SYLLABUS

for

BACHELORS DEGREE IN PHARMACY

(B.Pharma)

*  
School of Pharmacy
OPJS UNIVERSITY, CHURU(RAJASTHAN)

2014-15

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# Scheme of Examination

## (Bachelors Degree in Pharmacy)

### I- Year

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Paper Code</th>
<th>Name of Papers</th>
<th>M.M.(T./S./P.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>B.PY. 101T</td>
<td>Pharmaceutical Inorganic Chemistry, Theory</td>
<td>70+30</td>
</tr>
<tr>
<td>2.</td>
<td>B.PY. 102P</td>
<td>Pharmaceutical Inorganic Chemistry, Practical</td>
<td>70+30</td>
</tr>
<tr>
<td>3.</td>
<td>B.PY. 103T</td>
<td>Pharmaceutical Biochemistry &amp; Clinical Pathology, Theory</td>
<td>70+30</td>
</tr>
<tr>
<td>4.</td>
<td>B.PY. 104P</td>
<td>Pharmaceutical Biochemistry &amp; Clinical Pathology, Practical</td>
<td>70+30</td>
</tr>
<tr>
<td>5.</td>
<td>B.PY. 105T</td>
<td>Dispensing Pharmacy, Theory</td>
<td>70+30</td>
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<tr>
<td>6.</td>
<td>B.PY. 106P</td>
<td>Dispensing Pharmacy, Practical</td>
<td>70+30</td>
</tr>
<tr>
<td>7.</td>
<td>B.PY. 107T</td>
<td>Pharmaceutical Technology-I, Theory</td>
<td>70+30</td>
</tr>
<tr>
<td>8.</td>
<td>B.PY. 108P</td>
<td>Pharmaceutical Technology-I, Practical</td>
<td>70+30</td>
</tr>
<tr>
<td>9.</td>
<td>B.PY. 109T</td>
<td>Pharmaceutical Biology and Introductory Pharmacognosy, Theory</td>
<td>70+30</td>
</tr>
<tr>
<td>10.</td>
<td>B.PY. 110P</td>
<td>Pharmaceutical Biology and introductory Pharmacognosy, Practical</td>
<td>70+30</td>
</tr>
<tr>
<td>11.</td>
<td>B.PY. 111T</td>
<td>Human Anatomy, Physiology and Health Education, Theory</td>
<td>70+30</td>
</tr>
<tr>
<td>12.</td>
<td>B.PY. 112P</td>
<td>Human Anatomy, Physiology and Health Education, Practical</td>
<td>70+30</td>
</tr>
<tr>
<td>13.</td>
<td>B.PY. 113T</td>
<td>Pharmaceutical Jurisprudence, Theory</td>
<td>70+30</td>
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<tr>
<td>14.</td>
<td>B.PY. 114T</td>
<td>Pharmacy Practice, Theory</td>
<td>70+30</td>
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</tbody>
</table>

**Total** | **1400**

### II- Year

<table>
<thead>
<tr>
<th>S. No.</th>
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<th>M.M.(T./S./P.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>B.PY. 201T</td>
<td>Pharmaceutical Organic Chemistry, Theory</td>
<td>70+30</td>
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<tr>
<td>2.</td>
<td>B.PY. 202P</td>
<td>Pharmaceutical Organic Chemistry, Practical</td>
<td>70+30</td>
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<tr>
<td>3.</td>
<td>B.PY. 203T</td>
<td>Chemistry of Natural Drugs, Theory</td>
<td>70+30</td>
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<tr>
<td>4.</td>
<td>B.PY. 204P</td>
<td>Chemistry of Natural Drugs, Practical</td>
<td>70+30</td>
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<tr>
<td>5.</td>
<td>B.PY. 205T</td>
<td>Physical Pharmacy, Theory</td>
<td>70+30</td>
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<td>6.</td>
<td>B.PY. 206P</td>
<td>Physical Pharmacy, Practical</td>
<td>70+30</td>
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<tr>
<td>7.</td>
<td>B.PY. 207T</td>
<td>Pharmaceutical Engineering, Unit Operations and Engineering Drawing, Theory</td>
<td>70+30</td>
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<tr>
<td>8.</td>
<td>B.PY. 208P</td>
<td>Pharmaceutical Engineering, Unit Operations and Engineering Drawing, Practical</td>
<td>70+30</td>
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<tr>
<td>9.</td>
<td>B.PY. 209T</td>
<td>Pharmacology-I and Pathophysiology, Theory</td>
<td>70+30</td>
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<tr>
<td>10.</td>
<td>B.PY. 210T</td>
<td>Computer Applications, Theory</td>
<td>70+30</td>
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<tr>
<td>11.</td>
<td>B.PY. 211P</td>
<td>Computer Applications, Practical</td>
<td>70+30</td>
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</tbody>
</table>
### Mathematics and Bio-Statistics, Theory

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>12.</td>
<td>B.PY. 212T</td>
<td>Mathematics and Bio-Statistics, Theory</td>
<td>70+30</td>
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**Total**

1200

### III- Year

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>B.PY. 301T</td>
<td>Pharmaceutical Analysis, Theory</td>
<td>70+30</td>
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<tr>
<td>2.</td>
<td>B.PY. 302P</td>
<td>Pharmaceutical Analysis, Practical</td>
<td>70+30</td>
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<tr>
<td>3.</td>
<td>B.PY. 303T</td>
<td>Medicinal Chemistry-I, Theory</td>
<td>70+30</td>
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<tr>
<td>4.</td>
<td>B.PY. 304P</td>
<td>Medicinal Chemistry-I, Practical</td>
<td>70+30</td>
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<tr>
<td>5.</td>
<td>B.PY. 305T</td>
<td>Pharmaceutical Microbiology and Biotechnology, Theory</td>
<td>70+30</td>
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<tr>
<td>6.</td>
<td>B.PY. 306P</td>
<td>Pharmaceutical Microbiology and Biotechnology, Practical</td>
<td>70+30</td>
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<tr>
<td>7.</td>
<td>B.PY. 307T</td>
<td>Pharmaceutical Formulation, Theory</td>
<td>70+30</td>
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<td>8.</td>
<td>B.PY. 308P</td>
<td>Pharmaceutical Formulation, Practical</td>
<td>70+30</td>
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<tr>
<td>9.</td>
<td>B.PY. 309T</td>
<td>Hospital &amp; Community Pharmacy, Theory</td>
<td>70+30</td>
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<tr>
<td>10.</td>
<td>B.PY. 310T</td>
<td>Pharmacology –II and Pathophysiology, Theory</td>
<td>70+30</td>
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<tr>
<td>11.</td>
<td>B.PY.. 311P</td>
<td>Pharmacology-II and Pathophysiology, Practical</td>
<td>70+30</td>
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<td>12.</td>
<td>B.PY. 312T</td>
<td>Pharmacognosy-I, Theory</td>
<td>70+30</td>
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<td>13.</td>
<td>B.PY. 313P</td>
<td>Pharmacognosy-I, Practical</td>
<td>70+30</td>
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**Total**

1300

### Final Year

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<tbody>
<tr>
<td>1.</td>
<td>B.PY. 401T</td>
<td>Instrumental Analysis, Theory</td>
<td>70+30</td>
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<tr>
<td>2.</td>
<td>B.PY. 402P</td>
<td>Instrumental Analysis, Practical</td>
<td>70+30</td>
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<tr>
<td>3.</td>
<td>B.PY. 403T</td>
<td>Medicinal Chemistry-II, Theory</td>
<td>70+30</td>
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<tr>
<td>4.</td>
<td>B.PY. 404P</td>
<td>Medicinal Chemistry-II, Practical</td>
<td>70+30</td>
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<tr>
<td>5.</td>
<td>B.PY. 405T</td>
<td>Dosage Form Design and Cosmetology, Theory</td>
<td>70+30</td>
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<tr>
<td>6.</td>
<td>B.PY. 406P</td>
<td>Dosage Form Design and Cosmetology, Practical</td>
<td>70+30</td>
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<tr>
<td>7.</td>
<td>B.PY. 407T</td>
<td>Biopharmaceutics &amp; Pharmacokinetics, Theory</td>
<td>70+30</td>
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<td>8.</td>
<td>B.PY. 408P</td>
<td>Biopharmaceutics &amp; Pharmacokinetics, Practical</td>
<td>70+30</td>
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<td>9.</td>
<td>B.PY. 409T</td>
<td>Pharmacology -III and Clinical Pharmacy, Theory</td>
<td>70+30</td>
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<tr>
<td>10.</td>
<td>B.PY. 410P</td>
<td>Pharmacology-III and Clinical Pharmacy, Practical</td>
<td>70+30</td>
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<td>11.</td>
<td>B.PY. 411T</td>
<td>Pharmacognosy-II, Theory</td>
<td>70+30</td>
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<td>12.</td>
<td>B.PY. 412P</td>
<td>Pharmacognosy-II, Practical</td>
<td>70+30</td>
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<td>13.</td>
<td>B.PY. 413T</td>
<td>Pharmaceutical Industrial Management, Theory</td>
<td>70+30</td>
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<td>14.</td>
<td>B.PY. 414P</td>
<td>Project</td>
<td>50 (S)</td>
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<tr>
<td>15.</td>
<td>B.PY. 415P</td>
<td>Professional Training</td>
<td>50 (S)</td>
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</tbody>
</table>

**Total**

1400

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Details of Syllabus

I- Year

B.PY. 101T- PHARMACEUTICAL INORGANIC CHEMISTRY

Unit-I

1. Structure and properties: Atomic structure, atomic orbitals, valance bond theory, molecular orbital theory, wave equation, molecular orbital, bonding and anti-bonding orbitals, covalent bonds, hybrid orbitals, intermolecular forces, bond dissociation energy, polarity of bonds, polarity of molecules, structure and physical properties, intermolecular forces.

2. Accuracy & precision: Accuracy and precision, classification of errors, minimization of errors, rejection of doubtful values, significant figures & computations.


4. Sources of impurities in pharmaceutical substances.
An outline of preparation, properties, uses, tests for purity and identification, including limit tests for Iron, Arsenic, Lead, Heavy metals, Chloride, Sulphate and the special tests if any, of the following classes of inorganic pharmaceuticals included in the Indian Pharmacopoeia 1996.

Unit-II

5. Gastrointestinal agents: Acidifying agents: Dilute hydrochloric acid.
   Antacids: Sodium bicarbonate, Aluminum hydroxide gel, Calcium carbonate, Tri basic calcium phosphate, Milk of magnesia, Magnesium oxide, Magnesium trisilicate.
   Protective and adsorbents: Bismuth subcarbonate, Bismuth subnitrate, Kaolin, Activated charcoal.
   Cathartics: Sodium carboxy methylcellulose, Bisacodyl, Sodium phosphate, Potassium sodium tartrate.

   Astringents: Alum, Aluminium Sulphate.
   Anti-microbial agents: Hydrogen peroxide, Potassium permangnate, Iodine, Silver nitrate, Boric acid, Chlorinated lime, Borax, Sodium antimony gluconate.

7. Complexing and chelating agents: Disodium edetate, Dimercaprol.

Unit-III

8. Major intra- and extra-cellular electrolytes: Major physiological ions. Electrolytes used for replacement therapy, acid-base balance and electrolyte combination therapy - Sodium chloride and its preparations, Potassium chloride and its preparation, Calcium chloride, Calcium lactate, Calcium gluconate, Zinc Sulphate, Sodium acetate, Potassium acetate, Sodium bicarbonate, Sodium dihydrogen phosphate dihydrate, Sodium citrate.

9. Essential and trace elements: Transition elements and their compounds of pharmaceutical importance:
   Mineral supplements.

