ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati, Assam

SYLLABUS

For

Four Years Bachelor of Pharmacy (B. Pharm) Programme

SCHEME OF INSTRUCTIONS

1st SEMESTER

| SUBJECT | L | т | Р | CREDITS | SUBJECT GROUP |
|---------------------------------------|---|---|---|--|--|
| Communicative English | 2 | 0 | - | 2 | HM |
| HAP-I | 3 | 0 | - | 3 | PC |
| HAP-I Practical | - | - | 3 | 2 | PC |
| Pharmaceutics-I (Dispensing Pharmacy) | 3 | 0 | - | 3 | PC |
| Pharmaceutics- I Practical | - | - | 3 | 2 | PC |
| Pharm. Chemistry-I (Inorganic) | 3 | 0 | - | 3 | PC |
| Pharm. Chemistry-I Practical | - | - | 3 | 2 | PC |
| Pharmacognosy-I | 3 | 0 | - | 3 | PC |
| Pharmacognosy-I Practical | - | - | 3 | 2 | PC |
| Remedial Biology* & | 2 | 0 | - | 2 | BS |
| Remedial Biology Practical* OR | - | - | 2 | 1 | BS |
| Remedial Mathematics* | 3 | - | - | 3 | BS |
| TOTAL: 16/17 0 | 12/14 | 25 | | | |
| | SUBJECT Communicative English HAP-I HAP-I Practical Pharmaceutics-I (Dispensing Pharmacy) Pharmaceutics- I Practical Pharm. Chemistry-I (Inorganic) Pharm. Chemistry-I Practical Pharmacognosy-I Pharmacognosy-I Pharmacognosy-I Practical Remedial Biology * & Remedial Biology Practical* OR Remedial Mathematics* | SUBJECTLCommunicative English2HAP-I3HAP-I Practical-Pharmaceutics-I (Dispensing Pharmacy)3Pharmaceutics-I Practical-Pharm. Chemistry-I (Inorganic)3Pharm. Chemistry-I Practical-Pharmacognosy-I3Pharmacognosy-I Practical-Remedial Biology * &2Remedial Biology Practical* OR-Remedial Mathematics*3TOTAL: 16/1712/14 | SUBJECT L T Communicative English 2 0 HAP-I 3 0 HAP-IPractical - - Pharmaceutics-I (Dispensing Pharmacy) 3 0 Pharmaceutics-I Practical - - Pharmaceutics-I Practical - - Pharm. Chemistry-I (Inorganic) 3 0 Pharmacognosy-I 3 0 Pharmacognosy-I Practical - - Remedial Biology * & 2 0 Remedial Biology Practical* OR - - TOTAL: 16/17 0 12/14 25 | SUBJECT L T P Communicative English 2 0 - HAP-1 3 0 - HAP-1 Practical - - 3 Pharmaceutics-1 (Dispensing Pharmacy) 3 0 - Pharmaceutics-1 Practical - - 3 Pharmaceutics-1 Practical - - 3 Pharmaceutics-1 Practical - - 3 Pharmacognosy-1 Practical - - 3 Pharmacognosy-1 Practical - - 3 Remedial Biology *& 2 0 - Remedial Biology Practical* OR - - 2 Remedial Mathematics* 3 - - | SUBJECT L T P CREDITS Communicative English 2 0 - 2 HAP-1 3 0 - 3 HAP-1 Practical - - 3 2 Pharmaceutics-1 (Dispensing Pharmacy) 3 0 - 3 Pharmaceutics-1 Practical - - 3 2 Pharmacognosy-1 Practical - - 3 2 Pharmacognosy-1 Practical - - 3 2 Remedial Biology *& 2 0 - 2 Remedial Biology Practical* OR - - 3 3 TOTAL: 16/17 0 12/14 25 1 |

Contact hours: 29 or 30/week Credits: 25 (HM – 2, BS – 3, PC – 20)

*Candidates who did not pass Biology subject in entry qualification (+2Sc.etc) examination are required to take Remedial Biology (T&P), and those who did not pass Mathematics subject are required to take Remedial Mathematics. Candidates who pass both Biology and Mathematics subjects can take either Remedial Biology (T&P) or Remedial Mathematics.

L: Lecturer T: Tutorial P: Practical.

2ndSEMESTER

| COURSE NO. | SUBJECT | | L | т | Ρ | CREDITS | SUBJECT GROUP |
|------------|----------------------------------|--------|----|----|----|---------|---------------|
| PY132201 | HAP-II | | 3 | 0 | - | 3 | PC |
| PY132212 | HAP-II Practical | | - | - | 3 | 2 | PC |
| PY132203 | Pharm.Analysis-I | | 3 | 0 | - | 3 | PC |
| PY132214 | Pharm.Analysis-I Practical | | - | - | 3 | 2 | PC |
| PY132205 | Pharmacognosy-II | | 3 | 0 | - | 3 | PC |
| PY132216 | Pharmacognosy-II Practical | | - | - | 3 | 2 | PC |
| PY132207 | Hospital Pharmacy | | 3 | 0 | - | 3 | PC |
| PY132208 | Pharm.Chemistry-II (Org. Chem-I) | | 3 | 0 | - | 3 | PC |
| PY132219 | Pharm.Chemistry-II Practical | | - | - | 3 | 2 | PC |
| PY1322010 | Mathematics & Statistics | | 3 | 0 | - | 2 | BS |
| | | TOTAL: | 18 | 00 | 12 | 25 | |

Contact hours: 30/week Credits: 25 (BS – 2, PC – 23)

3rdSEMESTER

| Course No. | Subject | Contact Hrs L-T-P | Credits | Subject group |
|------------|---|-----------------------------|---------|---------------|
| PY132301 | Pharmaceutics- II (Phy. Pharm-I) | 3-0-0 | 3 | PC |
| PY132312 | Pharmaceutics- II Practical | 0-0-3 | 2 | PC |
| PY132303 | Basic Engineering-I (Unit Operations-I) | 3-0-0 | 3 | BE |
| PY132314 | Basic Engineering-I (Practical) | 0-0-3 | 2 | BE |
| PY132305 | Pharm.Chemistry-III (Org. Chem-II) | 3-0-0 | 3 | PC |
| PY132316 | Pharm.Chemistry-III Practical | 0-0-3 | 2 | PC |
| PY132307 | Pharmacognosy-III | 3-0-0 | 3 | PC |
| PY132318 | Pharmacognosy-III Practical | 0-0-3 | 2 | PC |
| PY132309 | Pathophysiology of Common Diseases | 3-0-0 | 3 | PC |
| PY1323010 | Community Pharmacy and Health Education | 3-0-0 | 2 | PC |
| | | | | |

Total 18-0-12 25

Contact hours: 30/week Credits: 25(BE –5, PC – 20)

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

| Course No. | Subject | | Contact Hrs L-T-P | Credits | Subject group |
|------------|---|-----------|-----------------------------|---------|---------------|
| PY132401 | Pharmaceutics- III (Phy. Pharm-II) | | 3-0-0 | 3 | PC |
| PY132412 | Pharmaceutics- III Practical | | 0-0-3 | 2 | PC |
| PY132403 | Basic Engineering-II (Unit Operations-II) | | 3-0-0 | 3 | BE |
| PY132414 | Basic Engineering-II (Practical) | | 0-0-3 | 2 | BE |
| PY132405 | Pharmacology-I | | 3-0-0 | 3 | PC |
| PY132416 | Pharmacology-I Practical | | 0-0-3 | 2 | PC |
| PY132407 | Computer Applications | | 3-0-0 | 2 | BS |
| PY132418 | Computer Applications Practical | | 0-0-3 | 2 | BS |
| PY132409 | Pharm.Chemistry-IV (Org. Chem-III) | | 3-0-0 | 3 | PC |
| PY1324010 | Pharmacognosy IV | | 3-0-0 | 3 | PC |
| | | Total | 18-0-12 | 25 | - |

4thSEMESTER

Contact hours: 30/week Credits: 25(BS –4, BE – 5, PC – 16)

5thSEMESTER

| Course No. | Subject | L-T-P | Contact Hrs | Credits | Subject group |
|------------|-----------------------------------|-------|-------------|---------|---------------|
| PY132501 | Pharmaceutics- IV (Pharm. Tech-I) | | 3-0-0 | 3 | PC |
| PY132512 | Pharmaceutics- IV Practical | | 0-0-3 | 2 | PC |
| PY132503 | Applied Microbiology | | 3-0-0 | 3 | PC |
| PY132514 | Applied Microbiology Practical | | 0-0-3 | 2 | PC |
| PY132505 | Pharm.Chemistry-V (Med. Chem-I) | | 3-0-0 | 3 | PC |
| PY132516 | Pharm.Chemistry-V Practical | | 0-0-3 | 2 | PC |
| PY132507 | Pharmacognosy-V (Phytochemistry) | | 3-0-0 | 3 | PC |
| PY132518 | Pharmacognosy-V Practical | | 0-0-3 | 2 | PC |
| PY132509 | Pharm.Analysis-II | | 3-0-0 | 3 | PC |
| PY1325110 | Pharm.Analysis-II Practical | | 0-0-3 | 2 | PC |
| | | | | | |
| | | Total | 15-0-15 | 25 | |

Contact hours: 30/week Credits: 25 (PC – 25)

6thSEMESTER

| Course No. | Subject | Contact Hrs L-T-P | Credits | Subject group |
|------------|---------------------------------------|-----------------------------|---------|---------------|
| PY132601 | Pharmaceutics- V (Pharm. Tech-II) | 3-0-0 | 3 | PC |
| PY132612 | Pharmaceutics- V Practical | 0-0-3 | 2 | PC |
| PY132603 | Pharm.Chemistry-VI (Med. Chem-II) | 3-0-0 | 3 | PC |
| PY132614 | Pharm.Chemistry-VI Practical | 0-0-3 | 2 | PC |
| PY132605 | Biochemistry | 3-0-0 | 3 | PC |
| PY132616 | Biochemistry Practical | 0-0-3 | 2 | PC |
| PY132607 | Pharmacology-II | 3-0-0 | 3 | PC |
| PY132618 | Pharmacology-II Practical | 0-0-3 | 2 | PC |
| PY132609 | Pharmaceutical Jurisprudence & Ethics | 3-0-0 | 3 | PC |
| PY1326210 | Industrial Training | 0-0-0 | 2 | PW |
| | | | | |

Total 15-0-12

25

Contact hours: 27/week Credits: 25 (PC – 23, PW - 2)

7thSEMESTER

| Course No. | Subject | | Contact Hrs L-T-P | Credits | Subject group |
|------------|---|------------|-----------------------------|---------|---------------|
| PY132701 | Pharmaceutics- VI (Bio-Pharmaceutics & Pharmaco | kinetics)3 | 3-0-0 | 3 | PC |
| PY132712 | Pharmaceutics- VI Practical | | 0-0-3 | 2 | РС |
| PY132703 | Pharmacology-III | | 3-0-0 | 3 | РС |
| PY132714 | Pharmacology-IIIPractical | | 0-0-3 | 2 | РС |
| PY132705 | Pharm.Chemistry-VII (Med. Chem-III) | | 3-0-0 | 3 | РС |
| PY132706 | Pharm.Analysis-III | | 3-0-0 | 3 | РС |
| PY132717 | Pharm.Analysis-III Practical | | 0-0-3 | 2 | РС |
| PY132708 | Pharm. Biotechnology | | 3-0-0 | 3 | PC |
| PY132709 | Elective -I | | 3-0-0 | 2 | PE |
| PY1327210 | Project Work (Seminar based on Literature | | | | |
| | Survey & Plan of Work) | | 0-0-3 | 2 | PW |
| | | Total | 18-0-12 | 25 | |

Contact hours: 30/week Credits: 25(PC – 19, PE-3, PW-3)

8thSEMESTER

| Course No. | Subject | | Contact Hrs L-T-P | Credits | Subject group |
|------------------|--|-----------|----------------------|---------|---------------|
| PY132801 | Pharmaceutics- VII (Pharmaceutical Technol | logy III) | 3-0-0 | 3 | PC |
| PY132812 | Pharmaceutics- VII Practical | | 0-0-3 | 2 | PC |
| PY132803 | Clinical Pharmacy & Therapeutics | | 3-0-0 | 3 | PC |
| PY132804 | Quality Assurance & GMP | | 3-0-0 | 3 | PC |
| PY132805 | Pharmaceutical Management | | 3-0-0 | 3 | НМ |
| PY132806 | Pharmacognosy VI (Industrial Pharmacognos | sy) | 3-0-0 | 3 | PC |
| PY132817 | Pharmacognosy VI Practical | | 0-0-3 | 2 | PC |
| PY132828 | Project Work & Viva- voce | | 0-0-9 | 6 | PW |
| | | Total | 15-0-12 | 25 | - |
| Contact hours: 3 | 0/week Credits: 25 (PC – 16, HM -3 | 8, PW-6) | 1 | | |

ELECTIVES

Herbal Drug Technology

Advanced Pharmaceutical Analysis

Pharmacy Practice

Advanced Pharmaceutics.

B. Pharm FirstSemester

COMMUNICATIVE ENGLISH

PY132101 THEORY

2 hours/week

UNIT-I 1. Communication

Verbal and non-verbal spoken and written, To inform, enquire, attract, influence, regulate and entertain, Bias-free and plain English, Formal and informal style.

UNIT-II 2 Communicative Cra

2. Communicative Grammar

Time, tense and aspect, Verbs of states and events, Statements, questions and responses, Omission of information, Expressing emotion and attitude, hope, pleasure, disappointment, regret, approval, surprise.

UNIT-III 3. Writing I

Paragraph writing – topic sentence, cohesion and coherence – sentence linkers (so, however etc.), Preparing notes – writing business letters and E-Mail messages

UNIT-IV 4. Writing-II

Writing curriculum vitae (both chronological and functional) along with an application for job. Making an oral presentation, Facing an interview

RECOMMENDED BOOKS:

- 1. Geoffrey Leach and Jan Svartvik, Longman, A communicative Grammar of English
- 2. J.D. O' connor, Better English Pronunciation, ELBS
- J.K.Chand and B.C. Das, A Millennium Guide to writing and Speaking English, Friends' Publishers
- 4. John Sealy, Oxford Guide to Writing and Speaking, OUP.
- 5. John Sealy, Oxford Guide to Writing and Speaking English, OUP.
- 6. J.V.Cilanilam, More effective Communication, Saga Publications
- 7. J.K.Chand and B.C. Das, A Millennium Guide to writing and Speaking English, Friends' Publishers
- 8. The Chicago manual of style (Part 2 Section 15) Prentice-Hall of India

HUMAN ANATOMY AND PHYSIOLOGY-I

PY132102. THEORY

3 hours/week

UNIT-I

1. Scope of anatomy and physiology and basic medical terminology used in these subjects, Structure of cell, its components and their functions, Elementary Tissues of the Human Body: Epithelial, connective, muscular and nervous tissues, their sub-types and their characteristics.

