

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**  
**B.PHARM. IV YEAR COURSE STRUCTURE & SYLLABUS (R16)**

**Applicable From 2016-17 Admitted Batch**

**IV Year I Semester**

S. No.	Course Code	Course Title	L	T	P	Credits
1	PC701	Pharmaceutical Analysis – II	4	1	0	4
2	PC702	Biopharmaceutics and Pharmacokinetics	4	1	0	4
3	PC703	Pharmacology - III	3	1	0	3
4	PC704	Medicinal Chemistry – II	4	1	0	4
5	HS705	Pharmacy Administration	3	1	0	3
6	PC706	Pharmaceutical Analysis – II Lab	0	0	3	2
7	PC707	Biopharmaceutics and Pharmacokinetics Lab	0	0	3	2
8	PC708	Medicinal Chemistry – II Lab	0	0	3	2
9	PC709	Seminar and Industrial visit	0	0	2	1
		<b>Total</b>	<b>18</b>	<b>5</b>	<b>11</b>	<b>25</b>

**PC701: PHARMACEUTICAL ANALYSIS - II****B. Pharm IV Year I sem**

L	T	P	C
4	1	0	4

**Course Objectives:** The principles involved in the determination of various bulk drugs and formulations are discussed. Modern methods and instrumental techniques are applied in the study and analysis of pharmaceutical substances.

**Course Outcome:** The students are exposed to the modern instrumental techniques for the study of pharmaceuticals to a high level which would be useful for their future in academia and industry.

**UNIT - I**

- a. UV & Visible Spectrophotometry:** Introduction to Spectroscopy, Basic terminology – Chromophore, Auxochrome, Bathochromic shift, Hypsochromic shift, hyperchromic and hypochromic shift. UV & Visible Spectrophotometry: Principle, Theory, Beer-Lamberts Law & Deviations, Instrumentation – Single Beam and Double Beam Spectrophotometers, Applications, Woodward –Feiser rule.
- b. Fluorimetry:** Principle, Theory, Quenching, Instrumentation and applications.

**UNIT - II**

- a. Infrared Spectrophotometry (IR):** Introduction, principle, theory, types of vibrations, Instrumentation, Single and double beam spectrophotometer, sampling techniques, applications, basic principles in the interpretation of IR Spectra.
- b. Atomic Absorption Spectroscopy:** Principle, Theory, Instrumentation and applications.

**UNIT - III**

**Nuclear Magnetic Resonance Spectrophotometry (NMR) :** Basic Principle, theory, instrumentation, chemical shift, shielding and deshielding, relaxation processes, spin-spin splitting, applications, basic principles in the interpretation of NMR spectra.

**UNIT - IV**

**Mass Spectrometry:** Basic principle, theory, instrumentation and applications, basic principles in the interpretation of Mass Spectra.

**UNIT - V**

An Elementary study of the following:

- GC: Columns, Carrier gas and detectors used
- HPLC & HPTLC: Basic Principles
- Electrophoresis: Various types of Electrohoresis
- ORD Curves, RIA & ELISA: Basic principles

**TEXT BOOKS**

- R.M. Silvesterin and G.C. Bassler. Spectrometric Identification of Organic Compounds.
- AH Beckett & Stenlake, Text book of Practical Pharmaceutical chemistry, Vol.I&II
- AI Vogel, Quantitative Chemical Analysis.

**REFERENCES**

- Settle, Handbook of Instrumental Techniques for Analytical Chemistry.
- Y.Anjaneyulu & Maraiah, Quality Assurance & Quality Management in Pharmaceutical Industry.

**PC702: BIOPHARMACEUTICS AND PHARMACOKINETICS****B. Pharm IV Year I sem****L T P C**  
**4 1 0 4**

**Course Objectives:** This course is designed to impart fundamental knowledge of Biopharmaceutics and Pharmacokinetics. It also helps to know how the absorption distribution, metabolism, excretion takes place and bioavailability and bioequivalence parameters.

**Course Outcome:** The students shall be able to understand Bioavailability, Bioequivalence, Biopharmaceutical parameters, Pharmacodynamic and Pharmacokinetics of the drug. It also explains the ADME of the drug besides non-linear pharmacokinetics.

**UNIT - I**

- a) Introduction:** Definitions of Biopharmaceutics, Pharmacokinetics and Pharmacodynamics.  
**b) Drug Absorption.** Mechanisms of GI absorption, physico-chemical, biological and dosage form factors influencing absorption.

