JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B. Pharm II-Sem	T	P	C
	3+1*	0	3

(R9701) NOVEL DRUG DELIVERY SYSTEMS & REGULATORY AFFAIRS

UNIT-I

Oral Control Drug Delivery Systems : Fundamental study of different types of Oral Contolled drug delivery systems. Dissolution Controlled, Diffusion Controlled, Ion Exchange Resins. Osmotic based systems, pH Independent Systems and altered density systems. Detailed study of Matrix systems.

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UNIT – II

Transdermal Drug Delivery Systems : Fundamentals, types of TDDS, Materials Employed and Evaluation of TDDS.

UNIT – III

Mucoadhesive Delivery Systems : Mechanism of bioadhesion, mucoadhesive materials, forumulation and development of mucoadhesive-based systems.

UNIT – IV

Targeted Drug Delivery Systems : Fundamentals and applications, formulation and evaluation of liposomes, resealed erythrocytes and nano particles.

UNIT-V

Introduction Drug Regulatory Agencies : Indian CDSCO, US FDA, Canadian HPFBI, and Australian TGA

Introduction to NDA & ANDA Submissions of USFDA

UNIT-VI

Introduction to quality assurance activities related to warehouse control, manufacturing control, packaging control and quality control.

UNIT-VII

Introduction to Good Manufacturing Practices : Salient features of Schedule – M (India).

UNIT-VII

Introduction to Validations : Process validation (prospective, retrospective & concurrent), analytical method validation (accuracy, precision, specificity, linearity, range, robustness etc.), cleaning validation (sampling procedure and acceptance criteria)

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TEXT BOOKS

1. Shobhan Rani R. Hiremath Text Book of Industrial Pharmacy – Universities Press
2. N.K. Jain, Control Drug Delivery Systems by
3. Y.Anjaneyulu & Maraiah, Quality Assurance & Quality Management in Pharmaceutical Industry.
4. L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy by, Lea & Febieger, Philadelphia Latest Edn.

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1. Leon Shargel Isadore Kanfer, Generic Drug Product Development, Solid Oral Dosage Forms, Marcel Dekker.
2. Sagarian & MS Balsam, Cosmetics Sciences &Technology.Vol.1, 2 & 3
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
4. E.A Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publ
5. HC Ansel, Introduction to Pharmaceutical Dosage forms
6. S.H. Willing, M.M Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, Marcel Dekker, Inc., New York
7. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, Ivth ed, marcel dekker, usa, 2005.
8. Yiew Chien, novel drug delivery systems, 2nd ed. marcel dekker 2003.
9. Robert. A. Nash, Pharmaceutical Process Validation, 3rd Ed Marcel Dekker, 2003.
10. Good Manufacturing Practices – Schedule M Read with The Drugs And Cosmetic Rules 1945.
11. M.E. Aulton, Pharmaceuitcs- The science of Dosage form Design 2nd ed.
12. Aukunuru Jithan, Oral Drug Delivery Technology.
13. Quality Assurance of Pharmaceuticals WHO PMP

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(R9702) PHARMACEUTICAL BIOTECHNOLOGY

UNIT - I

Fermentation Technology : Isolation, Selection, Screening of Industrially important microbes, Strain improvement. Types, design & operation of Bioreactor. Types of fermentations, optimization of fermentation process, Principle and Procedure involving in downstream process and effluent treatment.

UNIT - II

Specific Fermentations : Selection of organism, fermentation & purification of various antibiotics, vitamins, aminoacids, organic acids, solvents like penicillin, streptomycin, tertacyclin, erythromycin, riboflavin, cynacobalamin, glutamic acid, lysin, citric acid, lactic acid, alcohol, acetone etc.

UNIT - III

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Microbial Transformations : Types, Methods of bioconversions & Application in Pharma Industry, Steroidal transformation.

UNIT – IV

Recombinant DNA Technology : Introduction to r-dna technology and genetic engineering, steps involved, isolation of enzymes, vectors, recombination and cloning of ggenes.

Production of bio technology derived therapeutic proteins like humulin, humatrope, activase, intron a, monoclonal antibodies by hybridoma technique, recombivax HB(hepatitis b).

UNIT – V

Immunology & Immunological Preparations : Principles of Immunity, Humoral immunity, cell mediated immunity, Antigen – Antiboby reactions, Hypersensitivity and its applications.