UNIT-II

2. **Osseous System:** Structure, composition and functions of skeleton, Classification of joints, types of movements of Joints, Disorders of joints.

3. **Skeletal Muscles:** Gross anatomy; physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.

UNIT-III

4. **Haemopoietic System:** Composition and functions of blood and its elements, formation of red blood cell (Erythropoesis) and disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.

5. Lymph and Lymphatic System: Composition, formulation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.

UNIT-IV

6. **Cardiovascular System:** Basic anatomy of the heart, Physiology of heart, blood vessels and circulation. Basic understanding of Cardiac cycle, heart sounds and electrocardiogram.

7. Blood pressure and its regulation.

8. Brief outline of cardiovascular disorder like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

RECOMMENDED BOOKS:

1. Anatomy and Physiology in Health and Illness by Ross and Willson (Churchill living stone)

- 2. Concise Medical Physiology by S.K.Choudhury (New central book agency, Calcutta)
- 3. Guyton A C, Hall JE., Text book of Medical Physiology, W.B.Sandnders Company
- 4. Human Physiology, C CChatterjee, Medical allied agency, Calcutta
- 5. Tortora G.J., S.R.Grabowski&Anagnodokos N.P., Principles of Anatomy & Physiology
- 6. Dorasari and Gandhi's elements of Human anatomy, Physiology and health education by ThakorebhaiP.gandhi&R.K.Goyal (B.S.ShahPrakashan)

HUMAN ANATOMY AND PHYSIOLOGY-I

PY132113. PRACTICAL

3 hours/week

- 1. Study of human skeleton.
- 2. \times Study of different systems with the help of charts and models.
- 3. Microscopic study of different tissues.

4. Estimation of haemoglobin in blood. Determination of bleeding time, clotting time, R.B.C.Count, Total leucocyte count, D.L.C. and E.S.R.

5. Recording of body temperature, pulse rate and blood pressure, basic understanding of Electrocardiogram-PQRST waves and their significance

PHARMACEUTICS-I (DISPENSING PHARMACY)

PY132104. THEORY

3 hours/week

UNIT-I

1. History of pharmacy:

Origin & developments of pharmacy, scope of pharmacy, Pharmacy as a career, evaluation of pharmacy profession, introduction to pharmacopoeias with special references to I.P., B.P., U.S.P. & International Pharmacopoeia. Definition of Drug, New Drug as per D&C Act 1940, steps for New Drug Development- filing of INDA (Investigational new drug application).

2. Extraction & Galenicals:

Extraction processes, study of infusion, decoction, digestion, percolation, maceration and their modifications, preparation and applications of tinctures and extracts. Factors affecting selection of extraction process.

UNIT-II

3. Prescription:

Handling of prescription, source of errors in prescription, General dispensing procedures including labeling of dispensed products, care required in dispensing procedures including labeling of dispensed products. Typical prescriptions like mixtures, solutions, emulsions, creams, ointments, powders, capsules, pastes, jellies, suppositories, opthalmics, pastilles, lozenges, pills, lotions, liniments, inhalations, paints, sprays, tablet triturates etc.

4. Pharmaceutical calculations:

Imperial, metric and S.I., weights and measures, inter-conversion, Posology, Latin terms, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipies percentage solution, allegation, alcohol dilution, proof spirit.

UNIT-III

5. Pharmaceutical additives:

Diluents, vehicles, bases, solvents, organoleptic additives (Colouring, flavouring and sweetening agents), co solvents, preservatives, surfactant and their applications, antioxidants, polymers and their applications

6. Introduction of pharmaceutical dosage forms:

Brief definition and Classification of solids, semisolids and liquid dosage forms (solutions, mixtures, spirits, aromatic waters, glycerin, paints, syrups, elixirs, mouth washes, mucilage, lotions, liniments, pastes, inhalations, emulsions, suspensions and powders (effervescent powders, bulk powders, dusting powders, insufflations, dentifrices and cachets), conventional and novel delivery systems.

UNIT-IV

7. Incompatibilities :

Physical and chemical incompatibilities, inorganic incompatibilities including incompatibilities of metals and their salts, acids, alkalis, organic incompatibilities. Purine bases, alkaloids, Pyrazolone derivatives, Amino acids, Quaternary Ammonium Compounds, Carbohydrates, Glycosides, Anesthetics, Dyes, Surface active agents, correction of incompatibilities, Therapeutic incompatibilities.

RECOMMENDED BOOKS:

- 1. Cooper & Gunn's Dispensing for Pharmaceutical students CBS Publishers, New Delhi
- 2. Dispensing Pharmacy by R.M.Mehta (VallabhPrakashan, Delhi)

PHARMACEUTICS-I (DISPENSING PHARMACY)

PY132115. PRACTICAL

3 hours/week

- 1 Preparation of selected pharmacopoeial preparations under the category of aromatic waters, spirits, solutions, infusions, tinctures and extracts, (at least 10 preparations)
- 2. Dispensing procedures involving pharmaceutical calculations, dosage calculations for pediatric patients, etc.
- 3. Dispensing of prescriptions falling under the categories of mixtures, solutions, emulsions, creams, ointments, powders, suppositories, pastes, jellies, lotions liniments, inhalations and paints etc. (at least 30 preparations)
- 4. Dispensing of prescriptions involving adjustment of tonicity
- 5. Identification of various types of incompatibilities in prescriptions, correction and dispensing of such prescriptions (at least 10 prescriptions).
- 6. Dentifrices, cachets, suspension, ophthalmic and spray preparation.

PHARM.CHEMISTRY-I (INORGANIC)

PY132106. THEORY

3 hours/week

An outline of methods of preparation, uses, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests, if any of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia.

UNIT-I

- 1. Acids and Bases: Buffers, Water.
- 2. Gastrointestinal Agents: Acidifying agents, Antacids, Protectives, and Adsorbents, Cathartics.
- **3. Major Intra and Extra-cellular Electrolytes:** Physiological ions. Electrolytes used for replacement therapy, acid base balance and combination therapy.

UNIT-II

- **4. Essential and Trace Elements:** Transition elements and their compounds of pharmaceutical importance: Iron and Haematinics, Mineral supplements.
- 5. Cationic and anionic components of inorganic drugs useful for systematic effects.
- 6. Topical Agents: Protectives, Astringents and Anti-infectives.

UNIT-III

- 7. Gases and Vapors: Oxygen, Anesthetics and Respiratory Stimulants.
- 8. Dental Products: Dentifrices, Anti-caries agents.
- 9. Complexing and chelating agents used in therapy.

UNIT-IV

- 10. Miscellaneous Agents: Sclerosing agents, Expectorants, Emetics, Poisons and Anti-dotes, Sedatives etc. Pharmaceutical aids used in Pharmaceutical Industry. Anti-oxidants, preservatives, filter aids, absorbents, diluents, excipients, suspending agents, colorants etc.
- 11. **Inorganic Radio Pharmaceuticals:** Nuclear radio pharmaceuticals, Reactions, Nomenclature, Methods of obtaining their standards and units of activity, clinical applications and dosage, hazards and precautions.

RECOMMENDED BOOKS:

- 1. Inorganic Medicinal and Pharmaceutical Chemistry by Block, Roche, Soine, Wilson.
- 2. Bentley and Driver's Text Book of Pharmaceutical Chemistry.
- 3. Pharmaceutical Chemistry Inorganic by G.R.Chatwal.

PHARM.CHEMISTRY-I (INORGANIC)

PY132117. PRACTICAL

3 hours/week

The background and systematic qualitative analysis of inorganic mixtures of upto four radicals.Six mixtures to be analyzed, preferably by semi-micro methods. All identification tests for pharmacopocial inorganic pharmaceuticals and qualitative tests for cat ions and anions should be covered.

PHARMACOGNOSY-I

PY132108. THEORY

3 hours/week

UNIT-I

1. Definition, history, scope and development of Pharmacognosy

2. Classification of drugs: Alphabetical, morphological, taxonomical, chemical and pharmacological classification of drugs.

UNIT-II

3.Cultivation, Collection, Processing and **Storage** of crude drugs: Factors influencing cultivation of medicinal plants. Types of soils and fertilizers in common use. Pest management and natural pest control agents. Plant hormones and their applications.Polyploidy, mutation and hybridization with reference to medicinal plants.

4. Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods and properties.

UNIT-III

5. An introduction to following groups of plant constituents (only definition and brief explanation): Carbohydrates, Glycosides, Tannins, Volatile oils, Terpenes, Resins, Steroids, Alkaloids, Flavonoids, Anthraquinones, Coumarins, saponins, gums & mucilages.

6. Systematic pharmacognostic study of following

a) **Carbohydrates** and derived products: Agar, Guar gum, Gum acacia, Honey, Ispaghula, Pectin, Starch, Sterculia and Tragacanth.

b) **Lipids**: Bees wax, Castor oil, Cocoa butter, Cod liver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice, Bran oil, Shark liver oil and Wool fat.

UNIT-IV

7. a) Fibres: Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.

b) Pharmaceutical aids: Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colours.

RECOMMENDED BOOKS:

- 1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
- 2. Pharmacognosy by Trease G.E. and Evans W.C., (Balliene Tindall, Eastbourne)
- 3. Text Book of Pharmacognosy by T.E. Wallis.(CBS Publishers & Distributors, New Delhi)
- 4. Pharmacognosy by Tyler V.E., Brady L.R. and Robbers J.E., (Len & Febiger, Philadelphia)
- 5. Pharmacognosy and Phytochemistry by Vinod D Rangari. (Career Publications, Nashik)

PHARMACOGNOSY-I

PY132119. PRACTICAL

3 hours/week

1. Microscopic measurements of cells and Cell contents: Starch grains, calcium oxalate crystals and phloem fibres.

2. Determination of leaf constants such as stomatal index, stomatal number, vein-islet number, vein-termination number and palisade ratio.

- 3. Identification of crude drugs belonging to carbohydrates and lipids.
- 4. Study of fibres and pharmaceutical aids.
- 5. Preparation of herbarium sheets.

REMEDIAL BIOLOGY

PY1321010. THEORY

2 hours/week

UNIT-I

- 1. Morphology: Root and stem modifications, leaf, flower, fruit & seed.
- 2. Anatomy: Tissue system in root, stem, leaf, bark & wood.

UNIT-II

- 3. Plant cell: Organelles, cell division, tissues and types.
- 4. Methods of classification: Artificial, natural and phyllogenetic.

UNIT-III

6. Plant taxonomy: Families; Apocyanaceae, Solanaceae, Rutaceae, Fabaceae, Rubiaceae, Apiaceae, Lamiaceae, Brassicaceae, UmbelliferaePapaveraceae, Foaceae and Liliaceae.

UNIT-IV

- 6. Animal Kingdom: Structure and life history of Amoeba, Entamoeba, Trypanosoma, Ancyclostoma, Plasmodium, Taenia, Ascaris, Fasiola and Oxyuris.
- 7. General structure and life history of insects like Mosquito, Housefly, Mites and Silk worm.

RECOMMENDED BOOKS:

- 1. A Text book of Zoology by Pati, Nanda & Ghosh (kitabmahal, Cuttack).
- 2. A Text book of Botany by A.K.Nanda.
- 3. Pharmaceutical Botany by Heber W.Youngken (International book distribution, Dehradun).
- 4. An Introduction of plant Anatomy by A.J.Eames and L.H.Dantels.

REMEDIAL BIOLOGY

PY1321111. PRACTICALS

2 hours/week

- 1. Care, use and types of microscope
- 2. Morphology of plant parts indicate in theory, Preparation and microscopic examination of the following;
- 3. Stem of monocot and dicot plant
- 4. Root of monocot and dicot plant
- 5. Leaf of monocot and dicot plant
- 6. Gross identification of slides and structure and life cycle of lower plants and animals mentioned in theory.
- 7. Structure of parasites and insects infecting human as mentioned in the theory.

REMEDIAL MATHEMATICS

PY1321012. THEORY

3 hours/week

UNIT-I

1. Algebra :Equations reducible to quadratic, simultaneous equation (linear and quadratic). Determinants, properties of solution of simultaneous equations by Cramer's rule, matrices, definition of special kinds of matrices, arithmetic operations on matrices, inverse of a matrix, solution of simultaneous equations by matrices, pharmaceutical applications of determinants and matrices. Evaluation of En1, En2 and En3 mensuration and its pharmaceutical applications.

UNIT-II

- 2. Measures of Central Value :Objectives and pre-requisites of an ideal, measure mean, mode and median.
- **3. Trigonometry:** Measurement of angle, T-ratios, addition, subtraction and transformation formulae, T-ratios of multiple, sub-multiple, allied and certain angles. Application of logarithms in pharmaceutical computations.

UNIT-III

4. Analytical Plans Geometry :Certain co-ordinates, distance between two points, area of triangle, a locus of point, straight line, slope and intercept form double-intercept form, normal (perpendicular form), slope-point and two point form, general equation of first degree.

UNIT-IV

5. Calculus :

(I) **Differential :**Limits and functions, definition of differential coefficient, differentiation of standard functions, including function of a function (chain rule). Differentiation of implicit functions, logarithmic differentiation, parametric differentiation, successive differentiation.

(II) Integral :Integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, substitution and partial fractions, formal evaluation of definite integrals.

RECOMMENDED BOOKS:

- 1. A Text Book of Mathematics for XI,XII students, NCERT Publications, Vol-I to IV.
- 2. Elements of Mathematics(Vol.-I & II), Orissa State Bureau of Text Book Preparation and Production, Bhubaneswar.
- 3. Topics in Mathematics by G.Das, R.S.Rath, B.P.Acharya, P.Mohapatra, S.Padhy

B. Pharm Second Semester

HUMAN ANATOMY AND PHYSIOLOGY- II

PY132201. THEORY

3 hours/week

Anatomy and Physiology with emphasis on various systems:

UNIT-I

1. Digestive System: Gross anatomy of the gastro-intestinal tract, Basic structure (histology), functions of its different parts including those of liver, pancreas and function gall bladder, composition various gastrointestinal secretions and their role in the absorption and digestion of food. Disorders of digestive system.

2. **Respiratory System:** Anatomy of respiratory organs, functions, and mechanism of respiration. Mechanism and regulation of respiration, respiratory volumes and vital capacity.Disorders of respiratory system.

UNIT-II

3. **Central Nervous System:** Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain, Cranial nerves and their functions.Brief description about the common disorder of CNS.

4. Autonomic Nervous System: Physiology and functions of the autonomic nervous system. Common disease associated with ANS.

