Nayar S.L. and Chopra, I.C., "Glossary of Indian Medicinal Plants", C S I R, New Delhi.
8. "Cultivation and Utilization of Aromatic Plants", RRL Jammu.

BPH – 7.4 PHARMACOLOGY IV

THEORY

Lectures: 5 hrs / week

Unit-I

1. Introduction to Biotechnology:

- a. Definition, history, different branches and scope of biotechnology.
- b. Therapeutic and pharmaceutical applications of biotechnology.

1. Enzymes:

- a. Production of enzymes
- b. Methods of immobilization of enzymes: Adsorption, entrapment, microencapsulation and covalent coupling
- c. Analytical applications of immobilized enzymes
- d. Enzymes used in DNA recombinant technology
- e. Study of enzymes such as hyaluronidase, streptokinase, streptodornase, amylases and protease etc.

Unit-II

2. Immunology and Immunological preparations:

Cellular and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications.

3. Genetic engineering:

- a. Concept and techniques of genetic engineering (gene transfer via transduction, transformation, conjugation, protoplast fusion and gene cloning).
- b. DNA replication, its repair and recombination.
- c. Applications of genetic engineering for production of pharmaceuticals

Unit III

4. Tissue Culture and Cell Culture Technology:

- a. Introduction to cell culture and culture media
- b. Culture procedures and primary cultures
- c. Evolution of mammalian cell lines
- d. Cloning of cell lines
- e. Animal tissue culture and organ culture
- f. Embryo culture and egg culture
- g. Culturing of human embryonic stem cells
- h. *In vitro* fertilization in humans

5. Biotechnology in the field of pharmacy:

- a. Study and production of drugs obtained from biotechnology: Erythropoietins, interferons, vaccines, anticoagulants / thrombolytic agents, monoclonal antibodies, hormones etc.
- b. Design of drug delivery system for biotechnological products

Unit IV

6. Oncogenes and Tumor Suppressor Genes:

- a. Viral and cellular oncogenes.
- b. Tumor suppressor genes from humans.
- c. Structure, function and mechanism of action of pRB and p53 tumor suppressor proteins.

List of Books Recommended

Text Books

1. "Biotechnology and its Applications in Pharmacy", CBS Publishers.
2. S P Vyas and V Dixit, "Pharmaceutical Biotechnology", CBS Publishers.

Reference Books

1. B R Glick and J J Pasternak, "Molecular Biology; The Principle and Applications of Recombinant DNA", ASM Press.
2. "Harper's Review of Biochemistry", Lange Medical Publications.
3. Prescott and Dunn, "Industrial Microbiology", Mcgraw Hill Book Company Inc.

B.PHARM. 8TH SEMESTER

BPH – 8.1

PHARMACEUTICAL CHEMISTRY IX
(Medicinal Chemistry II)

THEORY

Lectures: 6 hrs / week

Unit I

Drug metabolism. Functionization reactions (Phase I)- Oxidation, reduction and hydrolytic reactions. Conjugation reactions: Glucuronic acid conjugation, sulphate conjugation, conjugation with amino acids, glutathione conjugation, acetylation, methylation. Chemistry and principles of prodrug design. QSAR by Hansch analysis

Unit II

Mode of action, uses, structure activity relationship including physico-chemical properties of the following classes of drugs: Drugs acting on Central nervous System: General anesthetics, Local anesthetics, Hypnotics and sedatives, opioid analgesics, antitussives, anticonvulsants, antiparkinsonian drugs, CNS stimulants, psychopharmacological agents (neuroleptics, antidepressants, anxiolytics). Steroids and related drugs: Steroidal nomenclature and stereochemistry; androgens and anabolic agents; oestrogens and progestational agents; adrenocorticoids.

Unit III

Chemotherapeutic agents: Antibacterials including antimetabolites. Antibiotics (b-lactams, tetracyclines, aminoglycosides, polyenes, cycloserine, chloramphenicol). Antiviral agents including anti-HIV agents, Antineoplastics, Antifungals, Antimycobacterials, Anthelmintics. Antiprotozoals. Antiseptics and disinfectants. Urinary antiseptics.

