## COURSE STRUCTURE

### III YEAR  
#### I SEMESTER

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pharm. Biochemistry</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Pharm. Microbiology</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Chemistry of Natural Drugs</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Pharm. Technology-I</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Pharmacology-I</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Pharm. Biochemistry Lab</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Pharm. Microbiology Lab</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Chemistry of Natural Drugs Lab</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Pharm. Technology-I Lab</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Tutorials</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total** -
PHARMACEUTICAL BIOCHEMISTRY

UNIT - I
Bio chemical organization of the cell, molecular constituents of membrane, active & passive transport process, sodium and potassium pumps, osmoregulation and hemostatis.

UNIT – II

UNIT – III

UNIT - IV

UNIT - V
Metabolism of Carbohydrates: Glycolysis, glycogenolysis, gluconeogenesis, Kreb’s cycle, HMP & uronic acid pathways, anaerobic respiration in muscle.

UNIT – VI
Metabolism of Proteins: Amino acid structure & classifications, deamination, Transamination, de-carboxylation, Urea cycle, Metabolism & examples: Valine, cystine, cystein, tryptophan, tryocine, methionine.

UNIT – VII
Metabolism of Lipids:
Oxidations: Alpha, Beta, Gama & Omega oxidations of fatty acids, bio-synthesis of fatty acids, cholesterol, ketogenesis.

UNIT – VIII
Introduction to xenobiotic metabolism, detoxification, conjugation, prostaglandins & related products (Ecosanoids).
TEXT BOOKS

1. Harper, Biochemistry
3. J.L.Jain, Fundamentals of Biochemistry
4. Satyanarayana, Text Book of Biochemistry
6. Conn, Outlines of biochemistry

REFERENCES

1. L.Stryer, Text Book of Bio Chemistry.
6. Conn, Outlines of Biochemistry.
7. Plummer, Practical Bio Chemistry.
8. Denniston, Topping & Caret; General, Organic, and Biochemistry, McGraw-Hill
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Pharmacy – I Sem.

PHARMACEUTICAL MICROBIOLOGY

UNIT - I
Introduction to Microbiology: Origin, scope and discovery of spontaneous generations theory, contributions of Antony Von Lewvonhock, Pasteur, Koch and Lister.

UNIT – II

UNIT – III
Nutrition and Growth of Microbes: Nutritional requirements, Types of Nutrient media and growth conditions and Nutritional types based on energy source. Isolation, cultivation (aerobic & anaerobic) and preservation of microorganisms, physiology of growth, bacterial growth curve, methods for determining bacterial numbers, mass and cell constituents. Exponential growth and generation time. Bacterial growth in batch and continuous culture (chemostat and turbidostat) synchronous growth.

UNIT – IV
Microorganisms and their Environment: Effects and microbial adaptations to environmental conditions – Temperature, oxygen desiccation, extreme cold ionic effect, electricity, osmotic pressure, radiant energy, hydrostatic pressure, mechanical impact, vibration.

UNIT – V

UNIT – VI

UNIT – VII
Epidemiology of Diseases: Study of etiology, diagnosis, source of infection, mode of transmission, immunization methods, prevention and control of the following diseases. Bacillary dysentery, diphtheria, tuberculosis, leprosy, cholera, typhoid, syphilis, gonorrhoea, tetanus, food poisoning and infection hepatitis.
UNIT – VIII
Application of Microbes in Pharmaceutical Industry

a. **Microbiological Assays:** Principles and Methods involved in Assay of Antibiotics, Vitamins, Amino acids & Bio-Sensors in Analysis.

b. **Microbial Source & applications of various pharmaproducts** like Antibiotics, vitamins, amino acids, solvents, enzymes & genetic engineered products etc.

**TEXT BOOKS**

1. Pelczar and Reid, Text Book of Microbiology
2. Anantha Narayan and Jayram Panikar, Text Book of Microbiology, Orient Longman, Delhi, KAKINADA.
3. N.K. Jain, Pharmaceutical Microbiology
4. Alcamo, Microbiology.
5. R.C. Dubey, A textbook of Microbiology

**REFERENCES**

1. Heritage, J Introductory Microbiology.
4. Tortora, Gerard Text Book of Microbiology.
5. E.A Rawlins, Betley’s Text Book of Pharmaceutics, 8th ed.
6. Garg, F C Experimental Microbiology
7. Gaud, R.S Practical Microbiology
III Year B.Phrarmacy – I Sem.

CHEMISTRY OF NATURAL DRUGS

UNIT – I


Opium alkaloids: Structural features of Morphine molecule – Peripheral groups. Modification of structure and effect on analgesic activity – SAR of morphine and morphine-like analgesics.

Narcotic antagonists: Nalorphine, Levallorphan. Anti-tussive agents: Noscapine, Dextromethorphan. Smooth muscle relaxants: Papaverine and related compounds like ethaverine, Dioxylane. Structures and uses of these compounds.