UNIT-III

5. Urinary System: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base (water and electrolyte) balance of Kidney.Diseases of the urinary system.

6. **Reproductive System:** Male and female reproductive systems and their hormones, physiology of menstruation and fertilization. Sex differentiation, spermatogenesis & oogenesis.Pregnancy its maintenance and parturition.

UNIT-IV

7. **Endocrine System:** Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and Ovary, their hormones and functions. Disease associated with Endocrine system.

8. **Sense Organs:** Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

RECOMMENDED BOOKS:

- 1. Anatomy and Physiology in Health and Illness by Ross and Willson (Churchill living stone)
- 2. Concise Medical Physiology by S.K.Choudhury
- 3. Guyton A C, Hall JE., Text book of Medical Physiology, W.B.Sandnders Company
- 4. Human Physiology, C C Chatterjee, Medical allied agency, Calcutta
- 5. Tortora G.J., & Anagnodokos N.P., Principles of Anatomy & Physiology

HUMAN ANATOMY AND PHYSIOLOGY- II

PY132212. PRACTICAL

3 hours/week

- 1. Study of different systems like digestive, respiratory,nervous,urinary, reproductive etc with the help of charts and models.
- 2. Microscopic studies of different tissues.
- 3. Simple experiments involved in the analysis of normal and abnormal urine: Collection of specimen, appearance, determination of pH of urine by pH meter. Qualitative determination of sugars, proteins, bile salt, blood product and ketone bodies.
- 4. Physiological experiments on nerve-muscle preparations.
- 5. Determination of vital capacity, experiments of spirometry.

PHARMACEUTICAL ANALYSIS- I

PY132203. THEORY

3 hours/week

UNIT-I

- 1. Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries & definitions, Significant figures, Rules for retaining significant digits, Types of errors, Mean deviation, Standard deviation, Statistical treatment of small data sets, Selection of sample, Precision & accuracy, Fundamentals of volumetric analysis, Methods of expressing concentration, Primary & secondary standards.
- 2. Acid Base Titrations: Acid base concepts, Relative strengths of acids and bases, Ionization, Law of mass action, Common-ion effect, Ionic product of water, pH, Hydrolysis of salts, Henderson-Hesselbach equation, Buffer solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, Mixed indicators, Polyprotic system, Polyamine and amino acid systems, Amino acid titration, Applications in assay of H₃PO₄, NaOH, CaCO₃ etc.

UNIT-II

 Oxidation Reduction Titrations : Concepts of oxidation and reduction, Redox reactions, Strengths and equivalent weights of oxidizing and reducing agents, Theory of Redox Titrations, Redox indicators, Cell representations, Measurement of electrode potential, Oxidation-Reduction curves, Iodimetry and Iodometry, Titrations involving Ceric Sulphate, Potassium Iodate, Potassium Bromate, Potassium Permanganate, Titanous Chloride and Sodium 2, 6 – Dichlorophenol Indophenol.

UNIT-III

1. Precipitation Titrations: Precipitation reactions, Solubility products, Effects of acids, temperature and solvent upon the solubility of a precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate and barium sulphate, Indicators, Gay-lussac method; Mohr's method; Volhard's method; Fajan's method.

UNIT-IV

2. Gravimetric Analysis : Precipitation techniques, Solubility products ; the colloidal state, Supersaturation co-precipitation, Post-precipitation, Digestion & washing of the precipitate, Filtration, Filter papers and crucibles, Ignition, Thermogravimetric curves, specific examples like Barium Sulphate, Aluminum as Aluminum Oxide, Calcium as Calcium Oxalate, Magnesium as Magnesium Pyrophosphate, Organic precipitants.

RECOMMENDED BOOKS:

- 1. Vogel's Text book of Quantitative Chemical Analysis (Person Education, Singapore)
- 2. Garratt, The Quantitative analysis of drugs
- 3. H.H.Willard, Instrumental Methods of Analysis (CBS Publishers, Delhi)

PHARMACEUTICAL ANALYSIS- I

PY132214. PRACTICAL

3 hours/week

The students should be introduced to the main analytical tools through demonstrations. They should have a clear understanding of a typical analytical balance, the requirements of a good balance, weights, care and use of a balance, methods of weighing and errors in weighing. The students should also be acquainted with the general apparatus required in various analytical procedures.

- 1. Standardization of analytical weights and calibration of volumetric apparatus.
- 2. Acid Base Titrations : Preparation with standardization of acids and bases; some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures e.g. boric acid should also be covered.

- 3. **Oxidation ReductionTitrations:** Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2, 6 dichlorophenol indophenol, and ceric ammonium sulphate.
- 4. **Precipitation Titrations:** Preparation and standardization of titrants like nitrate and ammonium thiocyanate, Titrations according to Mohr's, Volhard's and Fajan's methods.
- 5. **Gravimetric Analysis:** Preparation of gooch crucible for filtration and use of sintered glass crucible, Determination of water of hydration, Some exercises related to gravimetric analysis should be covered.

PHARMACOGNOSY - II

PY132205. THEORY

3 hours/week

UNIT-I

1. Resins: Study of Drugs Containing Resins and Resin Combination with chemical test - Colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of peru, benzoin, turmeric, ginger.

2. Tannins: Study of tannins and tannin containing drugs with chemical test - Gambir, black catechu, Pale catechu, gall and myrobalan.

UNIT-II

3. Volatile Oils : General methods of obtaining volatile oils from plants, Study of volatile oils with chemical test - Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood.

UNIT-III

4. Extraction of Phyto-pharmaceuticals: Principle and methods involved.

5. Plant bitters and sweeteners.

UNIT-IV

6. The holistic concept of drug administration in traditional systems of medicine. Introduction to ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Chumas, Lehyas and Bhasmas.

RECOMMENDED BOOKS:

- 1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (NiraliPrakashan, Pune)
- 2. Trease G.E. and Evans W.C., Pharmacognosy (BailliereTindall, Eastbourne)
- 3. Text Book of Pharmacognosy by T.E. Wallis.(CBS Publishers, New Delhi)
- 4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)
- 5. Pharmacognosy and Phytochemistry by Vinod D Rangari. (Career Publications, Nashik)

PHARMACOGNOSY - II

PY132216. PRACTICAL

3 hours/week

1. Identification of crude drugs mentioned.

2. Microscopic studies of seven-selected crude drugs and their powders mentioned under the category of volatile oils in theory and their chemical tests.

3. Practical relating general method of extraction and general chemical test of such extracts.

HOSPITAL PHARMACY

PY132207. THEORY

3 hours/week

UNIT-I

- **1. Health delivery systems in India:** Definition and role of hospitals in the health delivery systems. Types of hospitals.
- 2. Organization & Structure: Organization of a hospital and hospital pharmacy, functions and objectives of hospital pharmacy, Location, Layout & flow chart of material and men, personnel and facilities required, including equipments, responsibilities of a hospital pharmacist, Constitution and functions of Pharmacy therapeutics committee.
- 3. Hospital Formulary: Contents, preparation and revision of hospital formulary.

UNIT-II

4. Drug Store Management in hospitals settings:

- a) Organization of drug store, types of material stocked, storage conditions.
- b) Purchase & inventory control principles, purchase procedures, purchase order, procurement and stocking.

5. Drug Distribution Systems in Hospitals :

- a) Out-patient dispensing, methods adopted.
- b) Dispensing of drugs to in-patients. Types of drug distribution systems. Charging policy, labeling.
- c) Dispensing of drugs to ambulatory patients.
- d) Dispensing of controlled drugs.
- 6. **Central Sterile Supply Unit & their management:** Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, supply of sterile materials.

UNIT-III

7. Nomenclature and uses of surgical instruments, hospital equipments and health accessories: Primary wound dressing, absorbents, surgical cotton, surgical gauzes etc.,

bandages, adhesive tape, protective cellulosic hemostatstics, official dressings, absorbable and non-absorbable sutures, ligatures and catguts.

- 8. Manufacture of sterile and non-sterile products: Policy making of manufacturable item, personnel requirements, manufacturing practice, Master Formula Card, Production Control, manufacturing records.
- **9. Drug Information Services:** Sources of information on drugs, disease, treatment schedules, procurement of information, computerized services (e.g. Medline), retrieval of information, medication error.

UNIT-IV

10. Records and Reports: Application of computers in maintenance of records, medication monitoring, drug information and data storage and retrieval in hospital retail pharmacy establishment, Medication Error, reporting of drug interaction, adverse drug reaction, idiosyncratic cases.

RECOMMENDED BOOKS:

- 1. Hassan William E., Hospital Pharmacy (Lea & Febiger, Philadelphia)
- 2. Nand P., Khar R.K., Text book of Hospital & Clinical Pharmacy (Birla publication, Delhi)
- Dandiya P.C. &Mathur M., A text book of Hospital & Clinical Pharmacy. (VallabhPrakashan, Delhi)
- 4. G Parthasarathi, Karin Nyfont-Hanscen, Milap Nahata, A textbook of clinical pharmacy practice.

PHARMACEUTICAL CHEMISTRY-II (ORG. CHEM-I)

PY132208.THEORY

3 hours/week

UNIT-I

1. Structure & Properties :

Atomic Structure, Atomic orbitals, Molecular orbital theory, Wave equation, Molecular orbitals, Bonding & anti-bonding orbitals, Covalent bond, Hybrid orbitals, Intra-molecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, Structure & physical properties, Inter-molecular forces, Acids and bases.

UNIT-II

2. Stereochemistry I :

Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations.

UNIT-III

3. Organic reaction and their mechanism:

Types of organic reactions, Reaction intermediates: carbocations, Carbanions, Carbenes, Nitrene, Nitrenium ions.

UNIT-IV

4. Structure, Nomenclature, Preparation & Reactions of :

Alkanes, Alkenes, Alkynes, Cycloalkanes, Dienes, Alkyl Halides, Alcohols, Ethers, Epoxides, Aromatic Hydrocarbons.

RECOMMENDED BOOKS;

- 1. Organic chemistry by Morrison and Boyd.(Prentice Hall of India, New Delhi)
- 2. Advanced organic chemistry by Bhal&Bhal (S.Chand, New Delhi)
- 3. Organic Chemistry Vol. 1 and II by I.L.Finar (Longman, Singapur)
- 4. Bently and Drivers text of Pharmaceutical chemistry by Oxford University, New Delhi

PHARMACEUTICAL CHEMISTRY-II (ORG. CHEM-I)

PY132219.PRACTICAL

3 hours/week

- 1. The student should be introduced to the various laboratory techniques through demonstrations involving synthesis of selected organic compounds (e.g. aspirin, p-bromoacetanilide, anthraquinone from anthracine, reduction of nitrobenzene etc.)
- 2. Identification of organic compounds and their derivatization.
- 3. Introduction to the use of stereomodels.

MATHEMATICS & STATISTICS

PY 1322010 THEORY

3 hours/week

UNIT-I

1. Differential Equations :- Introduction to differential equations, Formation of different equations, Solution of differential equations of first order and first degree by the methods of variable separable, Homogeneous, reducible to homogeneous and linear equations, Reducible to linear equations, Exact differential equations. Differential equations of order greater than one with constant coefficients, Pharmaceutical applications.

UNIT-II

2. Laplace transforms: Introduction, The linearity property, Laplace transforms of some elementary functions, First shifting property, the inverse Laplace transforms, Laplace transforms of derivatives, Convolution Theorem (only statement), Application of Convolution Theorem.

UNIT-III

3. Statistics -I :- Introduction to statistics, Data collection random and noon -random sampling methods, Sample size, Diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams, Measures of central tendency, Measures of dispersion, Standard deviation, Measures of skew-ness, Measures of kurtosis, Correlation and regression analysis, Methods of least squares, Probability and events, Probability theorems, Baye's Theorem on probability.

UNIT-IV

4. Statistics- II :- Probability Distributions – Binomial , Poisson and normal distributions (normal curve and properties) , Tests of hypothesis(statistical inference) Standard error, Fudicial (confidence) limits, Tests of significance for small samples- Students t-distribution and t-tests, Paired t-test, chi-square tests (Pharmaceutical applications).

RECOMMENDED BOOKS:

- 1. Integral Calculus by Shanti Narayan.
- 2. Statistical Methods by S.P.Gupta. (S.Chand, New Delhi)
- 3. Higher Engineering Mathematics by B.S. Grewal. (Khanna Publishers, Delhi)
- 4. Mathematical Methods by Potter & Gold Berg.(Prentice Hall of India, New Delhi)
- 5. Calculus and Differential Equations by Dr. U.N.Misra & Prof. D.N.Sharma (Assam Book Depot).

B. Pharm Third Semester
PHARMACEUTICS-II

(Physical Pharmacy - I)

PY132301. THEORY

3 hours/week

UNIT -I

 Matter, Properties of Matter : State of matter, change in the state of matter, latent heats and vapour pressure, sublimation, critical point, eutectic mixtures, gases, aerosols, inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solids- crystalline, amorphous and polymorphism.

UNIT –II

2. Thermodynamics: First, second and third laws, Zeroth law, absolute temperature scale, thermochemical equations, phase equilibria and phase rule.

UNIT -III

- **3. Solutions:** Ideal and real solutions, colligative properties, partition coefficient, conductance and its measurement. Debye Huckel theory. Solubility expression, Determination of solubility, Solubility of gases in liquids, Solubility of liquids in liquids, Solubility of solids in liquids
- **4. Buffers:** Buffer equations and buffer capacity, buffers in pharmaceutical systems, preparation, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

UNIT -IV

- **5. Surface and Interfacial Phenomenon :** Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid-gas and solid-liquid interfaces, complex films, electrical properties.
- **6.** Adsorption :Freudlich and Gibbs adsorption isotherms, Langmuir theory of adsorption, BET equation.

RECOMMENDED BOOKS:

- Martin's Physical Pharmaceutical Sciences by P.J.Sinko (Lippincott William and Wilkins, Baltimore)
- 2. Cooper and Gunn's Tutorial Pharmacy edited by S.J. Carter
- 3. Bently's Textbook of Pharmaceutics edited by E.A. Rawlins

PHARMACEUTICS-II

(Physical Pharmacy - I)

PY132312. PRACTICAL

3 hours/ week

- **1.** To determine molar mass by Rast method and cryoscopic method.
- **2.** To determine refractive index of given liquids and find out the contribution of carbon, hydrogen and oxygen in molar refraction of a compound.
- 3. To determine molar mass of volatile liquids by Victor-Meyer method.
- **4.** To determine the specific rotation of sucrose at various concentrations and determine the intrinsic rotation
- 5. To determine the heat of solution, heat of hydration and heat of neutralization.
- 6. To determine the cell constant, verify Ostwald dilution law and perform conductometric titration.
- 7. To determine rate constant of simple reaction
- **8.** Determination of surface interfacial tension, HLB value and critical micellar concentration of surfactants.