Active & passive immunizations vaccine preparation, standardization & storage of BCG, cholera, smallpox, polio, typhus, tetanus toxoid, immuno serum & diagnostic agents.

UNIT – VI

Enzyme Technology : Techniques of immobilization of enzymes, factors affecting Immobilized enzyme kinetics, advantages of immobilization over isolated enzymes. Study of enzymes such as hyaluronidas, penicillinase, streptokinase, streptodornase, amylase, protease etc. immobilization of bacteria & plant cells.

UNIT - VII

Introduction, role, collection, process & storage of blood products, plasma substitutes and like whole human blood, human normal imunoglobulin, dextran and sutures & ligatures

UNIT – VIII

Introductory study & applications of bioinformatics, proteomics and genomics.

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TEXT BOOKS

1. Wulf Crueger and Anneliese Crueger, Biotechnology, 2nd Ed, Publ-Panima publication co-peration, New Delhi.
2. P. F. Stanbury & A. Whitaker, Principles of fermentation technology, Pergamon Press
3. Sambamurthy. K, Text Book of Pharmaceutical Biotechnology.
4. S. S. Kori, Pharmaceutical biotechnology.
5. S.P. Vyas and V.K. Dixit CBS Publisher, Delhi, Pharmaceutical Biotechnology
6. S.J.Carter, Cooper and Gunn's Tutorial Pharmacy 6th ed CBS Publisher, Delhi
7. U. Satyanarayana, Text book of Biotechnology

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1. Prescott and Dunne, "Industrial Microbiology" MC Caraw Hill Bool Company
2. Peppler "Microbial Technology" Vol. 1 & 2.
3. K. Kielsliched "Biotechnology" Vol 6, Verlegchemic, Switzerland.
4. OP Ward" Fermentation Technology, Principles, Processes products" Open University press, Milton Keynes, UK.
5. A. M. Campbelli, Monoclinical antibody technology.
6. A. Wiseman, Handbook of enzyme biotechnology.
7. J. D. Watson, Recombinant DNA technology.
8. Smith and Hood, Molecular biology and biotechnology.
9. E.A. Rawlins, Bentley's, A text book of pharmaceutics, 8th Ed, 1982 Bailler Tindall & Co.
10. Alexander N. Glazer & Hiroshi Nikaido, Microbial biotechnology, W. H. Freeman Co.
11. Ahwood.T.K, Introduction to Bio Informatics.
12. Cassida, Industrial microbiology.
13. H.K. Das, Textbook of Biochemistry.

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IV Year B. Pharm II-Sem	T	P	C
	3+1*	0	3

(R9703) MEDICINAL CHEMISTRY – III

Note:

A study of the following classes of drugs including introduction, classification with examples of structures, mechanism of action, SAR and metabolism. Synthesis of compounds specified against each class is to be studied for the following UNITS

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UNIT – I

Drugs acting on Cardio-vascular diseases:

General account of cardiovascular diseases

Antihypertensives – Methyldopa, amlodipine, enalapril, losartan.

UNIT – II

Anti-arrhythmics – Procainamide

Diuretics – **Acetazolamide, hydrochlorthiazide, furosemide**

Anticoagulants, Anti-anginals and Coronary vasodilators – Isosorbide dinitrate, verapamil, diltiazem

UNIT – III

Antihyperlipidemics (Hypocholesteremic drugs)- Clofibrate. A brief account on statins

General account on pancreatic and thyroid hormonal malfunctions.

Antidiabetics – Phenformin, Glipizide including a brief account on PPAR inhibitors. Meglitinide analogues,

a-Glucosidase inhibitors – Acarbose, Miglitol

Drugs affecting Thyroid Function : Methimazole, Propylthiouracil, Insulin preparations

UNIT – IV

Analgesics and NSAIDS (Non-steroidal anti-inflamatory agents):

i. Introduction and types of pain and inflammation
ii Classification and systematic development of analgesics of morphine, mild analgesics and strong analgesics: Meperidine and Methadone
iii. NSAIDS – Aspirin, paracetamol, oxyphenbutazone, ibuprofen, indomethacin, diclofenac and meloxicam
iv. A brief account on Cox-2 inhibitors and Nimsulide.