10. Dental products: Dentrificres, anti-caries agents- Sodium fluoride, Calcium carbonate, Dicalcium phosphate.

Unit-IV

   Expectorants- Ammonium chloride, Potassium iodide.
   Emetics.
   Antidotes- Sodium nitrite, Sodium Thiosulphate, Activated charcoal, Light Kaolin, Anti-oxidants- Sodium metabisulphite, Sodium bisulphite.
   Waters - Purified water, water for injection and sterile water for injection.

12. Inorganic radio pharmaceuticals: Nuclear radio pharmaceuticals, reactions, nomenclature, methods of obtaining their standards and units of activity,
measurements of activity (G.M. counters), clinical applications and dosage, hazards and precautions & radioimmuno assay. Biological applications of radioactive drugs: Cobalt compounds, gold compounds, iodine preparations, phosphorous preparations. Radio opaque contrast media, Barium Sulphate.

13. Gases & vapours
(a) Inhalant - Oxygen
(b) Anesthetic gas- Nitrous oxide

Unit-V
Aqueous acid – base titration – Neutralization, indicators, universal indicators, assay of sodium bicarbonate, sodium carbonate, ammonia solution, boric acid, ammonium chloride.
Oxidation – reduction titrations including iodometry & iodimetry – Introduction, determination of the end point in oxidation reduction titrations, assay of ferrous sulphate, hydrogen peroxide solution, iodine solution, chlorinated lime and copper-sulphate.

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B.PY. 102P- PHARMACEUTICAL INORGANIC CHEMISTRY

1. Introduction to the use and care of apparatus & equipment.
2. Limit tests & test for purity of pharmaceutical substances. The background and systematic qualitative analysis of inorganic mixture of upto four radicals. Six mixtures to be analyzed, preferably by semi micro methods. All qualitative identification tests for pharmacopoeial inorganic pharmaceuticals.
3. Preparation and standardization of 0.1 N hydrochloric acid solution.
4. Preparation and standardization of 0.1 N sodium hydroxide solution.
5. Assay of sodium hydroxide, sodium bicarbonate, sodium carbonate, strong ammonia solution.
6. Estimation of the mixtures of hydroxide and carbonate, hydroxide and bicarbonate and carbonate and bicarbonate.
7. Preparation and standardization of 0.1 N potassium permanganate solution.
8. Assay of ferrous sulphate, hydrogen peroxide
9. Preparation and standardization of 0.1 N solution of ceric ammonium sulphate.
11. Preparation and standardization of 0.1 N solution of sodium thiosulphate and iodine solution.
12. Assay of copper sulphate, iodine solution, chlorinated lime and other iodimetric analysis.
13. Other assays and estimations based on theory.

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B.PY. 103T- PHARMACEUTICAL BIOCHEMISTRY AND CLINICAL PATHOLOGY

Unit-I
Foundation of biochemistry: Cellular, chemical, physical, genetic, evolutionary, transport process across cell membrane.

Unit-II
Vitamins: Classification and biological importance of vitamin A, vitamin D, vitamin E, vitamin K, vitamin B- complex and ascorbic acid.
Carbohydrates: Properties, classification, metabolism-glycolysis, citric acid cycle, hexose monophosphate shunt, uronic acid pathway, glucogenesis, glycogenolysis, glyconeogenesis, glyoxylate cycle, regulation of metabolism, metabolism of fructose, galactose, abnormalities of carbohydrate metabolism, qualitative identification tests.

Unit-III
Lipids: Properties, classification, storage of lipids, structural lipids in membranes, lipids as signals, cofactors and pigments, digestion, mobilization and transport of fats, oxidation of glycerol, oxidation of fatty acids, ketone bodies, biosynthesis of fatty acids, eicosanoids, triglycerides, phospholipids, cholesterol, steroids, isoprenoids, regulation of fatty acids metabolism, phospholipids, sphingolipids, eicosanoids, abnormalities of lipid metabolism, qualitative identification tests.

Biological oxidation: Redox-potential, enzymes and co-enzymes involved in oxidations, reduction and its control, respiratory chain, its role in energy capture and its control, energetics, and mechanism of oxidative phosphorylation, inhibitors of respiratory chain.

Unit-IV
Amino acids, peptides and proteins: Properties, structure, classification, three-dimensional structure of proteins – primary, secondary, tertiary and quaternary, functions of protein-reversible binding of protein to a ligand, complementary interactions between proteins and ligands, protein interactions modulated by chemical energy, catabolism of amino acids, biosynthesis of amino acids, urea cycle, biosynthesis of porphyrin and bile pigments, regulation and abnormalities of metabolism of amino acids, peptides and proteins, qualitative identification test of amino acids and proteins.

Nucleic acids: Brief introduction of genetic organization (genes and chromosomes), structure and chemistry of nucleic acids, biosynthesis of purine and pyrimidine, biosynthesis and degradation of nucleotides, biosynthesis and replication of DNA, biosynthesis of RNA, mutagenesis, qualitative identification test of RNA and DNA.

Unit-V

Clinical pathology:
(i) Lymphocytes and platelets: role in health and disease
(ii) Erythrocytes: Role, abnormal cells and their significance
(iii) Liver and kidney: Functions, normal and abnormal constituents of urine and their significance, kidney and liver function tests.

11. Metabolic effects of insulin and glucagon.
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B.PY. 104P- PHARMACEUTICAL BIOCHEMISTRY AND CLINICAL PATHOLOGY

Qualitative identification tests for carbohydrates, lipids, proteins, amino acid and nucleic acids. Quantitative estimation of amino acids.

Identification of C-terminal amino acids of protein.

Determination of glucose by means of enzyme glucose oxidase.

Isolation and assay of glycogen from the liver and skeletal muscle of rats. Enzyme hydrolysis of glycogen by alpha and beta amylases.

Isolation and determination of RNA and DNA.

Practice in injecting drugs by intramuscular, subcutaneous and intravenous routes. Withdrawal of blood samples.

***

**B.PY. 105T- DISPENSING PHARMACY**

**Unit-I**

**Introduction:** Definition, general dispensing procedure, introduction to different dosage forms with examples, sources of information including different pharmacopoeias, labeling of different preparations, containers and closures, storage, Latin terms.

2. **Prescription:** Definition, various parts, handling and sources of errors.

**Unit-II**

3. **Pharmaceutical calculations:** Metric system (weights and measures), enlarging and reducing of recipes, isotonic solutions, alcohol dilutions, alligation method, proof spirit, percentage solution, displacement value.

4. **Posology:** Definition, factors influencing doses, calculation of doses.

**Unit-III**

5. **Incompatibility:** Definition, physical, chemical (including double decomposition and other chemical reactions), therapeutic and methods of correction.

**Unit-IV**

6. **Principles involved and procedure adopted in dispensing of:** Typical prescriptions like mixtures, syrups, elixirs, linctuses, liniments, lotions, collodions, gargles, mouthwashes, throat paints, douches, enemas, eardrops, nasal drops, nasal sprays, inhalations, ophthalmic and sterile dosage forms.

**Unit-V**

7. **Principles involved and procedure adopted in dispensing of:** Typical prescriptions like suspensions, emulsions, ointments, creams, pastes, jellies, poultices, suppositories, powders, pills, pastilles, lozenges, capsules, granules, cachets, tablet triturates and compressed tablets.

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**B.PY. 106P- DISPENSING PHARMACY**

Dispensing of prescriptions falling under the categories: Mixtures, solutions, emulsions, creams, ointments, powders, suppositories, ophthalmics, capsules, pastes, jellies, pastilles, lozenges, pills, tablet triturates, lotions, liniments, inhalations, paints, etc.

Identification of various types of incompatibilities in prescriptions, correction thereof and dispensing of such prescriptions.

Dispensing procedures involving pharmaceutical calculations, pricing of prescriptions and dosage calculations for pediatric and geriatric patients.

Dispensing of prescriptions involving adjustment of tonicity.

Categorization and storage of pharmaceutical products based on legal requirements of labeling and storage. Project report on visit to the nearby community for counseling on the rational use of drugs and aspects of health care.

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**B.PY. 107T- PHARMACEUTICAL TECHNOLOGY-I**
Unit-I

**Semisolid dosage forms:** Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection, general formulation of semisolid bases, clear gels manufacturing procedure, evaluation and packaging. **Suppositories:** Ideal requirements, bases, manufacturing procedure, packaging and evaluation.

Unit-II

**Extraction and galenical products:** Principle and method of extraction, percolation, maceration, continuous hot extraction, preparation of infusion, tincture, dry and soft liquid extracts.

Unit-III

**Liquid dosage forms:** Introduction, types of additives used in formulations, vehicles, stabilisers, preservatives, suspending agents, emulsifying agents, solubilisers, colors, flavours and the others, manufacturing packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.

Unit-IV

**Pharmaceutical Aerosols:** Definition, propellants, general formulation, method of preparation, packaging and containers, evaluation **Ophthalmic preparations:** Requirements of formulation, methods of preparation, containers, evaluation.

Unit-V

7. **Blood products and plasma substitutes:** Collection, processing of storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human normal immunoglobulins, human fibrin foam, plasma substitutes- ideal requirements, PVP, dextrans etc.

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**B.PY. 108P- PHARMACEUTICAL TECHNOLOGY-I**

1. Preparation, evaluation and packaging of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, aerosols, eye drops, eye ointments etc. Preparation of pharmacopoeial extracts and galenical products utilizing various methods of extraction. Collection processing, storage and fractionation of blood.

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**B.PY. 109T- PHARMACEUTICAL BIOLOGY AND INTRODUCTORY PHARMACOGNOSY**

Unit-I

Scope and significance of biology in pharmaceutical sciences. Methods of classification of plants. Plant cell, its structure and non-living cell inclusions; mitosis and meiosis; different types of plant tissues and their functions. Morphology, histology and uses different part of such as root, stem, bark, wood, leaf, flower, fruit and seeds.

Techniques in microscopy: Various tools used in microscopy (microscopes, micrometers, camira lucida, microphotography etc.,) preparation of drugs for microscopical examination, general use of different reagents used in microscopy. Quantitative microscopy: Lycopodium spore method and leaf constants viz, stomatal number, stomatal index, vein-islet number, vein-termination number and paliсадe ratio.

Unit-II

**Plant taxonomy:** Study of the following families with special reference to medicinally
important plants- Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Graminaceae, Labiatae, Cruciferae, Papaveraceae. Cultivation, collection, processing and storage of crude drugs. Factors influencing cultivation of medicinal plants. Types of soils and fertilizers of common use. Pest management and natural pest control agents.

Unit-III
Definition, history, scope and development of Pharmacognosy. Sources of drugs: Biological, marine, mineral and plant tissue cultures as sources of drugs. Classification of drugs: Alphabetical, morphological, taxonomical, chemical and pharmacological classification of drugs.

Carbohydrates and derived products: Agar, guar gum, acacia, honey, isabgol, pectin, starch, sterculia and tragacanth.

Unit-IV
General survey of animal kingdom; structure and life history of parasites like amoeba, entamoeba, trypanosoma, plasmodium, taenia, ascaris and schistosoma. General structure and life history of insects like mosquito, housefly, mites and silkworm.

Lipids: Bees wax, castor oil, cocoa butter, cod-liver oil, hypnocarpus oil, kokum butter, lard, linseed oil, rice bran oil, shark liver oil and wool fat.

Unit-V
Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation. An introduction to active constituents of drugs: Their isolation, classification and properties.

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B.PY. 110P- PHARMACEUTICAL BIOLOGY AND INTRODUCTORY PHARMACOGNOSY

Morphology of plant parts indicated in theory. Care, use and types of microscopes. Gross identification of slides of structure and life cycle of lower plants, animals mentioned in theory. Preparation, microscopic examination of stem, root and leaf of monocot and dicot plants.
Structure of human parasites and insects mentioned in theory with the help of specimen & charts. Morphological characteristics of plant families mentioned in theory. Microscopic measurements of cells and cell contents: Starch grains, calcium oxalate crystals and phloem fibers. Determination of leaf constants such as stomatal index, stomatal number, vein-islet number, vein-termination number and palisade ratio, lycopodium spore method.
Identification of crude drugs belonging to carbohydrates and lipids. Preparation of herbarium sheets.