Unit IV

Synthetic procedure for following drugs: Procaine, Lignocaine, Cinchocaine, Thiopentone, Phenobarbitone, Hexobarbitone, Diazepam, Mehtaqualone, Phenytoin, Troxidone, Pethidine, N-methylmorphine, Chlorpromazine, Trifluoperazine, Amitryptiline, Nikethamide, Cholesterol, Dihydroepiandrosterone, Oestradiol, Diethylstilbosterol, Progesterone, Cortisone acetate, Diethyl carbamazine, Thiabendazole, Sulphadiazine, Sulphamethoxazole, Trimethoprim, Chloramphenicol, Nalidixic acid, Norfloxacin, Nitorfurantoin, Isoniazid, Ethambutol, Clofazimine, Ketoconazole, Clotrimazole, Chlorambucil, Melphalan, Thio-TEPA, 5-Fluorouracil, Cisplatin.

PRACTICALS

(6 hrs / week)

1. Number of experiments based on QSAR
2. Synthesis of Methyl orange; Adduct of anthracene and maleic anhydride; P-nitroaceanilide; Sulfanilic acid; Sorbic acid; Mannich reaction; Methyl salicylate; Bentriazole; Benzamide; Bakelite

List of Books Recommended

Text Books

1. Wilson and Gisvold's "Textbook of Organic Medicinal and Pharmaceutical Chemistry", J. Lippincot Co., Philadelphia.
2. W O Foye, "Principles of Medicinal Chemistry", Lea and Febiger, Philadelphia.

Reference Books

3. C. Hansch, "Comprehensive Medicinal Chemistry", Pregman Press Oxford.
4. M. E. Wolff, Ed., "Burger's Medicinal Chemistry", John Wiley & Sons, New York.
5. T. Nogardy, "Medicinal Chemistry – A Biochemical Approach", Oxford University Press, New York, Oxford.
6. B. N. Ladu, H. G. Mandel and E. L. Way, "Fundamentals of Drug metabolism and Disposition", William and Walkins Co., Preston Street, Baltimore.
7. Martindale, "The Extra Pharmacopoeia", The Pharmaceutical Press, London.

BPH – 8.2

PHARMACOLOGY V

THEORY

Lectures: 6 hrs / week

Unit-I

1. **Drugs acting on the Gastrointestinal Tract:**
 - a. Antacids, antisecretory and anti-ulcer drugs.
 - b. Laxative and antidiarrhoeal drugs.
 - c. Appetite stimulants and suppressants.
 - d. Emetics and anti-emetics.
 - e. Miscellaneous: carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.
2. **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
- 3. Drugs acting on the urinary system**
- a. Fluid and electrolytic balance
 - b. Diuretics
- 4. 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

Unit II

- 5. Drugs acting on the respiratory system**
- a. Anti-asthmatic drugs including bronchodilators
 - b. Anti-tussive and Expectorants
 - c. Respiratory stimulants
- 6. Chemotherapy:**
- a. General principles of chemotherapy.
 - b. Sulphonamides and co-trimoxazole.
 - c. Antibiotics, penicillins, cephalosporins, betalactams, tetracyclines, aminoglycosides, chloramphenical, erythromycin, quinolones and miscellaneous antibiotics.
 - d. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.
 - e. Chemotherapy of malignancy and Immunosuppressive agents.

Unit III

- 7. Principles of Toxicology:**
- a. Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorus and atropine poisoning.
 - b. Heavy metals and heavy metal antagonists
- 8.** Introduction to Clinical Pharmacy.
- 9.** Therapeutic drug monitoring.
- 10.** Concept of essential drugs and rationale drug use.
- 11. Basic concepts of Pharmacotherapy:**
- a. Clinical Pharmacokinetics and individualisation of drug therapy.
 - b. Drug delivery systems and their biopharmaceutic and therapeutic considerations.
 - c. Drug use during infancy and in the elderly (Paediatrics & Geriatrics).
 - d. Drug use during pregnancy.
 - e. Drug induced disease.
 - f. The basics of drug interactions.
 - g. General principles of clinical toxicology.
 - h. Interpretation of clinical laboratory tests.