UNIT – V

Chemotherapeutic Agents:

Sulpha drugs - Sulphadiazine, Suphasalzine, Trimethoprim, Sulphamethoxazole, Sulphameter

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Anti viral Drugs - Acyclovir, Zidovudine
Antifungal Agents - Fluconazole and Itraconazole.

UNIT – VI

Anti tubercular agents ethambutol, : Isonicotinic acid hydrazide and
Anti leprotic agents : Dapsone, clofazemine
Antiamoebics : Metronidazole, diloxanide furoate

UNIT - VII

Anthelmintics : Diethylcarbamazine citrate, pyrantel pamoate, mebendazole, Ibendazole
Antimalarial drugs : Chloroquine, primaquine and pyrimethamine, norflaxacin and ciprofloxacin

UNIT – VIII

Anticancer Drugs : Chlorambucil, busulphan, procarbazine, carmustine, 5-flurouracil,
5-mercaptopurine methotrexate, vinca alkaloids – vinblastin, vincristine

TEXT BOOKS

1. William O. Foye, Textbook of Medicinal Chemistry by, Lea Febiger, Philadelphia.
2. JH Block & JM Beale, Wilson & Giswold's Textbook of organic Medicinal Chemistry and pharmaceutical chemistry by (Eds), 11th Ed, Lipcott, Raven, Philadelphia, 2004.
3. S. N. Pandeya, Textbook of mediacinal chemistry, SG Publ. Varanasi, 2003.
4. Rama Rao Nadendla, Medicinal Chemistry.

REFERENCES

1. D. Abraham (Ed), Burger Medicinal chemistry ad Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
2. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences
3. L. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press, Delhi.
4. B.N. Lads, MG.Mandel and F.I. way, Fundamentals of drug metabolism & disposition. William & welking co. Baltimore USA.
5. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, oxford
6. Daniel lednicer, Strategies For Organic Drug Synthesis And Design, John Wiley, N. Y. 1998.
7. D. Lednicer, Organic drug synthesis, Vol. 1 – 6, J.Wiley N.Y.
8. Korolkovas essentials of Medicinal Chemistry – 2 ed wiley-interscience publications.

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	3+1*	0	3

(R9704) PHARMACOGNOSY – III

UNIT - I

Evaluation of crude drugs.
Adulteration of curde durgs and their detection by
i) Organoleptic ii) Microscopic iii) Physical iv) Chemical and Biological methods of evaluation

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UNIT - II

a. Qualitative Phytochemical screening of various groups of phyto constituents.
b. Identification and Isolation of the following constituents.
(i) Sennosides from Senna (ii). Quinine from Cinchona (iii). Curcumin from Turmeric.
(iv). Lycopene from Tomato (v). Glycyrrhizine from Glycyrrhiza
c. Identificatin and estimation of Degoxin, Atropin, Podophyllotoxin, Vitamin-A, Berberin

UNIT – III

Introduction, Classification and study of following chromatographic methods and their applications in evaluation of Phytoconstituents.
(a). Paper Chromatography (b). TLC (c). HPTLC (d). Column Chromatography (e). HPLC

UNIT – IV

Plant Tissue Cultue : History, types, media requirements, methodology for establishment of cultures, growth measurements and applications.

UNIT – V

Study of traditional drugs : Common and vernacular names, sources, chemical constituests and uses of kantakari, shatavari, sankhapushphi, tylophora, bilva, rasna, apamarga, gokhru, gudhuchi, methi, guggul, punarnava and brahmi.

UNIT – VI

Herbal Formulations
a. General introduction to alternative systems of medicine like Ayurveda, Siddha, Unani and Homoeopathy.

b. Concept of Tridosha, Methods of preparation of formulations in Ayurveda like churnas, lehyas, tailas, bhasmas, asavas and arishta.

UNIT – VII

Herbal Formulations

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a. *General introduction to cosmecuticals role of herbs in cosmetics*: Study of the following drugs. Amla, henna, cyperus, soap nut, aloe vera, turmeric, sandal wood, bitter organge peel

b. *Definition and study of Neutraceuticals*: Garlic, spirulina, soya and royal jelly.

UNIT – VIII

a. Role of medicinal plants, Phytoconstituents in discovery of new chemical entities.

b. Status of herbal drug industry and herbal drug research in India.

