### SYLLABI OF BACHELOR OF PHARMACEUTICAL SCIENCES

#### THIRD YEAR B. PHARMACY

**3.1 (T) PHARMACEUTICS-II**  
(Theory) 90 Hrs. (3 hrs per week)

<table>
<thead>
<tr>
<th>Topic No</th>
<th>SECTION-I</th>
<th>Hrs.</th>
</tr>
</thead>
</table>
| 1.       | Concept of Formulation Design:  
  a) Preformulation: Introduction, General consideration, Preliminary evaluation & molecular optimization, Bulk characteristics, Solubility analysis, Stability analysis.  
  b) Design of Dosage Form: Principles, Dosage form design, Biopharmaceutical & Therapeutic aspects of dosage form design.  
  c) Study of excipients: Introduction, classification & selection criteria | | 5 |
| 2.       | Stability studies:  
  Concept of stability studies.  
  a) cGMP & ICH guidelines for Accelerated stability Testing.  
  b) Interaction of containers & closure Compatibility Testing | | 5 |
| 3.       | III. Solid Dosage Forms:  
  A. Tablets:  
    Introduction, Advantages & Disadvantages, Types of tablets.  
    **Formulation development:** Preformulation of drugs & additives.  
| 4.       | Tablet Coating:  
    Introduction and concept of tablet coating. Types of tablet coating including Sugar, Film & Enteric coating. Material, processes employed & equipments for tablet coating. Manufacturing problems & remedies during tablet coating. Evaluation of coated tablets. | | 4 |
| 5.       | Layout of tablet manufacturing section. | | 1 |
| 6.       | B. Capsules:  
  a) **Raw material for capsule shell:** Manufacturing of gelatin for capsule.  
    Introduction and concept of size selection of capsules. Selection criteria | | 10 |
and size selection of capsules (with examples)


**Soft gelatin capsules:** formulation and development, manufacturing, processing & equipment. In process quality control & quality control parameters. Packaging & labeling of capsules: Strip, Blister & Bulk Packaging.

### SECTION- II

**Disperse systems:**
Free energy consideration, thermodynamic v/s kinetic stability. Classification of disperse system.

<table>
<thead>
<tr>
<th>A) <strong>Suspensions:</strong></th>
<th>2</th>
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<tr>
<th>B) <strong>Emulsions:</strong></th>
<th>6</th>
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</table>

<table>
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<tr>
<th>C) <strong>Suspension &amp; emulsion manufacturing equipments:</strong></th>
<th>2</th>
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<tbody>
<tr>
<td>Mechanical stirrers, homogenizers, colloid mill, foaming removal.</td>
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</table>

<table>
<thead>
<tr>
<th>D) <strong>Layout and designing of manufacturing facility for suspension and emulsion.</strong></th>
<th>1</th>
</tr>
</thead>
</table>
2. **Semisolids:**

3. **III ) Cosmetics & Cosmeceuticals:**
   A) **Cosmetics:**
   Cosmetics v/s drug formulation. Type of cosmetics. Formulation, manufacturing & safety testing & quality control of following cosmetics.
   - **Skin products:** Moisturising, cleaning, cold, vanishing, face pack, anti wrinkle, antiperspirants, deodorants, suntan, & sunscreen preparations.
   - **Hair products:** Shampoos, hair tonics, hair dyes, depilatories, shaving preparations.
   - **Eye products:** Eye mascara, eye shadow, eye liner, eyebrow pencil.
   - **Lip product:** Lipstick.
   - **Manicure products:** Nail lacquer, Lacquer remover.

   B) **Cosmeceuticals:**

### 3.1 PHARMACEUTICS-II

*(Practical) 90 Hrs. (3 hrs/week)*

I) Raw material testing of any 5 Experiments
II) Formulation, Preparation and Evaluation of the following dosage forms.

