



SOLAPUR UNIVERSITY, SOLAPUR

Final Year B. Pharmacy

(Sem.VII & VIII)

w. e. f. 2013-14

**Final Year B. Pharmacy
Semester-VII**

Sub Code	Subject	Teaching scheme (Hours/week)	Semester Examination			Sessional examination		Maximum marks for the subject	Minimum marks for Passing the subject
			Duration (Hours)	Maximum marks	Minimum marks for marks for passing	Duration (Hours)	Maximum marks		
4.7.1	Sterile Dosage Forms	3	3	80	32	1	20	100	40
4.7.2	Pharmaceutical Jurisprudence	3	3	80	32	1	20	100	40
4.7.3	Medicinal Chemistry-III	3	3	80	32	1	20	100	40
4.7.4	Pharmaceutical Analysis-V	3	3	80	32	1	20	100	40
4.7.5	Pharmacology-III	3	3	80	32	1	20	100	40
4.7.6	Pharmacognosy-III	3	3	80	32	1	20	100	40
Practical									
4.7.7	Sterile Dosage Forms	3	4	80	32	3	20	100	40
4.7.8	Medicinal Chemistry-III	3	4	80	32	3	20	100	40
4.7.9	Pharmaceutical Analysis-V	3	4	80	32	3	20	100	40
4.7.10	Pharmacology-III	3	4	80	32	3	20	100	40
4.7.11	Pharmacognosy-III	3	4	80	32	3	20	100	40
Maximum Marks for the Semester - 1100									
Minimum marks for passing the semester - 550									

Semester-VIII

Sub Code	Subject	Teaching scheme (Hours/week)	Semester Examination			Sessional examination		Maximum marks for the subject	Minimum marks for Passing the subject
			Duration (Hours)	Maximum marks	Minimum marks for marks for passing	Duration (Hours)	Maximum marks		
4.8.1	Novel Drug Delivery Systems	3	3	80	32	1	20	100	40
4.8.2	Pharmaceutical Business Management	3	3	80	32	1	20	100	40
4.8.3	Medicinal Chemistry-IV	3	3	80	32	1	20	100	40
4.8.4	Pharmaceutical Analysis-VI	3	3	80	32	1	20	100	40
4.8.5	Pharmacology-IV	3	3	80	32	1	20	100	40
4.8.6	Herbal Technology	3	3	80	32	1	20	100	40
Practical									
4.8.7	Novel Drug Delivery Systems	3	4	80	32	3	20	100	40
4.8.8	Medicinal Chemistry-IV	3	4	80	32	3	20	100	40
4.8.9	Pharmaceutical Analysis-VI	3	4	80	32	3	20	100	40
4.8.10	Pharmacology-IV	3	4	80	32	3	20	100	40
4.8.11	Herbal Technology	3	4	80	32	3	20	100	40
Maximum Marks for the Semester - 1100									
Minimum marks for passing the semester - 550									

*The examination will be conducted by the colleges and the list of successful candidates shall be submitted to the University

Final Year B.Pharmacy

Semester-VII

4.7.1 Sterile Dosage Forms

1. Sterile Formulations:

Introduction, classification, scope of study

A. Parenteral Products:

Introduction

History of parenterals, conceptual origin, advantages and disadvantages, various parenteral routes of administration, essential characteristics like sterility, freedom from particulate matter and apyrogenicity

Preformulation Study

Detailed study of formulation parameters like volume, solvents, official monograph of solvents used for parenterals, osmotic pressure and adjustment of isotonicity, pH, maintenance of sterility, solubility, stability and other parameters

Types of Parenteral Formulations

Classification, manner of labeling, solutions, suspensions, emulsions and sterile solids, total parenteral nutrition (TPN)

Design of Production Facilities for Parenterals

Design of facilities in sterile area, change room design, windows, doors and services, laminar flow hoods and their efficiency tests, sources of contamination, personnel, environmental control, cleanliness classes, air handling (HVAC systems), HEPA filters, revised Schedule-M guidelines for the manufacture of parenterals

Processing of Parenterals

Different documents used in processing; aseptic and non-aseptic approaches of manufacturing, cleaning, filling and sealing of parenterals, applications of different methods of sterilization, validation of sterilization and environment

Packaging of Parenterals

Packaging components and types, specifications, quality control tests for glass, factors influencing choice of containers, prefilled syringes, form-fill-seal technique

Quality Control Tests for Parenterals

Test for sterility, pyrogen/endotoxin test, test for particulate matter, leaker test and other tests, quality assurance aspects of parenterals

B. Ophthalmic Products:

Anatomy of eye, ocular bioavailability, brief study of formulation and packaging of ophthalmics such as solutions, suspension, ointments and their quality control tests. Detailed study of inserts, ocuserts and contact lens solutions

2. Factory Layout:

Objectives, locational analysis, types of layouts, factors influencing layouts

3. Pilot Plant Scale-up Techniques:

Introduction, process considerations, scientific principle of scale-up and examples, SUPAC guidelines

Reference Books:

1. Pharmaceutical dosage forms: Parenteral medications, Vol. I, II, III, ed. by Kenneth A. Avis, Leon Lachman and H. A. Liberman, Marcel Dekker Inc., 1986.
2. J. Swarbrick, J. Boylan; Encyclopedia of Pharmaceutical technology, 2nd ed, Marcel Dekker, 2002.
3. Turco and Kings, Sterile Dosage forms, 3 rd Edn., Lea & Febiger, Philadelphia, 1985.
4. Modern Pharmaceutics, 4 th ed. Revised and Expanded ed. by Gilbert S. Banker and Christopher T. Rhodes, Marcel Dekker INC., 2002.
5. Pelczar MJ. Reid and Chan Microbiology. Tata McGraw Hill Publishing Co., New Delhi. Latest Edition.
6. Carter SJ. Cooper and Gunn's Dispensing for Pharmaceutical Students. Pitman Medical Publishing Co., New Delhi. Latest Edition.
7. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York
8. Hugo WB, Russel AD, Pharmaceutical Microbiology. Blackwell Scientific Publications. London. Latest edition.
9. Pharmaceutics The Science of dosage form design ed. by M. E. Aulton, 2nd ed., Churchill Livingstone, 2002.
10. The theory and practice of industrial pharmacy, ed. by Leon Lachman, H. A. Liberman, J. I. Kanig, 3 rd ed., Verghese Publishing house, 1987.
11. Ashim K. Mitra ed., Ophthalmic Drug Delivery, by, 1993, Marcel Dekker INC., Latest edition
12. Michael J. Akers, Quality Control of Parenterals, Marcel Dekker
13. Ansel, Howard, Pharmaceutical Dosage Forms and Drug Delivery Systems, Lippincott Williams and Wilkins London, 7th edition.
14. Carleton and Agalloco; Validation of Pharmaceutical sterile Products, 2nd Ed, Merce Dekker, 1999.
15. Michael Levin; Pharmaceutical Process Scale-Up, 2nd Ed, vol-157, CRS Press, 2006.
16. Mitra; Ophthalmic Drug Delivery System, 1st Ed, Vol-58, Marcel Dekker, 1993.
17. Ray & May; Freeze Drying / Lyophilization of pharmaceutical & Biological Products, Marcel Dekker