TEXT BOOKS

1. J.B.Harbone, Phytochemical Methods: A guide to modern techniques of Plant analysis by
2. Kokate C.K, Purohit AP & Gokhale S.B, The Pharmacognosy (Nirali)
3. Trease and Evans, Pharmacognosy, Latest Edition.
4. T.E. Wallis, Text Book of Pharmacognosy.

REFERENCES

1. Arya Vaidyasala Vol. 1-5, Indian Medicinal Plants – Universities Press
2. Atal C.R & Kapur B.M Cultivation & Utilization of Medicinal Plants.
3. Ayurvedic Pharmacopoeia of India, Pub by Govt. of India.
3. Pharmacognosy and Phytotherapy Research: Chapter contributed by Subhash C. Mandal & S.Mohana Lakshmi in the book Biodiversity and Environmental Biotechnology by P.Dwiveit ateal, Scientific Publisher, Jodhpur.
4. Handa & Kapoor, Text book of Pharmacognosy.
5. S.S. Agarwal & M. Paridhavi, Herbal Drug Technology, University Press, Hyderabad.
6. Timir Baran JHa & Biswajit Gosh, Plant Tissue Culture, University Press, Hyderabad.
7. P. Dwiveti, Tissue Culture and Plant Science, Scientific Publisher, Jodhpur.
8. M. K. Razdan, An Introduction To Plant Tissue Culture, Oxford & IBH Publishing Co., New Delhi.
9. Organic Chemistry of Natural products. Vol-I & II R.Chatwal of Arora Publishning House Pvt. Ltd.

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IV Year B. Pharm II-Sem

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(R9705) CLINICAL PHARMACY AND THERAPEUTICS

UNIT – I

Introduction to Clinical Pharmacy

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UNIT – II

Basic concepts of Pharmacotherapy

a. Clinical Pharmacokinetics and individualization of Drug Therapy.

b. Special precautions in drugs usage during infancy and in the elderly (Pediatrics & Geriatrics).

c. Special precautions in drugs usage during pregnancy & lactation

d. Adverse Drug Reactions

e. The Basics of Drug Interactions

f. Interpretation of Clinical laboratory Tests.

UNIT – III

Important Disorders of Organ Systems and their Management:

a. ***Cardiovascular Disorders***: Hypertension, congestive heart failure, angina, acute myocardial infarction, cardiac arrhythmias

b. ***CNS Disorders***: Epilepsy, parkinsonism, schizophrenia depression

UNIT – IV

a. ***Respiratory Disease :*** Asthma, COPD

b. ***Gastrointestinal Disorders :*** Peptic Ulcer Disease, Ulcerative Colitis, Hepatitis, and Cirrhosis.

UNIT –V

a. ***Endocrine Disorders :*** Diabetes mellitus and Thyroid Disorders.

b. ***Infectious Diseases :*** Tuberculosis, Urinary Tract Infefction, Enteric Infections.

UNIT – VI

Upper Respiratory Infections.

a. ***Hematopoietic Disorders*** : Anemias and drug induced blood disorders

b. ***Joint and Connective Tissue Disorders*** : rheumatic diseases, gout and Hyperuricemia.

c. ***Neoplastic Diseases*** : Acute leukaemias, Hodgkin's disease

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UNIT – VII

Therapeutic Drug Monitoring

UNIT – VIII

Concept of Essential Drugs. Drug and poision information.

TEXT BOOKS

1. Katzung, B.GBasic and Clinical Pharmacology, Prentice hall, International.
2. Laurence, DR and Bennet PN. Clinical Pharmacology, Scientific book agency
3. Dr. D.R Krishna, V. Klotz, Clinical pharmaco kinetics, Publ Springer Verlab
4. M Rowland and T N Tozer, "Clinical Pharmacokinetics" 2nd ed Lea & Febiger, NY.