Tropane alkaloids: Structures of Atropine/hyoscyamine, Hyoscine, Hydrolytic products of these – Tropine and Scopine. Relationship between tropine & pseudotropine. Biological actions and uses of tropane alkaloids. Homatropine.

UNIT – II


Ergot alkaloids: Classification, structures, hydrolytic products, pharmacological actions, therapeutic uses and toxicity. Synthetic derivatives: Methylergonovine (Methylergometrine), LSD, ethysergide.

UNIT – III

Terpenoids: Volatile oils: Definition of terpenoids, Classification, isoprene, special isoprene and gem-dialkyl rules.

Citral: Sources and structures, isomerism in citral, citral-a (Geranial), citral-b (Neral). Reduction of citral to citronellal, citronellol, geraniol and nerol. Oxidation of citral to geranic acid. Cyclodehydration of citral to p-cymene. Conversion of citrals – a and b into alpha-terpeneol and ionones.

Alpha – Terpeniol: Sources and structure. Conversion into p-cymene, 1,8 – terpin, terpinolene, dipentene, dipentene dihydrochloride. Preparation of alpha-terpeneol from limonene/dipentene, 1,8-Terpin and pinene.

UNIT – IV

Menthol and menthone: Sources, structures and uses. Oxidation of menthol to menthone. Conversion of menthol into thymol.

1,8-cineole: Sources and structure. Preparation from Cis-terpin. Mention of 1,4-cineole.


UNIT – V


UNIT – VI

Steroidal Anti-Inflammatory drugs: Classification, structures, SAR, uses & toxicity.

Cardiac glycosides: structures of glycosides from Digitalis, Strophanthus, Squill and Bufo. Enzymatic and acid hydrolytic reactions of the glycosides. Mechanism of action, SAR, therapeutic uses and toxicity.

Bile acids: Names, structures and functions.

UNIT – VII


Structures of synthetic estrogens. Therapeutic uses and side effects.

Progesterone and selected progestins – structures, uses and side-effects.

Preparation of progesterone from diosgenin. A note on Steroid contraceptive agents and regimens.


Hormones of Thyroid: Thyroxine and triiodothyronine – structure and functions.

UNIT – VIII

Adrenal Cortex Hormones:

Mineralocorticoids: Aldosterone, Deoxycorticosterone,

Fludrocortisone – structures, biological activity and uses. Aldosterone antagonist Spironolactone.

Glucocorticoids: Cortisone & Hydrocortisone – Structure, biological actions, uses.
Hormones of Pancreas:
Glucagon – Structure and Physiological role.

**NOTE:**

1. *Structure elucidation of compounds is not included in the syllabus.*
2. *Structural features like the basic nucleus; presence of substituent groups will be discussed.*
3. *Simple reactions like hydrolysis, selenium dehydrogenation, oxidation, reduction etc., will be taught wherever applicable.*

**TEXT BOOKS**

2. JB Harborne, Phyto Chemical methods.

**REFERENCES**

1. RT Morrison and R.N Boyd, Organic chemistry, Allyn and Bacon, inc., boston
3. F.G. Mann & B. Saunders, Practical Organic chemistry Longmans green & Co. Ltd., UK.
4. RM. Acheson, an introduction to the chemistry of heterocyclic compounds, Interscience NY.
5. Duquesn & others, Practical pharmacognocy, CBS Publ.
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Pharmacy – I Sem.

PHARMACEUTICAL TECHNOLOGY – I

UNIT-I
Preformulation: Physicochemical properties like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution, organoleptic additives, hydrolysis, oxidation-reduction, recemization, polymerization etc and their effect on formulation, stability and bioavailability study of prodrugs in solving problems related to stability bio availability in formulations. Stability testing of finished products as per ICH guidelines.

UNIT-II
Liquid dosage forms: Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubulizers, colors, flavours and others, manufacturing packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.

UNIT-III

UNIT-IV
Pharmaceutical aerosols: Definition, propellants general formulation, manufacturing and packaging methods, pharmaceutical applications.

UNIT-V
Ophthamalic Preparations: Requirements, formulation, methods of preparation, containers, evaluation.

UNIT-VI
Cosmeticology and Cosmetic Preparations –I: Fundamentals of cosmetic science, structures and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin, hair.

UNIT-VII
Cosmeticology and Cosmetic Preparations –II: Formulation, preparation & packaging of dentrifices like tooth powders, pastes, gels etc., and manicure preparations like nail polish, lipsticks, eye lashes, baby care products etc.