1. **Suspensions**
   - Calamine lotion
   - Milk of Magnesia
   - Paracetamol Suspension
   - Antacid Suspension


2. **Emulsions**
   - Liquid paraffin oral Emulsion
   - Turpentine Liniment
   - Formulation of Emulsion (HLB Consideration)

   Evaluation Parameters: Organoleptic Properties, pH, Globule size, wt/ml, and assay of any one preparation

3. **Semisolids**
   - Pain balm
- Antifungal ointment/cream
- Medicated Gel
- Antiacne preparation
- Non staining Iodine ointment with Methyl Salicylate

Evaluation Parameters: pH, Spreadability, Organoleptic properties and assay of any one preparation

4. Tablets
   - Aspirin – Using non aqueous binder solution
   - Paracetamol – By Wet granulation
   - Chewable, Dispersible, Effervescent Tablets

Evaluation of granules- Angle of repose, Particle size, Densities and Carr’s Index


5. Capsules
   - Ferrous Fumerate Capsules
   - Antibiotic Capsules

Evaluation of Empty and Filled Hard gelatin capsule shell.
Evaluation of capsule- Weight variation, dissolution time

6. Tablet Coating (Demonstration)

7. Cosmetics
   - Cold cream
   - Vanishing cream
   - Shampoo
   - Tooth Paste
   - Saving cream
   - Moisturising cream
   - Sunscreen cream/lotion
   - Lip stick
   - Eye shadow, Eye liner, Eye Mascara
   - After shave lotion
   - Nail lacquer

Evaluation Parameters: Organoleptic properties for all preparation.
Foam test for shampoo and shaving cream
Film formation test for lipstick and eye preparation.

**Recommended Books**

2. James J. Wells “Pharmaceutical Preformulation: The physicochemical properties of drug substances” Ellis Horwood, Chichester, UK, 1988
3. www.ich.org
19. L. Appell “The formulation and preparation of cosmetics, fragrance and flavours” Micelle press
20. W. A. Pocher “Poucher’s Perfumes, Cosmetics and Soaps” Vol. III; Chapman and Hall
21. Dr. Laba “Rheological properties of cosmetics and toiletries” Marcel Dekker.
### 3.2 PHARMACEUTICAL BIOTECHNOLOGY

*(Theory)* 60 Hrs. (2 hrs per week)

<table>
<thead>
<tr>
<th>Topic No</th>
<th>SECTION-I</th>
<th>Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Introduction to Biotechnology, Scope, Potential &amp; Achievements</strong></td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td><strong>Genetic Engineering:</strong></td>
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<td></td>
<td>2.1 <strong>Recombinant DNA technology:</strong></td>
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<td></td>
<td>- Gene cloning: Introduction, enzymes acting on DNA (restriction endonucleases, S1 nuclease, alkaline phosphatase, polymerase, ligase, reverse transcriptase), types of cloning vectors, expression vectors (expression vectors in brief), transformation &amp; growth of cells, Selection of clones (screening methods).</td>
<td>4</td>
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<td></td>
<td>- <strong>Gene transfer:</strong> - Introduction &amp; Types (Direct &amp; Indirect gene transfer methods) Ti &amp; Ri plasmid mediated gene transfer.</td>
<td>4</td>
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<td></td>
<td>2.2 <strong>Genetic Engineering techniques:</strong></td>
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<td></td>
<td>- Isolation of DNA, Genomic &amp; cDNA libraries, Gel electrophoresis, DNA Hybridization, Blotting techniques, polymerase chain reaction (PCR) Site directed mutagenesis, Restriction Fragment Length Polymorphism (RFLP), Human Gene therapy, DNA fingerprinting. Gene synthesis &amp; gene machine, Gene sequencing methods.</td>
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<td>3.</td>
<td><strong>Plant Cell and Tissue Culture:</strong></td>
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<td></td>
<td>3.1 Introduction to plant cell, media &amp; laboratory requirements for tissue culture</td>
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<td></td>
<td>3.2 Types of cultures: Callus, suspension, meristem, root-tip, hairy root, haploid cultures, anther cultures/Pollen grains (Introduction, methodology &amp; applications of above types)</td>
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<td>3.3 Protoplast culture &amp; protoplast fusion &amp; application</td>
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<td></td>
<td>Transgenic Plants introduction, Method, Application</td>
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<td>3.4 Germplasm storage &amp; cryopreservation</td>
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<td>4.</td>
<td><strong>Animal Cell Culture</strong></td>
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<td></td>
<td>4.1 Introduction, isolation of cells, preparing cells in culture, established cell lines, culture media for animals, Role of blood plasma &amp; serum, Preparation of chicken serum, mammalian serum &amp; embryo extract.</td>
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<td></td>
<td>4.2 Introduction to transgenic animals and their applications</td>
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<td>5.</td>
<td><strong>Immunotechnology</strong></td>
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<td>5.1 Vaccines Why vaccines? How it works? Traditional vaccine approaches, Subculture and recombinant vaccines, Future directions, Edible vaccines</td>
<td>7</td>
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<tr>
<td></td>
<td>5.2 Hybridoma technology, Preparation of Monoclonal Antibodies and its</td>
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### Applications
5.3 Immunoassay by different techniques- Enzyme Linked Immuno Sorbant Assay (ELISA), Radio Immuno Assay (RIA), Immunofluoroscence