REFERENCES

1. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences, 20th Edition.
2. Hamsten, Drug interaction, Kven Stockley.
3. J.K. Mehra, Drug interaction, Basic Bussiness Publ, Bombay.
4. Grahame smith and Aronson, Clinical pharmacology and drug therapy
5. Richard A Helms, Text Book of Therapeutics Drug and Disease Management Hardbound.
5. Herfindal E T and Hirschman JL, Williams and Wilkins, Clinical Pharmacy and therapeutics
6. Applied Therapeutics, The clinical uses of Drugs applied therapeutics INC
7. Dr. A.R. Paradker, Hospital and Clinical Pharmacy, Nirali Prakashan.
8. G. Parthasarathi / Karin Nyfort-Hansu A text book of Clinical Pharmacy practice – Universities Press
9. D. Sudheer Kumar. Fundamentals of Clinical Pharmacy Practice-Pharm Med Press

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IV Year B. Pharm II-Sem	T	P	C
	0	0	4

(R9706) PROJECT WORK AND COMPREHENSIVE VIVA

1. Industrial Pharmacy / Technology
2. Clinical Pharmacy / Pharmacology
3. Pharmacognosy / Medical Chemistry
4. Pharmaceutical Analysis / Quality Assurance
5. Pharmaceutical Marketing
6. Herbal Drugs
7. Pharmainformatics
8. Computer aided drug design
9. Neutraceuticals
10. Nano Technology
11. Bio Technology
12. Pharmaco economics

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IV Year B. Pharm II-Sem

T	P	C
0	3	2

(R9707) NOVEL DRUG DELIVERY SYSTEMS AND REGULATORY AFFAIRS LAB

1. Preparation and Evaluation of Matrix Tablets
2. Formualtion and Evaluation of Film Coated Tablets.
3. Formualtion and Evaluation of Enteric Coated Tablets.
4. Prepartion and Evaluation of Transdermal Drug Delivery Systems.
5. Formulation and Evaluation of Mucoadhesive Delivery Systems.
6. Evaluation of Market SR Formualtions.
7. Preparation and Evaluation of Alginate Beads.
8. Analytical Method Validation.
9. Assignment on Product development and filing to various regulatory agencies , FDA,MCC, EMEA,TGA.Etc (Ref.: www.fda.gov)

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JV Year B. Pharm II-Sem

T	P	C
0	3	2

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(R9708) PHARMACEUTICAL BIOTECHNOLOGY LAB

1. Isolation of antibiotic producing microorganism from soil.
2. Enzyme immobilization by Ca-alginate method.
3. Determination of minimum inhibitory concentration of the given antibiotic. Antibiotic assay by cup plate method.
4. Collection, Processing, Storage and fractionation of blood.
5. Standardization of Cultures.
6. Microbiological assay of Antibiotics / Vitamins.
7. Production of alcohol by fermentation techniques.
8. Comparison of efficacy of immobilized cells.
9. Sterility testing of Pharmaceutical products.
10. Isolation of mutants by gradient plate technique.
11. Preparation of bacterial vaccine and standardization.
12. Extraction of DNA.
13. Separation techniques: Various types of Gel Electro Phoresis, Centrifugation.

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IV Year B. Pharm II-Sem

T	P	C
0	3	2

(R9709) MEDICINAL CHEMISTRY – III LAB

Assay of some drugs from their formulations:

1. Sulpha methoxazole (anti bacterial)
2. Glibenclamide (hypoglycemic agent)
3. Metronidazole (antiprotozoal)
4. Ibuprofen (analgesic, antiinflammatory)
5. Furosemide (diuretic)
6. Isoniazid (anti tubercular)
7. Aspirin (analgesic, antipyretic, antiinflamatory and antithrombotic)
8. Phenytoin (anticonvulsant)
9. Phenobarbitol (sedative and hypnotic)
10. Diethylcarbamizine (antihelmintic)
11. Salbutamol (antiasthamatic)
12. Phenyl butazone (anti inflammatory)
13. compound benzoic acid (anti fungal)

REFERENCES

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1. I.P. – 1996.
2. P.D.Sethi – Quantative Analysis of Drugs and Pharmaceuticals.
3. B.P. - 2004.

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IV Year B. Pharm II-Sem

T	P	C
0	3	2

(R9710) PHARMACOGNOSY – III LAB

1. Measurement of phloem fibres of any two powdered crude drugs.
2. Determination of quality and pury of powdered crude drugs by lycopodium spore method (Ginger, Cardamomum, etc.)
3. Determination of Leaf Constants
   a. Stomatal number and stomatal index of Senna and Datura
   b. Vein islet number and veinlet termination number of Datura
4. Isolation of volatile oil from clove and eucalyptus.
5. Aspetic seed genrmination of Trigonella
6. Establishment of callus cultures of Catheranthus roseus.