**UNIT - II**

**Drug distribution:** Factors of drug distribution, volume of distribution, protein binding – factors affecting and significance and kinetics of protein binding.

**UNIT - III**

- a) Drug Metabolism:** Pathways of drug metabolism. Phase-I (oxidative, reductive and hydrolytic reactions). Phase II reactions (conjugation) Enzyme induction and inhibition  
**b) Drug excretion.** Glomerular filtration, tubular secretion and reabsorption, effect of pH and other drugs. Clearance concept, excretion through bile, feces, lungs and skin in brief.

**UNIT - IV****Bioavailability and bioequivalence**

Definitions, concept of equivalence, Definitions of various types of equivalence, types of Bioavailability studies, measurement of Bioavailability, plasma level and urinary excretion studies. Bioequivalence study design. Bioavailability testing procedure and protocol (CDSCO), Invitro – Invivo correlation of data

**UNIT - V**

**Pharmacokinetics:** Basic considerations, compartment modeling, one compartment open model - i.v. bolus and extra vascular administration, urinary excretion studies. Calculation of pharmacokinetic parameters, brief over view of nonlinear kinetics, noncompartmental models

**TEXT BOOKS**

1. Venkateshwarlu, Fundamentals of Biopharmaceutics and Pharmacokinetics, Pharma Book Syndicate.
2. Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma Book Syndicate.Hyderabad
3. DM Brahmanekar and SB Jaiswal, biopharmaceutics and pharmacokinetics- a treatise, Vallabh Prakasham, Delhi.

**REFERENCES**

1. Remington's pharmaceutical sciences, Mac Pub. Co., Easton Pennsylvania.
2. Modern pharmaceuticals by banker Marcel Dekker Inc., NY

**PC703: PHARMACOLOGY – III****B. Pharm IV Year I sem**

L	T	P	C
3	1	0	3

**Course Objectives:** This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. The basic practical knowledge relevant to therapeutics will be imparted. This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

**Course Outcome :** Understand the pharmacological aspects of drugs, importance of pharmacology subject as a basis of therapeutics and correlate the knowledge therapeutically. Knowledge on experimental methodologies on various animal models is carried out. The pathophysiology of selected disease states and the rationale for drug therapy and the therapeutic approach to management of these diseases.

**UNIT - I****Drugs Acting on the Gastrointestinal Tract**

- Antacids, Antisecretory and Anti-ulcer Drugs
- Laxatives and antidiarrhoeal drugs
- Appetite Stimulants and Suppressants.
- Emetics and anti-emetics
- Miscellaneous; Carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.

**UNIT - II****Chemotherapeutic agents and their applications:**

- General principles of chemotherapy.
- Sulphonamides and co-trimoxazole.
- Antibiotics: Penicillins, cephalosporins, betalactams,
- Tetracyclines aminoglycosides, chloramphenicol, erythromycin,
- Quinolones and miscellaneous antibiotics.

**UNIT - III****Chemotherapy of following diseases**

- Tuberculosis
- Leprosy
- Urinary tract infections
- Fungal diseases
- Viral diseases,

**UNIT - IV**

- Antineoplastic agents
- Immunopharmacology: Immunosuppressants and Immunostimulants
- Antimalarial & Anti-protozoal agents
- Anti-filarial agents

**UNIT - V**

**Principles of Toxicology:** Definition of poison, general principles of treatment of poisoning with

particular reference to barbiturates opioids, organ phosphorous and atropine poisoning. Heavy metals and heavy metals antagonists, Diagnostic agents.

**TEXT BOOKS**

1. Tripathi, Textbook of Pharmacology, JAYPEE
2. F.S.K Barar, Essentials of Pharmacotherapy.
3. H.P Rang, M. M. Dale & J.M. Ritter, Pharmacology, Churchill Livingstone, 4<sup>th</sup> Ed.

**REFERENCES**

1. Sathoskar, Pharmacology and pharmacotherapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai Crossland, Lewis 's Pharmacology, Church livingstone
2. Mark A. Simmons, Pharmacology An Illustrated Review

**PC704: MEDICINAL CHEMISTRY – II****B. Pharm IV Year I sem**

L	T	P	C
4	1	0	4

**Course Objectives:** The drug discovery and design with respect to the lead molecules and its optimization is clearly discussed. The concept of CADD is also discussed. Sufficient information about various antibiotics and their chemotherapeutic agents are also studied in depth.

**Course Outcome:** The students would be in a position to participate in the community pharmacy activities with the knowledge they gained through the study of the various topics of the syllabus.