BASIC ENGINEERING - I

(Unit Operations – I)

PY132303. THEORY

3 hours/ week

UNIT -I

- Fluid Flow: Concept of fluid statics and fluid dynamics, Type of flow, Reynold's number, Viscosity, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.
- 2. **Dehumidification, Humidity Control and Air Conditioning:** Basic concepts and definition, wet bulb and adiabatic saturation temperature, psychometric chart and measurement of humidity, application of humidity, measurement in pharmacy, equipments of dehumidification operations, Refrigeration, Theories of refrigeration & Air conditioning.

UNIT -II

3. Material Handling Systems:

Liquid handling – different types of pumps.

Gas handling – various types of fans, blowers and compressors.

Solid handling – Conveyers

UNIT –III

- 4. Filtration andCentrifugations: Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter. Factors affecting filtration.Principles of centrifugation, industrial centrifugal filters and centrifugal sedimenters.
- 5. Crystallization: Characteristics of crystals like purity, size shape, geometry, habit, forms size and factors affecting them. Solubility curves and calculation of yields, material and heat balances around Swenson Walker Crystalizer. Supersaturation theory and its limitations, nucleation mechanisms, crystal growth, study of various types of crystallizer, tanks, agitated batch, Swenson Walker, single vacuum, circulating magma and Krystal crystallizer, caking of crystals and its prevention.

UNIT -IV

- 6. **Materials of Construction:** General study of composition, corrosion, resistance, properties and applications of materials of construction with special reference to stainless steel and glass.
- 7. **Industrial Hazards and safety Precautions:** Mechanical, Chemical, Electrical, fire and dust hazards, industrial dermatitis, and accident records etc.

RECOMMENDED BOOKS:

- 1. Cooper and Gunn's Tutorial Pharmacy Edited by S J Carter (CBS Publishers, Delhi)
- 2. Pharmaceutical Engineering by K.Sambamurty (New Age International, New Delhi)
- 3. Chemical Engineering by Badger and Banchero (MGH, New Delhi)

BASIC ENGINEERING-I

(Unit Operations – I)

PRACTICAL

3 hours/ week

- 1. Measurement of flow of fluids and their pressure, determination of Reynolds number.
- 2. Determination of humidity use of Dry Bulb and Wet Bulb temperatures and Psychrometric charts.
- 3. Experiments to demonstrate applications of centrifugation filtration.
- 4. Experiments based on crystallization.
- 5. Other experiments based on theory.

PHARMACEUTICAL CHEMISTRY-III

(Organic Chemistry-II)

PY132305. THEORY

3 hours/ week

UNIT –I

Stereochemistry:II

Stereo chemistry of addition of halogens to alkenes syn and anti-addition.Mechanism of addition of halogens to alkenes.Stereo chemistry of E2 reaction ,syn and anti elimination reaction.Stereo specific and streo selective reaction,symphoria-neighbouring group effect

$\mathbf{UNIT} - \mathbf{II}$

Aldehydes and Ketones: General methods of preparation, acidity of α -hydrogen Nucleophilic addition reactions, Aldol condensation reaction, Cannizzaro reaction, Clemmensen reduction. Amines: Structure, Nomenclature, method of preparation of amines. Properities of Amines: Basicity of amines,Effect of substituents on basicity of aromatic amines, Reactions with special reference to the synthesis of diazonium salts. conversion of amines into substituted amides, ring substitution in

UNIT – III

Benzene and its homologues: Structure of benzene, Resonance, Aromatic character, Huckel Rule. General methods of preparation, Physical properties, Chemical properties: Electrophilic substitution reactions, Friedel crafts reaction, Catalytic hydrogenation.

Orientation of aromatic substitution in mono-substituted benzene

Phenols:General methods of preparation, Acidity, Characteristic reactions

aromatic amines, Carboxylic Acids, Functional derivatives of Carboxylic

Polynuclear Aromatic Hydrocarbons: Preparation and chemical reactions of anthracene and phenanthrene.

$\mathbf{UNIT}-\mathbf{IV}$

Nucleophilic aromatic substitution reactions, α , β -unsaturated carbonyl compounds,organic reagents used in drug synthesis (e,g,(Aluminium tert-butoxide, Lithium Aluminium Hydride, Grignard reagent, N-Bromo-succinimide (NBS), Diazomethane)

RECOMMENDED BOOKS:

- 1. Organic Chemistry by R.T. Morrison and R.N.Boyd.(Prentice Hall of India, New Delhi)
- 2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl.(S.Chand, New Delhi)
- Bentley and Driver's Text Book of Pharmaceutical Chemistry.(Oxford University Press, New Delhi)
- 4. Organic Chemistry Reactions and Reagents by O.P.Agarwal.(Krishna Prakashan, Meerut)

5. Organic Chemistry by I.L. Finar Vol. I & Vol. II.(Longman, Singapore)

PHARMACEUTICAL CHEMISTRY-III

(Organic Chemistry-II)

PY132316. PRACTICAL

3 hours/ week

At least five exercises in synthesis involving various heterocyclic ring systems. An exercise involving stereoselective synthesis of a compound.Resolution of racemic DL-alanine ar any other example.Workshop on molecular modeling of primary, secondary and tertiary structures of proteins, molecular modeling on double helical structure of nucleic acid showing hydrogen bonding.

PHARMACOGNOSY-III

PY132307. THEORY

3 hours/ week

UNIT -I

1. General methods of isolation and phytochemical screening of glycosides.

2. Study of the biological source, cultivation, collection, chemical constituents, adulterants, uses, macroscopic, microscopic features and chemical tests of following group of drugs containing –

i) Saponins : Liquorice, ginseng, dioscorea, sarasparilla and senega.

ii) Cardioactive sterols : Digitalis, squill and strophanthus

iii) Anthraquinone cathartics : Aloes, senna, rhubarb and cascara.

iv) Others : Psoralea, gentian, saffron, chirata and quassia

UNIT -II

3. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, Papain, Pepsin, Trypsine, Pancreatin.

UNIT -III

4. General techniques of biosynthetic studies and basic metabolic pathways. Biogenesis of aromatic amino acids, steroidal glycosides, tropane alkaloids and indole alkaloids.

UNIT -IV

5. An introduction to poisonous plants in India.

6. Marine pharmacognosy, novel medicinal agents from marine sources.

RECOMMENDED BOOKS:

- 1. Textbook of Pharmacognosy by C.K.Kokate and D.P.Purohit (Nirali Prakashan, Pune)
- 2. Trease G.E. and Evans w.e., Pharmacognosy (Baillere Tindall, Eastbourne)
- 3. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)
- 4. Pharmacognosy by T.E. Wallis(CBS Publisher, New Delhi)
- 5. Staba E.J., Plant Tissue Culture as a source of Bio-medicinals
- 7. Pharmacognosy and Phytochemistry by Vinod D Rangari. (Career Publications, Nashik)

PHARMACOGNOSY-III

PY132318. PRACTICAL

3 hours/ week

- 1. Macroscopic and Microscopic study of six glycoside and six alkaloidal drugs.
- 2. Specific chemical tests for glycosides and alkaloides.
- 3. Standardization of some traditional drug formulations.
- 4. Chromatographic study of some herbal constituents.

PATHOPHYSIOLOGY OF COMMON DISEASES

PY132309. THEORY

3 hours/ week

UNIT -I

1. **Basic Principles of Cell Injury and Adaptation :** Causes of Cellular injury, 5pathogenesis, morphology of cell injury, intercellular alterations in lipids, proteins and carbohydrates, Cellular adaptations, atrophy, hypertrophy, hyperplasia, metastasis & dysplasia.

2. Basic Mechanisms involved in the process of inflammation and repair :

Alteration in vascular permeability and blood flow, migration of WBCs, acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.

UNIT -II

3 Pathophysiology of Common Diseases :Rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania,

UNIT -III

4. Hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, diabetes, peptic ulcer asthma, ulcerative colitis, hepatic disorders like jaundice, viral hepatitis, hepatocellular carcinoma, cirrhosis & portal hypertension, acute and chronic renal failure.

UNIT -IV

5. Tuberculosis, urinary tract infections, sexually transmitted diseases, anemias. Common types of neoplasms like carcinoma of lung, skin cervix, colon & brief outline on different types of leukemias. Wherever applicable the molecular basis should be discussed.

RECOMMENDED BOOKS:

- 1. Pathologic basis of diseases by Robbins S.L. (Harcourt India, New Delhi).
- 2. Pathology Quick Review and MCQs based on Harsh Mohan's Text Book of Pathology (Jaypee brothers medical publishers, New Delhi)

COMMUNITY PHARMACY AND HEALTH EDUCATION

PY1323010. THEORY

3 hours/ week

UNIT -I

- 1. **Community Pharmacy**: Organization and structure of retail and wholesale drug store, types of drug store and design. Legal requirements for establishment, maintenance and drug store-dispensing of proprietary products, maintenance of records of retail and wholesale.
- 2. Patient counseling: role of pharmacist in community health care and education.

UNIT -II

- 3. Concepts of health and disease: Disease causing agents and prevention of disease.
- 4. Classification of food requirements: Balanced diet, nutritional deficiency disorders, their treatment and prevention.

UNIT -III

5. **Communicable diseases**: Brief outline, their causative agents, modes of transmission and prevention (Chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea, and AIDS).

UNIT -IV

- 6. Demography and family planning: Introduction, Methods and procedures.
- 7. **First Aid**: Emergency treatment of shock, snakebites, burns, poisoning, fractures and resuscitation methods.

RECOMMENDED BOOKS:

1. Role of Pharmacist in the Health care system, WHO/ PHArm/94.569

2. Remington's sciences and practice of Pharmacy; 20th edition Lippin cott. Williams and Welkens.

3. Medicare scenario in India; Perceptions and Perspectives – Delhi society foir promotion of rational use of drugs

B. Pharm Fourth Semester

PHARMACEUTICS-III

(Physical Pharmacy – II)

PY132401.THEORY

3 hours/week

UNIT -I

 Micromeretics and powder Rheology : Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle size, volume, shape, surface area, specific surface, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT -II

2. Rheology : Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, Newtonian and non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling sphere, rotational viscometers.

UNIT -III

3. Dispersion Systems: Colloidal dispersions, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions: Interfacial properties of suspended particles, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, Emulsions: theories of emulsification, physical stability and rheological considerations.

UNIT -IV

- **4. Kinetics and Drug Stability:** General considerations & concepts, zero order, first order, second order reaction, half-life determination, Influence of temperature, light, solvent, catalytic species, Accelerated stability study, determination of expiry date.
- **5. Diffusion and dissolution:** Definition, steady state diffusion, diffusion cell, dissolution, factors affecting, Noyes Whitney equation, dissolution apparatus, drug release, biological diffusion.
- 6. Complexation: Classification of complexes, methods of preparation, analysis and applications.

RECOMMENDED BOOKS:

- 1. Martin's Physical Pharmacy & Pharmaceutical Sciences by P.J.Sinko.(Lippincott Williams and Wilkins, Baltimore)
- 2. Cooper and Gunn's Tutorial Pharmacy edited by S.J. Carter (CBS Publishers, Delhi)
- 3. Bentley's Textbook of Pharmaceutics edited by E.A. Rawlins (All India Traveler Book Seller, New Delhi)

PHARMACEUTICS-III

(Physical Pharmacy – II)

PY132412. PRACTICAL

- 1. Determination of particle size and particle size distribution using various methods of particle size analysis.
- 2. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
- 3. Study of rheological properties of various types of systems using different viscometers.
- 4. Preparation of various types suspensions and determination of their sedimentation parameters.
- 5. Preparation and stability studies of emulsions.
- 6. Determination of critical solution temperature phenol water system.
- 7. Determination of half-life, rate constant and order of reaction.
- 8. Preparation of pharmaceutical buffers and determination of buffer capacity.

49

3 hours/ week

BASIC ENGINEERING – II

(Unit Operations II)

PY132403. THEORY

3 hours/week

UNIT -I

1. Heat Transfer: Mechanism of heat flow, equipment- heat exchangers and heat interchangers, steam production & utilization.

 Drying: Theory of drying, equilibrium moisture content (EMC) & Measurement of EMC. Classification and types of dryers, dryers used in pharmaceutical industries and special drying methods.

UNIT -II

3. Size Reduction and Size Separation: Definition, objectives of size reduction and size separation, factors affecting size reduction, laws governing energy and power requirements of mills including ball mill, hammer mill, fluid energy mill, sieve analysis, standards of sieves, size separation equipment shaking and vibrating screens, gyratory screens, cyclone separator, air separator, size separators basing on sedimentation theory.

UNIT -III

- **4. Mixing and Homogenization:** Theory of mixing, mixing efficiency, solid-solid, solid-liquid and liquid-liquid mixing equipments, homogenizers.
- **5. Evaporation:** Basic concept of phase evaporation, factors affecting evaporation, evaporators, film evaporator, single effect and multiple effect evaporators.

UNIT -IV

6.Distillation: Raoult's law, phase diagrams, volatility, simple, steam and flash distillations, principles of rectification, Fractional distillation, general method for fractional distillation, efficiency of the fractional distillation, distillation under reduced pressure, Azeotropic and extractive distillation.
7. Environmental pollution & control: Water pollution & control, Air pollution & control, Thermal pollution & control, Noise pollution & control.

RECOMMENDED BOOKS:

- 1. Cooper and Gunn's Tutorial Pharmacy Edited by S.J.Carter (CBS Publishers, Delhi)
- 2. Pharmaceutical Engineering by K.Sanbamurty (New Age International, New Delhi)
- **3.** Chamical Engineering by Badger and Banchero (Mc Graw Hill, New Delhi)
- 4. Pharmaceutical Dosage forms by Aulton.(Churchill Livingstone, Edinburg)

BASIC ENGINEERING – II

(Unit Operations II)

PY132414. PRACTICAL

3 hours/week

- **1.** Determination of rate of evaporation.
- 2. Determination of overall heat transfer coefficient.
- **3.** Experiments based on steam, extractive and azeotropic distillations.
- 4. Experiments based on determination of radiation constant.
- 5. Experiments based on sieve analysis.
- 6. Determination of rate of drying, free moisture content and bound moisture content.
- 7. Experiments to illustrate the influence of various parameters on the rate of drying.
- **8.** Experiments to illustrate solid solid mixing, determination of mixing efficiency using different types of mixers.

PHARMACOLOGY – I

PY132405. THEORY

3 hours/week

UNIT -I

1. General Pharmacology: Introduction to Pharmacology, Sources of drugs, dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacokinetics: Absorption, Distribution, Metabolism and Excretion of drugs, Drug Addiction & Drug abuse.