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BOOKS RECOMMENDED FOR REFERENCE:

PHARMACEUTICS

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1. Cooper and Gunns "Tutorial Pharmacy" ed. S.J Carter, 6th edition. CBS Publisher, Delhi,
2. A N Martin, Arthur Cammarata, James Swarbrick, "Physical Pharmacy", 3rd edition, K M Varghese & Co., Bombay,
3. E Shotton and K Ridgway, "Physical Pharmaceutics" Oxford University Press, London,
4. "Remington's Pharmaceutical Sciences", ed. A R Gennaro, 18th ed, Mack Publishing Co., P.A..
5. Leon Lachmen, H A Lieberman and J L Kanig, "The Theory and Practice of Industrial Pharmacy, 3rd ed. Lea & Febiger Philadelphia.
6. H C Ansel "Introduction to Pharmaceutical Dosage Forms", 3rd (Indian ed) K M Varghese & Co. Bombay .
7. Cooper and Gunn's "Dispensing for Pharmaceutical Students" ed S J Carter, 12th ed., CBS Publishers, Delhi.
8. "Sprowl's American Pharmacy" ed L W Dittert, 7th ed J & B Lippincott Co., Philadelphia .
9. "Bentley's Textbook of Pharmaceutics" ed EA Rawlines, 8th ed ELBS Bacilliere Tindall.
10. "Dispensing of Medication", ed J E Hoover, 8th ed Mack Publishing Co., Easton PA.
11. William E Hassan, "Hospital Pharmacy", 5th ed Lea & Febiger, Philadelphia.
12. "Modern Pharmaceutics" ed G S Banker and C T Rhodes, 2nd ed Marcel Dekker Inc., NY.
13. "Pharmaceutical Dosage, Forms and Drug Delivery Systems", 5th ed Lea and Febiger, Philadelphia .
14. S.Turco and R.E.King, "Sterile Dosage Forms" 3rd ed Lea and Febiger, Philadelphia.

15. H M Chitton and R L Witcofski, "Nuclear Pharmacy", Lea and Febiger, Philadelphia.
16. K A Connores, G L Amiden and V J Stella, "Chemical Stability of Pharmaceuticals" , 2nd ed John Wiley & Sons NY 1986.
17. "Pharmaceutics The Science of Dosage Form Design" , ed M E Aulton, ELBS/Churchill Livingstone
18. J T Carstensen, "Drug Stability", Marcel Dekker Inc NY.
19. "Cosmetic Science and Technology" ed Sagarian and M S Balsam, Vol 1 3, 2nd ed John Wiley & Sons, NY
20. J S Jellinek, "Formulation and Function of Cosmetics", John Wiley & Sons, NY.
21. S G Thomsen, "Modern Cosmetics" Universal Publishing Corporation, Bombay.
22. "Advance in Pharmaceutical Sciences", ed H S Hean, A H Beckett, and J E Carless, Vol 1 4 Academic Press, London.
23. W L Macbe and J C Smith, "Unit Operation of Chemical Engineering" 4th ed McGraw Hill International Book Co., London.
24. C G Brown etal, "Unit Operations" (Indian ed) Asia Publishing House, Bombay.
25. W L Badger and J T Banchero, "Introduction to Chemical Engineering" McGraw Hill International Book Co., London.
26. B T Loftus and Robert Nash, "Pharmaceutical Process Validation", Marcel Dekker I.Inc. NY.
27. M L Schroff, "Professional Pharmacy", Five Star Enterprises, Calcutta
28. "Dispensing of Medication", Ed, E W Martin, 7th ed Mack Publishing Co., Eastern PA.
29. M J Stocklose, "Pharmaceutical Calculation", 6th ed Lea & Febiger, Philadelphia.
30. Joel L Zatz, "Pharmaceutical Calculations" John Wiley & Sons, NY.
31. J G Wagner, "Fundamentals of Clinical Pharmacokinetics", Drug

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Intelligence Publications, Hamilton.