4.7.7 Sterile Dosage Forms

1. Perform the microbiological validation of aseptic area.
2. Preparation, filling, sealing, sterilization and evaluation of the following injections:
 - a. Sodium chloride Injection I.P.
 - b. Dextrose Injection I.P.
 - c. Calcium gluconate Injection I.P.
 - d. Ascorbic acid Injection I.P.
 - e. One injection in suspension form
 - f. One injection with the use of co-solvents
 - g. Intravenous fat emulsion for TPN
3. Preparation, filling, sealing, sterilization and evaluation of the eye drops and eye ointment (one each).
4. Evaluation of marketed parenteral suspension and emulsion for parameters like particle size, sterility and rheological parameters.

4.7.2 Pharmaceutical Jurisprudence

1. **Pharmaceutical Legislations in India:**

A brief review

2. **Pharmacy Act 1948:**

Objective, Definitions

Constitution and Functions of Central and State Pharmacy Councils,

Education Regulations and Approval of Courses and Institutions

Registration of Pharmacists, Preparation of Registers and qualifications for entry into register

Offences and Penalties

3. **Drugs and Cosmetic Act 1940 & Rules 1945:**

Definitions

Administrative Bodies:

Advisory: Constitution and function of Drugs Technical Advisory Board (DTAB) and Drug Consultative Committee (DCC),

Analytical: Central Drug Laboratory (CDL), Drug Control Laboratories, Government Analyst

Executive: Drug inspectors, Licensing Authorities, Controlling Authorities and Customs Collectors

Provisions Governing Import, Manufacture and Sale of Drugs

Labeling and Packaging of Drugs

Provisions applicable to manufacture and Sale of Ayurvedic Drugs

Provisions governing Import, Manufacture and Sale of Homeopathic Drugs

Various offences and corresponding Penalties

Broad content of various Schedules of the Drugs and Cosmetic Act and Rules

4. **Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 & Rules 1955:**

Objectives, Definitions, Official's duties, Classes of Prohibited Advertisement, Classes of Exempted Advertisement, Offences & Penalties

5. **Narcotic Drugs and Psychotropic Substances Act 1985:**

Definitions

Narcotics Commissioner and other officers

Illicit Traffic and measures to prevent illicit traffic of opium

Offences and Penalties

6. **Prevention of food adulteration act 1954:**

Definitions, central committee for food standards, central food laboratory; composition & functions, public analyst; qualification & duties, food inspectors; qualification, powers duties & sampling procedures, offences & penalties.

7. **Drug (Price Control) Order 1995:**

Object, Definitions, Retail price of formulation, Drugs Prices Display Rule 1961 and other relevant orders

Reference Books:

1. "Forensic Pharmacy", Kuchekar and Kadtare and Itkar, Nirali Prakashan, 5 th edition, 2005.
2. "Textbook of Forensic Pharmacy" N. K. Jain, Vallabh prakashan, 4 th edition, 1999.
3. D & C Acts, 1940 and Rules, 1945, S. W. Deshpande and Nilesh Gandhi, Sumit Publishers, 2006, Mumbai.
4. Govt. of India Publication of above Acts and Rules.
5. 'Text Book of Forensic Pharmacy', Mithal B.M. 7th ed, National Book Centre, Calcutta, 1985.
6. Jain N.K., 'A Text Book of Forensic Pharmacy (Pharmaceutical Jurisprudence)', Vallabh Prakashan, Pune, 1989.
7. Kuchekar B.S. & Khandatare A.M., Forensic Pharmacy including Industrial and Labour Laws. Nirali Publication, Pune, 1989.
8. 'Code of Pharmaceutical Ethics', Pharmacy Council of India (P. B. No. 337), New Delhi Year.
9. Current Government of India Publications of all Drugs Acts and Rules.

4.7.3 Medicinal Chemistry-III

The following classes of drugs should be discussed in relation to:

- A) Introduction to the rational development (if any)
- B) Detailed Classification of each class
- C) Chemical nomenclature
- D) Structure-activity relationship
- E) Mechanism of action
- F) Synthesis of compounds with asterisk

1. Drugs acting on central nervous system:

a. Anxiolytics, Hypnotics and Sedatives:

Benzodiazepines: Diazepam*, Oxazepam, Nitrazepam, Midazolam, Alprazolam.

Barbiturates: Phenobarbital, Amobarbital, Pentobarbital*;

Miscellaneous : Glutethimide, Meprobamate

b. Anticonvulsants:

Hydantoins: Phenytoin*, Mephenytoin.

Oxazolinediones: Trimethadione, Paramethadione;

Succinimides: Phensuximide, Ethosuximide;

Barbiturates: Mephobarbital;

Benzodiazepines: Clonazepam;

Ureas: Carbamazepine, Oxcarbazepine;

Miscellaneous: Primidone, Phenacemide, Sodium Valproate.

c. Psychotherapeutic Agents:

Phenothiazines: Chlorpromazine*, Triflupromazine, Fluphenazine, Thioridazine
Thiothixene;

Fluorobutyrophenones: Haloperidol .

Benzodiazepines: chlorodiazepoxide, Flurazepam, diazepam, Lorazepam,
Clonazepam.