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B.PY. 111T- HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION

Unit-I
1. Scope of anatomy & physiology, definition of various terms used in Anatomy. Structure of cell, functions of its components.
Elementary tissues of human body: epithelium, connective, muscular and nervous.
Structure and functions of skeleton & joints: classification, movement and disorders of joints.
2. Skeletal muscles: Name, position and functions of various muscle: Neuromuscular junction: Physiology of muscle contraction.

Unit-II
Blood: Composition and functions of blood elements, blood group and coagulation of blood.
Lymph nodes: Their position, name and functions. Lymph: Its composition and functions.

Unit-III
4. Digestive system: Gross Anatomy and functions of various parts of alimentary canal including pancreas and liver. Composition and functions of various juices used in digestion. Role of vitamins in body.
Respiratory system: Anatomy of various parts of respiratory system. Physiology and regulation of respiration.

Unit-IV
Reproductive system: Male and female reproductive organs: their position and functions.

Unit-V

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B.PY. 112P- HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION

To record pulse, B.P., heart rate and temperature.
To estimate haemoglobin Content and oxygen carrying capacity of blood sample.
To count RBC in blood sample.
To count total WBC in blood sample.
To prepare slide for differential leucocyte count.
To find out erythrocyte sedimentation rate.
To find out bleeding time and clotting time.
To study digestive system with the help of model and chart.
To study liver with the help of model and chart.
To study urinary system with the help of model and chart.
To study kidney with the help of model and chart.
To study Heart with the help of model and chart.
To study respiratory system with the help of model and chart.
To study Brain with the help of model and chart.
To study Eye with the help of model and chart.
To study Ear with the help of model and chart.
To study spleen with the help of model and chart.
To study male reproductive system with the help of model and chart.
To study female reproductive system with the help of model and chart.
To study Arterial system with the help of model and chart.
To study venous system with the help of model and chart.
To study Bones of limbs chart.
To study vertebral column chart.
To study bones of skull.
To study Bones of ribs.
To study various histological slides.
To record respiratory parameters in an individual by using spirometer. Physiological experiments on (muscle nerve preparation).

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B.PY. 113T- PHARMACEUTICAL JURISPRUDENCE

Unit-I
Origin, development, scope, objectives and nature of pharmaceutical legislation in India. Evolution of the “Concept of Pharmacy” as an integral part of the health care system. Principles and significance of professional ethics. Critical study of the code of pharmaceutical ethics drafted by Pharmacy Council of India. Pharmaceutical education – A brief review. Pharmacy Act, 1948 – The general study of the Pharmacy Act with special reference to Education Regulations, working of State and Central Councils, constitutions and functions of these councils, registration procedures under the Act.

Unit-II
The Drugs and Cosmetics Act, 1940 & Rules 1945 – General study of the Drugs and Cosmetics Act and the Rules there under. Definitions and salient features related to retail and wholesale distribution of drugs. The powers of inspectors, the sampling procedures and the procedure and formalities in obtaining licences under the rule. Facilities to be provided for running a Pharmacy effectively. General study of the schedules with special reference to schedules C, C1, F, G, J, H, P and X and salient features of labeling and storage conditions of drugs.
AICTE Act, 1987 - A brief study.

Unit-III
An elaborate study of the following (as amended to date)
(a) Drugs (Price Control) Order
(b) Medicinal and Toilet Preparations (Excises Duties) Act, 1955
(c) Poisons Act 1919
(d) Patents Act 1970
Narcotic Drugs and Psychotropic Substances Act, 1985 – A brief study of the Act with special reference to its objectives, offences and punishment.

Unit-IV
4. A brief study of the following with special reference to the main provisions (as amended to date)
(a) Medical Termination of Pregnancy Act, 1970 & Rules 1975
(b) Prevention of Cruelty to Animals Act, 1960
(c) Essential Commodities Act

The Drugs and Magic Remedies (Objectionable Advertisement) Act, 1954 – General study of the Act, objectives, special reference to be laid on advertisements, magic remedies and objectionable and permitted advertisement and diseases which cannot be claimed to be cured.

Unit-V
5. A brief study of the following with special reference to the main provisions
(a) States Shops and Establishments Act & Rules.
Factories Act, 1948
Minimum Wages Act, 1948
Drugs & Pharmaceutical Industry – A brief review.
B.PY. 114T- PHARMACY PRACTICE

Unit-I

**Introduction:** Trade, industry and commerce, functions and subdivision of commerce. Forms of business organizations.

**Drug house management:** Selection of location of drug store, layout and legal requirements, chain store.

**Material management:** Importance and objectives of purchasing, selection of suppliers, credit information, tenders, contracts and price determination and legal requirements thereto.

**Storage:** General principles, codification, handling of drug store and other hospital supplies.

**Inventory control:** Objectives and importance, modern techniques like ABC, VED analysis, the lead time, inventory carrying cost, safety stock, minimum and maximum stock levels, economic order quantity, scrap and surplus disposal.

Unit-II

**Sales promotion:** Salesmanship, qualities of salesman, literature detailing, advertising and window display. Recruitment, selection, orientation, training, evaluation and compensation of the Pharmacist. Channels of distribution, buying, selling, transportation, storage, wholesale, retail, departmental store, multiple shop, mail order business with special reference to Indian marketing environment.

Unit-III

Banking and finance service and functions of bank, finance planning and sources of finance. **Cost accounting:** Cost ascertainment, various elements of cost sheet preparation, statement of cost.

Unit-IV

**Accountancy:** Introduction to the accounting concepts and conventions, double entry book keeping, different kinds of accounts, recording of transactions-journal, cash book, ledger, trial balance, profit and loss account, balance sheet, computation of various ratios and analysis of financial statements.

Unit-V

7. **Budgeting:** Meaning importance and types of budgets. Elementary knowledge of preparing sales, cash, production and flexible budgets.

B.PY. 201T- PHARMACEUTICAL ORGANIC CHEMISTRY

Unit-I

**Stereochemistry:** Isomerism, stereoisomerism, optical activity, enantiomers, diastereomers, meso compounds, chirality, racemic modification & its resolution, configuration (R&S, D&L, d&l), sequence rules, conformational isomers. Rotation about C-C single bond, conformation due to rotation, Vander waals repulsion, stereochemical reaction (selective & specific), syn and anti addition and elimination.

Unit-II

**Reactions:** Definition, reaction, mechanism, applications of all the following reactions -
SN1 & SN2 reactions, E1 & E2, reactions, electrophilic & free radical addition reactions, markonikov rule and antimarkonikov rule.

Unit-III
Reactions: Definition, reaction, mechanism, applications of all the following reactions – aldol and claisen condensations, Wittig reaction, wolf-kishner reduction, clemmensen reduction, cannizaro and crossed cannizaro reaction, perkin condensation, Grignard synthesis, wurtz reaction, Williamson ether synthesis, fischer esterification, Diels alder reaction.

Aromatic compounds: Structure of benzene and its derivatives, aromaticity, resonance theory, stability of benzene ring and huckle rule.

Unit-IV
Aliphatic compounds: Structure, nomenclature, preparation, physical properties and chemical reactions of aliphatic compounds: dienes, unsaturated carbonyl compounds, cycloalkanes. Aliphatic and aromatic alcohols, ethers, esters, carboxylic acids, aldehydes and ketones, phenols and amines.

Unit-V
Reactions: Electrophilic aromatic substitution, nucleophilic acyl substitution, friedal crafts alkylation and acylation, kolbe’s synthesis, reimer tieman reaction, hoffmann reaction, Diazotization reaction and coupling reactions of amines.

Poly nuclear hydrocarbons: Structure, nomenclature, preparation and reactions naphthalene, anthracene and phenanthrene.

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B.PY. 202P- PHARMACEUTICAL ORGANIC CHEMISTRY

1. Basic Laboratory Techniques
2. To find out melting and boiling point of given samples.
3. To carry out elemental detection in given organic samples.
4. To carry out identification reactions of known functional groups.
5. To identify unknown organic compounds and submit their derivatives.

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B.PY. 203T- CHEMISTRY OF NATURAL DRUGS

Unit-I
1. Heterocyclic compounds (single and fused rings): Structure, nomenclature, preparations, chemical reactions of pyrrole, furan, thiophene, imidazole, pyrazole, pyridine, piperazone, pyrimidine, purine, indole, benzimidazole, quinoline, isoquinoline (important medicinal derivatives under each class should be discussed)

Unit-II
2. Carbohydrates: Structure, detailed chemistry, properties and reactions of mono, di and poly saccharides and qualitative analysis of carbohydrate.
3 Cardiac glycosides Source, chemistry, biogenesis and pharmacological activity of digitoxin, digoxin, diosgenins, strophanthidin and sennosides.

Unit-III
4 Lipids: Classification & composition of fats and oils, properties, determination and significance of acetyl value, acid value, saponification and iodine value.
5  Amino acids, peptides and proteins: Structure, classification, properties & reactions of amino acids, nomenclature of peptide and protein, solid phase peptide synthesis, classifications of proteins and levels of protein structure and protein denaturation.

Unit-IV
7.  Terpenoids & Terpenes: Sources, classification and structural elucidation and pharmacological activity of menthol, camphor, citral.
   Antibiotics: Source, chemistry and therapeutic activity of natural penicillins, streptomycins and tetracyclines.

Unit-V
   Alkaloids: Source, general classifications, chemistry and structural elucidation and pharmacological activity of atropine, quinine, reserpine, morphine, papavarine, ephedrine, ergot and vinca alkaloids.
   Lignans and flavonoids: Chemistry and biogenesis of medicinally important lignans and flavonoids.
   Vitamins: Source, chemistry and uses of vitamins of plant origin.

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B.PY. 204P- CHEMISTRY OF NATURAL DRUGS

Synthesis of heterocyclic compounds like coumerine, furan derivatives, barbiturate and other related heterocyclic compounds.
Qualitative analysis of natural products like carbohydrates, proteins, fats, alkaloids, glycosides. Analysis of fats and oils (acid value, iodine value, acetyl value, ester value, saponification value).

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B.PY. 205T- PHYSICAL PHARMACY

Unit-I
   Matter, properties of matter: State of matter, change in the state of matter, latent heats and vapor pressure, sublimation-critical point, eutectic mixtures, gases, aerosols-inhalers, relative humidity, liquid. Complexes, liquid crystals, glassy state, solids-crystalline, amorphous and polymorphism. Thermal analysis(DSC,DTA,TGA)

Unit-II
   Dispersion systems: Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions and emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, Donnan membrane equilibrium; Emulsions-types, theories, physical stability.

Unit-III
   Complexation: Classification of complexes, methods of preparation and analysis, applications.
   Buffers: Buffers equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity,
calculations and methods of adjusting isotonicity. Henderson Hesselbalch equation, influence of solvents on the solubility of drugs, combined effect of pH and solvents, preservation, action of weak acids, distribution of solutes between immiscible solvents, effect of ionic dissociation and molecular association on partition co-efficient & drug action.

Unit-IV
**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 of interface.

**Viscosity and rheology:** Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant and plastic flow; thixotropy in formulation, determination of viscosity; capillary, falling ball, rotational viscometers.

Unit-V
**Micromeritic and powder rheology:** Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness and flow properties.

**Solubility & distribution phenomenon:** Solubility, factors affecting solubility, expression of solubility, dissolution rate, solvent-solute interaction, polar and non-polar solvents, solubility of gases in liquid, liquid in liquid, effect of pressure, temperature, salting-out, chemical reasons, solubility calculations, ideal and real solution, colligative properties and mol. wt. determinations, miscibility, influence of foreign substances, dielectric constant and solubility, solubility of solid in liquids, ideal and non ideal solutions, solution and association in solution, solubility of slightly soluble substances and electrolytes.