<table>
<thead>
<tr>
<th>6. Enzyme Technology</th>
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<tbody>
<tr>
<td>Introduction to enzyme, Immobilization of enzyme &amp; its applications</td>
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<tr>
<th>7. Fermentation Technology</th>
<th>10</th>
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<tbody>
<tr>
<td>Study of methods at sterilization details &amp; their applications to Pharmaceutical Manufacturing</td>
<td></td>
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<tr>
<td>Fermentation as a biochemical process – Fermenter, its material of construction, Accessory components and working, Down streaming Processing (Product Recovery and Processing), Fermentation discharge and Effluent treatment</td>
<td></td>
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<tr>
<td>General Application of fermentation in Manufacturing of Antibiotics (penicillin, Streptomycin, Tetracycline), Dextran, Vitamins (Vitamin B₂ and Vitamin B₁₂)</td>
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<tr>
<th>8. Healthcare Biotechnology</th>
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<tbody>
<tr>
<td>Examples of Biotechnology derived Products: Human insulin, Somatotropin, Interferons, Biogenetic drugs (Production and uses)</td>
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<tr>
<td>Purification Toxicity studies in establishing safety and efficacy in biotechnological Products.</td>
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<tr>
<td>Introduction to collection, processing, and storage of blood and blood products</td>
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<table>
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<tr>
<th>9. Biotechnology and Ethics</th>
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<tbody>
<tr>
<td>Social &amp; ethical issue in Pharmacy, Agriculture, Energy &amp; Environment.</td>
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<tr>
<td>Humans:- Artificial Insemination (AI), In-vitro Fertilization &amp; embryo Transplants, Surrogate motherhood, Freezing germ cells, Human Embryos and Cloning (Facing Problems and finding solutions)</td>
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<th>Total</th>
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<tbody>
<tr>
<td>Recommended Books:</td>
<td>60</td>
</tr>
</tbody>
</table>
5. Vyas and Dixit Pharmaceutical Biotechnology, 1st CBS Publisher New Delhi, 1991
8. S.S. Purohit, Biotechnology Fundamentals and Applications Student edition Agrobios Publisher;2002

### 3.3 MEDICINAL CHEMISTRY – I

(Theory) 90 Hrs. (3 hrs per week)

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>SECTION- I</th>
<th>Hrs.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>General considerations: Structure of biological membrane, Selected physicochemical properties affecting drug action; solubility, partition coefficient, Ferguson principle, stereo chemical aspects of drug action, Bioisosterism, Drug absorption; distribution, metabolism and elimination, Protein binding, Blood brain barrier.</td>
<td>06</td>
</tr>
<tr>
<td>2</td>
<td>Receptors: Types of receptors, Types of forces involved in drug receptor interaction; intracellular cyclic nucleotides and other mediators of biological response, Transduction mechanism.</td>
<td>04</td>
</tr>
<tr>
<td>3</td>
<td>History and general aspects of the design &amp; development of drugs including classification, nomenclature, structure activity relationship (SAR), mechanism of action, adverse effects, therapeutic uses, and recent developments of following categories. Biochemical approaches in drug designing wherever applicable should be discussed.</td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Cholinergic agonists and antimuscarinic agents: Neurotransmitters, impulse, Biosynthesis of acetylcholine, its release and metabolism. Cholinergic agonists: Receptor subtypes and their structural features, Cholinergic antagonists, cholinesterase inhibitors, Antimuscarinic agents: Ganglionic Blockers and neuromuscular blockers: Ganglionic stimulants, Ganglionic transmission, Ganglionic blockers and nicotinic receptors. Neuromuscular blockers</td>
<td>09</td>
</tr>
<tr>
<td>3.2</td>
<td>Adrenergic agonists and antagonists: Biosynthesis, release and metabolism of noradrenaline, Receptor subtypes and their structural features.</td>
<td>07</td>
</tr>
</tbody>
</table>
| 3.3    | Cardiovascular drugs  
a. Cardiotonic drugs  
b. Antianginal agents  
c. Antiarrhythmic agents  
d. Antihypertensive agents  
e. Currently used Anti-lipedemic drugs | 12 |
| 3.4    | Diuretic agents | 05 |
### SECTION-II