Tricyclic Antidepressants: Imipramine, Desipramine, Amitriptyline, Nortriptyline,
Doxepin, Maprotiline;

MAO inhibitors: Phenelzine, Tranylcypromine;

Selective Serotonin reuptake inhibitors: Fluoxetine, paroxetine,

β -aminoketones: Molindone.

d. CNS Stimulants:

Analeptics: Pentylentetrazole;

Central Sympathomimetic agents: Amphetamine, Methamphetamine, Fenfluramine,
Phenmetrazine;

Methylxanthines: Caffeine, Theophylline

2. Narcotic Analgesic Agents:

Morphine and related compounds: Morphine, Codeine, thebaine, ethylmorphine,
dihydrocodeine, Heroin*, Levorphanol, Dextromethorphan, Meperidine*, Bemidone,
anilaridine, Methadone*, Fentanyl, dextropropoxyphene and pentazocine;

Morphine antagonist: Nalorphine, Naloxone, Naltrexone

3. Analgesics, Antipyretics and Anti-inflammatory agents (NSAIDs) :

Salicylic acid derivatives: Aspirin*;

Aryl acetic acid derivatives: Indomethacin, Naproxen, Ketoprofen, Ibuprofen*,
Diclofenac, Sulindac, Ketorolac, Nimesulide, piroxicam;

p-aminophenol derivatives: Acetaminophen*;
Pyrazolidinedione derivatives: Phenylbutazone, Oxyphenbutazone;
N-arylanthranilic acid: Mefenamic acid,
Selective COX-2 inhibitors: Rofecoxib, Valdecoxib;
Antigout-Allopurinol, Probenecid

4. Antihistaminics, Antiemetics and antiulcer drugs:

H₁ antagonist drugs: Diphenhydramine*, Doxylamine, Triprolidine, Pheniramine, chlorpheniramine*, Promethazine, Tripelenamine*, Cyclizine, Meclizine, Cyproheptadine, Terferadine, Cetirizine;

H₂ antagonist drugs: Cimetidine; Famotidine,

Proton pump inhibitors: Omeprazole, Lansoprazole, Ranitidine, Rabeprazole, Pentaprazole;

Antiemetic drugs: Ondansetron, Domperidone.

5. Steroids:

Adrenocorticoids: Cortisol, Hydrocortisol acetate, Fludrocortisone acetate, Dexamethasone, Betamethasone, Flucinolone acetonide, Triamcinolone, Prednisone, Prednisolone, Aldosterone.

Androgens and Anabolic Steroids: Testosterone, Fluoxymesterone, Oxymesterone.

Estrogens: Estrone, Ethinyl estradiol, Estriol, Menstranol, chlorotrianisene, Dienesterol, Diethylstilbesterol.

Progestational agents: Progesterone, Norethinodrel, Norgestrel, Medroxyprogesterone acetate, Dimethisterone,

Oral contraceptives-Mestranol, Lynestrenol

Reference Books:

1. Chemistry by Ashutosh Kar, 1st edition, New Age International Publications.
2. Vogel's Elementary M.E. Wolf: Burger's Medicinal Chemistry, John Wiley and Sons, New York.
3. R.F. Doerge, Wilson & Gisvold's: Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott.
4. W.O.Foye: Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
5. D.Lednicer and L.A. Mitschier: Ale Organic Chemistry of Drug synthesis Vol. 1, II & III John Wiley and Sons, New York.
6. S.N.Pandeya: A Textbook of Medicinal chemistry, Vol-I, S.G.Publishers, Varanasi.
7. Ashutosh Kar: Medicinal Chemistry, Wiley Eastern, Ltd., New Delhi
8. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry by Wilson and Gisvold, J. Lippincot Co. Philadelphia.
9. Medicinal Chemistry-A Biochemical Approach by Nogrady T, Oxford University Press New York, Oxford.
10. Antibacterial Chemotherapeutic Agents by SL Dax, Blackie Academic and Professional Publications, Chapman and Hall, 1997.
11. Principles of Medicinal Chemistry by Kadam SS, Mahadik KR, Bothara KG, Vol. I & II, 10 th Edition, Nirali Prakashan.
12. Introduction to Medicinal Chemistry' – How Drugs Act and Why by Alex Gringauz,
13. Willey-VCH Publication 1997.
14. Practical Organic Chemistry by Mann FC & Saunders BC, The English Language

15. Book Society and Longman Group Limited, London.
16. Vogel's A Text book of Practical Organic Chemistry by Vogel, 3rd edition, The English language book society and Longman group limited, London.
17. Advanced practical Medicinal Practical Organic Chemistry Small Scale Preparation by Arthur I., 2nd Edition, Part-I, CBS Publication.

4.7.8 Medicinal Chemistry-III

Synthesis, M.P. & TLC of following drugs & intermediates:

- 1) Aspirin
- 2) Paracetamol
- 3) Phenoxyacetic acid
- 4) Phenytoin
- 5) Barbituric acid
- 6) Benzhydrol

4.7.4 Pharmaceutical Analysis-V

Chromatography:

Definition & classification of chromatography, Terminology- Retention time, Retention volume, Adjusted retention time & volume, height equivalent to theoretical plate (HETP), temperature programming, resolution, column performance, derivatization, detection.

1. Paper Chromatography:

Introduction, papers used, development techniques & applications.

2. Thin Layer Chromatography :

Introduction, selection of adsorbent, preparation of the chromatoplate, sample spotting, development of chromatogram, detection of compound, qualitative & quantitative measurements and applications.

HPTLC-introduction, theory & applications.

3. Column Chromatography:

Introduction & classification

- a. Adsorption chromatography- theory, adsorbents used and applications.
- b. Partition chromatography- theory & applications.
- c. Ion-exchange chromatography – introduction, principle, types of ion exchange resins, applications.
- d. Gel chromatography – theory & principle, gels used, applications.

4. Gas Chromatography :

Introduction(GLC & GSC), carrier gas, columns, sample injection system, Detectors- Flame ionization detector (FID), Thermal conductivity detector,(TCD), Electron Capture detector (ECD), Atomic emission Detector (AED),Thermionic detector (TID), Nitrogen Phosphorous detector (NPD), Photoionisation detector (PID), Flame photometric detector(FPD) & Applications.

5. High Performance Liquid Chromatography :

Introduction, scope, principle & Instrumentation-

Mobile phase reservoirs- solvent treatment systems, Isocratic Elution, Gradient Elution.

Pumps-Reciprocating pump, Displacement pump & Pneumatic pump.

Injection system- sample loop system, stop flow etc.

Columns-Analytical columns, Guard columns, column thermostats, Types of column packing, Column packing material.