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**B.PY. 206P- PHYSICAL PHARMACY**

Determination of latent heat, vapor pressure, critical point. Studies on polymorphs, their identification and properties.

Determination of particle size, distribution and surface area using various methods of particle size analysis. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.

Determination of surface/ interfacial tension, HLB value and critical micellar concentration of surfactants. Study of rheological properties of various types of systems using different viscometers. Study of different types of colloids and their properties. Preparation of various types of suspensions and determination of their sedimentation parameters. Preparation and stability studies of emulsions.
Studies on different types of complexes and determination of their stability constants.
Determination of half-life, rate constant and order of reaction.
Study of influence of various factors on the rate of reaction.
Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals. Preparation of pharmaceutical buffers and determination of buffer capacity. Experiments involving toxicity adjustments.
Determination of the heat of solution, heat of hydration and heat of neutralization.
Determination of rate constant of simple reaction.
Determination of partition coefficient.
Determination of solubility.

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B.PY. 207T- PHARMACEUTICAL ENGINEERING, UNIT OPERATIONS AND ENGINEERING DRAWING

Unit-I
1. **Unit operations:** Introduction, basic laws.
2. **Material of construction:** General study of composition, corrosion, resistance, Properties and applications of the materials of construction with special reference to glass, plastics and metals, corrosion.
3. **Material handling systems:**
   a. Liquid handling – Different types of pumps.
   b. Gas handling – Various types of fans, blowers and compressors.
   c. Solid handling – Different types of conveyers.

Unit-II
4. **Fluid flow:** Types of flow, Reynolds number, Bernoulli’s theorem, energy losses, basic equation of fluid flow, valves, measurement of flow.
6. **Size reduction, size separation, drying, compression and compaction.**

Unit-III
7. **Dehumidification and humidity control:** Basic concepts and definition, wet bulb and adiabatic saturation temperatures, Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations.
8. **Refrigeration and air conditioning:** Principal and applications of refrigeration and air conditioning.
9. **Heat transfer:** Applications, modes of heat transfer, Fourier’s law, film coefficients, Boltzmann’s law, heat exchangers and heat interchangers.

Unit-IV
10. **Evaporation:** Theory, factors affecting evaporation, efficiency of evaporators, natural circulation types—evaporating pans and stills, short tube evaporators, forced circulation type—long tube evaporators, wiped film evaporators, evaporation under reduced pressure.
11. **Distillation:** Theory and applications, simple distillation, flash distillation, fractional distillation, steam distillation, molecular distillation, azeotrope distillation, distillation under reduced pressure. Preparation of purified water IP and WFI IP, construction and working of the still used for the same.
12. **Mixing:** Theory of mixing, solid-solid mixing, solid-liquid and liquid-liquid mixing, mixing of semisolids, equipments used in mixing.

Unit-V
13. **Crystallization:** Theory of crystallization, characteristics of crystals like-purity, size, shape, geometry, habit, forms size and factors affecting them, solubility curves and calculation of yields, study of various types of crystallizers – agitated batch crystallizer, Swenson walker crystallizer, krystal crystallizer, vacuum crystallizer, caking of crystals and its prevention.
14. **Industrial hazards and safety precautions:** Mechanical, chemical, electrical, fire and
dust hazards and accident records.

15. **Automated process control systems**: Introduction to automatic process system and elements of automatic process control, measurement of variables like temperature, pressure level and vacuum.

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**B.PY. 208P- PHARMACEUTICAL ENGINEERING, UNIT OPERATIONS AND ENGINEERING DRAWING**

Measurement of flow of fluids and their pressure, determination of Reynold’s number and calculation of frictional losses.
Evaluation of filter media, determination of rate of filtration and study of factors affecting filtration. Experiments to demonstrate applications of centrifugation.
Thermometers and psychrometric charts, determination of humidity – use of dry bulb and wet bulb.
Determination of overall heat transfer coefficient.
Experiment to study the influence of various parameters on rate of evaporation. Experiments based on steam, extractive and azeotropic distillation.
Determination of rate of drying, free moisture content and bound moisture content.
Experiments to illustrate principles of size reduction and size separation, laws governing energy and power requirements of size reduction.
Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers.
Basic engineering drawing practice; drawing of simple pharmaceutical machinery parts bolts, nuts, riveted fronts, screws, worn screws as per specification.

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**B.PY. 209T- PHARMACOLOGY – I AND PATHOPHYSIOLOGY**

**Unit-I**
**General pharmacology**: Introduction to pharmacology, sources of drugs, dosage forms. Routes of administration, mechanism of drug action, dynamic of drug absorption, distribution, metabolism and excretion. Theories of receptors, dose response relationship, affinity constants.

**Unit-II**

3. Autocoids:
   - Histamine, 5HT and their antagonists.
   - Prostaglandins, Thromboxanes and Leukotrienes, Platelet activating factors. Pentagastrin, Cholecystokinin, Angiotensin, Bradykinin and substance P.
   - Nitric oxide.
   - Free radicals.

4. Endocrine system:
   - Hypothalamic hormone and Pituitary hormones.
   - Thyroid and anti thyroid drugs, Parathormone, Calcitonin.
   - Corticosteroids.
   - Gonadal hormones (sex hormones) and their antagonists.
   - Drugs affecting calcium balance.
   - Insulin, oral hypoglycaemic agents and glucagons.
   - Oxytocic drugs and uterine relaxants.

**Unit-III**
5. **Drugs acting on peripheral nervous system:**
   a. Skeletal muscle relaxants.
   b. Local anaesthetics.

6. **Drugs acting on central nervous system:**
   a. General anaesthetics.
   b. Alcohol.
   c. Narcotic and Non-narcotic analgesics.
   d. Antiepileptics.
   e. Sedatives and hypnotics.

**Unit-IV**

7. a. C.N.S. stimulants and cognitive enhancers.
   b. Antiparkinson drugs.
   c. Psychopharmacological drugs (antipsychotics, antianxiety, anti-depressants)
   d. Drugs used in gout and rheumatoid arthritis.

8. Pathophysiology of following diseases: Rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania.

**Unit-V**

9. **Pathophysiology of following common diseases:** Basic principle of cell injury and adaptation: Causes of cellular injury, pathogenesis, morphology of cell injury. Intercellular alterations in lipids, proteins and carbohydrates, cellular adaptation, atrophy and hypertrophy. Basic mechanism involved in the process of inflammation and repair: Alterations in vascular permeability and blood flow, migration of WBCs, acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.

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**B.PY. 210T- COMPUTER APPLICATIONS**

**Unit-I**

Data, Need of Data Processing, Information & its Need, Levels of information, Quality of information, Comparison of manual & electronic storage of data. Introduction to computer: Brief history of development of computers, computer system concept, computer system characteristics, capabilities and limitations, Applications in general and pharmacy in particular. Elements of computer systems: The architecture of a computer system, CPU – ALU, CU, Memory – Primary and Secondary, Input/Output and Storage Devices - Keyboard, Magnetic Tape, Magnetic Disk, Monitor, Printer, Floppy Disk, Hard Disk.

Peripheral devices — mouse, OCR, OMR, MICR, scanner, monitor, Printers – impact and non-impact printers – DMP, daisy wheel, line and drum printers, ink-jet and laser printers, plotters. Types of computers – Analog, Digital, Hybrid, General, Special, Purpose, Micro, Mini, Mainframe, Super, Personal computer (PCs) – Configuration, Pentium and Newer PCs specifications and main characteristics, types of PCs – Desktop, Laptop, Notebook, Palmtop, Workstations etc. – their characteristics.

**Unit-II**

Unit-III

Unit-IV
Electronic Spread Sheet– MS–Excel — Worksheet basics, creating worksheet, entering data into worksheet, heading information, data, text, dates, alphanumeric, values, saving & quitting worksheet, Opening and moving around in an existing worksheet, Toolbars and menus, Keyboard shortcuts, Working with single and multiple workbook, working with formulae & cell referencing, Auto sum, Coping formulae, Absolute & relative addressing, Working with ranges, formatting of worksheet, Previewing & Printing worksheet, Graphs and charts, Database, Creating and using macros, Multiple worksheets – concepts, creating and using. Presentation Graphics (MS-PowerPoint) : introduction, various uses, creating and saving presentation, creating slides – different types of slides, different views of slides, editing and formatting slides, backgrounds, inserting pictures from files, presentation shows, animation, customization of slides.

Unit-V
Introduction to Databases with MS-Access: What is database, uses, hardware requirement, types, use of form, reports, query and simple code generation. Introduction to internet: History, requirements, e-mail, search engines, websites and webservers, basics of html, scientific information retrieval using databases, search engines, pubmed, patent databases

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B.PY. 211P- COMPUTER APPLICATIONS

   (a) To test some of the basic systems operations on files/ folders.- create, rename, cut, copy, paste, delete.
   (b) To use accessories available in Windows
2. Study of Different Software available in Windows.
   (a) Exercises based on word-processing – creating documents, writing text in paragraph etc.
   (b) Writing Informal letter, Formal letter, writing reports on current topics, writing news, writing article, creating brochure
3. Exercises based on electronic worksheet – creating sheet, entering data, applying formulae, functions on cells etc.
4. Application of absolute and relative referencing on data
5. Creating reports based on the experiments done in laboratories.
6. Searching of scientific information using database Pubmed, Searching of scientific information from patent databases, Searching of scientific information using search engines scholar.google.com and scirus.com
7. E-mail, creating of account, drafting, sending, attachments
8. Database creation, modification, searching of information, data input using forms, report creation, simple query process
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B.PY. 212T- MATHEMATICS AND BIOSTATISTICS

Unit-I
Sets, relations and functions equation of straight line. Calculus of finite differences
Finite different, difference table finite difference operator and their properties.
Linear equation and matrices, solution of linear programming problems by graphical
method and simplex method.

Unit-II
Transportations and assignment problems. Theory of games, queuing theory: One
length, waiting time in Poisson que.

Unit-III
Differential calculus limits continuity and differentiability. Differentiation: Basic
fundamental theorems on differentiation, differentiation of trigonometric and
hyperbolic function (including inverse trigonometric and hyperbolic function),
logarithmic differentiation. Partial differentiation.
Integral Calculus: Integration as inverse process of differentiation. Integration by
substitution, integration by parts, integration of algebraic functions.

Unit-IV
Differential equations: Formation, order and degree of a differential equation.
Differential equation of first order and first degree, linear differential equation with
constant coefficients. Homogeneous linear differential equations.
Laplas and inverse laplas transforms and their properties. Evaluation of laplas and
inverse laplas transforms of simple functions (including higher transcedational functions)
Application of laplas and its inverse to solve linear ordinary differential equation.

Unit-V
Bio-statistics: Tables and graphs 'Life tables' only, Linear correlation coefficient,
Pearson's assumptions and causality; Regression of Y on X and X on Y, standard error
estimate, Correlation coefficient: Linear and curvilinear correlation; Sampling: Non Probability and probability samples, Sampling
distribution, confidence intervals, computing 99% and 95% fiducial limits from tables of areas and ordinates of
normal curve. Probability rules, binomial experiments, 'Z' score computing 't' tests and
analysis of variance. All calculation should be illustrated with examples from true
laboratory pharmacological experimental models.

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III- Year

B.PY. 301T- PHARMACEUTICAL ANALYSIS

Unit-I
Pharmaceutical analysis: Types of analytical methods, different types of instrumental
methods and the physical/chemical property used, data domains, criteria for
analytical method selection, performance characteristics of instruments viz. precision, bias, sensitivity, LOD, LOQ, LOL,
selectivity, calibration of
instruments.
Non-aqueous acid-base titrations: Non-aqueous acid – base chemistry, solvents for non-aqueous titrations, leveling solvents, indicators for non-aqueous titrations, determination of organic acid & base in non aqueous media, assay of phenobarbitone, benzocaine, dapsone, sodium amino salicylate, sulphamethoxazole, sulphathiazole etc.