32. R L Juliano, "Drug Delivery System", Oxford University Press, Oxford.
33. R E Notari, "Biopharmaceutics and Pharmacokinetics an Introduction" 2nd ed Marcel Dekker Inc NY.
34. M Rowland and T N Tozer, "Clinical Pharmacokinetics" 2nd ed Lea & Febiger, NY.
35. M Gibaldi & D Perrier, "Pharmacokinetics", 2nd ed Marcel Dekker Inc NY
36. J G Wagner, "Pharmacokinetics for the Pharmaceutical Scientist", Technomic Publishing A G Basel, Switzerland .
37. "Milo Gibaldi, "Biopharmaceutics & Clinical Pharmacokinetics" 3rd ed. Lea & Fibiger, Philadelphia .
38. "Pharmaceutical Dosage Forms Tablets, Vols. 1 3 ed H A Lieberman, L Lachman & J B Schwartz, 2nd ed K E Avis, L Lachman and H A Lieberman, Macel Dekker Inc. NY.
39. "Pharmaceutical Dosage Forms; Disperse Systems", Vols. 1&2 ed H A Liberman, N M Rieger and G S Banker, Marcel Dekker Inc. NY.
40. J R Robinson & Vincent Lee, "Controlled Drug Delivery Fundamentals & Applications" 2nd ed Marcel Dekker Inc..
41. M C Winter, "Basic Clinical Pharmacokinetics", Applied Therapeutics, Inc San Fransisco
42. "Pharmacokinetics" eds A Pecile and A Rescigno, Plenum Press, NY.
43. S H Willing, IV, "Good Manufacturing Practices for Pharmaceuticals" 2nd ed Marcel Dekker Inc NY .
44. "Hard Capsules", ed K Ridgwey. The Pharmaceutical Press, London.
45. "Textbook of Hospital Pharmacy", ed M C Allwood and J T Fell, Blackwell Scientific Publications, Oxford .
46. A Owunwonne, "Handbook of Radiopharmaceuticals", Narosa Publishing House, New Delhi.

47. Peter G Welling and Francis L S Tse. "Pharmacokinetics", 2nd ed Marcel Dekker Inc NY.
48. H K Bharati, "Drugs and Pharmacy Laws in India", Sadhana Mandir, Indore .

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49. Sanford Bolton, "Pharmaceutical Statistics" 2nd ed Marcel Dekker Inc NY.
50. "Chemical Engineers" Handbook ed R H Parry & C H Chilton, 5th ed McGraw Kogakusha Ltd .
51. J C KacChenney "Packaging of Cosmetics and Toiletories, Newness Butterworth, London.
52. W A Ritschel, "Handbook of Basic Pharmacokinetics", Drug Intelligence Publications, Hamilton .
53. Pharmacopoeias of India, published by the Controller of Publications, Delhi, 1st ed 1966 3rd ed .
54. British Pharmacopoeias, Her Majesty's Staionery office, University Press, Cambridge.
55. The United States Pharmacopoeias, 22nd revision. The United States Pharmacopoeial Convention, Mack Pub Co. Easton, PA.
56. The British Pharmaceutical Codex, 12th ed. The Pharmaceutical Press, London.57. Martindale: The Extra Pharmacopoeias, ed J E F Reynolds, 28thed. The Pharmaceutical Press, London .
58. British National Formulary, No.15 Pub jointly by British Medical Association and Royal Pharmaceutical Society of Great Britain .
59. The Merck Index 9th ed, Merck & Co., Inc NJ.
60. R Y Stanier, Ingraham, "General Microbiology" 5th ed, Wheellis and Painter.
61. Rugu and Russel, "Pharmaceutical Microbiology; Blackwell Scientific Publication, Oxford.
62. A J Salle, "Fundamental Principles of Bacteriology",
63. Bergy's Manual of Determinative Bacteriology.

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64. G Sykes, "Disinfection and sterlization, II ed.
65. Davis, Dulbertro, Eisen "Microbiology".
66. Benjamin Lewis, Gene V "Microbiology"
67. Prescott and Dunn, "Industrial Microbiology" , 2nd ed McGraw Hill Book Company Inc.
68. Peppler, "Microbial Technology", Vol I & II
69. Suichi Aiba Humphrey and Millis, "Biochemical Engineering", University of Tokyo
70. K Kielslich Ed "Biotechnology" Vol 6a, Verleg Chemie, Switzerland.
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