**UNIT - I****(a) Drug discovery and drug design.**

Introduction to discovery of lead molecule, lead optimization, pharmacophore identification, General structure activity relationship studies,

**(b) Computer aided drug design:** Introduction to CADD, Parameters in QSAR, Hansch analysis, Free Wilson analysis

**UNIT - II**

**a. Antibiotics:** Brief historical background, definition, classification of antibiotics.

Penicillins: Historical background and biological sources. Structures of different penicillins.

Reactions: Hydrolysis of penicillin by cold and hot dilute mineral acid, alkali, enzymatic hydrolysis with Penicillinase, amidase.

Classification: Oral and parenteral, based on spectrum of  $\beta$ ,  $\gamma$  – lactamase, as natural, biosynthetic and semi-synthetic.

General method of synthesis of penicillins from 6-APA, SAR, mechanism of action, therapeutic uses, toxicity.  $\beta$  –lactamase inhibitors.

**b. Cephalosporins:** Structures of some important compounds (Cephalosporins, Cephamecins. Cefadroxil, Cefoxitin. Acid hydrolysis of Cephalosporin C. Comparison of 6-APA and 7-ACA, penam and cepham.

Classification: Generations of cephalosporins, Oral and parenteral, SAR and Advantages over penicillins.

**UNIT - III**

**a. Tetracyclins:** Biological sources, structures of the important tetracyclines, important structural units and the three acidity constants in the tetracycline molecule, Amphoteric nature, mechanism of action, spectrum of activity, SAR and toxicity.

**b. Aminoglycosides:** Structure of streptomycin, acid hydrolysis, mechanism of action, therapeutic uses and toxicity. Dihydrostreptomycin and its importance and mention other aminoglycoside antibiotics.

A brief account of chloramphenicol and its synthesis, macrolide and polypeptide antibiotics and rifampicin (Structures not included).

**c. Quinoline type: Ciprofloxacin & norfloxacin**

**UNIT - IV****Chemotherapeutic Agents:**

**a. Sulphadruugs** : Sulphadiazine, Suphasalazine Trimethoprim, Sulphamethoxazole, Sulphameter

**b. Antifungal Agents** : Fluconazole and Itraconazole.

**c. Anti viral Drugs** : Acyclovir, Zidovudine

**d. Anti tubercular agents** : Isonicotinic acid hydrazide and ethambutol

- e. Anti leprotic agents** : Dapsone, clofazemine  
**f. Antiamoebics** : Metronidazole, diloxanide furoate  
**g. Anthelmintics** : Diethylcarbamazine citrate, pyrantel pamoate, mebendazole, Ibandazole  
**h. Antimalarial drugs** : Chloroquine, primaquine and pyrimethamine, norflaxacin and ciprofloxacin

#### UNIT - V

- a. Anticancer Drugs:** Chlorambucil, busulphan, procarbazine, carmustine, 5-fluorouracil, 5-mercaptopurine, methotrexate, vinca alkaloids – vinblastin, vincristine  
**b. Immunosuppressive agents.**  
Brief introduction to therapeutic agents developed from recombinant DNA technology  
**c. Diagnostic agents and radioprotective agents.**

#### TEXT BOOKS

1. William O. Foye, Textbook of Medicinal Chemistry, Lea & Febiger, Philadelphia.
2. JH Block & JM Beale, Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry by (Eds), 11<sup>th</sup> Ed, Lipincott, Raven, Philadelphia, 2004.
3. S. N. Pandeya, Textbook of medicinal chemistry, SG Publ. Varanasi, 2003.

#### REFERENCES

1. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003.
2. Rama Rao Nadendla, Medicinal Chemistry.

**HS705: PHARMACY ADMINISTRATION****B. Pharm IV Year I sem**

L	T	P	C
3	1	0	3

**Course Objectives:**

- To exposes the students, facets of business administration in the new economic environment.
- The manufacturing management.
- Social and behaviour aspects of pharmacy: Pharmaceutical outcomes, Pharmacoeconomics and Pharmacovigilance.

**Course Outcome:** At the end of the course, these students will be familiarized with the above all areas.

**UNIT - I****Features of Business Organisations & New Economic Environment:**

Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-Liberalisation scenario.

**UNIT - II**

**Manufacturing Management:** Goals of Production Management and Organisation – Production, Planning and Control – Plant location –Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), New Product Development.