Detectors-solute property detector & solvent property detector (Absorbance detectors, IR detector, Fluorescence detectors, Refractive index detectors, Evaporative light scattering detector, electrochemical detectors)

Reference Books:

1. H. Beckett, J. B. Stenlake, practical pharmaceutical chemistry, 4th edition, CBS publications.
2. Vogel's textbook of quantitative chemical analysis, J Mendham, R.C. Denney, D. Barnes, M. Thomas, B, Sivasankar, VI th edition, pearson.
3. Principles of instrumental analysis, 4th edition, Skoogh, Holler, Nieman, Thomson

4. Gurdeep R. Chatwal, Sham K. Anand, Instrumental methods of chemical analysis, Himalay Publishing House.
5. Indian pharmacopoeia.
6. Handbook of Modern Pharmaceutical Analysis. Edited by Satinder Ahuja, Stephen Scypinski
7. Handbook of Pharmaceutical Analysis by HPLC. Edited by Satinder Ahuja, Michael Dong
8. Connors K A, A Textbook of Pharmaceutical Analysis, Wiley Interscience, New York.
9. Willard H. H., L. L. Merritt & John Dean Instrumental Method of Analysis, 6th edition,
10. Dr. B. K. Sharma Instrumental Methods of Chemical Analysis

4.7.9 Pharmaceutical Analysis-V

1. Separation of mixture using Thin-layer chromatography (two).
2. Separation of mixture using ascending and radial paper chromatography (two from each).
3. Demonstration of HPLC
4. Chromatographic analysis of Pharmaceutical dosage forms containing combinations (three).
5. Column chromatographic separations of two component mixtures (one).
6. Isolation of compounds using preparative chromatography (one)

4.7.5 Pharmacology-III

1. Central Nervous System:

General Considerations- Study of Neurotransmitters in the CNS and their mechanisms

Alcohols- Ethanol & disulfiram, treatment of methanol poisoning

General anesthetics

Sedatives, hypnotics and anxiolytics

Psychopharmacological agents- Disorders of psychology- psychosis, neurosis (Antipsychotics), Antidepressants

CNS stimulants

Antiepileptics

Drugs used for Parkinsonism and other neurodegenerative disorders

Cognition enhancers

2. Pain Management:

Opioid analgesics

Antipyretics, analgesics, steroidal and non-steroidal anti-inflammatory drugs

3. Drugs acting on Immune System:

Immunostimulant Agents: Vaccination schedules/ active immunization

Immunosuppressive agents

4. Pharmacology of Endocrine System (Hormones and Hormones antagonists):

Insulin, Oral hypoglycemic agents, GLP analogues

Thyroid and antithyroid drugs, parathyroid hormones, drugs regulating calcium homeostasis, Vitamin D

Antifertility agents

Reference Books:

1. Satoskar R.S. and Bhandarkar S.D.: Pharmacology & Pharmacotherapeutics, Popular Prakashan, Bombay.
2. Tripathi K.D.: Essentials of Medical Pharmacology, Jaypee Brothers, Medical Publishers, New Delhi.
3. Goodman and Gillman: Pharmacological Basis of Therapeutics, McGraw-Hill, Medical Publishing Division, New York.
4. Rang H.P. and Dale M.M.: Pharmacology, Churchill Livingstone, Edinburgh.
5. Katzung B.G.: Basic and Clinical Pharmacology, Lange Medical Publications, California.
6. Bowman W.C. and Rand M.J.: Textbook of Pharmacology, Blackwell Scientific Publications, Oxford.
7. Craig C.R. and Stitzel R.E.: Modern Pharmacology, Little Brown and Co., Boston.
8. Melman K.I. and Morelli H.F.: Clinical Pharmacology: Basic Principles in Therapeutics, Macmillan Press, New York.
9. Laurence D.R. and Bennett P.N.: Clinical Pharmacology, Churchill Livingstone, Edinburgh.
10. P.N Bennett & M J Brown: Clinical Pharmacology, Churchill Livingstone, Edinburgh.
11. Bevan J.A. and Thompson J.H.: Essentials of Pharmacology, Harper and Row Publishers, Philadelphia.
12. Drill V.A.: Pharmacology in Medicine, McGraw Hill Co., New York.
13. Grollman A.: Pharmacology & Therapeutics, Lea & Fabiger, Philadelphia.

14. Avery G.S.: Drug Treatment, Adiss Press, Sydney.
15. Das M.M. and Dutta S.K.: Ghosh's Modern Concepts on Pharmacology & Therapeutics, Hilton & Co., Calcutta.
16. Krantz and Carr: Pharmacology Principles of Medical Practice, Williams & Wilkins Co, Baltimore.
17. Pharmacopoeia of India (1985), Controller of publication, Delhi.
18. Pradhan S.N., Maickel R.P. and Dutta S.N.: Pharmacology in Medicine-Principles and Practice, S.P. Press International Inc., Maryland.
19. P Jagadish Prasad.: Conceptual Pharmacology, Universities Press (India), Pvt Ltd. Hyderabad.

4.7.10 Pharmacology-III

Discussion of the following aspects

1. Care and handling of common laboratory animals, animal welfare and introduction of CPCSEA and its guidelines, OECD guidelines.
2. Introduction to various experimental animals and their physiology with biochemical reference values in various animal species.
3. Introduction to commonly used instruments in experimental Pharmacology.
4. Introduction to the techniques of Euthanasia, stunning and pithing, study of various anesthetics employed to anesthetize laboratory animals.
5. Study of various routes of drug administration.
6. Study of physiological salt solutions, drug solution and use of molar solution in various animal experiments.
7. Study of various methods for collection of blood, body fluids and urine from experimental animals.

Experiments:

1. Computer simulations of following experiments through computerized simulated software programme using software such as X-Pharma, X-cology etc.
2. Record and interpret the concentration response of acetylcholine/histamine using suitable isolated tissues.
3. Study of synergism and antagonism using isolated tissues.
4. Study of the miotic and mydriatic effect of drugs using rabbit eyes.
5. To study effects of various drugs on heart using a suitable model.
6. Behavioral pharmacology demonstrations using various instruments preferably by simulations on computers.
7. Study of analgesic activity of drugs using Eddy's hot plate/ Tail-Flick analgesiometer/ tail immersion method.
8. Study of locomotor activity of drug using actophotometer.
9. Study of anticonvulsant activity of drug using maximal electroshock/ pentyleneterazol/ strychnine/ INH method.
10. Study of muscle relaxant property of drug using rota rod.
11. Study of various drugs on sleeping time using suitable animals.
12. Study of local anesthetic effect of drugs using suitable animal.
13. Study of Haloperidol/ Clonidine/ Pentazocin induced catalepsy using suitable animal.

Note:

- Wherever possible the simulated experiments may be done.
- CPCSEA approval to be obtained for experiments on animals.