UNIT -II

2. Pharmacology of drugs acting on Peripheral Nervous System:

A. Neurohumoral transmission (autonomic and somatic)

B. Cholinergic drugs, Cholinergic blockers, Adrenergic drugs, Adrenergic blockers, Ganglionic stimulants and blocking agents

- C. Skeletal Muscle Relaxants
- **D**. Local anaesthetic agents

UNIT -III

3. Pharmacology of drugs acting on Central Nervous System:

- A. Neurohumoral transmission in the C.N.S
- **B.** General Anesthetics
- C. Alcohol and treatment of alcoholism
- D. Sedatives, hypnotics
- E. Anti-epileptics drugs (Anticonvulsants)
- F. Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs.
- G. Narcotic analgesics and antagonists

UNIT -IV

H. Psychopharmacological agents – Antipsychotics (Neuroleptic drugs), Antidepressants, Psychomimetics, Anti-anxiety drugs,

I. Anti-parkinsonian drugs

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

J. C.N.S.stimulants

RECOMMENDED BOOKS:

- 1. Essentials of Medical Pharmacology by K.D.Tripathy
- 2. Pharmacology and pharmacotherapeutics by Satoshkar and Bhandarkar
- 3. Pharmacology by Prasun K Das, S.K.Bhattacharya and P.Sen.
- 4. Text book of Pharmacology by S.D. Seth
- 5. The Pharmacological basis of Therapeutics by Goodman and Gilman
- 6. Pharmacology by Rang, Dale and Ritter.
- 7. Basic and Clinical Pharmacology by B.G.Katzung.

PHARMACOLOGY – I

PY132416. PRACTICAL

3 hours/week

- 1. Introduction to Experimental Pharmacology
- 2. Preparation of different solutions for experiments
- 3. Common Laboratory animals and their maintenance
- 4. Study of commonly used instruments in experimental pharmacology

Procedures for rendering animals unconscious – stunning of rodents, pithing of frogs, chemical anaesthesia

2. Experiments on intact preparations;

Study of different routes of administration of drugs in mice / rats. To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone/hexobarbitone/thiopental sodium sleeping time in mice.

3. Experiments on Central Nervous System:`

Recording of spontaneous motor activity, stereotypy, analgesia, anticonvulsant

activity and muscle relaxant activity of drugs using simple experiments.

4. Effects of autonomic drugs on rabbit's eye.

5. Effects of various agonists and antagonists and their characterisation using isolated preparations like ileum preparations of rats, guinea pig and rabbit.

COMPUTER APPLICATIONS

PY132407. THEORY

3 hours / week

UNIT -I

1. Computer fundamentals:

History: Introduction to Computer, Computer classifications (According to generation, size and use). **Hardware**: Introduction to hardware, CPU, Mother board, Input devices, Output devices, Storage Devices and Memory. Various ports and slots available with mother board – ISA, PCI Serial, Parallel, PS/2 and USB and their uses.

Networking: Introduction to networking, Classification of networking like LAN, WAN, MAN. Hardware of networking – Modem, Hub, Cables.

Power devices used in various line conditions like CVT, UPS.

Number systems - Binary, Octal, Hexadecimal and their uses in computer

Software: Introduction to software, Simple example and use of Machine language, Assembly language and Higher level languages. Operating systems and classifications of application software according to their use.

UNIT -II

2. Application of computers in pharmacy

Introduction to various uses of computer in pharmaceutical research and development, industries, authorities, education and hospitals.

3. Operating systems:

Introduction to different types of file manipulation and storage maintenance functions by using DOS, WINDOWS (98 & XP) & LINUX –

File manipulations: Directories / folder / files searching, creating, copying, moving, deleting, renaming.

Maintenance: Checking, Scanning and formatting a floppy disk, CD Writing.

UNIT-III

4. Programming Language (Programming with C)

Introduction to programming; Problem analysis, algorithm, flow chart, coding, execution, debugging and testing, program documentation.

Introduction to C: Programming rules. C-Declarations: C-Character set, Key words, identifiers, constants, variables, defining variables, data type, declaring variables, initializing variables, conversion types etc.

Operators and expression, input and output statement in C.

Decision statements: If, if.... Else, Nested if..... else, Go to, Switch ()...... Case, break, default statement, loop control statement: While, Do.....While, for, nested for.

Arrays: One dimensional

Two dimensional

The **sscanf** () and **sprintf** () functions

Preprocessor directives: # include, # define

UNIT -IV

5. Internet:

History of internet, Introduction to Internet Browsers, URL.Introduction to email and how to check and compose an email? Important websites related to pharmaceutical information – like sites for information regarding drugs, medical literature, plants, adverse effects, clinical data, patent sites, FDA, WHO, etc.

RECOMMENDED BOOKS:

- 1. Computer and common sense, 4th edn., Hunt & Shelly, Prentice-Hall India.
- DOS 6 & 6.22: An Introduction with computer fundamentals. Pradeep Nair, Payal Lotia, BPB Publications.
- 3. DOS 6 & 6.22 Instant Reference, 2nd Edn. Robert M. Thomas, BPB Publications.
- 4. Windows 98 Instant Reference, Peter Dyson, BPB Publications.
- 5. ABCs of Windows 98, Sharon Crawford & Neil J. Salkin, BPB Publications.
- 6. Programming in ANSI C by E.Balguruswamy (TMH, New Delhi)
- 7. Programming in C++ by D.Ravichandran (TMH, New Delhi)
- 8. Complete Reference MS-Office
- 9. Complete Reference Windows XP.

10. Complete Reference Internet11. Linux OS

COMPUTER APPLICATIONS

PY132418. PRACTICAL

1. Demonstration of hardware.

2. Operating system: DOS, WINDOWS & LINUX

Searching directories or folders

Creating and deleting files and folders

Copying and Moving files and folders / directories

Saving in floppies and CD Writing.

Formatting and checking by floppy disks and Bootable CD.

3. Simple programming in C or C++: at least five programs.

4. Create and save a document in a word processor program like MS WORD. Type few paragraphs, format them, and paste an image.

5. Create and save presentations in POWERPOINT

6. Create and save a work sheet using MS EXCEL. Input data in cells, copy and move the data, make calculations, plot a graph from X and Y sets of data.

7. Internet (Search Engine, email, groups)

56

3 hours/week

PHARMACEUTICAL CHEMISTRY-IV

(Organic Chemistry-III)

PY132409. THEORY

3 hours/week

UNIT-I

Heterocyclic compounds: Nomenclature Chemistry, preparation and some important reaction of-Furan, Pyrrole, thiophen, imidazole, Oxazole, indole, pyridine, pyrimidine, quinoline, isoquinoline, thiazole.

UNIT-II

Carbohydrates: Classification, reducing and non-reducing sugars, chemistry (Excluding structure elucidation) of glucose, fructose, sucrose, maltose, lactose, starch and cellulose, Ascending and descending of sugars.

Lipids (Fats and Oils): Classification and structure, physical and chemical properties (saponification, Hydrogenation, oxidation).

UNIT-III

Amino acids and Proteins: Structure of commonly occurring amino acids, Synthesis of amino acids and their physical properties and some characteristic chemical reactions, classification of proteins, physical properties, purification of proteins, concept of polypeptides.

UNIT-IV

Study the following reactions with mechanism.

Benzoin condensation reaction, Reformatsky reactions, Beckmann rearrangement, Michael addition, Mannich reaction, Oppenaur oxidation, Claisen condensation, Knoevenagel condensation, Diels – Alder reaction and their applications.

RECOMMENDED BOOKS:

- 1. Organic Chemistry by R.T. Morrison and R.N.Boyd.(Prentice Hall of India, New Delhi)
- 2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl.(S.Chand, New Delhi)

- Bentley and Driver's Text Book of Pharmaceutical Chemistry.(Oxford University Press, New Delhi)
- 4. Organic Chemistry Reactions and Reagents by O. P.Agarwal.
- 5. Organic Chemistry by I.L. Finar Vol. I & Vol. II.(Longman, Singapore)

PHARMACOGNOSY-IV

PY1324010. THEORY

3 hours/ week

UNIT -I

- 1. General methods of isolation and chemical tests of alkaloids.
- Systematic study of source, cultivation, collection, chemical constituents, adulterants, uses, macroscopic, microscopic features and chemical tests of the following alkaloids containing drugs.

Pyridine - Piperidine Tobaco, arica and lobelia

Tropane - Belladona, hyoscyamus, daturas coca and withania.

Quinoline and Isoquinoline - Cinchona, Ipecac, opium

Indole - Ergot, rauwolfia, catharanthus nux-vomica and physostigma

Imidazole - Pilocarpus

Steroidal - Veratrum and kurchi

Alkaloid amines - Ephedra and colchicum

Glycoalkaloid - Solanum

Xanthine alkaloid - Coffee, tea and coca.

UNIT -II

3. Study of traditional drugs, common vernacular names, botanical source, chemical constituents, uses and marketed formulations (any two) of the following drugs:

Amla, Satavari, Bhilwa, bael, bach, rasna, punarnava, gokhru, shankhapusphi, brahmi adusa, arjuna, lahsun, guggul, gymnema, neem ,tulsi, Shilajit and Spirulina.

UNIT -III

4. Applications of chromatography in evaluation of herbal drugs.

UNIT –IV

5. Natural allergens and photosensitizing agents.

RECOMMENDED BOOKS:

- 1. Trease G.E. and Evans W E., Pharmacognosy.
- 2. Pharmacognosy by T.E. Wallis.
- 3. Pharmacognosy by C.K. Kokate.
- 4. Kalia A N., Text book of Industrial Pharmacognosy.
- 5. Rangari V D., Text book of Pharmacognosy Vol-I & II.
- 6. Atal C K., Cultivation and utilization of medicinal and aromatic plants of India.

B. Pharm Fifth Semester

PHARMACEUTICS-IV

(Pharmaceutical Technology – I)

PY132501. THEORY

3 hours / week

UNIT -I

 Liquid Dosage Forms: Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizer, colors, flavours and others, manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions.

UNIT -II

 Semisolid Dosage Forms: Definitions, types, mechanisms of drug permeation, factors influencing permeation, semisolid bases and their selection. General formulation of semisolids: like ointments, creams, pastes & gels, their manufacturing procedure, evaluation and packaging.

3. Suppositories: Ideal requirements, bases, manufacturing procedure, packaging and evaluation.

UNIT -III

4. Tablets:

Types of tablets, excipients used, and different granulation techniques used for preparation of tablets, types of tablet press, manufacturing defects and evaluation of tablets.Physics of Tablet compression. Coating of Tablets: Types of coating- sugar coating, film coating, enteric coating, film defects, materials used and evaluation of coated tablets.

UNIT –IV

5.Capsules: Advantages and disadvantages of capsule dosage forms, materials used for production of hard gelatin capsules, different sizes of capsules, methods of capsulefilling. Soft gelatin capsules, capsule shell and content of capsules, importance of base absorption and minim/gm factor filling of soft gelatin capsules.Quality control and storage of capsule dosage forms.

RECOMMENDED BOOKS :

- Bently's Textbook of pharmaceutics edited by E.A. Rawlins (All India Traveller Book Seller, New Delhi)
- 2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig (Varghese Pub. House, Bombay)
- Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich (B.I.Waverly Pvt. Ltd., New Delhi)
- 4. REMINGTON : The Science and Practice of Pharmacy, 20th Edition (Lippincott Williams & Wilkins, Baltimore)
- 5. Pharmaceutics : The Science of Dosage Form Design by Aulton (Churchill Livingstone, Edinburgh)

PHARMACEUTICS-IV

(Pharmaceutical Technology - I)

PY132512. PRACTICAL

3 hours / week

Preparation, evaluation and packaging of liquid orals like solutions, suspensions and emulsions, ointments suppositories, tablets, capsules etc.

APPLIED MICROBIOLOGY

PY132503. THEORY

3 hours/ week

UNIT -I

1. Introduction to the scope of microbiology.

2. Classification of microbes and their taxonomy. Morphological study of Bacteria, Actinomycetes, Fungi, rickettsiae, spirochetes and viruses.

3. Identification of Microbes : Stains and types of staining techniques,

electron microscopy.

4. Nutrition, cultivation and isolation bacteria, actinomycetes, fungi and viruses. Preservation microbial cultures.

UNIT -II

5. Microbial genetics – Mutations, Isolation of mutants, factors influencing rate of mutation, mutagens. Phenotypic and Genotypic changes, Plasmids.Genetic mechanism of drug resistance.

6. Control of microbes by physical and chemical methods.

a) Disinfection, factors influencing disinfectants and antiseptics and their evaluation.

b) Sterilization, different methods, validation of sterilization methods & equipment.

UNIT -III

7. Test for sterility – Sampling media and general procedure. Control tests and inactivation of inhibitory substances.

UNIT -IV

 Microbiological assay of antibiotics – penicillin, streptomycin and tetracycline, Vitamins – vitamin B12 and amino acids – lysine.

ECOMMENDED BOOKS:

- 1. Microbiology of Pelczar and Kreig.
- 2. Text Book of Microbiology by Anantanarayana and Panicker.

- 3. Dispensing for pharmaceutical students by Cooper and Gunn.
- 4. Bently's Text Book of Pharmaceutics
- 5. Tutorial Pharmacy by Cooper and Gunn
- 6. Indian Pharmacopoeia
- 7. Shah and Shah (Pharmaceutical Microbiology)

APPLIED MICROBIOLOGY

PY132514. PRACTICAL

3 hours/ week

Experiments devised to prepare various types of culture media, sub-culturing of common aerobic bacteria, fungi and yeast. Various staining methods, various methods of isolation of microbes, sterilization techniques and validation of sterilizing techniques, evaluation of antiseptics and disinfectants, Testing the sterility of pharmaceutical products as per I.P. requirements and Microbiological assay of antibiotics.

- 1. Preparation of Nutrient broth & Nutrient Agar medium
- 2. Preparation of Potato dextrose Agar medium
- 3. Subculture of aerobic bacteria, fungi and yeast by asceptic technique
- 4. Gram's staining Technique
- 5. Isolation of microbes by streak plate, spread plate methods.
- 6. Moist heat dry heat saterilization
- 7. Phenol coefficient method.
- 8. Test for sterility of Dextrose injection I.P.
- 9. Microbiological assay of antibiotics.
- 10. Demonstrating the use of membrane filtration technique.
- 11. Motility of bacteria using hang drop method.

PHARMACEUTICAL CHEMISTRY-V

(Medicinal Chemistry – I)

PY132505. THEORY

3 hours/ week

UNIT -I

- 1. Basic Principles of Medicinal Chemistry: Physico-chemical aspects (optical, geometric and bio-isosterism) of drug molecules and biological action, Drug-receptor interaction including transduction mechanisms.
- **2. Principles of Drug Design (Theoretical Aspects):** Quantitative Structure Activity Relationship (QSAR); Computer Aided Drug Designing (CADD); Molecular Modeling.