Unit IV

- 12. Important disorders of organ system and their management:**
- a. Cardiovascular disorders: hypertension, congestive heart failure, angina, acute myocardial infarction and cardiac arrhythmias.
 - b. Respiratory disease: asthma.
 - c. Gastrointestinal disorders: peptic ulcer disease, ulcerative colitis, hepatitis and cirrhosis.
 - d. Haematopoietic disorders: anemias.
 - e. Infectious disease: tuberculosis, urinary tract infection, enteric infections, upper respiratory infections.
 - f. Neoplastic disease: acute leukemias, Hodgkin's disease and Carcinoma of breast.

PRACTICALS

(6 hrs / week)

Demonstration of effect of various drugs on following pathologies using suitable animal models:

1. Stress
2. Alzheimer's disease
3. Parkinson's disease
4. Diabetes
5. Diarrhoea
6. Hypertension

Demonstration of techniques and equipments utilized in pharmacological Research

7. Microtome
8. Langendorff's apparatus
9. Autoanalyzer
10. Electrophoresis

11. Neurotransmitter estimation
12. Estimation of Oxidative stress

Demonstration of Bioassay procedures

13. matching bioassay
14. bracketing bioassay
15. interpolation bioassay
16. 4 point bioassay
17. pA2 determination
18. pD2 determination
19. Delineation of mechanism of action by drug antagonism
20. Delineation of mechanism of action by drug agonism

Simulations on pharmacological experimentation

Alternatives to Animal Experimentation

To demonstrate the procedures for recording the effects of self chosen placebos or samples on human behaviors:

21. anxiety
22. sedation
23. Analgesia
24. Skin irritation
25. inflammation

List of Books Recommended

Text Books

1. Katzung, B G, "*Basic and Clinical Pharmacology*", Prentice Hall International
2. *Davidson's Principles and Practice of Medicine*", Churchill Livingstone

Reference Books

3. Goodman and Gilman's, "*The Pharmacological Basis of Therapeutics*", Pregman Press.
4. Paul L, "*Principles of Pharmacology*", Chapman and Hall.
5. H. P. Rang and M M Dale, "*Pharmacology*", Churchill Livingstone..
6. Herfindal E T and Hirschman, J L, "*Clinical Pharmacy and Therapeutics*", Williams and Willkins.
7. Dipiro, J L, "*Pharmacotherapy: A Pathophysiological Approach*", Elsevier.
1. Laurence, D R and Bennet, P N, "*Clinical Pharmacology*", Churchill Livingstone."

BPH – 8.3

PHARMACEUTICS XII

(Biopharmaceutics)

THEORY

Lectures: 6 hrs / week

Unit - I

1. Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting.
2. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
3. Factors influencing absorption-physiochemical, physiological and pharmaceutical.
4. Drug distribution in the body, barriers to distribution of drugs in the body.
5. Models in Biopharmaceutics – Introduction to compartment models, non-compartmental models, physiological models and pharmacological models.

Unit - II

6. One compartmental kinetics – determination of various pharmacokinetic parameters, such as K, t_{1/2}, V_d, etc., after drug administration by intravascular route and oral route, from plasma and urine data. Significance of plasma drug concentration measurements and various pharmacokinetic parameters as above. Application of method of residuals in compartmental kinetics.
7. Two compartmental kinetics – determination of various pharmacokinetic parameters, such as K, t_{1/2}, V_d, etc., after drug administration by intravascular route and oral route, from plasma and urine data. Significance of plasma drug concentration measurements and various pharmacokinetic parameters as above. Application of method of residuals in compartmental kinetics. Application of Wagner nelson method and Loo-Riegelmann method.
8. Pharmacokinetics of drug administration by slow intravenous infusion route.
9. Multiple dosage regimen – oral and iv route. Principle of superposition.

Unit - III

10. Binding of drugs to plasma proteins, kinetics of plasma protein binding, plasma protein binding displacement interactions.

11. Metabolism of drugs : Hepatic metabolism of drugs, first pass effect, extraction ratio, biliary excretion of drugs, enterohepatic circulation.
12. Elimination of drugs : Renal and non-renal excretion of drugs, concept of clearance, renal clearance.
13. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menten equation, determination of non-linearity (saturation mechanism).

Unit - IV

14. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menton equation, determination of non-linearity (saturation mechanism).
15. Adjustment of dosage regimen in patients of renal failure.
16. Introduction to pharmacokinetic drug interactions and their significance in combination therapy.
17. Bioavailability and bioequivalence. Measures of bioavailability – C_{max}, t_{max} and Area under the curve, AUC. Design of single dose bioequivalence study. Overview of regulatory requirements for bioavailability and bioequivalency.