Redox titration: Theory of redox reaction, balancing the redox reaction equation, types of indicators in redox titration, end-point determination in redox titration, iodometry, iodimetry, bromometry, Nernst equation, electrodes and their types, potentiometric method of end-point determination, assay of FeSO4, H2O2, Iodine solution, chlorinated lime, copper sulphate.

Unit-II


Unit-III


The theoretical aspects, basic instruments & applications of the following analytical techniques should be discussed.

Unit-IV
8. Potentiometry and Conductometry

Unit-V
9. Amperometry, coulometry and polarography

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B.PY. 302P- PHARMACEUTICAL ANALYSIS

Calibration of weights and measures.
To prepare and standardize E.D.T.A. solution.
To estimate metal ions like calcium, magnesium, zinc and others. To estimate mixture of cations.
To carry out the assay of calcium carbonate, magnesium sulphate, zinc sulphate and other cations by complexometric titrations.
To prepare and standardize acetoxy perchloric acid solution. To estimate and perform assay of given organic bases.
To prepare and standardize sodium methoxide solution.
To estimate and perform assay of given organic acids.
To carry out the assay of sodium sulphate and magnesium sulphate by gravimetric analysis. Acid-base and redox titration by using potentiometer. Acid-base titration by using pH-meter.
Acid-base titration by using conductometer.
To carry out the estimation of given samples by using polarography.

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B.PY. 303T- MEDICINAL CHEMISTRY-I
Unit-I

Principles of medicinal chemistry: Physico-chemical aspects (solubility, partition coefficient, optical, geometrical and biososterism, ionization, hydrogen binding, chelation, redox-potential and surface activity) of drug molecule and biological action. Drug receptor interaction including transduction mechanism.

Drug metabolism: General pathways of drug metabolism, sites of drug biotransformation, role of cytochrome P-450, oxidative reactions, reductive reactions, hydrolytic reactions, conjugation reactions, factor affecting drug metabolism.

Unit-II

Prodrug and drug latentiation: Basic concepts, prodrugs of functional groups, bioprecursor produgs, chemical delivery systems. The following topics shall cover classification, nomenclature, S.A.R., synthesis, physicochemical properties, metabolism and therapeutic uses of drugs mentioned under each category. (Biochemical approaches in drug design wherever applicable should be discussed. A brief introduction of latest drugs under each category should also be discussed)


Vitamins: Classification, detailed chemistry and biological importance of vitamin A, vitamin D, vitamin E, vitamin K, vitamin B-complex and ascorbic acid.

Unit-III

Chemotherapeutic agents: Antimicrobial agents.
(i) Antiseptics and disinfectants: Chlorphene, hexachlorophene, povidone-iodine, chloramines-T, thiomersal, benzalkonium chloride, cetyl pyridinium chloride, gentian violet, chlorhexidine, chloroxylenol, chlorocresol.
(ii) Antibacterial:
   Sulphonamides: Sulphacetamide, sulphadiazine, sulphadimidine, sulphafurazole, sulphamethoxazole, sulphadimethoxyl, pyridazine, succinyl sulphathiazole, phthalsulphathiazole, sulphaguanidine, sulphisoxazole, sulfoxozone, salphasalazin.
   Antibiotics: Beta-lactum antibiotics (penicillins and cephalosporines), aminoglycosides– streptomycin, gentamycin, tobramycin, amikacin, tetracyclines, macrolides– erythromycin, roxithromycin, azithromycin, quinolones – nalidixic acid, norfloxacin, ciprofloxacin, ofloxacin, sparflaxacin, levofloxacin, gemifloxacin and miscellaneous– chloramphenicol, clindamyacin, polymyxin, vancomycin, bactracin, cycloserine. Antitubercular agents: Isoniazid, rifampicin, pyrazinamide, ethambutol, streptomycin, ethionamide, thiacetazone, PAS.
   Antileprotic agents: Dapsone, clofazimine.
(iii) Antifungal agents: Amphoterincin-B, Flucytozine, ketoconazole, itraconazole, fluconazole, voriconazole, griseofulvin, clotrimazole, tolnaftate, naftifine, nystatin.

Unit-IV
(iv) Antiviral and anti-HIV agents: Vidarabine, acyclovir, cidofovir, famciclovir, foscarnet, ganciclovir, idoxuridine, amantadine, zanamivir, adefovir, interferons, lamivudine, zidovudine, didanosine, stavudine, nevirapine, saquinavir, ampravir, HIV protease inhibitors.

Chemotherapeutics agents: Parasitic infections
(i) Antimalarials: Quinine, chloroquine, amodiaquine, quinacrine, primaquine, pyrimethamine, proguanil, artesmisinin, artemether, atovaquone.
(ii) Antiamoebic agents: Diloxanide furoate, metronidazole, tinidazole, diiodohydroxy quinoline, emetine.
(iii) Anthelmintics: Thiabendazole, albendazole, benzimidazole, mebendazole, diethylcarbamazine, praziquantel, pyrantel pamoate, niclosamide, levamisol.
Unit-V

Chemotherapeutics agents: Antineoplastics – cylophosphamide, chlorambucil, melphalan, carmustine, altretamine, thiotepa, dacarbazine, procarbazine, cisplatin, methotrexate, 6-mercaptopurine, capecitabine, cytarabine, gemcitabine, 5-fluorouracil, vinblastine, vincristine, paclitaxel, camptothecin, dactinomycin, etoposide, L-asparaginase hydroxyurea, tamoxifen.
Diagnostic agents: Iodohippurate, diatrazoate, iopanoic acid, propylidone, rose bengal, fluorescein, etyrapone, evans blue.
Immunomodulators: Cyclosporine, tacrolimus, mycophenolate mofetil, azathioprine.

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B.PY. 304P- MEDICINAL CHEMISTRY-I

Separation and identification of organic mixtures containing not more than two compounds. Typical synthesis of drugs & drug intermediates using following types of reactions.
Chlorosulphonation – saccharin & sulfa drugs
Esterification.
Amination by reduction.
N-methylation and N- alkylation. Mannich type reaction.

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B.PY. 305T- PHARMACEUTICAL MICROBIOLOGY AND BIOTECHNOLOGY

Unit-I
Growth of microorganisms in culture: batch, continuous and synchronous cultures.
Control of microbes by physical and chemical methods, evolution of anti-microbial chemical agents, sterilization, different methods, validation of sterilization processes, sterility testing of pharmaceutical products.

Unit-II
5. Enzyme immobilization: Techniques of immobilization, and their applications in the industry, dynamics of enzymatic activity, factors affecting enzyme kinetics, study of enzymes such as hyaluronidase, penicillinase, streptokinase, streptodornase, amylases and proteases, immobilization of bacteria and plant cells.

Unit-III
6. Immunology and immunological preparations: Host-microbe interactions, the process of infection, natural resistance and nonspecific defense mechanisms, basic and theoretical aspects of immune response.
Manufacturing and quality control of immunological products- Introduction, vaccines, in-vivo diagnostics, immune sera, human immunoglobuline including important bacterial and viral vaccines (highlights on its source material, processing, potency assay and safety tests).
7. Production & applications of Monoclonal antibodies.

Unit-IV
8. **Fermentation technology:** Introduction, Fermenter: its design, control of different parameters, downstream process, production of lactic acid, alcohol, penicillin and vitamin B12.

**Unit-V**  
9. **Pharmaceutical biotechnology:**  
   - **Nucleic acids, the genetic code and protein synthesis:** (a) Synthesis of DNA-polymerization of nucleotides into DNA – Basic chemical structure, replication and its role in protein synthesis. (b) Synthesis of proteins – the three roles of RNA in Translation, (mRNA, tRNA and rRNA). Genetic engineering and its application in pharmaceutical biotechnology. Recombination DNA techniques.

10. Microbial assays of antibiotics and vitamins  
    10,6,2,5--------1,4,7--------8,9,3  
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**B.PY. 306P- PHARMACEUTICAL MICROBIOLOGY AND BIOTECHNOLOGY**

Experiments devised to prepare various types of culture media,  
Sub culturing of common aerobic and anaerobic bacteria, fungi and yeast, Various staining methods,  
Various methods of isolation and identification of microbes,  
Sterilization techniques and their validation, Evaluation of antiseptics and disinfectants,  
Testing the sterility of pharmaceutical products as per I.P. requirements,  
Microbial assay of antibiotics and vitamins etc.  
Preparation and standardization of immobilized preparations, Fermentative production of antibiotics,  
Immobilization of enzymes.  
Standardisation of inoculum and estimation of MIC by serial dilution.

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**B.PY. 307T- PHARMACEUTICAL FORMULATION**

**Unit-I**  
**Aseptic technique:**  
Sources of contamination and methods of prevention, design of aseptic area, laminar flow bench services and maintenance.  
Sterility testing of pharmaceuticals.  
**Parenteral products:** Preformulation factors, routes of administration, WFI, pyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.  
Formulation details, containers and closures and selection.

Prefilling treatment, washing of containers and closures, preparation of solutions and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization and preparation of sterile powders, equipment for large-scale manufacture and evaluation of parenteral products.

**Unit-II**  
**Tablets:** Formulation of different types of tablets, granulation technology on large-scale by various techniques, physics of tablet making, theory of compression, heckle plot, different types of tablet compression machinery and equipments employed, evaluation of tablets.  
Coating of tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating, coating process, evaluation of coated tablets.

**Unit-III**  
**Capsules:** Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, method of capsule filling, soft
gelatin capsule, capsule shell and capsule contents, importance of base adsorption and minim/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

**Microencapsulation:** Types of microcapsules, importance of microencapsulation in Pharmacy, microencapsulation by phase separation, coacervation, multi orifice, spray drying, spray congealing, polymerization, complex emulsion, air suspension technique, coating pan and other technique, evaluation of microcapsules.

**Unit-IV**

**Surgical products:** Definition, primary wound dressings, absorbents, surgical cotton, surgical gauzes, etc., bandages, adhesive tapes, protective cellulosic haemostatics, official dressings, absorbable and nonabsorbable sutures, ligatures & catgut. Medical prosthetics and organ replacement materials.

**Unit-V**

**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.

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**B.PY. 308P- PHARMACEUTICAL FORMULATION**

Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like powders, capsules, tablets, parenteral, microcapsules, surgical dressings etc.
Evaluation of materials used in pharmaceutical packaging.

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**B.PY. 309T- HOSPITAL & COMMUNITY PHARMACY**

**HOSPITAL PHARMACY**

**Unit-I**

1. **Organization and structure:** Organization of a hospital, organization & personnel of hospital pharmacy, responsibilities of a hospital pharmacist, pharmacy procedural manual, Budget preparation and Implementation, Pharmacy and Therapeutic Committee, Hospital Formulary and its contents, preparation and revision of hospital formulary.

2. **Drugs store Management and inventory control:**
   (a) Organization of drugs store, Types of materials stocked, storage conditions
   (b) Purchase and inventory control principles, purchase procedures, purchase order, procurement and stocking.
   (c) Quality control of drugs in hospitals.

**Unit-II**

3. **Drug distribution systems in hospitals:** Dispensing of drugs to out-patients.
   Dispensing of drugs to in-patients.
   Dispensing of controlled drugs. Pre-packaging and
Unit-II

1. **Drugs acting on autonomic nervous system**: General consideration of ANS, Neurotransmitters, cholinoreceptors, Cholinergic and Anticholinergic drugs, Neuromuscular blockers. Adrenoceptors, Adrenergic drugs and adrenergic blockers. Drugs acting on autonomic ganglion.