UNIT -II

3. Synthetic procedures of the drugs given bellow, mode of action, uses, structure, activity, relationship including physico-chemical properties of the following classes of drugs :

A. Drugs acting at synaptic and neuro-effector junction sites :

- (i) CholinergicsandAnti-cholinesterases:Neostigmine, Physostigmine,Methacholine,Pilocarpine,Atropine.
- (ii) Adrenergicdrugs:Ephidrine,Isoprenaline,Amphetamine,Salbuta mol, Terbutaline, Adrenaline.
- (iii) Anti-spasmodic and anti-ulcer drugs:Dicyclomine, Ranitidine, Omiprazole
- (iv) Neuro-muscular blocking agents:Gallamine, Triethidide, Mephenesin.

UNIT -III

4. Synthetic procedures of the drugs given bellow, mode of action, uses, structure, activity, relationship including physico-chemical properties of the following classes of drugs :

B. Autocoids :

- (i) Anti-histamines: Diphenhydramine, Promethazine, Cyproheptadine, Cetrizine, Famotidine.
- (ii) Analgesic-antipyretics, anti-inflammatory (non-steroidal) agents: Aspirin, Mefenamic acid, Ibuprofen, Dichlofenac, Acetaminophen, Naproxen, Indomethacin.

UNIT -IV

5. Drugs affecting uterine motility:

Oxytoxics including oxytocin, ergot alkaloids and prostaglandins.

RECOMMENDED BOOKS

- 1. Wilson and Grisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry.
- 2. Principles of Medicinal Chemistry by William O.Foye.
- 3. A Text Book of Medicinal Chemistry by S.N.Pandeya.
- 4. Medicinal Chemistry by Ashutoshkar.
- 5. Bentley's and Driver's Text Book of Pharmaceutical Chemistry.

PHARMACEUTICAL CHEMISTRY-V

(Medicinal Chemistry – I)

PY132516. PRACTICAL

3 hours/week

- 1. Exercises based on QSAR : Hansch& Free-Wilson methods
- 2. Synthesis of selected drugs from the course content.
- 3. Establishing the pharmacopoeial standards of the drugs synthesized.
- 4. Determination of partition co-efficient, dissociation constant and molar refractivity of compounds for QSAR analysis.

PHARMACOGNOSY- V (PHYTOCHEMISTRY)

PY132507. THEORY

3 hours / week

UNIT -I

Concept of stereoisomerism taking examples of natural products (citral, menthol, camphor, ephedrine and atropine).

UNIT -II

Glycosides: Source, structures, Pharmacological properties and study of interrelationship between cardinolides and bufadienolides (Chemistry of digoxin & digitoxin). Introduction to diosgenin, sennosides.

Terpenes:Classification, General methods of extraction and separation, special isoprene rule and chemistry of citral, carvone, menthol & camphor

UNIT -III

Vitamins : Classification, Chemistry of vitamin A, B, Folic acid and vitamin C.

Alkaloids :Classification, isolation, chemistry of atropine, ephedrine, reserpine, morphine, quinine and papaverine.

UNIT -IV

Chemistry and therapeutic activity of penicillin streptomycin and tetracyclines. **Flavonoids:** Classification, pharmacological properties and chemistry of quercetin.

RECOMMENDED BOOKS:

1. Chemistry of Organic Natural Products (Vol.-1 & 2) by O.P. Agarwal.

2. Organic Chemistry of Natural Products (Vol.-1 & 2) by Gurdeep Chatwal.

3. Organic Chemistry (Vol.-2) by I.L. Finar.

PHARMACOGNOSY- V (PHYTOCHEMISTRY)

PY132518. PRACTICAL

3 hours/week

- 1. Analysis of fixed oils including acid value, saponification value, iodine value.
- 2. Isolation of active principles from natural sources.
- 3. Exercises on paper and thin layer chromotographic evaluations of herbal drug constituents.

PHARMACEUTICAL ANALYSIS-II

PY132509. THEORY

3 hours/ week

UNIT -I

Theoretical considerations and application in drug analysis and quality control of the following analytical techniques:

- 1. Non-aqueous titrations : Theoretical considerations, scope and limitation, types of solvents, Lewis theory of acids and bases, conjugate acid and conjugate base solvents, methods of non-aqueous titration, experimental details, titration of basic and acidic substances in non-aqueous solvents with reference to IP/BP compounds.
- 2. Complexometric titrations: Theory of complexation and complexometry, stability constant, titration curve, types of EDTA titrations, metal-ion indicators, titration of mixtures, marking agent.

UNIT -II

- 3. Introduction, Instrumentation and applications of Karl-Fischer titration.
- **4. Potentiometry:**Electrochemical cells electrode potential, half cells, Nernst equations, standard potential, standard electrode, reference electrode. Theoretical consideration of potentiometry, location of end point in potentiometry, analytical application, Ph meter, use of Ph meter in determining Ph and in acid base titration.

UNIT -III

- **5. Conductometry:** Conductance, specific and molar conductance, Kohlrausch law, measurement of conductance and conductometric titrations.
- 6. Basic concepts of Polarography, Amperometry

UNIT -IV

- 7. Nephelometry and Turbidimetry.
- 8. Radioimmuno Assays.

9. Chromatography: The following techniques will be discussed with relevant examples of pharmacopoeial products.

Thin Layer Chromatography, Paper Chromatography and Column Chromatography

RECOMMENDED BOOKS:

- 1. Vogel's Text Book of Quantitative Chemical Analysis.
- 2. Practical Pharmaceutical Analysis by Beckette and Stenlake Vol. I & II.
- 3. Indian Pharmacopocia Vol. I & II
- 4. Instrumental methods chemical analysis by B.K. Sharma
- 5. Bently and Driver's Text Book of Pharmaceutical Chemistry.

PHARMACEUTICAL ANALYSIS-II

PY1325110. PRACTICAL

3 hours/ week

- Nonaqueous Titrations: Preparation and standardization of perchloric acid and sodium/potassium/lithium methoxides solutions; Estimations of some pharmacopoeial products.
- **2.** Complexometric Titrations:Preparations and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titrations.

- **3.** Exercises based on acid base titration in aqueous and non-aqueous media, oxidation-reduction titrations using potentiometric technique. Determination of acid base disassociation constants and plotting of titration curves using pH meter.
- 4. Exercises involving conductometric and polarographic techniques.
- 5. Exercises involving Nephelometry and Turbidimetry technique.
- **6.** Chromatographic analysis of some pharmaceutical products, (Paper chromatography of Amino acids, TLC of alkaloids, sulphonamides etc)

B. Pharm Sixth Semester
PHARMACEUTICS – V

(Pharmaceutical Technology II)

PY132601. THEORY

3 hours / Week

UNIT -I

- 1. **Cosmetics**: Fundamentals of cosmetic science, Formulation, preparation and packaging of cosmetics like dental care products, creams, lotions, shampoos, hair conditioners & dyes, nail polish and lipsticks. Special formulation considerations for baby care products.
- Pharmaceutical Aerosols: Definition, applications, components of aerosol package: Propellants, container, valve, general formulation, manufacturing and filling methods, evaluation.

UNIT-II

3. Parenteral Products:

- a. Routes of administration,
- b. Formulation: Vehicles, additives. containers and closures,
- c. Facilities: Design of aseptic area, environmental control, traffic control, house keeping, surface disinfection, air control, personnel.
- d. Processing: Cleaning of equipment, containers and closures, filling, sealing, sterilization, packaging and labeling.
- e. Evaluation of parenteral products.

UNIT –III

4. Ophthalmic Preparations: Types, Requirements, packaging, proper administration of ophthalmic preparations, contact lenses & care and use solutions.

UNIT -IV

5. Packaging of Pharmaceutical Products: Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.

RECOMMENDED BOOKS :

- 1. Bently's Textbook of pharmaceutics edited by E.A. Rawlins
- 2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig
- 3. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich
- 4. REMINGTON : The Science and Practice of Pharmacy, 20th Edition
- 5. Pharmaceutics : The Science of Dosage Form Design by Aulton

PHARMACEUTICS – V

(Pharmaceutical Technology II)

PY132612. PRACTICAL

3 hours/week

Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like, parenterals, cosmeics, Ophthalmic products etc. Evaluation of materials used in pharmaceutical packaging.

PHARMACEUTICAL CHEMISTRY - VI

(Medicinal Chemistry – II)

PY132603. THEORY

3 hours/week

UNIT -I

Synthetic procedures of drugs given bellow, mode of action, uses, structure activity relationship including physico-chemical properties of the following classes of drugs:

- 1. Steroids and Related Drugs: Steroidal nomenclature and stereochemistry.
 - a) Androgens and anabolic agents: Testosterone, Stanazolol.
 - b) Estrogens and progestational agents: Progesterone, Estradiol, nonsteroidal estrogens.
 - c) Adrenocortecoids: Prednisolone, Dexamethasone, Betamethasone.

UNIT -II

- 2. A. Drugs acting on the Nervous System :
 - a) General anesthetics: Thiopental, Ketamine.
 - b) Local anesthetics: Lignocaine, Benzocaine.
 - c) Hypnotics and sedatives: Phenobarbitone, Pentobarbitone.
 - d) Opioid analgesics: Methadione, Pentazocine.
 - e) Anti-tussives:Cramiphen, Dextromethorphen.

UNIT -III

- 2. B. Drugs acting on the Nervous System :
 - a) Anti-convulsants: Phenytoin, Carbamazepine, Ethosuximide.
 - b) Anti-parkinsonism drugs:Carbidopa, Levodopa
 - c) CNS stimulants: Nikethamide
 - d) Psychopharmacological agents:
 - ✓ **Neuroleptics (anti psychotic drug):** Chlorpromazine, Haloperidol
 - ✓ Anti-depressants: Imipramine, Amitriptyline,
 - ✓ **Anxiolytics:**Meprobamate, Diazepam.

UNIT -IV

3. Diuretics: Acetazolamide, Chlorthiazide, Frusemide.

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4. Cardiovascular drugs:

- ✓ Anti anginal drug: Nitroglycerine, Methyldopa
- ✓ Anti-hypertensive drug:Nifedipine, Propanolol, Captopril
- ✓ Antiarryhthmic drug: Procainamide
- ✓ **Hypolipidemic drug:**Clofibrate
- ✓ Anticoagulant:Warfarine, Coumarin

RECOMMENDED BOOKS:

- 1. Wilson and Grisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry
- 2. Principles of Medicinal Chemistry by William O.Foye
- 3. A Text Book of Medicinal Chemistry by S.N.Pandeya
- 4. Medicinal Chemistry by Ashutoshkar
- 5. Bentley's and Driver's Text Book of Pharmaceutical Chemistry.

PHARMACEUTICAL CHEMISTRY - VI

(Medicinal Chemistry – II)

PY132614. PRACTICAL

3 hours/week

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

BIOCHEMISTRY

PY132605. THEORY

3 hours/ week

UNIT -I

- **1. Enzymes:** Nomenclature, Enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.
- 2. Co-enzymes: Vitamins as co-enzymes and their significance.

UNIT -II

- **3. Carbohydrate Metabolism:** Glycolysis and fermentation and their regulation, Gluconeogenesis, Glycogenolysis, Glycogenesis, and Pentose phosphate Pathway.
- 4. The Citric Acid Cycle: Significance, reactions and energetic of the cycle.
- **5. Biological Oxidation:** Redox-potential, Components and complexes of respiratory chain, its role in cellular respiration. Mechanism of oxidative phosphorylation. Inhibition of respiratory chain and oxidative phosphorylation.

UNIT -III

- **6.** Lipids Metabolism: Oxidation of fatty acids, β-oxidation & energetic, α-oxidation. Control of lipid metabolism, essential fatty acids and eicosanoids (prostaglandins, thromboxanes and leukotrienes), phospholipids and sphingolipids. Metabolism of ketone bodies.
- **7. Metabolism of Proteins:** Nitrogen balance, essential amino acid, transamination, deamination, urea cycle and its metabolic disorders.

UNIT -IV

- 8. Biosynthesis of Nucleic Acids : Brief introduction of genetic organization of the mammalian genome, bio-synthesis of DNA and its replication, Mutation, physical and chemical mutagenesis / carcinogenesis, DNA repair mechanism, Bio-synthesis of RNA.
- **9. Genetic Code & Protein Synthesis:** Genetic code, components of protein synthesis and inhibition of protein synthesis.

RECOMMENDED BOOKS:

- 1. Harper's Biochemistry R.K.Murray and Others (Prentice Hall of India, New Delhi)
- 2. Lehninger Principles of Biochemistry by Michel M.Cox and David L.Nelson
- 3. Biochemistry by Stryer.(W.H.Freeman, New York)
- 4. Text Book of Biochemistry by West & Todd (Oxford & IBH Pub., Co., New Delhi)
- 5. Fundamentals of Biochemistry by Dr.A.C.Deb (New Central Book Agency, Calcutta)
- Text Book of Biochemistry by Dr.A.V.S.S.Rama Rao (UBS Publishers & Distributors, New Delhi)
- 7. Text Book of Biochemistry by Dr.Satyanarayana

BIOCHEMISTRY

PY132616. PRACTICAL

3 hours/ week

- 1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
- 2. Estimation of blood glucose.
- 3. Estimation of cholesterol, creatinine, urea and uric acid in biological fluids.
- 4. Qualitative test for normal and abnormal constituents of urine.
- 5. Estimation of bilirubin contents the blood.
- 6. Effect of temperature on the activity of enzyme.
- 7. Effect of substrate concentration on the activity of enzyme.
- 8. Study of enzyme kinetics using Lineweaver- Burk plot.
- 9. Estimation of SGOT, SGPT.
- 11. Determination concentration of amino acid by Ninhydrine reaction
- 12. Estimation of protein concentration by Biuret assay method.
- 12. Estimation of serum sodium, potassium and calcium levels.