UNIT-VIII
Suppositories: Ideal requirements of bases, Different types of bases, manufacturing procedure packing and evaluation.
TEXT BOOKS


REFERENCES

1. Shobha Rani, Text of Industrial Pharmacy, Hiremath Orient Longman
2. Sagarian & MS Balsam, Cosmetics Sciences & Technology Vol.1, 2 & 3
4. E.A.Rawlkins, Bentley’s Text Book of Pharmaceutics, Elbs publ
5. HC Ansel Introduction to Pharmaceutical Dosage forms
10. Good Manufacturing Practices – Schedule M Read With The Drugs And Cosmetic Rules 1945
III Year B.Pharmacy – I Sem.

PHARMACOLOGY – I

UNIT I
General Pharmacology: Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, Structural activity and relationship (SAR), factors modifying drug action, tolerance and dependence, Pharmacogenetics Enzyme induction & Inhibition, Absorption, distribution metabolism and excretion of drugs, Principles of drug discovery and development of new drugs.

UNIT II
Pharmacology of Autonomic Nervous System:
Neurohumoral transmission in peripheral nervous system (autonomic and Somatic) Parasympathomimetics & parasympatholytics, sympathomimetics & sympatholytics Ganglionic-stimulants and blocking agents, Neuromuscular blocking agents.

UNIT III
Drugs acting on Central Nervous System:
Neurohumoral transmission in the C.N.S, General anesthetics, Alcohols and Disulfiram, Sedatives, hypnotics, & anti-anxiety agents.

UNIT IV

UNIT V
Pharmacology of Local Anaesthetics & Skeletal muscle relaxants Antipsychotics & Lithium, Antidepressants, Pharmacology of Anti-epileptic drugs, Pharmacological management of Parkinsonism & other movement disorders

UNIT VI
Drugs Acting on the Gastrointestinal Tract

UNIT VII
Principles of Toxicology: Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine, heavy metals and heavy metal antagonisits.

TEXT BOOKS
2. Bertram. G. Katzung, Basic and clinical pharmacology, 9th Edn
3. Tripathi, Text book of Pharmacology
REFERENCE BOOKS
3. J. Crossland, Lewis's Pharmacology, Church living stone.
**PHARMACEUTICAL BIOCHEMISTRY LAB**

Experiments:

1. To prepare standard buffers (citrate, phosphate & carbonate) and measure the pH.
2. Titration curve for amino acids.
4. The separation of lipids by T.L.C.
5. Identification of carbohydrates
6. Identification of amino acid.
14. Estimation of alkaline phosphatase in serum
PHARMACEUTICAL MICROBIOLOGY LAB

1. Introduction to equipment and glassware used in microbiology laboratory.
2. Preparation of various culture media.
3. Sterilization techniques and their validations.
4. Aseptic transfer of culture into different types of medias.
5. Characterisation of microbes by staining methods (simple gram’s, acid fast and negative staining) and motility testing by hanging drop method.
6. Enumeration of bacteria by pour plate/spread plate technique.
7. Enumeration of bacteria by direct microscopic count.
8. Isolation of pure cultures by streak plate, spread plate, pour plate.
9. Evaluation of antiseptics and disinfectants, sterility of pharmaceutical products as per ip requirements.
10. Observation of colony characteristics.
11. Biochemical reactions:
   i) Indole test.
   ii) Methyl red test.
   iii) Voges proskauer test.
   iv) Starch hydrolysis test.
   v) Fermentation of carbohydrates.
13. Preservation of microrganisms (slant and stab cultures)
III Year B.Pharmacy – I Sem.

CHEMISTRY OF NATURAL DRUGS LAB

1. Preparation of different alkaloid testing reagents like Dragendroff, Mayer’ Wagner’s, etc. and testing some alkaloids and plant extracts using these reagents.
2. Identification of alkaloids by specific colour tests.
3. Tests for steroids, steroidal glycosides and cardiac glycosides. Liberman- Burchard test, Salkowski reaction, Kedde reaction, etc.
4. Tests for flavanoids and their glycosides. Shinoda Test (Mg /Hcl test), Fecl₃ test.
5. TLC end examination of alkaloids, steroids, steroidal glycosides and cardiac glycosides.
7. Extraction of caffeine from tea leaves.
8. Extraction of lactose from milk.
9. Extraction of nicotine from tobacco.
10. Extraction of piperine from black pepper.
11. Extraction of lycopene from tomatoes.
12. Extraction of beta - carotene from carrots.
13. Volatile oil production by steam distillation (Demonstration only)

TEXT BOOKS

1. Indian Pharmacopoeia – 1996.
2. Weagners, Phyto Chemical Methods of Drug Analysis.
3. C.K. Kokate, Practical Pharmacognosy
PHARMACEUTICAL TECHNOLOGY - I LAB

1. Preparation, evaluation and packaging of solutions, suspensions and emulsions, ointments. Suppositories, aerosols, eye drops, eye ointments etc.
2. Formulation of various types of cosmetics for skin, hair, dentrifices and manicure preparations.