Reference Books:

1. Ghosh M.N., Fundamentals of Experimental Pharmacology, Scientific Book agency, Calcutta.
2. Hand book of Experimental Pharmacology, 2nd Ed., S.K.Kulkarni., Vallabh Prakashan, Delhi.
3. Sheth, U. K. Dadkar, N. k. and Kamat, U. G. Selected Topics in Experimental pharmacology.
4. Mc. Leod. Pharmacological Experiments on Intact preparations.
5. R.K.Goyal. Practicals in Pharmacology: B.S. Shah Prakashan, Ahmedabad.
6. Suitable Softwares such as X-Pharma, X-cology

4.7.6 Pharmacognosy-III

1. Alkaloids:

Definition, occurrence, properties, General methods of Extraction, classification, chemistry & uses of Alkaloids. Source, constituents, uses, adulterants & substitutes of following drugs:

- a. Indole – Ergot*, Rauwolfia, Nux-vomica, Vinca
- b. Tropane – Datura*, Coca
- c. Quinoline – Cinchona
- d. Isoquinoline – Opium*, Ipecac
- e. Pyridine/ Piperidine – Lobelia
- f. Quinazoline – Vasaka
- g. Amino alkaloids – Ephedra*
- h. Steroidal – Ashwagandha

*Biosynthetic pathway to be studied

2. Glycosides:

Introduction, definition, occurrence, properties, classification, chemistry, uses along with their hydrolysis product. General methods of extraction

- a. Anthraquinones – Senna, Aloe
- b. Cardioactive - Digitalis, Squill
- c. Saponins – Liquorice
- d. Bitters - Kalmegh, Chirata
- e. Cynogenetic – Bitter almond
- f. Isothiocyanate – Mustard

3. Marine Drugs:

Sources and Pharmacological activities of newer medicinal agents of Marine source with special reference to Anti-inflammatory, Cardiovascular and anticancer agents.

4. Proteins and Enzymes:

Papain, Bromelin, Streptokinase, Serratiopeptidase and Urokinase.

5. Bioflavonoids:

Introduction and their medicinal importance, Green tea, Citrus peel, Gingko leaves and Soyabean.

Reference Books:

1. Trease and Evans, Pharmacognosy, Saunders company, London.
2. Tyler, Brady, and Robbers, Pharmacognosy, Lea Febiger, USA.
3. Wallis T. E., Text Book of Pharmacognosy, CBS publishers & distribution, Delhi.
4. Kokate, Purohit, Gokhale, Pharmacognosy, Nirali Prakashan, pune.
5. Rangari V.D., Pharmacognosy & Phytochemistry, Vol I, II, Career Publication,
6. E. Ramstad, Modern Pharmacognosy, Mc-graw hill Book Company.
7. Pridham J B, Swain T, Biosynthetic pathway in higher plants, Academic Press, New York.
8. Scheuer P G, Marine natural products, Academic Press, London.
9. Shah and Quadri Text Book of Pharmacognosy.

10. Ayurvedic Pharmacopoeia.
11. Ayurvedic Formulary.
12. Indian Pharmacopoeia.
13. British Pharmacopoeia.
14. Martindale Extra Pharmacopoeia.
15. Indian Herbal Pharmacopoeia.
16. Wagner, Plant drug analysis.
17. M. A. Iyengar, S. G. K Nayak "Pharmacognosy Lab Manual", Manipal Press.
18. M. A. Iyengar, "Anatomy of Crude Drugs", Manipal Press.
19. M. A. Iyengar, "Pharmacognosy of powdered crude drugs", Manipal Press.
20. Dr. Pulok K. Mukharjee, Quality control on Herbal Drugs, Business Horizon.
21. Kalia A. N., Industrial Pharmacognosy.
22. Mohd. Ali, "Pharmacognosy" CBS Publication. New Delhi.
23. Aushotosh Kar "Pharmacognosy & Pharmacobiotechnology" New Age International Publisher.

4.7.11 Pharmacognosy-III

1. Study of morphological, Histological(TS) characters, chemical microchemical tests for following crude drugs:
 - Leaf – Vinca
 - Root- Rauwolfia & Liquorice
 - Bark – Cinchona
 - Stem- Ephedra
 - Seed – *Nux-Vomica*
2. Powder Analysis of following drugs:
 - a) Vinca
 - b) Rauwolfia
 - c) Liquorice
 - d) Cinchona
 - e) Ephedra
 - f) Nux vomica
3. Identification of crude drugs mentioned in theory syllabus by their Morphological and physical characteristic.
 - a) Alkaloids- Vasaka, Aswagandha
 - b) Glycosides- Kalmegh, Mustard, Chirata
 - c) Bioflavonoids- Soybean, Citrus peel
4. General methods of extraction along with their identification test.
Alkaloids and Glycosides

Semester-VIII

4.8.1 Novel Drug Delivery Systems

1. Fundamentals of Novel Drug Delivery Systems:

Basic concepts, different terms used, classification, advantages and disadvantages, comparative study with conventional release monographs, commercial importance

2. Oral Modified Release Systems:

Introduction, historical development, pre-requisites of drug candidates, pertinent physiological parameters, biopharmaceutical considerations, dose calculation, various approaches to design sustained and controlled release, dissolution, diffusion controlled systems, matrix formulations, mechanisms of drug release from matrix, reservoir systems, ion exchange systems, osmotically controlled systems, gastroretentive systems, delayed release approaches like bioadhesive systems, colon targeting, study of polymers used in such systems, different drug release kinetics and model fitting, official and unofficial methods of evaluation

3. Recent Advances in Drug Delivery Systems:

Introduction, classification, principle involved, merits, demerits and applications of following systems excluding formulation aspects: transdermal drug delivery system, iontophoresis, sonophoresis, implants, intrauterine drug delivery system, liposomes, resealed erythrocytes

4. Pharmaceutical Aerosols:

Definition, general information, pharmaceutical applications, components, principle of working, important physicochemical parameters of aerosol system, classification, uses, safety and regulatory considerations of propellants, containers and closures, metered dose aerosols, formulations like solutions, suspensions, emulsions and dry powder inhalers, manufacturing techniques, official and unofficial methods of evaluation of aerosols

Reference Books:

1. Y. W. Chien; Controlled drug delivery, Fundamentals and Applications,, 2nd Ed. Marcel Dekker Inc., New York
2. Joseph R. Robinson; Sustained and controlled drug and delivery, Marcel Dekker Inc., New York
3. N. K. Jain; Advances in controlled and novel drug delivery, 1st Ed., CBS Publication, 2001.
4. Dekker.
5. R.C.Rowe & P.J.Sheskey; handbook of Pharmaceutical excipients, 5th Wd, Pharmaceutical
6. Peter.J.Tarcha; Polymers for Controlled drug delivery, 1st Ed,CRC Press,1991, Press,2006.
7. Benita; Microencapsulation- methods & Industrial Applications, 2nd Ed, vol-158, Taylor & Francis Publication, 2006.
8. Hadgraf & Guy; Transdermal Drug Delivery, 1st Ed, Vol-35, Marcel Dekker, 1989.
9. Drug Delivery and Targeting for Pharmacists and Pharmaceutical Scientists, Ed by Anya M Hillery, Andrew W. Lloyd and James Swarbrick, Taylor & Francis, London.