PHARMACOLOGY - II

PY132607. THEORY

3 hours / week

UNIT -I

1. Pharmacology of drugs acting on Cardiovascular System:

- a) Digitalis and cardiac glycosides
- b) Antihypertensive drugs
- c) Antianginal and vasodilator drugs
- d) Antiarrhythmic drugs
- e) Hypolipidemic agents

2. Drugs acting on urinary system:

- (a) Diuretics,
- (b) Anti-diuretics

UNIT -II

3. Drugs Acting on the Haemopoetic System:

- (a) Haematinics
- (b) Anticoagulants, Fibrinolytic and anti-platelet drugs
- (c) Vitamin K and haemostatic agents
- (d) Blood and Plasma volume expanders

UNIT -III

4. Autacoids:

- (a) Histamine, 5-HT and their antagonists
- (b) Prostaglandins, thromoboxanes and leukotrienes.
- (c) Pentagastrin, Cholecystokinin, Angiotensin, Bradykinin and substance P

5. Drugs Acting on the Respiratory System:

- (a) Anti-asthmatic drugs including bronchodilators
- (b) Anti-tussives and expectorants
- (c) Respiratory stimulants

UNIT -IV

6. Bioassay of Drugs and Biological Standardization. Official bio-assay procedures of drugs/hormones.

7. Clinical trial and new drug development process.

RECOMMENDED BOOKS:

- 1. Essentials of Medical Pharmacology by K.D.Tripathy
- 2. Pharmacology and Pharmacotherapeutic by Sathoskar and Bhandarkar
- 3. Pharmacology by Prasun K.Das, S.K.Bhattacharya and P.Sen.
- 4. Text Book of Pharmacology by S.D. Sheth
- 5. The Pharmacological basis of Therapeutics by Goodman and Gillman
- 6. Pharmacology by Rang, Dale and Ritter.
- 7. Basic and Clinical Pharmacology by B.G.Katzung.

PHARMACOLOGY – II

PY132618. PRACTICAL

3 hours / week

Experiments on Isolated Preparations;

(a) To record the dose response curve (DRC) of acetylcholine using rectus abdominis muscle of frog.

(b) To study the effects of physostigmine and d-tubocurarine on the DRC of acetylcholine using rectus abdominis muscle preparation of frog.

(c) To record the DRC of histamine on isolated loop of guinea pig ileum.

(d) To calculate the pA2, value of mepyramine or chlorpheniramine using histamine as agonist on isolated loop of guinea pig ileum.

(e) To estimate the strength of the test sample of agonist/drug (e.g. Acetylcholine, Histamine) using a suitable isolated muscle preparation employing matching bioassay, Bracketing assay. Three point assay and four point bioassay.

PHARMACEUTICAL JURISPRUDENCE & ETHICS

PY132609. THEORY

3 hours/week

UNIT -1

- 1. Pharmaceutical Legislations A brief review
- 2. Code of Pharmaceutical Ethics.
- 3. Pharmacy Act 1948

UNIT -2

4. Drugs and Cosmetics Act 1940 and Rules 1945

UNIT -3

5. Medicinal & Toilet Preparations (Excise Duties) Act 1955

- 6. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules
- 7. Drugs Price Control Order 1995
- 8. Drugs and Magic Remedies (Objectionable Advertisements) Acts 1954

UNIT -4

- 9. A brief study of the following with special reference to the main provisions only
- 10. Poisons Act 1919
- 11. Medical Termination of Pregnancy Act 1970 & Rules 1975
- 12. Prevention of Cruelty of Animals Act 1960
- 13. Factories Act 1948
- 14. Patents Act 1970

RECOMMENDED BOOKS:

- 1. A Textbook of Forensic Pharmacy by B.M.Mithal
- 2. A Textbook of Forensic Pharmacy by N.K.Jain
- 3. Drugs and Cosmetics Act and Rules published by Government of India
- 4. Pharmacy Act, Published by Government of India
- 5. Law of Drugs
- 6. Drug Cases published by International Law Book Co. Delhi (Reference)

B. Pharm Seventh Semester

PHARMACEUTICS-VI

(Biopharmaceutics & Pharmacokinetics)

PY132701. THEORY

3 hours/ week

UNIT -I

1. Introduction to Biopharmaceutics and Pharmacokinetics and their role in information development and clinical setting.

2. Biopharmaceutics :

Passage of drugs across biological barrier (passive diffusion, active transport facilitated Diffusion and pinocytosis. Factors influencing absorption-Physicochemical, physiological and pharmaceutical.

UNIT -II

Drug distribution in the body, plasma protein binding. Metabolism of drugs.

3. Pharmacokinetics:

Different Pharmacokinetic models and their significance.Compartment model- Definition and scope.Significance of Plasma drug concentration measurement.

UNIT -III

Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant. Volume of distribution and distribution coefficient.Compartment kinetics – One compartment and two compartment models.Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.

UNIT -IV

Clearance concept, Mechanism of renal clearance, clearance ratio, determination of renal clearance.Extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation.

4. Bioavailability and bioequivalence:

Measures of bioavailability, C_{max} , t_{max} and area under the curve (AUC), Methods of measurement, Bioequivalence study, IVIVC.

RECOMMENDED BOOKS:

- 1. Biopharmaceutics and Pharmacokinetics by D.M. Brahmankar and Sunil B. Jaiswal
- 2. Fundamentals of Biopharmaceutics and Pharmacokinetics by V. Venkateswarulu
- 3. Biopharmaceutics and Clinical Pharmacokinetics by Notari
- 4. Biopharmaceutics and Clinical Pharmacokinetics by Gibaldi
- 5. Applied Biopharmaceutics and Pharmacokinetics by Shargel and Yu

PHARMACEUTICS-VI

(Biopharmaceutics & Pharmacokinetics)

PY132712. PRACTICAL

3-hours/ week

- 1. Experiments designed for the estimation of various pharmacokinetic parameters with given data.
- 2. Analysis of biological specifications for drug content and estimation of the pharmacokinetic parameters based on compartment models.
- 3. In vitro evaluation of different dosage forms for drug release.
- 4. Absorption studies *in-vitro* and *in-situ*.
- 5. Statistical treatment of pharmaceutical data.
- 6. Experiment based on protein binding of drugs.

PHARMACOLOGY – III

PY132703. THEORY

3 hours / week

UNIT -I

1. Drugs Acting on the Gastrointestinal Tract.

(a) Antacids, Anti Secretory and Anti-ulcer drugs

- (b) Laxatives and antidiarrhoel drugs
- (c) Appetite stimulants and suppressants
- (d) Emetics and anti-emetics

(e) Miscellaneous – carminatives, demulcents, protectives, adsorbents, astringents, digestants, emzymes and mucolytics.

UNIT -II

2. Pharmacology of drugs affecting Endocrine System:

- (a) Hypothalamic and pituitary hormones
- (b) Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and

Vitamin D

- (c) Insulin, oral hypoglycaemic agents and glucagon
- (d) ACTH and corticosteroids
- (e) Androgens and anabolic steroids
- (f) Estrogens, progesterone and oral contraceptives.

UNIT -III

3. Chemotherapy

- (a) General principles of Chemotherapy
- (b) Sulfonamides and cotrimoxazole, Quinolones
- (c) Antibiotics-pencillins, Cephalosporins, Tetracyclines, Amino glycoside

antibiotics, Chloramphenicol, Erythromycin and Miscellaneous Antibiotics.

- (d) Chemotherapy of tuberculosis, leprosy fungal diseases, viral diseases
- (e) Chemotherapy of malignancy and immunosuppressive agents

(f) Antiprotozoal, antimalarial, antiamoebic and anthelmintics drugs.

UNIT -IV

4. Principles of Toxicology

(a) Definition of poisons, Adverse drug reactions, general principles of treatment

of poisoning with particular reference of barbiturates, opioids,

organophosphorous and atropine poisoning.

(b) Heavy metals and heavy metal antagonists.

PHARMACOLOGY – III

PY132714. PRACTICAL

3 hours / week

1. Experiment on Isolated tissue preparations:

a) To calculate the PD₂ value of serotonin (5HT), Acetylcholine, Histamine on isolated tissue preparation.

b) To estimate the strength of test sample of agonist/drug (e.g. Histamine, oxytocin, adrenaline and 5HT etc) using a suitable isolated muscle/tissue preparation employing interpolation bioassay method, three point bioassay and four point bioassay method.

c) To calculate the PA_2 value of different antagonists using suitable isolated tissue preparations and agonists.

2. Pharmacology of gastrointestinal tract:

To study the anti secretary activity and anti- ulcer activity of a drug using pylorus legated method on rats.

PHARMACEUTICAL CHEMISTRY - VII

(Medicinal Chemistry – III)

PY132705. THEORY

3 hours / Week

UNIT -I

1. Drug metabolism and Concepts of Prodrugs.

2. Classification, mode of action, uses and structure activity relationship of the

following classes of drugs. Synthesis of those compounds only exemplified

against each class.

• Antibacterial agents: Sulphonamides – Sulphamethoxazole, Sulphadiazine, Sulphacetamide.

• Antiseptic and Disinfectant: Hexachlorophene.

UNIT – II

- Antibiotics:
 - i. Quinolone and Fluroquinolone Antibiotics:

Nalidixic acid, Ciprofloxacin.

ii. Beta- lactam antibiotics:

Penicillin:

- ✓ Natural Penicillin- Penicillin-G
- ✓ Acid Resistant Penicillin- Penicillin-V
- ✓ Semisynthetic penicillin- Methicillin, Amphicillin.
- ✓ **Cephalosporin:**Cephalothin, Cephalexin,
- iii. Broad Spectrum Antibiotics:

Tetracycline- Tetracycline, Doxycycline; Chloramphenicol.

- Antimycobacterial agents: Dapsone, Isoniazid.
- Antifungal agents: Ketoconazole., Greseofulvin.

UNIT -III

• Antiprotozoal agents:

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Antimalarials: Chloroquine, Primaquine

Antiamoebics: Metronidazole, Tinidazole.

Anthelmintics: Mebendazole, Niclosamide

Antileismanial drug: Pentamidine

- a) Anti-neoplastic agents: Chlorambucil, 5-Flurouracil, Methotrexate, Busulphan, Thiotepa.
- b) Anti-viral including anti-HIV agents: Amantedine, Acyclovir, Zidovudine.

UNIT -IV

- Immunosuppressive and immunostimulants.
- Amino acids, peptide, nucleotides and related drugs :
 - i. Insulin and oral hypoglycaemic agents: Glibenclamide, Tolbutamide.
 - ii. Thyroid and anti-thyroid drugs: Propylthiouracil, Methimazole.

RECOMMENDED BOOKS:

- 1. Wilson and Grisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry
- 2. Principles of Medicinal Chemistry by William O. Foye
- 3. A Text book of Medicinal Chemistry by S.N.Pandeya Vol I & Vol II
- 4. Medicinal Chemistry by Ashutosh Kar
- 5. Bentley's and Driver's Text Book of Pharmaceutical Chemistry

PHARMACEUTICAL ANALYSIS-III

PY132706. THEORY

3 hours/ week

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

UNIT -I

- 1. Ultraviolet and visible spectrophotometry.
- 2. Infrared spectrophotometry

UNIT -II

3. Fluorimetry

- 4. Flame Photometry
- 5. Atomic Absorption Spectroscopy

UNIT -III

- 5. Nuclear Magnetic resonance spectroscopy including C^{13} NMR.
- 6. Mass Spectrometry

UNIT-IV

7. Chromatography:

High performance liquid chromatography (HPLC), Gas liquid chromatography (GLC)

and High performance thin layer chromatography (HPTLC).

- 8. Radio Immunoassay
- 9. X-ray Diffraction

RECOMMENDED BOOKS:

- 1. Vogel's Text Book of Quantitative Chemical Analysis
- 2. Instrumental methods of Chemical Analysis by B.K. Sharma
- 3. Instrumental methods of Analysis by Willard Den & Merrit
- 4. Practical Pharmaceutical Chemistry by Beckette and Sten Lake Vol. 2
- 5. Text Book of Pharmaceutical Analysis by Conner

PHARMACEUTICAL ANALYSIS-III

PY132717. PRACTICAL

3-hours/ week

1. Quantitative estimation of at least ten formulations containing single or more than one drug, using instrumental techniques like spectrophotometry, fluorimetry etc. (at least 5 experiments).

2. Estimation of Na⁺, K⁺, Ca⁺⁺ ions using flame photometry. 3 Experiments.

3. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS. 3 Demonstration.

5. Demonstration of HPLC and GLC

PHARMACEUTICAL BIOTECHNOLOGY

PY132708. THEORY

3 hours/week

UNIT -I

1. **Immunology and Immunological Preparations :** Principles of immunology, antigens, antibodies and haptens, Immune system- cellular and humoral immunity, antigenantibody reactions and their applications, Hypersensitivity, Active and passive immunization, Preparation, standardization and storage of immunological products.

UNIT –II

2. Genetic Recombination: Transformation, conjugation, transduction, protoplast fusion and gene cloning and its applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as Activase, Humulin, Humatrope etc.

UNIT -III

- Microbial Transformation: Introduction, types of reactions mediated by microorganisms, design of biotransformation process, selection of organisms, biotransformation process and its improvements with special reference to steroids.
- **4. Antibiotics :**Historical development of antibiotics. Antimicrobial spectrum and methods used for their standardization. Fermenter, its design, control of different parameters. Design of fermentation process.

UNIT -IV

5. **Enzyme immobilization:** Techniques of immobilization of enzymes, factors affecting enzyme kinetics, study of enzymes such as hyaluronidase, pencillinase, streptokinase and streptodornase, amylases and proteases etc.

RECOMMENDED BOOKS:

- 1. Industrial Microbiology by Casida.
- 2. Industrial Microbiology by A.H. Patel.
- 3. Industrial microbiology by Prescott and Dunn.
- 4. Pharmaceutical Biotechnology by Vyas and Dixit.
- 5. Molecularbiology and Genetic Engineering by A.M.Narayanan, A.M.Selvaraj, A.Mani
- 6. Text Book of Microbiology by Anantanarayana and Panicker.
- 7. Concepts in Biotechnology by Balasubramanium.
- 8. Molecular Biotechnology by Glick.
- 9. Molecular Biotechnology by Gingold.
- 10. Pharmaceutical Biotechnology by K.Sambamurthy and Ashutosh Kar.

Elective-I PY132709

ADVANCED PHARMACEUTICAL ANALYSIS (E1)

3hrs/week

UNIT -I

1. Advanced Chromatographic Techniques: Super Critical Fluid Chromatography, Ion Exchange Chromatography, Size Exclusion Chromatography, Fast Protein Liquid Chromatography.

UNIT-II

- **2. Miscellaneous Methods of Analysis:** Diazotisation titrations, Kjeldahl method of nitrogen estimation, Oxygen flask combustion gasometry.
- 3. Electrophoresis: Gel Electrophoresis.

4. Differential Scanning Calorimetry (DSC), Differential thermal analysis and thermal gravimetric analysis (TGA).

UNIT-II

- 5. Concept of GLP. Principles of laboratory hygiene and safety.
- 6. Packaging and labeling controls

UNIT-IV

- 7. In process quality control (IPQC) tests, IPQC problems in pharmaceutical industries.
- 8. Sampling plans Sampling and operating characteristics curves.