Unit-III


Unit-IV


4. **Urinary system**: a. Water, electrolytes and acid-base balance of body. b. Diuretics and Antidiuretics

Unit-V

5. **Respiratory system**: a. Anti asthmatic drugs Antitussives, Mucolytics and expectorants, respiratory stimulants.
6. Gastrointestinal Tract:
   a. Antacids and other anti ulcer drugs.
   b. Laxatives and Antidiarrhoeal drugs.
   c. Appetite stimulants and suppressants.
   d. Emetics, anti emetics and prokinetic drugs.
   e. Carminative, digestants, enzymes and mucolytics.

Unit-V
7. **Pathophysiology of following diseases:** Hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, diabetes, peptic ulcer, asthma, ulcerative colitis, hepatic disorders, acute and chronic renal failure, tuberculosis, urinary tract infections, sexually transmitted diseases, anemias and common types of neoplasms. (wherever applicable the molecular basis should be discussed).
   Bioassay: Principle and methods of bioassay. Some official bioassay of important drugs.

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**B.PY. 311P- PHARMACOLOGY II AND PATHOPHYSIOLOGY**

Study of various animals used in experimental pharmacology.
Study of various anesthetic agents used in experimental pharmacology and procedure to anaesthetize the animals.
Study of various instruments used in experimental pharmacology.
Preparation of different physiological salt solution used in experimental pharmacology. Study of different routes of drug administration in animals.
Study of method of drug dilution.
Study of effect of mydriatics and miotics by using rabbit eye.
Study of surface anesthesis in rabbit eye.
Study of the effect of various routes of drug administration on the responses of the drug. Demonstration of *in vitro* organ bath experiments (including mounting of isolated tissue in organ tube).
Demonstration of the effect of various drugs and ions on isolated frog's heart and perfused frog heart (using software system).
Identification of the nature of unknown agent using guinea pig ileum.
Study of the dose response curve and to find out the PD2 value of acetylcholine and histamine on various tissues. Study of effect of hepatic microsomal enzyme inhibitors on metabolism of drugs.
Recording of spontaneous activity and muscle relaxant activity of drugs. Effects of spasmosgens and spasmyotics.

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**B.PY. 312T- PHARMACOGNOSY-I**

Unit-I
Systematic study of biological source, cultivation, collection, processing, of the following:

**Resins:** Study of drugs containing resins and resin combination like colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of peru, benzoín, turmeric, ginger.
Tannins: Study of tannins and tannin containing drugs like gambir, black catechu, gall and myrobalan.

**Volatile oils:** General methods of obtaining volatile oils from plants, study of volatile oils of 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-II
Phytochemical Screening: Preparation of extracts.
Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and
leucoanthocyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts.
Fibres: Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.
Pharmaceutical aids: Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors.

Unit-III
5. Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides:
   Saponins: Liquorice, ginseng, dioscorea, sarsaparilla, and senega. Cardioactive sterols: Digitalis, squill, strophanthus and thevetia. Anthraquinone cathartics:
   Aloe, senna, rhubarb and cascara. Others: Psoralea, ammi majus, ammi visnaga, gentian, saffron, chirata, quassia.

Unit-IV
6. Studies of traditional drugs, common vernacular names, botanical sources, morphology, and chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulation of following indigenous drugs:
   Amla, kantkari, satavari, tyllophora, bhilawa, kalijiri, bach, rasna, punarnava, chitrak, apamarg, gothru, shankhapushpi, brahmi, adusa, arjuna, ashoka, methi, lahsun, palash, guggal, gymnema, shilajit, nagarmotha and neem.

Unit-V
7. The holistic concept of drug administration in traditional systems of medicine. Introduction to ayurvedic preparations like arishtas, asvas, gutikas, tailas, churnas, lehyas and bhasmas.

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B.PY. 313P- PHARMACOGNOSY-I

Identification of crude drugs mentioned in theory. Study of fibers and pharmaceutical aids. Microscopic studies of seven-selected crude drugs and their powders mentioned under the category of volatile oils in theory and their chemical tests. General chemical tests for alkaloids, glycosides, steroids, flavonoids and tannins. Microscopic study of some important glycosides containing crude drugs as outlined above. Study of powdered drugs. Standardization of some traditional drug formulations.

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Final-Year

B.PY. 401T- INSTRUMENTAL ANALYSIS

Unit-I
1. Chromatography: Theoretical consideration, application in drug analysis and quality control of the following analytical techniques: column chromatography, GC, HPLC.

Unit-II
2. Theoretical consideration and application in drug analysis and quality control of the following analytical techniques: TLC, HPTLC, paper chromatography.
Unit-III
The theoretical aspects, basic instruments, interpretation of spectra (for UV, IR, NMR, and mass spectroscopy), and applications of the following analytical techniques should be discussed:

Absorption spectroscopy:
I. Ultraviolet and visible spectrophotometry
II. Infrared spectroscopy
III. Atomic absorption spectroscopy.
4. Nuclear magnetic resonance spectroscopy including $^{13}\text{C}$-NMR

Unit-IV
5. Mass spectroscopy
6. Emission spectroscopy
   I. Flame photometry
   II. Fluorimetry
   III. X-ray diffraction

Unit-V
7. Quality assurance:
   GLP, ISO 9000, TQM, quality review and quality documentation.
   Regulatory control, regulatory drug analysis and interpretation of analytical data.
   Validation, quality audit, quality of equipment, validation of equipment and validation of analytical procedures.

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B.PY. 402P- INSTRUMENTAL ANALYSIS

Experiments involving separation of drugs by different analytical techniques.
Experiments involving chromatographical analysis of some pharmaceutical products for (e.g. amino acids, alkaloids, proteins, sulpha drugs, terpenes, etc.)
Quantitative estimation of at least ten formulations containing single drug or more than one drug, using instrumental techniques.
Estimation of Na$^+$, K$^+$, Ca$^{++}$ and iron, using flame photometry.
IR. of samples with different functional groups (-COOH, -COOR, -CONHR, -C=CH-N=CH$_2$, -NHR, -OH etc.) Workshop to interpret the structure spectral of simple organic compounds using UV, IR, NMR, and MS.

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B.PY. 403T- MEDICINAL CHEMISTRY-II

Unit-I
Principles of drug design: QSAR methods, quantum, mechanics, computer aided drug design (CADD) and molecular modeling.
The following topics shall cover classification, nomenclature, S.A.R., synthesis, physicochemical properties, metabolism and therapeutic uses of drugs mentioned under each category. (Biochemical approaches in drug design wherever applicable should be discussed. A brief introduction of latest drugs under each category shall also be discussed).

Unit-II
Drugs acting on autonomic nervous system:
(i) Cholinergic and anticholinesterases: Acetylcholine, methacholine, carbachol, bethanechol, pilocarpine, muscarine, edrophonium, phystostigmine, neostigmine, rivastigmine, parathion, diazinon, malathion.
(ii) Anticholinergics: Atropine, scopolamine, pirenzepine, tolterodine.
(iii) **Adrenergics:** Epinephrine, nor-epinephrine, salbutamol, dopamine, dobutamine, terbutaline, tyramine, albuterol, amphetamine, ephedrine, isoprenaline, nephalozine, oxymetazoline.

(iv) **Agents acting at the neuromuscular junction and autonomic ganglia:** Atracurium, tubocurarine, decamethonium, succinylcholine, nicotine, hexamethonium, mecamylamine.

**Drugs acting on peripheral nervous system:**

(i) **Skeletal muscle relaxants:** Mephenesin, methocarbamol, carisoprodol, metaxalone, chlorozoxazone, orphenadrine

(ii) **Local anaesthetics:** Cocaine, benzocaine, procaine, tetracaine, lidocaine, articaine, bupivacaine, etidocaine, ropivacaine, dibucaine, dyclorine, pramoxine.

**Unit-III**

4. **Drugs acting on central nervous system:**

(i) **General anaesthetics:** Isoflurane, sevoflurane, nitrous oxide, thiopental, ketamine, etomidate, propofol.

(ii) **Sedative and hypnotics:** Alprazolam, chlordiazeopoxide, clonazepam, diazepam, lorazepam, nitrazepam, oxazepam, midazolam, zolpidem, phenobarbitone, pentobarbitone, meprobamate.

(iii) **Antidepressants:** Amitriptyline, doxepine, desipramine, citalopram, fluoxetine, sertraline, bupropion, phenelzine, pargyline, meclomamide.

(iv) **Antipsychotics:** Chlorpromazine, fluphenazine, trifluoperazine, thiothixene, clozapine, haloperidol, loxapine, pimozide, ziprasidone, risperidone.

(v) **Antiepileptics:** Phenytoin, carbamazepine, ethosuximide, lamotrigine, valproic acid, gabapentin, lamotrigine, zonisamide.

(vi) **Antiparkinsonian drugs:** Levodopa, carbidopa, bromocriptine, pergolide, trihexyphenidyl.

(vii) **Opioid analgesics:** Morphine, heroin, codeine, naloxone, naltorphine, meperidine, fentanyl, methadone, dextro-proxypheine, dextromethorphan, pentazocine.

(viii) **Non-steroidal anti-inflammatory drugs:** Aspirin, paracetamol, indomethacin, mefenamic acid, tolmetin, diclofenac, ibuprofen, ketoprofen, phenylbutazone, analgin, piroxicam, nimesulide, valdecoxib, etoricoxib, acelofenac.

(ix) **CNS stimulants:** Strychnine, picrotoxin, nikethamide, bemebride, caffeine, theophylline.

**Unit-IV**

5. **Drugs acting on cardiovascular system:**

(i) **Antihypertensive agents:** Reserpine, guanethidine, diazoxide, hydralazine, minoxidil, methyldopa, prazosin, clonidine, pargyline, propranolol, phenoxybenzamine, atenolol, captorpril, enalapril, lisinopril, nifedipine, amlodipine, diltiazem, verapamil.

(ii) **Antiarrhythmic agents:** Quinidine, di-isopyramide, procainamide, moxilintene, amiodarone, flecainide.

(iii) **Antiangular agents:** Glyceryltrinitrate, amyl nitrate, isosorbide dinitrite.

(iv) **Antiatherosclerotic agents:** Atorvastatin, simvastatin, clofibrate, gemfibrozil.

6. **Drugs acting on kidney:** **Diuretics** — Mannitol, furesamide, bumetanide, ethacrylic acid, chlorothiazide, hydrochlorothiazide, chlorothalidone, acetazolamide, amiloride, triamterene, spironolactone.

**Unit-V**

7. **Hormones and related drugs:**

(i) **Hypoglycaemic drugs:** Insulin, tolbutamide, chlorpropamide, phenformin, metformin, glyburide, glipizide, repaglinide, pioglitazone.

(ii) **Thyroid hormone and antithyroid drugs:** Thyroxine, propylthiouracil, methimazole, carbimazole.

8. **Autocoids and related drugs:**

(i) **Antihistaminics:** Diphenhydramine, dimenhydrinate, doxylamine, mepyramine, tripellanamine, pheneramine, chlorpheniramine, dextchlorpheniramine, triprolidine, promethazine, methdilazine, antazoline, cyproheptadine, azatidine, astemazole, cetirizine, fexofenadine.

(ii) **Eicosanoids:** Prostaglandins: misoprostol, rioprostil, dinoprostone, carboprost tromethamine, alprostadil, metenprost.

9. **Drugs acting on gastrointestinal tract:**

(i) **Antilulcer drugs:** Cimetidine, ranitidine, famotidine, loratidine, roxatidine,
(ii) **Antidiarrhoeal drugs:** Loperamide, diphenoxylate, racecadotril.
(iii) **Emetics and antiemetics:** Emetine, apomorphine, ondansetron, metoclopramide, cyclizine, promethazine, domperidone.

10. **Combinatorial chemistry:** Introduction, supports, linkers, solution-phase combinatorial chemistry, pooling strategies, detection, purification, analysis, high-throughput screening, chemical diversity and library design.

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**B.PY. 404P- MEDICINAL CHEMISTRY-II**

Typical synthesis of drugs & drug intermediates by use of the following types of reactions and establishing pharmacopoeial standards of the drugs synthesized.