10. Transdermal and Topical Drug Delivery: From Theory to Clinical Practice, By Adrian C. Williams Pharmaceutical Press,
11. Hillery and loyed, Drug delivery and targeting, Tylor and francis London. 1st edition.
12. J. Hickey; Pharmaceutical Inhalation Aerosol Technology; 1st ed, Marcel Decker, 2004.
13. Modern Pharmaceutics, 4 th ed. Revised and Expanded ed. by Gilbert S. Banker and Christopher T. Rhodes, Marcel Dekker INC., 2002.
14. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York
15. Pharmaceutics The Science of dosage form design ed. by M. E. Aulton, 2nd ed., Churchill Livingstone, 2002.
16. The theory and practice of industrial pharmacy, ed. by Leon Lachman, H. A. Liberman, J. I. Kanig, 3 rd ed., Verghese Publishing house, 1987.
17. Ansel, Howard, Pharmaceutical Dosage Forms and Drug Delivery Systems, Lippincott Williams and Wilkins London, 7th edition.

4.8.7 Novel Drug Delivery Systems

1. Study of drug release requirements in different pharmacopoeias.
2. Formulation and evaluation of any two fast dissolving tablets.
3. Formulation and pre-compressional study of matrix tablets.
4. Evaluation of matrix tablets.
5. Formulation of multiparticulate oral sustained release formulation.
6. *In-vitro* drug release study of multiparticulate system.
7. Study on diffusion of drug through membranes.
8. Dissolution study of any two marketed products.
9. Formulation of a multiple emulsion.
10. Applications of software in modeling of drug release.

4.8.2 Pharmaceutical Business Management

1. Introduction to the Concepts of Management:

Managerial work, functions of management-primary functions like planning, organizing, Staffing, directing & controlling. Secondary functions like decision making, leadership, Delegation of authority/responsibility.

2. Introduction to Forms of Business Organization:

Forms of business Organization (in brief), Hindu Undivided family, Sole proprietorship, Partnership, Company and Cooperative Society.

3. Channels of Distribution:

Need of distribution channels, various channels of distribution like carrying & forwarding agents, super stockist, Wholesale & retail sellers.

4. The Pharmaceutical Product:

Market consideration in product development, marketing mix, product life cycle, modification of existing product, Marketing Generic drug, Branding- concept of brand, different types of brand, importance & reasons of branding.

5. Pharmaceutical Marketing:

Meaning & scope of marketing, quantitative & qualitative aspect, size & composition of market, market segmentation, marketing research. Uniqueness of medical products marketing. Professional Sales Representative-qualities of PSR, duties of PSR, purpose of detailing, selection & training of PSR.

6. Marketing Management:

Identifying and classifying market, understanding market behavior/consumer behavior, Pharmaceutical market in India, Pharmaceutical Industry Scenario.

Reference Books:

1. Koontz and O'Donnell., 'Principles of Management' by International Student edition of McGraw Hill.
2. Reddin. W. J., 'Effective Management', New Delhi, Tata M. C. Graw Hill,Publishing Co. Ltd.,
3. Peter Drucker, 'Practice of Management' Allied Publishers, New Delhi.
4. Principles and Practice of Drug store administration - Dr.Mahesh Burande [Nirali Prakashan
5. R. M. Mehta - Drug Store and Management [Vallabh prakashan]
6. Smith - Principles and methods of Pharmacy management
7. The practice of Management by Peter Dracket [Allied Publication, New Delhi.
8. Pharmaceutical Marketing Management – Mukhopadhyaya
9. Marketing Management by Philip Kotlar; Prentice-Hall of India Ltd., New Delhi.
10. Management and Organization by Louis A. Allen; McGraw Hill, Tokyo.
11. Marketing Management 2nd edition by Dr. Rajan Saxena.

4.8.3 Medicinal Chemistry-IV

The following classes of drugs should be discussed in relation to:

- A) Introduction to the rational development (if any)
- B) Detailed Classification of each class
- C) Chemical nomenclature
- D) Structure-activity relationship
- E) Mechanism of action
- F) Synthesis of compounds with asterisk

1. Drugs Acting on Cholinergic Nervous System:

Biosynthesis and metabolism of Acetylcholine.

Cholinergic receptor agonist: Acetylcholine, Bethanechol, Carbachol, Pilocarpine;

Cholinesterases Reversible Inhibitors: Neostigmine, Physostigmine;

Cholinesterases Irreversible Inhibitors: Echothiophate iodide, Isoflurophate, Parathione, Malathion;

Anticholinergics: Atropine, Scopolamine, Hyoscyamine, Dicyclomine*, Cyclopentolate*, benztropine, procyclidine, Isopropamide, Papaverine;

Ganglionic blocking agents: Mecamylamine;

Neuromuscular blocking agents: d-Tubocurarine chloride, Succinyl choline chloride

2. Drugs Acting on Adrenergic Nervous System:

Biosynthesis and metabolism of Epinephrine/norepinephrine.

Drugs affecting catecholamine biosynthesis: Metyrosine;

Drugs affecting catecholamine storage and release: Reserpine, Guanethidine;

Adrenergic receptor agonists: Epinephrine, norepinephrine, dopamine, phenylephrine, Clonidine, methyldopa*, dobutamine, Isoproterenol, Metaraminol, Terbutaline, Ephedrine;

Adrenergic receptor antagonists: tolazoline, Phenoxybenzamine, prazosin, Yohimbine, Propranolol*, Atenolol, Metoprolol, Labetolol, Phenylpropanolamine, Salbutamol*

3. Cardio Vascular Drugs:

Antianginal agents and vasodilators: Amyl nitrite, Nitroglycerin, isosorbide dinitrite;

Calcium antagonists: Verapamil, Diltiazem, Nifedipine*, Amlodipine

Antiarrhythmic drugs: Quinidine, Procainamide*, Flecainide, Amiodarone;

Antihypertensive drugs: Enalapril, Captopril, Losartan, Telmisartan, Hydralazine, Diazoxide, minoxidil;

Positive inotropic agents: Digitalis;

Antihyperlipidemic drugs: Clofibrate, Gem fibrozil, atorvastatin, Pravastatin, Lovastatin, Simvastatin, Cholestyramine

4. Drug Design:

Computer Aided Drug Design (CADD)

Quantitative Structure Activity Relationship (QSAR)- Introduction to various methods of QSAR – Physicochemical parameters – lipophilic, electronic and steric. Hansch LFER model and Free Wilson analysis.