<table>
<thead>
<tr>
<th>3.5</th>
<th>CNS Stimulant Drugs</th>
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<tbody>
<tr>
<td>a.</td>
<td>Analeptics and respiratory stimulants</td>
</tr>
<tr>
<td>b.</td>
<td>Hallucinogens</td>
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<td>04</td>
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<tr>
<td>3.6</td>
<td>CNS Depressant Drugs</td>
</tr>
<tr>
<td>a.</td>
<td>General anesthetic agents</td>
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<td>b.</td>
<td>Sedative &amp; Hypnotic agents</td>
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<td>c.</td>
<td>Anticonvulsants</td>
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<td></td>
<td>06</td>
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<tr>
<td>3.7</td>
<td>Drugs used in Neurodegenerative diseases</td>
</tr>
<tr>
<td>a.</td>
<td>Parkinson’s disease</td>
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<td>b.</td>
<td>Alzheimer’s disease</td>
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<td></td>
<td>05</td>
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<tr>
<td>3.8</td>
<td>Psychotherapeutic agents</td>
</tr>
<tr>
<td>a.</td>
<td>Antipsychotic agents</td>
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<td>b.</td>
<td>Antidepressant agents</td>
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<td>c.</td>
<td>Anxiolytic agents</td>
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<td></td>
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<td>3.9</td>
<td>Local anesthetic agents</td>
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<td>3.10</td>
<td>Anti-migraine agents</td>
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<tr>
<td>3.11</td>
<td>Diagnostic agents: Radio Opaque diagnostic agents, Agents for organ function test, Miscellaneous diagnostic agent.</td>
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<tr>
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<td>03</td>
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<tr>
<td>3.12</td>
<td>Oral hypoglycemic drugs (including insulin)</td>
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<td>05</td>
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<tr>
<td>3.13</td>
<td>Prodrugs, soft drugs and hard drugs</td>
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<td>03</td>
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<tr>
<td>4</td>
<td>Scheme of synthesis of following drugs from various therapeutic categories: Carbachol, dantrolene sodium, methyldopa, propranolol, atenolol, salbutamol, thiopeental sodium, lignocaine, prazocin, guanethidine, terbutaline, captopril, amitryptiline, hydralazine, imipramine, diazepam, chlorpromazine, haloperidol, trifluperazine, phentoin, sodium valproic acid, losartan, alprazolam, metazepam, fluoxetine, clofibrate, sumatriptan, ondansetron, glyburide, rosiglitazone, tolbutamide, furosemide, dicyclomine hydrochloride, chlorothiazide, amiloride, donepezil</td>
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<td><strong>Total</strong></td>
<td><strong>90</strong></td>
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</tbody>
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### 3.3 (P) MEDICINAL CHEMISTRY –I  
(Practical) (90Hrs. (3 hrs per batch))

1. Purification techniques of solvents/liquids by Fractional distillation and distillation under vacuum
2. Determination of partition co-efficient, dissociation constant, molar refractivity and RM values of compounds for QSAR analysis.
3. Resolution of Recemic mixtures of any two APIs by any two methods
4. Demonstration of simple QSAR software (Hansch Analysis)
5. Demonstration of construction of stereo models of drugs (minimum two)
6. Preparation of acid salts of drugs and evaluation of its physical properties.
7. Two or more step synthesis of drugs and drug intermediates being studied in theory (any ten)

**Recommended Books for Theory and Practicals**
1 An Introduction to the Chemistry of Heterocyclic Compounds, by Acheson RN, Interscience Publishers New York.
8 Profiles in Drug Synthesis Vol 1 & 2 by Gogate.
9 Exploring QSAR Vol; I Fundamentals and Applications in Chemistry and Biology by C Hansh and A Leo Vol. II: hydrophobic, Electronic and Steric Constants by C Hansh, A Leo and D Hockman ACS Book Catalog.
25 Steric Constants by C Hansch, A Leo and D Hockman, ACS Book Catalog.