PRACTICALS

(6 hr / wk)

Number of experiments based on aforementioned theory topics, should be conducted.

List of Books Recommended

Text Books

1. L Shargel and B C Andrew, "*Applied Biopharmaceutics and Pharmacokinetics*", Prentice Hall International, USA.
2. Brahmankar, CBS Publishers

Reference Books

3. J G Wagner, "*Fundamental of Clinical Pharmacokinetics*", Drug Intelligence Publications, Hamilton.
4. R E Notari, "*Biopharmaceutics and Pharmacokinetics- an Introduction*", Marcel Dekker Inc, NY
5. Sarfaraz Niazi, "*Textbook of Biopharmaceutics and Clinical Pharmacokinetics*", Appelton – Century Crofts, New York.
6. M Gibaldi and D Parrier, "*Pharmacokinetics*", Marcel Dekker Inc, NY
7. J G Wagner, "*Pharmacokinetics for the Pharmaceutical Scientist*", Technomic Publishing A G Basel, Switzerland.
8. Milo Gibaldi, "*Biopharmaceutics and Clinical Pharmacokinetics*", Lea and Fibiger, Philadelphia.

BPH – 8.4

PHARMACEUTICS XIII

(Pharmaceutical Packaging)

THEORY

Lectures: 4 hrs / week

Unit - I

1. **Introduction:** Purpose of packaging, selection of the ideal package, hazards encountered by the package, various types of inner and outer packages, selection of a suitable package .
2. **Child resistant package and Tamper Evident Packaging.**
3. **Packaging materials:** Detailed study with regard to composition packaging characteristics, advantages, economics and limitations of various packaging materials with special emphasis on glass, plastics, metals and rubber. Evaluation of packaging materials.
4. **Environmental considerations of packaging**

Unit - II

5. Production of **oriented and non-oriented films and laminates.**
6. **Strip Packing:** Significance of Strip Packing, advantages, economics and limitation of Strip Packing, Strip Packing machinery, films employed in Strip Packing (including composites and laminates) and evaluation of films and strips packs.
7. **Blister Packaging:** Blister packing materials, significance of Blister packing, advantages, economics and limitation of blister packing, blister packing machinery, various types of blister packages, evaluation of blister package.
8. **Pouch packaging:** Materials used, advantages, economics and limitation of pouch packing, pouch packing machinery, spectrum of applications, evaluation of pouch packing.

Unit - III

6. **Liquid Formulation Packaging:** Various containers/closures employed for liquid formulations. Machinery employed for liquid filling – constant level, volumetric, gravimetric etc. Evaluation of liquid formulation packages.
7. **Semi-Solid Packaging:** Various types of containers/packages used for semi-solid products, filling and sealing machinery (including collapsible tube filling and sealing machine) merits and limitations of various packages, evaluation of semi-solid product package.

8. **Labelling:** Types of label(including Bar code, RF, structured program, ,in- mould and decorative labeling),Legal requirements of Labelling, packaging inserts and outserts. Adhesives and machinery employed for labelling. Concept of paperless labeling.

Unit - IV

9. **Sterile Product Packaging:** General principles of packaging of sterile products. Various types of containers used for sterile products including small volume and large volume parenterals. Types of closures used for the sterile products. Sterile product filling and sealing machinery i.e. ampoule filling and sealing machine. Limitations and merits of various packages. Evaluation of the sterile product packages

Books Recommended

1. Al Brody & K S Marsh, *“The Wiley Encyclopedia of Packaging Technology”*, John Wiley & Sons, New York
2. Leon Lachman, H A Liberman and J L Kanig, *“The Theory and Practice of Industrial Pharmacy”*, Lea & Febiger, Philadelphia
3. Deans .
4. Sanju Nanda,Rakesh Pahwa and Arun Nanda. *“Pharmaceutical Packaging Technology*, New Age Publications, New Delhi.
5. T C KacChesney, *“Packaging of Cosmetics and Toiletries”*, Newness- Butterworth, London
6. *“Remington’ Pharmaceutical Sciences”*, Mack Publishing Co., P.A