RECOMMENDED BOOKS:

- Beckett, A H and Stenlake, J.B, Practical Pharmaceutical Chemistry, Vol I and II, The Athlone Press of the University of London.
- 2. Mendham J. Denny RC Barnes, J.D. Thomas M.J.K. "Vogel's Text Book of Quantitative Chemical Analysis" Pearson Education Asia.
- 3. Connors KA, A text book of Pharmaceutical Analysis, Wiley Intescience, New York.
- 4. Willing, Tuckerman and Hitchings, Good Manufacturing Practices for Pharmaceuticals.

- 5. OPPI, Quality Assurance.
- 6. Loftus and Nash, Pharmaceutical Process Validation.
- 7. Florey, Analytical Profile of Drugs (All volumes).
- 8. Indian Pharmacopoeia.
- 9. United States Pharmacopoeia.
- 10. British Pharmacopoeia.
- 11. Garfield, Quality Assurance Principles for Analytical Laboratories.
- 12. Manohar A. Potdar,"C.GMP for Pharmaceuticals".

ADVANCED PHARMACEUTICS (E2)

3hrs/Week

UNIT-I

1. Polymers as drug delivery carriers

Hydrophilic cellulose derivatives, poly (vinyl alcohol), acrylate and methacrylate as a drug delivery carrier, smart polymers for controlled drug delivery, complexing polymers in drug delivery.

2. Colloidal drug delivery system

Micro emulsion formation, characterisation, micro emulsion as drug delivery system, multiple emulsion definition, preparation, characterisation and application. Nanoparticle preparation methods, drugs bound to nanoparticles, characterisation and application.

UNIT-II

3. Microparticle drug delivery system

Microencapsulation terminology, preparation of microparticles, preparation of biodegradable microparticles, preparation of non biodegradable microparticles, *in-vitro- in-vivo* studies of microperticles.

UNIT-III

4. Controlled and novel drug delivery system

Overview of controlled release system, drug release from swellable controlled release system. Osmotic drug delivery system, transdermal drug delivery system, parentral controlled release system.

UNIT-IV

5. Packaging technology

Introduction to pharmaceutical packaging, regulatory aspects and specifications, different packaging components used in pharmaindustries, different closures and closure systems, warehousing, handling and distribution of packaged products, packaging line.

6.In vitro-in vivo correlation

Elementary aspect of *in vitro- in vivo* correlation and its significance in dissolution study.

HERBAL DRUG TECHNOLOGY AND PHARMACOLOGICAL SCREENING (E3)

3hrs/Week

UNIT-I

- 1. Introduction and general methods of extraction, phytochemical plant analysis, method of extraction, isolation, separation, identification and analysis of results. The principles rationale and the technology involved in the production of herbal formulation and herbal cosmetics. Stability and standardization of such preparation.
- 2. Quality control and quality assurance of herbal ingredients as per W.H.O. guidelines.

UNIT-II

3. Toxicity studies—Introduction, acute toxicity test, sub acute toxicity test, chronic toxicity test, special test & design of acute toxicity test. Alternatives to animal experiments.

UNIT-III

4. Pharmacological screening of herbal drugs. Introduction, New strategies for evaluation of herbal drugs.Screening of antidiabetic, antiulcer, analgesic, antipyretic, antiinflammatory, wound-healing, antidiarrheal, hepatoprotectant, anticancer, antihypertensive & antioxidant agents.Screening of CNS agent.

UNIT-IV

5. Bioassay of some important drugs like- digitalis, insulin, oxytocin, growth hormone, heparin, dtubocurarine, Androgen, progesterone, estrogen.

RECOMMENDED BOOK:

- 1. Pharmacognosy, W.C. Evans, Trease & Evans, Elsevier, Sriniwaspuri, New Delhi, 15thed.
- Quality Control of Herbal Drugs, Pulak K. mukharjee, Business Horizons, Masjid Math, New Delhi, 1st ed.
- 3. Plant Drug Analysis, H. Wagner & S. Bladt, Springer(India), New Delhi, 2nd ed.
- 4. Pharmacological screening methods, by S. K. Gupta. 2nded.

- 5. Fundamentals of experimental pharmacology by M. N. Ghosh. 4thed.
- 6. Pharmacology By Goyel & Ghadi. 4th ed.
- 7. Botanical safety hand book, Michael Meguffin, American Herbal production association.
- 8. Indian herbal pharmacopoeia, Indian drug Manufacturer's Association, Mumbai, Revised New ed.
- 9. Ayurvedic Pharmacopoeia, Ministry of Health & Family Welfare, Govt. Of India,
- 10. Drug discovery & evaluation by H. Gerhard Vogel, 2nded.

PHARMACY PRACTICE (E4)

3hrs/Week

UNIT-I

 Rational use of drugs: problems of irrational drug use, prescribing indicators, patient care indicators health facility indicators role of pharmacist in promotion of rational use of drugs. Self medication, over the counter drugs, Patient compliace, patient counseling.

UNIT-II

 Essential drug concept, selection, quantification, procurement and distribution of essential drugs, WHO model list of essential drugs. Radiopharmaceutical and its applications.

UNIT-III

 Pharmacoepidemiology, Pharmacoeconmics: types of health economic evaluations, Therapeutics in practice- decision marking in drug therapy. Therapeutic Drug Monitoring (TDM), Case studies Adverse Drug Reactions, drug-food interactions, Pharmacovigilance, National Pharmacovigilance programme.

UNIT-IV

- 4. Drug information system: Introduction to drug information resources, Drugs and poisons information, design of literature searches, literature evaluation, development of a drug and poison information database, emergency treatment of poisoning.
- Public Health Policy and Health Care System. Immunization Programmes and its success in India.Status of Health care system in India.

RECOMMENDED BOOKS:

- 1. Role of Pharmacist in Health Care System, WHO/PHARM/94.569
- 2. Remington's sciences and practice of pharmacy; 20th edition Lippincott.

Williams and Welkens.

- 3. Medicare scenario in India; Perceptions and perspectives- Delhi society for promotion of rational use of drugs.
- 4. WHO publications on essential drugs and medicines.
- 5. Relevant review articles from recent medical and pharmaceutical journals.
- 6. Hospital pharmacy, by W.E. Hassan, 2nd edition, Philadelphia.

B. Pharm Eighth Semester

PHARMACEUTICS-VII

(Pharmaceutical Technology III)

PY132801. THEORY

3 hours / week

UNIT -I

1. Preformulation studies: Principal areas like

- Bulk Characterization: Crystallinity and Polymorphism, hygroscopicity, bulk density, powder flow properties. Drug excipient compatibility study- Differential Scanning calorimetry (DSC) methods
- b. Solubility analysis: pKa, pH solubility profile, Common ionic effect, thermal effects, solubilization ,partition coefficient and dissolution, effect of ionic strength, dielectric constant, solvent species, temperature. Drug stability studies.

UNIT -II

Sustained release formulations: Concept, Rationale for Extended – Release Pharmaceuticals, Terminology, Techniques of Extended – Release oral dosage forms, Delayed - Release oral dosage forms, Evaluation of sustained release formulations.

UNIT -III

3. Brief introduction to controlled release dosage forms.

Design and evaluation of transdermal drug delivery systems. Parenteral Controlled Release systems.

Basic concepts of liposomes, nanoparticles, resealed erythrocytes, osmotic pump, implants, IUDs and ocuserts,

UNIT -IV

4. **Micro-encapsulation**: Types of microcapsule, applications of microencapsulation in pharmacy, microencapsulation by co-acervation phase separation, multi orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique and pan coating, evaluation of microcapsules.

RECOMMENDED BOOKS:

- 1. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig
- 2. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich
- 3. REMINGTON : The Science and Practice of Pharmacy, 20th Edition
- 4. Pharmaceutics : The Science of Dosage Form Design by Aulton
- 5. Bently's Textbook of pharmaceutics edited by E.A. Rawlins

PHARMACEUTICS-VII

(Pharmaceutical Technology III)

PY132812. PRACTICAL

3 hours / week

- 1. Solubility enhancement by different techniques (at least 2).
- 2. Dissolution testing and data evaluation for oral solid dosage forms.
- 3. Determination of pharmacokinetic parameters from the given plasma drug concentration time and urinary excretion data.
- 5. Preparation (at least 6) and evaluation (at least 2) of cosmetic products.
- 6. Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like micro capsules

CLINICAL PHARMACY & THERAPEUTICS

PY132803. THEORY

3 hours/week

UNIT -I

- 1. Introduction to Clinical Pharmacy
- 2. Basic concepts of Pharmacotherapy
- 3. The Basics of Drug Interactions with suitable examples: Pharmacokinetic drug interactions, pharmacodynamic drug interactions, food and drug interactions, alcohol and drug interactions

UNIT -II

4. Important disorders of organ systems and their management:

Cardiovascular Disorders – Hypertension, Congestive Heart Failure, Angina, Acute Myocardial infarction, Cardiac arrhythmias

CNS Disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression

Respiratory Diseases – Asthma and COPD

Gastrointestinal Disorders – Peptic ulcer, Ulcerative colitis, Hepatitis, Cirrhosis

Endocrine Disorders – Diabetes mellitus and Thyroid Disorders.

$\mathbf{UNIT}-\mathbf{III}$

- 5. Infectious Diseases Tuberculosis, Urinary Tract Infection, Enteric Infection, Upper Respiratory Infection
- 6. Haematopoietic Disorders Anemias
- 7. Joint and Connective Tissue Disorders Rheumatic Disease, Gout and Hyperuricemia
- 8. Neoplastic Diseases Acute Leukemias, Hodgkin's diseases

UNIT -IV

- 9. Therapeutic Drug Monitoring.
- 10. Concept of Essential Drugs and Rational Drug use.
- 11. Adverse drug reactions and approaches to minimize them

RECOMMENDED BOOKS:

- 1. Remington the Science and Practice of Pharmacy
- 2. Clinical Pharmacology by Laurence, Bennett and Brown
- 3. Medical diagnosis and treatment by Tierney, Mc phee and Papadakis
- 4. Clinical Pharmacy & Therapeutics by Roger Walker, Edwards.
- 5. Clinical Pharmacy and Therapeutics by Herfindal, Gourley and Lloyd Hart.
- 6. Physiological basis of Medical Practice by John B. West
- 7. Drug Interactions by Ivan Stockley

QUALITY ASSURANCE & GMP

PY132804. THEORY

3 hours/week

UNIT -I

 Good Manufacturing practices: GMP and cGMP and salient features of Drugs & Cosmetics Act & Rules with reference to manufacture of drugs in India.

UNIT -II

2. Pharmaceutical Validation: Validation of Water systems for sterile & Non Sterile products, cleaning validation, process validation, Equipment validation, Analytical method validation.

UNIT -III

- Basic concept of Quality Assurance. Quality Assurance with reference to organization, personnel, Building & facility equipment, Product Control, ware housing, Returned goods & reprocessing, Documentation.
- 4. Introduction to SOP, TQM, ISO and IPR.

UNIT -IV

- 5. Drug Regulatory Affairs: Role of Regulatory Affairs Dept, Nomenclature and salient features of regulatory authorities of India and US.
- 6. Stability testing protocols of drug products as per ICH guidelines.

RECOMMENDED BOOKS:

- 1. Pharmaceutical Process Validations Ira R.Berry, Robert A.Nash
- 2. GMP P.P.Sharma
- 3. Quality Assurance Manual D.H.Shab Business Hortzons
- 4. Quality Assurance for Pharmaceuticals Vol-I&II-Pharma Book Syndicate
- 5. SOP Guidelines D.H.Shab Business Horizons
PHARMACEUTICAL MANAGEMENT

PY132805. THEORY

3 hours/week

UNIT – I

 Concept of Management: Administrative management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/Morale). Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, innovation, creativity, delegation of authority/responsibility and record keeping) Identification of Key points to give maximum thrust for development and perfection.

$\mathbf{UNIT} - \mathbf{II}$

- 2. Accountancy: Principles of accountancy, Ledger posting and book entries, Preparation of trial balance, columns of a cash book, bank reconciliation statement, rectification of errors, profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of checks, bills of exchange, promissory notes and hundies, documentary bills.
- **3. Economics:** Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labour welfare, general principles of insurance, inland and foreign trade, procedure of exporting and importing goods.

UNIT – III

- **4. Pharmaceutical Marketing:** Function, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.
- **5. Salesmanship:** Principles of sales promotion, advertising, ethics of sales, merchandising, literature & detailing. Recruitment, training, evaluation and compensation to the pharmacist.
- 6. Market research: Prerequisites, Basic information services.

$\mathbf{UNIT} - \mathbf{IV}$

- **7. Materials management:** A brief exposure to the basic principles of materials management, purchase, stores & inventory control and evaluation of materials management.
- 8. Production Management : A brief exposure of the different aspects of production management (Visible & Invisible) inputs, methodology of activities, performance evaluation techniques, process flow, process know how and maintenance management.

RECOMMENDED BOOKS:

- 1. M. J. Etazel , B. J. Walker and W. J. Stanton, Marketing, Tata McGraw Hill, 13th Edition, 2004.
- 2. R. Saxena, "Marketing Management" Tata McGraw Hill, second Edition, 2003.

PHARMACOGNOSY- VI (INDUSTRIAL PHARMACOGNOSY)

PY132806.

THEORY

3 hours/week

UNIT – I

Water Treatment: Water quality standards, Water sources and their quality, Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.
Solid Waste Management: Sources classification and composition of MSW; properties and separation, storage and transportation, MSW Management, Waste minimization, Reuse and recycling, Biological treatment, Thermal treatment, Landfill, Integrated waste management.
Air Pollution: Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change - green house gases, non-criteria pollutants, emission standard from industrial sources, air pollution metereology, Atmospheric dispersion.

$\mathbf{UNIT} - \mathbf{II}$

4. Utilization and production of phytoconstituents such as quinine, calcium sennosides, podophyllotoxin, diosgenin, solasodine, and tropane alkaloids.

5. Utilization of aromatic plants and derived products with special reference to sandalwood oil, mentha oil, lemon grass oil, vetiver oil, geranium oil and eucalyptus oil.

$\mathbf{UNIT} - \mathbf{III}$

6. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy.

7. Chemotaxonomy of medicinal plants.

$\mathbf{UNIT}-\mathbf{IV}$

- 8. Herbs as health foods.
- 9. Herbal cosmetics.

RECOMMENDED BOOKS:

1. Environmental Engineering Irwin/McGraw Hill International Edition, 1997, G. Kiely,

2. Principles of Environmental Engineering and Sciences, K.L. Davis and S.J. Masen, McGraw Hill International Edition, 2004.

- 3. Textbook of Industrial Pharmacognosy by A.N Kalia.
- 4. Pharmaceutical Biotechnology by Vyas and Dixit.

PHARMACOGNOSY- VI (INDUSTRIAL PHARMACOGNOSY) PRACTICAL

PY132817 PRACTICAL

3 hours/ week

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

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