3.4 (T) PHARMACEUTICAL ANALYSIS-II
(Theory) 90 Hrs. (3 Hrs./week)

<table>
<thead>
<tr>
<th>Topic No</th>
<th>SECTION-I</th>
<th>Hrs.</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to analytical methods, (Gravimetric methods, Titrimetric methods, Neutralization titrations and its applications, Complexometric reactions and titrations), Advantages and disadvantages of instrumental methods of analysis and respective problems, Instruments for analysis.</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Atomic Absorption Spectroscopy: Theory, Instrumentation line broadening, Doppler effect, Flame types, different Interference and their Corrections, Pharmaceutical applications</td>
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<tr>
<td>3</td>
<td>Flame Photometry: Principles, Instrumentation and Pharmaceutical applications</td>
<td>3</td>
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<tr>
<td>4</td>
<td>Refractometry: Specific and molar refraction, Refractive index, Measurement of RI (angle of refraction), Instrumentation and applications.</td>
<td>3</td>
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<td>5</td>
<td>Electrophoresis – Principle, Instrumentation, Various types of Developments</td>
<td>5</td>
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<td>6</td>
<td>Polarography: - Introduction, Principle, Dropping Mercury Electrode and Other Mercury Electrodes, Polarogram, half wave potential, Linear Scan&amp; Differential Pulse Polarography, applications covering nonaqueous polarography</td>
<td>5</td>
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<tr>
<td>7</td>
<td>Fluorimetry and phosphorimetry: - Molecular luminescence, measurement of fluorescence, factors affecting fluorescence, quantitative aspects of fluorescence, Excitation and emission spectra. Instrumentation, advantages and disadvantages, applications, synchronous fluorescence. Spectrofluorometry Instrumentation, advantages and disadvantages, applications, optical bleachers,</td>
<td>12</td>
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</tbody>
</table>
High Performance Thin Layer Chromatography (HPTLC): Theory, Instrumentation and Applications, Automated Multiple Development, Horizontal TLC and other development modes, Labeling of TLC, Centrifugal TLC

SECTION-II


11. Amperometry: - Principles, Amperometric titration apparatus, general procedure, advantages and disadvantages, applications, Biamperometric titrations and its applications. Rotating Disc, ring and similar types of electrodes


3.4 (P) PHARMACEUTICAL ANALYSES-II
(Practical) (75 Hrs. per batch)

1. Determination of refractive index by Abbe’s Refractometer Molar refraction calculations, Use oils, fats and other similar samples also. Three exercises

2. UV spectrophotometric estimations of API and same from their formulations Four exercises

3. Flurometric estimation of few florescent compounds. Minimum Three exercises

4. Na⁺, K⁺ Calcium and Lithium estimation from formulations by Flame Photometry, two exercises each for available filter

5. Nepheloturbidimetric estimation of few analytes containing ions, vitamins, alkaloids Three exercises

6. Paper chromatography ascending, Radial Three exercises each

7. Thin Layer chromatography Three exercises

Recommended Books for Theory and Practicals
6. Introduction to Chromatography (Theory and Practice) by VK Srivastav and KK Shrivastav.
11. Handbook of Instrumental Techniques for Analytical Chemistry by Frank Settle, Practice Hall Publications.
12. Instrumental Methods of Analysis by Willard Merit, Dean Settle, 7th edition, CBS Publisher & Distributor.
18. Indian Pharmacopoeia. latest edition

3.5 (T) PHARMACOLOGY
(Theory) 90 Hrs. (3 Hrs./week)

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>SECTION- I</th>
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<tbody>
<tr>
<td>Basic pharmacology (classification, mechanism of action, pharmacokinetics, pharmacological actions, adverse effects, contraindications, therapeutic uses, drug interaction, dosage, symptoms and treatment of poisoning) and Clinical Management of diseases and drugs acting on following categories:</td>
<td></td>
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<tr>
<td>1.</td>
<td>Autonomic Nervous System</td>
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<tr>
<td></td>
<td>a) Autonomic Nervous system-General Considerations</td>
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<td></td>
<td>b) Cholinergic system and drugs</td>
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66
### 2. Drugs acting on Central Nervous System

- a) Aliphatic alcohol
- b) General anesthetics
- c) Sedative and Hypnotics
- d) Antiepileptic drugs
- e) Anti-Parkinsonian drugs
- f) Drugs used in Mental illness (Psychopharmacological drugs)- Antipsychotic, anti-anxiety, antidepressant, anti-mania drugs
- g) Opioid analgesics and antagonists
- h) NSAIDs
- i) CNS stimulants and nootropic
- j) Drug dependence
- k) Introduction to Patient addiction rehabilitation Center and Principle of rehabilitation of drug addicts- Alcohol, tobacco, opioids.