(i) Benzoin condensation
(ii) Benzilic acid rearrangement
(iii) Friedel Crats alkylation and acylation
(iv) Hoffmann – Bromamidine reaction
(v) Perkin condensation
(vi) Grignard reaction
(vii) Claisen condensation
(viii) MVP reduction,
(ix) Catalytic hydroenation
(x) Skraup synthesis.

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**B.PY. 405T- DOSAGE FORM DESIGN AND COSMETICOLOGY**

**Unit-I**

1. **Preformulation studies:** Study of physical properties of drugs like physical form, particle size, shape, density, wetting and dielectric constant, solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability.

   Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc. and their influence on formulation and stability of products. Study of pro-drugs in solving problems related to stability, bioavailability and elegance of formulations.

**Unit-II**

2. Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets and solutions.

   Stabilization & stability testing protocol for various pharmaceutical products with special reference to tablets and solutions.

**Unit-III**

3. Performance evaluation methods:

   In-vitro dissolution studies for solid dosage forms; methods, interpretation of dissolution data. In-vivo methods of evaluation and statistical treatment.

4. GMP and quality assurance, quality audit.

**Unit-IV**

5. **Cosmetology and cosmetic preparation:** Fundamentals of cosmetic science, structure and function of skin and hair. Formulation preparation and packaging of cosmetic for
skin, hair, dentifrices and manicure
preparation lipsticks, eyelashes, baby care products etc.

Unit-V
6. Novel drug delivery systems: Basic concept, merits and demerits, design, development, production & evaluation of following delivery systems- sustained & controlled release dosage forms (with special reference to tablets, capsules and oral liquids), nanoparticles, liposomes, resealed erythrocytes, microspheres, microcapsules, fast dissolving dosage forms.

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B.PY. 406P- DOSAGE FORM DESIGN AND COSMETICOLOGY

Preformulation studies including drug-excipient compatibility studies, effect of stabilizers, preservatives etc. in dosage form design.
Experiments demonstrating improvement in bioavailability through prodrug concept. Stability evaluation of various dosage forms and their expiration dating.

Dissolution testing and data evaluation for oral solid dosage forms.
In-vivo bioavailability evaluation from plasma drug concentration and urinary excretion curves. Design, development and evaluation of controlled release formulation. Formulation of various types of cosmetics for skin, hair, dentifrices and manicure preparations.

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B.PY. 407T- BIOPHARMACEUTICS AND PHARMACOKINETICS

BIOPHARMACEUTICS

Unit-I
1. Introduction to Biopharmaceutics
2. Delivery of drugs: Routes of administration, transport of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion, pinocytosis, etc.).
3. Absorption of drugs: Factors influencing absorption such as physicochemical factors, biopharmaceutical factors, manufacturing processing factors, pharmacokinetic factors
4. Distribution of Drugs: Tissue permeability, physiological barriers, volume of distribution.

Unit-II

6. Bioavailability and bioequivalence: Measure of bioavailability, Cmax, tmax, and area under the curve (AUC), Design of single dose bio-equivalence study and relevant statistics, Review of regulatory requirements for conduction of bioequivalent studies

PHARMACOKINETICS

7. Introduction to pharmacokinetics: Rate, Rate constants and order of reactions (Zero order and first order kinetics)
8. Concept of compartment modeling: Introduction, compartment models- intravenous
administration, extravascular administration

Unit-IV
9. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menten Equation, determination of non-linearity (Saturation mechanism).

MISCELLANEOUS

10. In vivo-In vitro Correlation

Unit-V
11. Mean residence time concept
12. Statistical moments analysis
13. Multiple dosing and steady state levels and their relationship with single dose administration.
14. International regulation regarding bioavailability and bioequivalence studies

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B.PY. 408P - BIOPHARMACEUTICS AND PHARMACOKINETICS

Absorption studies in-vitro and in-situ.
Statistical treatment of pharmaceutical data.
Preparation of surgical dressings, sterile infusions, adhesive tapes and bandages.
Experiments based on sterilization of various types of materials like surgical dressings, surgical equipments, glasswares, gowns, headgears, mask, gloves etc. used in Hospitals.
Evaluation of cotton, bandages, dressings, tapes and infusion.
Evaluation of containers and closures for parenteral use. Preparation of haemostat.
Practicals designed on the use of computers in Drug Information Center, prescription filling, documentation of information on drug interaction.

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B.PY. 409T - PHARMACOLOGY – III AND CLINICAL PHARMACY

Unit-I
1. Chemotherapy: General principles of chemotherapy
   Antimicrobial drugs: Sulfonamides and cotrimoxazole, beta-lactam antibiotics,
   Cephalosporins, tetracyclines and chloromphenicol (broad spectrum antibiotics),
   quinolones, aminoglycoside antibiotics, macrolides and other antibacterial

Unit-II
   Antifungal, Antiviral, Antimalarial, Antiamoebic and other antiprotozoal drugs,
   anthelmintics.

Unit-III
3. Chemotherapy of urinary tract infections, cancer, tuberculosis, leprosy and sexually transmitted diseases and immunosuppressive agents.
4. Complete pharmacology of following local anti infective agents, sera, vaccines,
   diagnostic agents and vitamins. Gene-therapy.

Unit-IV
5. Clinical Pharmacy:
a. Basic concepts of pharmacotherapy
b. Clinical pharmacokinetics and individualization of drug therapy
c. Drug delivery systems, their biopharmaceutical and therapeutic considerations.
d. Use of drugs in infants and in elderly patients
e. Use of drugs during pregnancy and lactation
f. Therapeutic Drug monitoring
g. Concept of essential drugs & Rational drug Use.
h. Drug induced diseases.
i. Basics of drug interactions.
j. Interpretation of clinical laboratory tests.

Unit-V
6. a. Principles of Toxicology: Definition of poison, general principles of treatment of poisoning with particular reference to barbiurates, opioids, salicylates, organo-phosphorous and atropine poisoning.
b. Heavy metals and heavy metal antagonists.

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B.PY. 410P- PHARMACOLOGY-III AND CLINICAL PHARMACY

Bioassay of gallamine (d-tobucurarine), mepyramine and atropine.
Study of non-competitive antagonism between acetyl choline and papaverine on guinea pig ileum.
Study of competitive antagonism between histamine and mepyramine and to find out the PA-2 value of mepyramine on guinea pig ileum.
Study of competitive antagonism between acetyl choline and atropine and to find out the PA-2 value of atropine on rat ileum.
Demonstration of dose response curve of oxytocin on rat uterus. Demonstration of dose response curve using guinea pig tracheal chain.
Study of the anti secretory and anti ulcer activity using rat pylorus.
Evaluation of anti-inflammatory activity of drugs.
Evaluation of antipsychotic and hypnotic drugs. Evaluation of anticonvulsant drugs.
Evaluation of local anaesthetic drugs Evaluation of analgesic drugs.
Study of the effect of antihistaminics on histamine induced asthma.
15. Pyrogen testing.
16. Demonstration of effect of drugs on dog B.P. and respiration, intestine and spleen (using suitable software system).
17. Clinical Pharmacology: To determine the effect of certain clinically useful drug on human volunteers like :
   a. Antihistaminics.
   b. Anti anxiety and sedative drug.
   c. Analgesics.
   d. Beta blockers.

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B.PY. 411T- PHARMACOGNOSY-II

Unit-I
1. Systematic study of biological source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid-containing drugs:
   (a) Pyridine-piperidine: Tobacco, areca and lobelia.
   (b) Tropane: Belladonna, hyoscyamus, datura, duboisia, coca and withania. (c) Quinoline and isoquinoline: Cinchona, ipecac, opium.
   (d) Indole: Ergot, rauwolfia, catharanthus, nux-vomica and phystostigme. (e) Imidazole: Pilocarpus
   (f) Steroidal: Veratrum and kurchi
   (g) Alkaloidal amine: Ephedra and colchicum. (h) Glycoalkaloid: Solanum.
   (i) Purines: Coffee, tea and cola.
**Unit-II**

2. Role of medicinal and aromatic plants in national economy. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin and pancreatin.


**Unit-III**

4. World-wide trade in medicinal plants and derived products with special reference to diosgenin (disocorea), taxol (Taxus sps) digitalis, tropane alkaloid containing Plants, Papain, Cinchona, Ipecac, Liquorice, Ginger, Aloe, Valerian, Rauwolfia, and Plants containing laxatives. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Utilization and production of phytoconstituents such as quinine, calcium sennosides, podophylotoxin, diosgenin, solasodine, and tropane alkaloids.

**Unit-IV**

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

**Unit-V**


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**B.PY. 412P- PHARMACOGNOSY-II**

Identification of crude drugs listed above.
Microscopic study of characters of eight-selected drugs (Belladonna, datura, sinchona, rauwolfia, nux-vomica, withania, ephedra, ipecac, etc.) given in theory in entire and powdered form.
Chemical evaluation of powdered drugs and enzymes. Chromatographic studies of some herbal constituents.
Isolation of some selected phytoconstituents studied in theory (nicotine picrate, caffeine, ammonium glycyrhrizante, calcium citrate etc.)
Extraction of volatile oils and their chromatographic profiles.
Some experiments in plant tissue culture (like preparation of various plant tissue culture media, aseptic transfer, role of growth regulators, micro-propogation etc).

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**B.PY. 413T- PHARMACEUTICAL INDUSTRIAL MANAGEMENT**

**Unit-I**

1. **Management:** Meaning, Evolution - Scientific, administrative and human relation

Functional areas of management: Production management, marketing management, personnel management, financial management - their meaning and functions. Entrepreneurship development.

2. **Economics**: Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labour welfare.

Unit-II
3. **Production management**: Nature and scope of production and operations management, strategic operations management A brief exposure of different aspects of production management- visible and invisible inputs, methodology of activities, performance evaluation techniques, process flow, process know how and maintenance management. Production planning and control, production processes - mass, job and project; plant location and lay out; work study (preliminary idea only). manufacturing and services operations, product and process design, process planning, plant utilities, production technology, materials handling, factory building, shop floor planning. Materials management, purchasing, purchasing policies, materials storing and inventory management.

Unit-III
4. **Market research**: Marketing research and information system Market demands-major concepts in the demand measurement, estimating current demands, geo-demographic analysis, estimating industry sales, market share and future demand.

5. **Pharmaceutical marketing**: Evolution of modern concept; market segmentation; concept of marketing mix; product planning; pricing, promotion; channels of distribution developing the marketing mix – product and service strategies, new product development and product life cycle strategies. Field sales management, sales organization, training of sales personnel, compensation of sales force, field sales planning control and risk, sales forecasting, sales budget and budgetary control, sales literature, catalogue and price list. Concepts and nature of advertising, advertising and marketing, effects of advertising, social effects of advertising, ethics, advertising process, media selection, massages, planning and budget.

Unit-IV
6. **Personnel management**: Marketing – objective an scope, developing marketing opportunities and strategies Recruitment and selection of employees, orientation and training, evaluation and compensation, retrenchment, lay off and discharge. General principles of insurance and inland and foreign trade, procedure of exporting and importing goods.

Unit-V

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**REFERENCE BOOKS (LATEST EDITION)**

**B.PHARM FIRST YEAR**

**Pharmaceutical Inorganic Chemistry (B.PY. 101T & B.PY. 102P)**

Pharmacopoeia of India, Ministry of Health, Govt. of India, New Delhi.
Brey W. S., Physical Chemistry and its Biological Applications,

**Pharmaceutical Biochemistry and Clinical Pathology (B.PY. 103T & B.PY. 104P)**


**Dispensing Pharmacy (B.PY. 105T & B.PY. 106P)**

Martin E. W., Dispensing of Medication, Mack Publishing Co., Easton PA,

**Pharmaceutical Technology (B.PY. 107T & B.PY. 108P)**


**Pharmaceutical Biology and introductory Pharmacognosy (B.PY. 109T & B.PY. 110P)**

Tyagi Y. D., Text Book of Botany, Universal Publication.
Dutta A. C., Text Book of Botany, Oxford University Press,
Kokate C. K., Purohit A. P. and Gokhale S. B., Pharmacognosy, Nirali Prakashan, Pune.