Prodrugs

Reference Books:

1. Chemistry by Ashutosh Kar, 1st edition, New Age International Publications.
2. Vogel's Elementary M.E. Wolf: Burger's Medicinal Chemistry, John Wiley and Sons, New York.
3. R.F. Doerge, Wilson & Gisvold's: Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott.
4. W.O.Foye: Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
5. D.Lednicer and L.A. Mitschier: Ale Organic Chemistry of Drug synthesis Vol. 1, II & III John Wiley and Sons, New York.
6. S.N.Pandeya: A Textbook of Medicinal chemistry, Vol-I, S.G.Publishers, Varanasi.
7. Ashutosh Kar: Medicinal Chemistry, Wiley Eastern, Ltd., New Delhi
8. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry by Wilson and Gisvold, J. Lippincot Co. Philadelphia.
9. Medicinal Chemistry-A Biochemical Approach by Nogrady T, Oxford University Press New York, Oxford.
10. Antibacterial Chemotherapeutic Agents by SL Dax, Blackie Academic and Professional Publications, Chapman and Hall, 1997.
11. Principles of Medicinal Chemistry by Kadam SS, Mahadik KR, Bothara KG, Vol. I & II, 10 th Edition, Nirali Prakashan.
12. Introduction to Medicinal Chemistry' – How Drugs Act and Why by Alex Gringauz,
13. Willey-VCH Publication 1997.
14. Practical Organic Chemistry by Mann FC & Saunders BC, The English Language
15. Book Society and Longman Group Limited, London.
16. Vogel's A Text book of Practical Organic Chemistry by Vogel, 3rd edition, The English language book society and Longman group limited, London.
17. Advanced practical Medicinal Practical Organic Chemistry Small Scale Preparation by Arthur I.,2nd Edition, Part-I, CBS Publication.

4.8.8 Medicinal Chemistry-IV

Synthesis, M.P. & TLC of following drugs & intermediates;

- 1) Diphenylmethane
- 2) Methyl salicylate
- 3) Benzocaine
- 4) N-phenylanthranilic acid
- 5) *o*-benzoylbenzoic acid
- 6) Methyl orange

4.8.4 Pharmaceutical Analysis-VI

1. Mass Spectrometry:

Principle, theory, ion sources, mass analyzer, types of ions and applications.

2. NMR Spectroscopy:

Basic principles, theory, chemical shift, factors affecting chemical shift, spin-spin coupling & applications.

3. Quality Assurance & Quality Control:

Introduction to Q.A. & Q.C, Components of Q.A, Q.C & quality management. Documents and formats in Quality policy (quality manual & SOP).

4. Analytical method development and validation according to ICH for UV and HPLC and application in the analysis of API and formulations. Introduction to process and equipment validation

5. Packaging Material Testing (PMT):

Quality Control test of packaging material used for pharmaceutical products-Glass bottles, Metals, Plastics, Aluminium foils, Rubber closure, Paper board cartons, Corrugated box. (Permeability of plastics, burst and tensile strength, cartons drop test, folding endurance test, hydrolytic resistance test, grammage, leakage test etc.)

6. Bio-Statistics:

Statistics in quality control: Definition of terms- mean, median, mode, normal distribution. Standard deviations, t-test, f-test, Chi (ψ) square test, Linear regression & non-linear regression, ANOVA & Statistical Quality Control Charts.

Reference Books:

1. A.H.Beckett, J.B.Stenlake, practical pharmaceutical chemistry, IVth edition, CBS publications.
2. Vogel's textbook of quantitative chemical analysis, J Mendham, R.C.Denney, J.D.Barnes, M.Thomas, B,Sivasankar, VI th edition, pearson.
3. Principles of instrumental analysis, Vth edition, Skoog, Holler, Nieman, Thomson
4. Gurdeep R. Chatwal, Sham K. Anand, Instrumental methods of chemical analysis, Himalay Publishing House.
5. William Kemp, Organic spectroscopy, ELBS.
6. Y.R.Sharma, elementary organic spectroscopy –principles & chemical applications, S.Chand & company Ltd.
7. Manohar A. Potdar, pharmaceutical quality assurance, nirali prakashan.
8. Remington Pharmaceutical Sciences, Vol-1
9. Theory & Practice of Industrial Pharmacy, Lachmann.
10. Walter Soroka, Fundamental's of Packaging technology.
11. D. A. Sawant, The Pharmaceutical sciences pharma pathway, Nirali Prakashan.
12. R M Silverstein and F X Webster, Spectrometric identification of organic compounds 6th Edition
13. Dixie A, Dean, Roy Evans, Ian Hall Pharmaceutical Packaging Technology

4.8.9 Pharmaceutical Analysis-VI

1. Determination of drug concentration in multicomponent drug formulation by simultaneous equation & absorption ratio methods (One each).
2. Development and validation methods using UV Visible and applications for assay of API and formulations (Demo).
3. Determination of grammage of packaging materials. (Two)
4. Determination of bursting strength of aluminum foil, corrugated box. (Two)
5. Q.C. test for plastic, rubber closure & glass as per IP. (Three)
6. Interpretation of NMR & Mass spectrum. (One each)
7. Calculation involving t-test (two)

4.8.5 Pharmacology-IV

1. Chemotherapy:

General principles of chemotherapy of infections

Drug resistance: Introduction, types, mechanisms and its importance in chemotherapy

Sulfonamides, cotrimoxazole and quinolones

Beta lactam antibiotics: Penicillins, Cephalosporins and Carbapenems

Tetracycline and chloramphenicol

Aminoglycoside antibiotics

Macrolides

Antitubercular drugs

Antileprosy drugs

Antifungal drugs

Antiviral drugs

Antiprotozoal (Antimalarial, Antiamoebic etc.) drugs

Anthelmintic drugs

Antineoplastic drugs

2. Drugs used in the disorders of eye, ENT & skin:

Drugs with special reference to its Indications, Dose and Uses to be discussed for following:

Eye - Glaucoma, keratitis, conjunctivitis

ENT- Allergic rhinitis, otitis media, vertigo, meneiers disease.

Skin- Acne, candidiasis, alopecia, erythema nodosum, eczema, contact dermatitis, Herpes simplex, pediculosis, psoriasis, pyoderma, scabies, urticaria, pruritis.