### SECTION-II

#### 3. Drugs acting on Respiratory tract

- Drugs for cough and bronchial asthma

#### 4. Drugs acting on gastrointestinal tract

- a) Drugs for peptic ulcers
- b) Emetics and antiemetics
- c) Drugs for constipation and diarrhea

#### 5. Hormones and Hormones antagonists

- a) Anterior and Posterior Pituitary hormones
- b) Corticosteroids and corticosteroid antagonists
- c) Thyroid and antithyroid drugs, parathyroid hormones, drugs regulating calcium homeostasis, Vitamine D
- d) Insulin, Oral hypoglycemic agents, glucagon
- e) Gonadal hormones and Oral contraceptives, antifertility agents
- f) Oxytocin and drugs acting on uterus.

#### 6. Pharmacotherapy of gout, rheumatoid arthritis and osteoarthritis.

#### 7. Local Anesthetics

### 3.5 PHARMACOLOGY- II

(Practical) (90 hrs; 3 hrs/week)

1. Introduction to commonly used instruments in experimental pharmacology.
2. Care and handling of common laboratory animals, animal welfare and introduction of CPCSEA and its guidelines, OECD guidelines.
3. Introduction to animal physiology with their biochemical reference values in various animal species.
4. Study of various anesthetics employed to anesthetize laboratory animals.
5. Study of various routes of drug administration
7. Introduction to the techniques of Euthenessia, stunning and pithing
8. Study of various methods for collection of blood, body fluids and urine from experimental animals.
9. Computer simulations of following experiments through computerized simulated software programme using software such as X-Pharma, X-cology etc.
   a) Record and interpret the concentration response of acetylcholine/histamine using suitable isolated tissues.
   b) Study of synergism using isolated tissues.
   c) Study of drug antagonism using isolated tissues.
   d) Study of the miotic and mydriatic effect of drugs using rabbit eyes
   e) To study effects of various cardiovascular drugs on following heart preparations.
10. Bioassay-Definition, Principle, types, advantages of various methods
11. Bioassay of Acetylcholine and histamine using suitable animal preparation
12. Behavioral pharmacology demonstrations using various instruments preferably by simulations on computers (A small number of mice (3) to be used for each the following experiments and the animals should not be sacrificed).
   a) Study of analgesic activity of drugs using Eddy’s hot plate analgesiometer, tail immersion.
   b) Study of locomotor activity of drug using actophotometer.
   c) Study of anticonvulsant activity of drug using maximal electroshock/ pentylenetrazol/ strychnine/INH method.
   d) Study of muscle relaxant property of drug using rotarod.
   e) Study of various drugs on sleeping time using suitable animals.
   f) Study of local anesthetic effect of drugs using suitable animal.
   g) Study of Haloperidol/ Clonidine/ Pentazocin induced catalepsy using suitable animal.

**Recommended Books**

4. Crossland, James and; Lewis,s Pharmacology Basis of Therapeutics, (Pergamon Press, New York)
6. Goodman and Gilman; Pharmacological Basis of Therapeutics, McGraw-Hill
7. Katzung, B.G; Basic and Clinical Pharmacology, Lange Medical Publisher, USA
8. Rang, H.P. and Dale, M.M.; Pharmacology, Churchill Livingston, UK
### 3.6 (T) PHARMACOGNOSY
(Theory) 90 Hrs. (3 Hrs./week)