**Human Anatomy, Physiology and Health Education (B.PY. 111T & B.PY. 112P)**

Derehashi and Gandhi; Human Anatomy and physiology; B.S.
Shah Prakashan. C. Chatterjee; Human Physiology; Medical Allied Agency, Calcutta.
Goyal, Bhatt and Kumar; Basics of Health Education and Community Pharmacy; B.S.
Shah Prakashan. Warwick & Willman Longman; Gray’s Anatomy.
Sahana’s Text Book of Anatomy.


N.S. Parmar; Health Education and Community Pharmacy; CBS Publishers.

Ranade V.G.; Text Book of Practical Physiology; Pune Vidyarthi Griha Prakashan, Pune.


Pharmaceutical Jurisprudence (B.PY. 113T)

Original laws published by Govt. of India.


Pharmacy Practice (B.PY. 114T)

Remington Pharmaceutical Science.

Merchant S. H., Text Book of Retail Pharmacy Management.

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B.PHARM SECOND YEAR

Pharmaceutical Organic Chemistry (B.PY. 201T & B.PY. 202P)


Gupta R. D., A Text book of Analytical Chemistry


Roberts J. D. and Caserio M. C., Basic Principles of Organic Chemistry, W. A. Benjamin,

Chemistry of Natural Drugs (B.PY. 203T & B.PY.. 204P)


Remington Pharmaceutical Sciences.

**Physical Pharmacy (B.PY. 205T & B.PY. 206)**

Alfred Martin, Physical Pharmacy, B.I. Waverly Pvt. Ltd., New Delhi
CVS Subramaniam et al, Physical Pharmaceutics, Vallabh Prakashan.
Gennaro A.R., Remington: The Science and Practice of Pharmacy, Lippincot Williams and Wilkins
Allen L.V., Popovich W.G. & Ansel H.C., Ansel’s Pharmaceutical Dosage Forms and Drug Delivery Systems, Lippincott Williams and Wilkins

**Pharmaceutical Engineering, Unit Operations and Engineering Drawing (B.PY. 207T & B.PY. 208P)**

Brown C.G., Unit Operations (Indian Ed.) Asia Publishing House, Bombay.

**Pharmacology – I and Pathophysiology (B.PY. 209T & B.PY. 210P)**

Goyal R. K., Derasari & Gandhi’s Elements of Pharmacology, B. S. Shah Prakashan.
Barar F. S. K., Essentials of Therapeutics; Interprint New Delhi.
Tripathi, K.D., Essentials of Medical Pharmacology, Jaypee Brothers, New Delhi
Herindal E. T. & Hirschman J.L., Williams and Wilkins, Clinical Pharmacy and Therapeutics.
Theoharides T. C., Pharmacology; Little Brown & Co. B. C. Bose, Pharmacology

**Computer Applications (B.PY. 211T & B.PY. 212P)**
Advanced Mathematics and Biostatistics (B.PY. 213T & B.PY. 214P)


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Pharmaceutical Analysis (B.PY. 301T & B.PY. 302P)

Pharmacopoeia of India, Govt. of India, Ministry of Health, New Delhi.
Medicinal Chemistry-I (B.PY. 303T & B.PY. 304P)

Wilson & Gisvold’s, Testbook of Organic medicinal & Pharmaceutical chemistry; J. B. Lippincott Co.
W. O. Foye, Principles of medicinal chemistry.
M. E. Wolff, Burger’s medicinal chemistry, John Witey & Sons.
Remington’s Pharmaceutical Sciences
Vogel’s Textbook of Practical Organic Chemistry, ELBS.
Mann & Saunier’s – Practical Organic Chemistry.

Pharmaceutical Microbiology and Biotechnology (B.PY. 305T & B.PY. 306P)

Carter S. J., Cooper and Gunn’s Tutorial Pharmacy, CBS Publishers, Delhi.
Prescott and Dunn, Industrial Microbiology, McGraw Hill Book Co. Inc.

Pharmaceutical Formulation (B.PY. 307T & B.PY. 308P)

Rawlins E. A., Bentley’s Textbook of Pharmaceutics, ELBS Bacilliere Tindal.

Hospital & Community Pharmacy (B.PY. 309T)

Pharmacopoeia of India; published by Controller of Publications Delhi, All editions. Hassan W.E.; Hospital Pharmacay; Lea and Febiger, Philadelphia.
Merchant & Quadry, Hospital Pharmacy, B.S. Shah Prakashan,

Pharmacology II and Pathophysiology (B.PY. 310T & B.PY. 311P)

Goyal R.K., Derasari & Gandhi’s Elements of Pharmacology, B. S. Shah Prakashan.
Delhi.
Craig C. R. & Stizel R. R., Modern Pharmacology, Little Brown and
Company. Davidson's Principles and Practice of Medicine,
ELBS/Churchill Livingstone.
J.G. Hardman, L.E., Limbird, P.B. Molinoss, R.W. Rudden & A. G. Gil, Goodman & Gilman's, The
Pharmacological basis of Therapeutics, Pergamon Press.
Herindal E. T. & Hirschman J. L., Williams and Wilkins, Clinical Pharmacy and
International.
Lawrence D.R. and Bennet P. N., Clinical Pharmacology; Churchill Livingstone.
Myeek M. J., Gertner S. B. & Perper M. M., Pharmacology Lippincott's Illustrated Reviews,
Lippincott Company, Philadelphia.
Paul L., Chapmom and Hall, Principles of Pharmacology.
Dipiro, J. L. Elsevier, A Pathophysiologial Approach:
Pharmacotherpay. Rang M. P., Dale M.M., Riter
J.M., Pharmacology, Churchill Livingstone. Robinson S. L.
and Kumar V.; Basic Pathology, W. B. Saunders Co.
Theoharides T. C., Pharmacology; Little Brown & Co.
Turner; Screening of
drugs. B. C. Bose,
Pharmacology
Pharmacognosy I (B.PY. 312T & B.PY. 313P)
Trease G. E. and Evans W. C., Pharmacognosy, Bailliers Tindall, Eastbourne, U. K.
Wallis T E., Text Book of Pharmacognosy, J & A Churchill Limited,
London. Welsch J. R., Fundamentals of Plant Genetics and
Breeding, Wiley, New York.
Zafar R., Medicinal Plants of India, C.B.S. Publisher, New Delhi.

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B.PHARM FINAL YEAR

Instrumental Analysis (B.PY. 401T & B.PY. 202P)
Atal C.K. and Kapur B.M., Cultivation and Utilization of Medicinal Plants, RRL, Jammu.
Barz W., Reinhard E. and Zenk M.H., Plant Tissue Culture and its Biotechnological
Phytopharmaceuticals, Wright- Scientetchnica, Bristol.
Export Potential of Selected Medicinal Plants, prepared by Basic Chemicals,
Pharmaceuticals and Cosmetic
Export Promotion Council, Bombay and Other Reports.
Peach K., and Tracey M.V., Modern Methods of Plant Analysis, 1-4, Narosa Publishing
House, New Delhi. Ross M. S. E. and Brain K. R., An Introduction to Phytopharmacy,
Pitman Medical, Kent.
Staba E. J., Plant Tissue Culture as a Source of Biomedicinals, CRC Press,
Florida. Stahl E., Thin Layer Chromatography – A Laboratory Hand Book,
Springerverlag, Berlin.
Swan T., Chemical Plant Taxonomy, Academic Press,
London. Swan T., Comparative Phytochemistry,
Medicinal Chemistry-II (B.PY. 403T & B.PY. 404P)
Pharmacopoeia of India, Govt. of India, Ministry of Health, New Delhi.
Jeffery G.H., Bassett J., Mendham J., Denney R.C., Vogel's Text Book of quantitative
quantitative
chemical analysis, E.L.B.S. London.
Atherden L.M, Bentley and Driver’s Text Book of Pharmamaceutical Chemistry, Oxford University Press, London
Willard, Instrumental analysis.
Ewing, Method of instrumental analysis.
Sharma B. K., Methods of Instrumental Analysis.
Chatwal and Anand, Instrumental Methods of Analysis.

**Dosage Form Design and Cosmeticology (B.PY. 405T & B.PY. 406P)**

Wilson & Gisvold’s Textbook of Organic Medicinal & Pharmaceutical chemistry,
J.B.Lippincott Co. Foye W.O., Principles of Medicinal chemistry.
Vogel’s Textbook of Practical Organic Chemistry, ELBS.
Pharmacopoeia of India
British Pharmacopoeia
United States Pharmacopoeia
Mann & Saunders – Practical Organic Chemistry.

**Biopharmaceutics and Pharmacokinetics (B.PY. 407T & B.PY. 408P)**

Sharma P.P., How to Practice GMP, Vandana Publications, Delhi.
Banker G.S. and Rhode C.T., Modem Pharmaceutics, Marcel Dekker Inc., NY.
Remington’s The Science and Practice of Pharmacy, Mack Publishing Co. Easton, Pernsybria.
Loftus B. T. and Nash Robert, Pharmaceutical Process validation, Marcel Dekker Inc., NY.
Pharmacopoeia of India, Published by the Controller of Publications, Delhi..

**Pharmacology – III and Clinical Pharmacy (B.PY. 409T & B.PY. 410P)**

Rowland M. and Tozer T.N.; Clinical Pharma cokinetics, Lea & Febiger, NY.
Welling Peter G. and Tse Francis L.S.; Pharmacokinetics, Marcel Decker Inc. N.Y.
Winter M.E.; Basic Clinical Pharmacokinetics, Applied Therapeutics, Ine San Francisco.
Wagner J.G.; Pharmacokinetics for Pharmaceutical Scientist; Technomic Publishing A. G. Basel, Switzerland.
Wagner J.G.; Fundamentals of Pharmacokinetics; Drug intelligence publication, Hamilton.
Ritschel W. A.; Handbook of Basic Pharmacokinetics; Drug Intelligence Publication, Hamilton.
Motari R.E.; Biopharmaceutics and Pharmacokinetics an Introduction; Marcel Decker Inc. NY.
Gibaldi M.; Biopharmaceutics and Clinical Pharmacokinetics; Philadelphia.
Gibaldi M. and Perrier D.; Pharmacokinetics; Marcel Decker Inc. NY.
Pecile A. and Resigno A.; Pharmacokinetics; Plenum Press NY.

Pharmacognosy II (B.PY. 411T & B.PY. 412P)
Goyal R.K., Derasari & Gandhi’s Elements of Pharmacology, B. S. Shah Prakashan.
Applied Therapeutics: The Clinical Use of Drugs, Applied Therapeutics, Inc.
Barar F. S. K., Essentials of Therapeutics; Interprint New Delhi.
Davidson’s Principles and Practice of Medicine, ELBS/Churchill Livingstone.
Gilmans, The Pharmacological basis of Therapeutics, Pergamon Press.
Herindal E. T. & Hirschman J.L., Willams and Wilkins, Clinical Pharmacy and Therapeutics.

Pharmaceutical Industrial Management (B.PY. 413T)
Shukla M. C.: Business Organization and Management; S. Chand
and Company. Sherlakar S. A.: Business Organization and
Management; Himalaya.
Filippo E. B.: Personnel Management; McGraw Hill.
Kotler Philip: Marketing Management; Prentice Hall of India.
Rao and Narayan: Organizational Behaviour; Konark
Chand and Company.
K.Asathappa and K. Sridhara Bhat, Production and Operations Management, Himalaya
Publishing House, New Delhi.
M. N. Mishra, Sales promotion and advertising management,Himalaya Publishing House, New
Delhi.

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