2. Bioassays:

Definition, Principles, types of bioassays & applications;

Bioassay of following drugs:

a. Acetylcholine

b. d-Tubocurarine

c. Heparin

d. Insulin

Reference Books:

1. Satoskar R.S. and Bhandarkar S.D.: Pharmacology & Pharmacotherapeutics, Popular Prakashan, Bombay.
2. Tripathi K.D.: Essentials of Medical Pharmacology, Jaypee Brothers, Medical Publishers, New Delhi.
3. Goodman and Gillman: Pharmacological Basis of Therapeutics, McGraw-Hill, Medical Publishing Division, NewYork.
4. Rang H.P. and Dale M.M.: Pharmacology, Churchill Livingstone, Edinbergh.
5. Katzung B.G.: Basic and Clinical Pharmacology, Lange Medical Publications, California.
6. Bowman W.C. and Rand M.J.: Textbook of Pharmacology, Blackwell Scientific Publications, Oxford.
7. Craig C.R. and Stitzel R.E.: Modern Pharmacology, Little Brown and Co., Boston.
8. Melman K.I. and Morelli H.F.: Clinical Pharmacology: Basic Principles in Therapeutics, Macmillan Press, New York.

9. Laurence D.R. and Bennett P.N. Clinical Pharmacology, Churchill Livingstone, Edinburgh.
10. P.N Bennett & M J Brown.: Clinical Pharmacology, Churchill Livingstone, Edinburgh.
11. Bevan J.A. and Thompson J.H.: Essentials of Pharmacology, Harper and Row Publishers, Philadelphia.
12. Drill V.A.: Pharmacology in Medicine, McGraw Hill Co., New York.
13. Grollman A.: Pharmacology & Therapeutics, Lea & Fabiger, Philadelphia.
14. Avery G.S.: Drug Treatment, Adiss Press, Sydney.
15. Das M.M. and Dutta S.K.: Ghosh's Modern Concepts on Pharmacology & Therapeutics, Hilton & Co., Calcutta.
16. Krantz and Carr: Pharmacology Principles of Medical Practice, Williams & Wilkins Co, Baltimore.
17. Pharmacopoeia of India (1985), Controller of publication, Delhi.
18. Pradhan S.N., Maickel R.P. and Dutta S.N.: Pharmacology in Medicine-Principles and Practice, S.P. Press International Inc., Maryland.
19. P Jagadish Prasad.: Conceptual Pharmacology, Universities Press (India), Pvt Ltd. Hyderabad.

4.8.10 Pharmacology-IV

1. Introduction to general principles, types and applications of bioassays.
2. Introduction to cell based assay: Definition, Types, Advantages, limitations of cell based assay and application to High throughput screening.
3. Bioassay of Acetylcholine using Chick ileum/ goat trachea by interpolation method.
4. Bioassay of Acetylcholine using Chick ileum/ goat trachea by matching method.
5. Bioassay of Acetylcholine using Chick ileum/ goat trachea by three point method.
6. Bioassay of Atropine/ Mepyramine using Chick ileum.
7. Bioassay of Histamine using Chick ileum/ goat trachea by matching method.
8. To demonstrate effect of antihistaminic drugs on guinea pigs.
9. To demonstrate the effect of anti-motility drugs using mice/rat.
10. To demonstrate bioassay of oxytocin using rat uterus.
11. To demonstrate the diuretic activity in rats using metabolic cage.
12. To study the anthelmintic activity using earthworm model.
13. Bioassay of Heparin using the Sheep blood.

Note:

- Wherever possible the simulated experiments may be done.
- CPCSEA approval to be obtained for experiments on animals.

Reference Books:

1. Ghosh M.N., Fundamentals of Experimental Pharmacology, Scientific Book agency, Calcutta.
2. Hand book of Experimental Pharmacology, 2nd Ed., S.K.Kulkarni., Vallabh Prakashan, Delhi.
3. Sheth, U. K. Dadkar, N. k. and Kamat, U. G. Selected Topics in Experimental pharmacology.
4. Perry, W. L. M. Pharmacological Experiments on Isolated preparations.
5. R.K.Goyal. Practicals in Pharmacology: B.S. Shah Prakashan, Ahmedabad.
6. Suitable Softwares such as X-Pharma, X-cology.

4.8.6 Herbal Technology

1. Introduction:

Role of natural products in herbal medicine, General status and importance of herbal medicine

2. Processing of Herbs:

Methods of processing of herbs, Quality assessment, packing and storage of herbs.

3. Herbal Formulations:

Introduction to herbal formulations, Principle, methods, single herb formulation, poly-herbal formulation & their merits and demerits.

4. Regulatory Requirements of Herbal Medicines:

Safety and efficacy consideration, Regulatory control for Import and Export of herbal products, Herbal drug regulations in India (Brief)

5. Introduction to Ayurvedic Dosage Forms:

Definition, Classification, method of preparation and evaluation of following formulations- Asava & Arista, Gutika, Taila, Bhasma, Churna & Leha.

6. Herbal Cosmetics:

Introduction and brief history, Skin and hair care products, production and quality control thereof.

Reference Books:

1. Trease and Evans, Pharmacognosy, Saunders Company, London.
2. Shah and Quadri Text Book of Pharmacognosy.
3. Atal C K, Cultivation and utilization of medicinal and aromatic plant.
4. Chopra, Indigenous drug of India.
5. Wealth of India.
6. Nadkarni, Material Medica.
7. Shehnaz Husain's Beauty Book, Orient Press.
8. Jain Urjita, Beauty through herbs, Institute of Herbs.
9. Chaudhari R D, Herbal Drug Industry, Eastern publication
10. Dr. Pulok K. Mukharjee, "Quality control Herbal Drugs" Business Horizons,
11. Ayurvedic Pharmacopoeia.
12. British Pharmacopoeia.
13. Martindale Extra Pharmacopoeia.
14. Indian Herbal Pharmacopoeia.
15. Wagner, Plant drug analysis.
16. Mohd. Ali, "Pharmacognosy" CBS Publication. New Delhi.
17. Herbal Drug Technology by S.S. Agrawal & M. Paridhavi
18. Kirtikar and Basu Indian Medicinal Plant.
19. Kalia A. N., Industrial Pharmacognosy.
20. Modern Methods of Plant Analysis by Peach & Tracey

4.8.11 Herbal Technology

1. Preparation and Evaluation of Herbal Cosmetics:
 - a) Hair Cosmetics (Any two)
 - b) Skin Cosmetics (Any two)
2. Extraction and Isolation of following phytoconstituents:
 - a) Caffeine
 - b) Citric acid
 - c) Eugenol from Clove oil
3. Study of following Health food with reference to morphology:
Honey, Brahmi, Shatavari, Spirulina, Guggul, Shankpushpi, Bael fruit, Pipal fruit, Cucumber and Fenugreek
4. Evaluation of marketed herbal and Ayurvedic Formulation: (Group Experiment)
Any one herbal and Ayurvedic preparation.