**Work Study** –Basic procedure involved in Method Study and Work Measurement-Statistical Quality Control:  $\bar{X}$  chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

**UNIT - III**

**Social Pharmacy:** Social uses of drugs; Abuse of prescription drugs.

**Behavioral Pharmacy:** Compliance / Adherence to medications.

**Introduction to pharmacoeconomics:** Definitions of Efficacy; Comparative cost effectiveness ratios; Comparative Clinical Effectiveness and cost Benefit ratios.

**Pharmaceutical Outcomes (Quality of life concepts)**

History of Pharmaceutical out comes movements in India and abroad.

**Pharmacovigilance / Pharmacoepidemiology:**

Present status in India; State and Central initiatives; Reporting of Adverse Drug Reactions; Prescribed format for reporting Adverse Drug Reactions; Irrational Drug Combinations, CDSCO: List of Drugs banned by Government of India and other State Governments.

**UNIT - IV**

**Organisation of Distribution and Marketing:** Functions of Marketing, Marketing ix, Marketing Strategies based on Product Life Cycle., Channels of distribution –Factors influencing channels of distribution, sales organization and sales promotion.

**UNIT - V**

**Pharma Industry:** Growth of pharma industry in India – current status and its role in building national economy and national health – Structure of pharma industry in India – PSUs in pharma industry – Progress in the manufacture of basic drugs, synthetic and drugs of vegetable origin. Export and import of drugs and pharmaceuticals – Export and import Trade.



**TEXT BOOK**

1. Aryasri and Subbarao, Pharmaceutical Administration, TMH.
2. Smarta, Strategic Pharma Marketing.
3. Pharmaceutical Industrial Management by G.Vidya Sagar.

**REFERENCES**

1. Subbarao Chaganti, Pharmaceutal Marketing in India – Concepts and Strategy Cases, Pharma Book Syndicate.
2. Pharmacy administration by G. Vidya Sagar.

**PC706: PHARMACEUTICAL ANALYSIS – II LAB****B. Pharm IV Year I sem**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**List of Experiments**

1. Interpretation of IR Spectra of any two compounds.
2. Determination of  $\lambda_{\text{max}}$  of few bulk drugs.
3. Assay of any two bulk drugs and their formulations by UV-spectro photometry.
4. Assay of any two bulk drugs and their formulations by Colorimetric method.
5. Assay of Quinine Sulphate by Flourimetry
6. Ascending paper chromatography.
7. Radial paper chromatography.
8. Two dimensional paper chromatography
9. Thin layer chromatography.
10. Column chromatography
11. Determination of amino acids by Paper electrophoresis.
12. Gel electrophoresis (**Demonstration Only**).
13. HPLC (**Demonstration Only**).

**PC707: BIOPHARMACEUTICS AND PHARMACOKINETICS LAB****B. Pharm IV Year I sem**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**List of Experiments**

1. Estimation of various Pharmacokinetic parameters from the given data
2. Influence of dosage form on dissolution behaviour of same API
3. Influence of Physico-chemical properties (Particle size, salt form, crystalline form) on dissolution rate of drug substances.
4. Approaches to enhance the dissolution rate of drugs  
i.e., i) Cyclodextrin complexation  
ii) Inclusion of Hydrophilic polymers such as PVP, PEG.  
iii) Co-solvency
5. Absorption studies – invitro and invivo
6. Determination of rate of clearance
7. Statistical treatment of Pharmaceutical data i.e.,  
i) test ii) Chi-square test iii) ANOVA

**Reference book**

1. Dr. D. Dhachinamoorthi- Biopharmaceutical and Pharmacokinetic- A Practical Manual

**PC708: MEDICINAL CHEMISTRY – II LAB****B. Pharm IV Year I sem**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**Estimations of the following.**

1. Ascorbic acid.
2. Vitamin B1.
3. Penicillin.
4. Alkaloid (by gravimetry).
5. Ibuprofen by volumetric method
6. Aspirin by volumetric method
7. Metronidazole (antiprotozoal)
8. Ibuprofen (analgesic, antiinflammatory)
9. Furosemide (diuretic)
10. Isoniazid (anti tubercular)
11. Compound benzoic acid (anti fungal)

**REFERENCES**

1. Indian Pharmacopoeia.. – 1996, 4<sup>th</sup> Edition.
2. P.D.Sethi – Quantitative Analysis of Drugs and Pharmaceuticals.
3. B.G.Nagavi Lab Hand Book of Instrumental Drug Analysis.
4. Organic chemistry a Lab manual Cengage India Pvt. Ltd. By Pavia