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>SECTION- I</th>
<th>Hrs.</th>
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</thead>
<tbody>
<tr>
<td><strong>Note:</strong> Drugs mentioned in Bold must be studied in detail for their cultivation, collection and extraction</td>
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<tr>
<td>1.</td>
<td>Glycosides - Introduction, definition, occurrence, properties, classification, uses, general biogenetic pathway. General extraction and isolation methods. <strong>Anthraquinones – Senna, Aloe, Rhubarb</strong>&lt;br&gt;<strong>Cardioactive - Digitalis, Squill</strong>&lt;br&gt;<strong>Saponins – Liquorice, dioscorea, shatavari</strong>&lt;br&gt;<strong>Bitter- Quassia, Kalmegh, chirata</strong>&lt;br&gt;<strong>Cynogenic – Bitter almond</strong>&lt;br&gt;<strong>Isothiocyanate – Black mustard</strong>&lt;br&gt;<strong>Flavonoid – Orange peels.</strong>&lt;br&gt;<strong>Coumarin/ furocumarin – Psoralea</strong>&lt;br&gt;<strong>Lactone – Artemesia</strong></td>
<td>20</td>
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<tr>
<td>2.</td>
<td>A) Terpenoids - Introduction, occurrence, properties, classification, chemistry, uses, general biogenetic pathway. <strong>B) Volatile Oils – Introduction, occurrence, properties, classification, chemistry, uses, general methods of extraction and evaluation of volatile oils.</strong> <strong>Cardamom, cinnamon, cassia, lavender, caraway, dill, coriander, eucalyptus, nutmeg, fennel, clove, tulsi.</strong></td>
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<td>3.</td>
<td>Lipids – introduction, occurrence, properties, classification, uses, methods of extraction, adulteration, evaluation, general biogenetic pathway. <strong>Fixed Oils- Castor oil, olive oil, Linseed oil, Seasame oil, Cod liver oil, Shark liver oil, soya oil.Fats – Cocoa butter, Kokum butter</strong>&lt;br&gt;<strong>Waxes – Bees wax, Wool fat, Carnauba wax</strong></td>
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<td>4.</td>
<td>General methods to study the biogenetic pathways with special reference to Tracer Technique and its application in the biogenetic investigations with suitable examples.</td>
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<td><strong>SECTION- II</strong></td>
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<td>5.</td>
<td>Tannins – introduction, definition, classification, properties, uses, chemical tests and general method of extraction. <strong>Ashoka, Arjuna, Bahera, Amala, Myrobalan, Pale catechu, Black catechu</strong></td>
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<td>6.</td>
<td>Resins and resins combinations – introduction, classification, properties, chemical composition extraction, and uses. <strong>Podophyllum, Asafoetida, Ginger, Turmeric, Capsicum, Benzoin, Colophony, Shellac, Cannabis, Guggul</strong></td>
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<td>7.</td>
<td>Plant pesticides – Pyrethrum, Tobacco, Neem, Derris root.</td>
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<td>8.</td>
<td>Enzymes and proteins - Papain, gelatin, Bromelin, Streptokinase, Serratiopeptidase, Urokinase</td>
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<td>9.</td>
<td>Drugs of mineral origin – Shilajit, Bentonite, Kaolin, Calamine, Fullers earth.</td>
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<td>10.</td>
<td>Extraction of Plant Material- Soxhlet extraction, Droplet-counter-current Extraction, Supercritical fluid extraction, Froth floating technique, Evaluation</td>
<td>3</td>
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</table>
of herbal extract.

11. Applications of Medicinal Plant Tissue Culture in Pharmacognosy.
   • Cultivation of Medicinal Plant Cells
   • Production of Secondary Metabolites
   • Biocoversions Using Plant Cells
   • Plant Cell Immobilization
   • Genetic manipulation: Mutation, Polyploidy, Hybridisation, Chemodemes, Transgenic plants,
   • Conservation of Endangered species through micropropagation.

**Recommended Books**

2. Tyler, Brady and Robbers: Pharmacognosy: CBS Publisher and Distributors, New Delhi.
8. The British Pharmacopoeia.
15. Rainerat and Bajaj, plant tissue culture.

**3.6 Pharmacognosy- II**

(Practical) (90 hrs: 3 hrs/week)

1) Study of plant tissues, stomata, trichomes, starch grains and calcium oxalate crystals.
2) Analytical study of morphological and microscopical characters, chemical and microchemical tests for following crude drugs in entire and in powdered form (including surface preparation wherever required).
   • Leaf – Senna, Digitalis, Eucalyptus (Comparative study)
   • Bark – Cassia, Cinnamon
   • Fruit – Fennel, Caraway, Dill, Coriander, Cardamom, Capsicum
   • Seed – Isapghula, Linseed
   • Flower bud – Clove
   • Wood – Quassia
   • Stem – Kalmegh, Chirata
   • Root and Rhizomes – Liquorice, Shatavari, Ginger. (Comparative study)
3) Quantitative microscopy:
   - Determination of Leaf constant- Stomatal number and Stomatal index, Palisade ratio, Vein-islet no., Veinlet termination no.
   - Determination of length, width and diameter of cellular material/ cell contents.
   - Determination of % purity of crude drugs by lycopodium spore method
4) Experiments on – Sampling of crude drug for analysis. Determination of foreign matters, Moisture content (Loss on drying/ Toluene Distillation) Ash Values, Extractive values, Swelling index, Foaming index, Crude fibre (by dutch method)
5) Estimation of Acid Value/ Saponification value/ Iodine Value
6) Identification of natural fibres by general chemical tests and microscopical examination.
7) A) Identification of crude drugs mentioned in theory syllabus from their morphological and physical characters and preparation of herbarium for one medicinal plant.
   B) Identification of unorganized drugs by physical characteristics and chemical Tests. Acacia, Agar, aloe, Asafoetida, Catechu, Castor oil, Honey, Colophony, Guggul, Shellac, Benzoin, Tragacanth
8) Detection of adulteration in oils
9) Visit to a tissue Culture Laboratory.

Recommended Books

1. Kokate, Purohit, Gokhale, Pharmacognosy, Nirali Prakashan, Pune.
6. Chopra, Indigenous drugs of India.
7. Wealth of India
8. Materia Medica by Nadkami,
### 3.7 (T) Pharmaceutical Business Management  
(Theory) 60 Hrs. (2 Hrs./week)

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>SECTION- I</th>
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<tbody>
<tr>
<td>1.</td>
<td><strong>Fundamentals of management</strong></td>
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<td></td>
<td>i) Management basic Concepts: Definition, Need for management, Function of management, Management thoughts, Contribution of Taylor, Fayol, Peter Drucker in modern management. Functions and responsibilities of a manager.</td>
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<td></td>
<td>ii) Planning: Nature and purpose of planning, important steps in planning, types of planning, planning process, advantages and limitations. Sales forecasting methods, analysis, advantages and limitations.</td>
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<td>iii) Objectives: Types of objectives, Importance of objective, Management by objectives, Advantages and Limitations</td>
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<td>iv) Organizing: Organizational structure, basic principals of organization, Departmentalization, Delegation, Decentralization, Staffing, Line &amp; Staff organization.</td>
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<td>v) Decision making: Types of strategies, Policies, Definition and Importance of decision making, Decision making process</td>
<td>2</td>
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<td></td>
<td>vi) Controlling: Concepts and purpose of control techniques, Budgetary and non budgetary control, Management audit, Manage--ment information system, Break even analysis, Network techniques (PERT &amp; CPM), Profit and loss account, Balance sheets</td>
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<td>2.</td>
<td><strong>Pharmaceutical industry and operation management</strong></td>
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<td></td>
<td>i) Historical perspective of pharmaceutical industry in India, Current status and growth scenario.</td>
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<td>ii) Operation management in Pharmaceutical Industry: Controlling of manufacturing operation, Importance and function of Q.C and Q.A.</td>
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<td>iii) R&amp;D in Pharma industry, Drug discovery process, Drug development process, Clinical research organization.</td>
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<td>iv) Material management: Classification of materials, objectives and principals of purchasing, inventory control.</td>
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<td>3.</td>
<td><strong>Industrial relations.</strong></td>
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<td><strong>SECTION- II</strong></td>
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<tr>
<td>1.</td>
<td><strong>Pharmaceutical Marketing</strong></td>
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<td>i) Difference between marketing and selling, Channels of distribution, Wholesale, Retail, Departmental.</td>
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<td>ii) Sales promotions, Objective, Principles &amp; Techniques. Ethics of sales, Advertising- Needs &amp; Methods, Merchandising, Detailing</td>
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<td>iii) Medical representative: Role &amp; Qualities.</td>
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<td>iv) Marketing research: Nature &amp; Importance</td>
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<td>v) Product management: Product life cycle, Launching a new product,</td>
<td>3</td>
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Branding, Packaging

vi) Price: Definition, Factors affecting, procedure for determination of price, types of price

2. Human Resource and Development

i) Motivation: definition, concept, Theory’s- Maslow’s Theory, Hertzberg’s theory, Vroom’s theory, Expectancy theory, Reinforcement theory, Equity or social comparison theory X & Y.

ii) Leadership: definition, importance, qualities of leadership, leadership styles, trait theory, managerial grid

iii) Communication: importance, functions, communication process, forms of communication, types of communication

iv) Interview techniques: presentation skills, group discussion

v) Performance appraisal: need and techniques, recruitment and training

3. International market.

Pharmaceutical export, procedure, documentation. Export, registration authorities, regulatory agencies

Recommended Books

13) Principles and Methods of Pharmacy Management by Harry Smith.
14) Marketing Management by Philip Kotlar.
16) Principles and Management: Koonz O’ Donnel.