

**SYLLABUS**

**for Courses affiliated to the**

**KERALA UNIVERSITY OF HEALTH SCIENCES**

**Thrissur 680596**



**BACHELOR OF PHARMACY (B. Pharm)**

**( 2016-17 Academic year onwards)**

**Course Code:009**

**2016**

## 2. COURSE CONTENT

### 2.1. Title of course:

Bachelor of Pharmacy –B. Pharm

### 2.2. Objectives of course

The objectives of the course is to mould the student to suit the varied requirements of

- Pharmaceutical industry – Research & Development, Manufacturing, Formulation, Quality Control, Quality assurance, Packaging, Marketing.
- Practice settings in – Hospital Pharmacy, Clinical Pharmacy and Community Pharmacy.
- Academics.
- Regulatory affairs.
- Clinical Research.
- Drug discovery and development

### 2.3. Medium of instruction:

Medium of instruction and examinations shall be English

### 2.4. Course outline

The B.Pharm course is of four years duration, with University examinations at the end of each year and includes one month internship/practical training and industrial visit.

Those admitted directly to the second year, the course of study for B. Pharm course shall be for a minimum period of three academic years with University examinations at the end of each year and includes one month internship/practical training and industrial visit.

## 2.5. Duration

The course of study for B. Pharm shall be for a period of four academic year, with University examinations at the end of each year and includes one month internship/practical training and industrial visit. Direct admission of Diploma in Pharmacy holders to the second year B. Pharm course is subjected to the ceiling of approved strength of the first year course by the Pharmacy Council of India and All India Council for Technical Education. For those admitted directly to the second year, the course of study for B. Pharm course shall be for a minimum period of three academic years with University examinations at the end of each year and includes one month internship/practical training and industrial visit.

Each academic year consists of minimum 240 working days.

The working day can include hours for conducting seminars, synopsis, group discussions or such academic activities as decided by the principals/HOD s

## 2.6. Syllabus

First B Pharm

Subject code	Subject	Hours of theory per week	Hours of practical per week
1-1	Pharmaceutical chemistry I ( Inorganic and Physical chemistry )	3	3
1-2	Pharmaceutical chemistry II ( Organic chemistry )	3	3
1-3	Pharmaceutics I (Dispensing and General pharmacy )	2	6
1- 4	Human Anatomy & Physiology	3	3



1-5	Pharmacognosy-I	3	3
	Tutorials	3	
	Total number of hours /week	17	18

### Second B Pharm

Subject code	Subject	Hours of theory per week	Hours of practical per week
2- 1	Pharmaceutical chemistry –III (Advanced organic chemistry)	3	3
2- 2	Pharmaceutical Analysis -I	2	6
2- 3	Pharmaceutics –II (Physical Pharmacy)	2	3
2- 4	Pathophysiology & Health Education	2	-
2- 5	Mathematics, Biostatistics & Computer applications	4	-
2- 6	Pharmaceutical Technology ( Pharmaceutics III )	2	3
2- 7	Applied Biochemistry & Molecular Biology	3	3
	Total number of hours /week	18	18

### Third B Pharm



Subject code	Subject code	Hours of theory per week	Hours of practical per week
3- 1	Pharmaceutics IV ( Pharmaceutical Microbiology & Biotechnology)	2	3
3- 2	Pharmaceutical Chemistry IV (Chemistry of Natural Products)	3	3
3- 3	Pharmacology – I	3	3
3- 4	Pharmaceutics- V (Bio pharmaceutics &Pharmacokinetics)	2	3
3- 5	Pharmaceutical Jurisprudence	2	-
3- 6	Pharmacognosy -II	3	3
3- 7	Pharmaceutical Management	2	-
	Tutorials	3	-
	Total number of hours /week	20	15

#### Fourth B Pharm

Subject code	Subject	Hours of theory per week	Hours of practical per week
4- 1	Pharmaceutical chemistry –V ( Medicinal Chemistry )	3	3
4- 2	Pharmaceutical analysis -II	2	3
4- 3	Pharmacognosy-III	2	3



4- 4	Pharmaceutics VI ( Formulative & Industrial pharmacy)	3	6
4- 5	Pharmacology –II -	3	3
4- 6	Pharmacy Practice	2	2
4- 7	Project work	1	
	Total numbers of hours /week	16	20

## 2.7. Total number of hours

First B Pharm-

Total number of hours/week      17/ week(theory)      18/ week(Practical)

Second BPharm

Total number of hours/week      18/ week(theory)      18/ week(Practical)

Third BPharm

Total number of hours/week      20/ week(theory)      15/ week(Practical)

Fourth BPharm

Total number of hours/week      16/ week(theory)      20/ week(Practical)

The concept of health care counseling shall be incorporated in all relevant areas.

## 2.8. Branches if any with definition

Not applicable

## 2.9. Teaching learning methods

- Lecture and practical classes
- INDUSTRIAL VISIT



Students of fourth B Pharm course should visit some manufacturing houses or national research laboratories as a supplement to the academic training and submit a report to the satisfaction of the Head of institution.

- Practical training in a Pharmaceutical manufacturing house/hospital

## 2.10. Content of each subject in each year

### FIRST YEAR B PHARM

#### 1.1 PHARMACEUTICAL CHEMISTRY – I (INORGANIC CHEMISTRY)

**THEORY (3hrs/wk)**

**INORGANIC CHEMISTRY:**

1. **Introduction: (2 hours)** Pharmacopoeia and monograph.
2. **Quality control and test for purity: (4 hours)** Sources of impurities in Pharmaceutical substances.  
**Limit tests:** Definition, importance, general procedure for limit test for chlorides, sulphates, iron, arsenic, heavy metals, lead and modifications with suitable examples.
3. **Radiopharmaceuticals and contrast media: (3 hours)** Nuclear reactions, nomenclature, units and measurement of radioactivity, clinical applications and dosage, hazards and precautions, handling & storage, radio pharmaceutical preparations and standards of radioactive material iodine-131( $^{131}\text{I}$ ), Cobalt -58( $\text{Co}^{58}$ ). Radio opaque contrast medium-barium sulphate
4. **Study of pharmaceutically important compounds:** Method of preparation, properties, assay (of compounds with asterisk ), identification test, test for purity, official preparation, storage conditions and uses of inorganic compounds listed in I.P belonging to the following categories.



### **a. Gastrointestinal agents and related compounds (10 hours)**

(i) **Acidifiers:** Dilute hydrochloric acid, Ammonium chloride\*

(ii) **Antacids:** Classification, Qualities of an ideal antacid, side effects, advantages of combination therapy, acid neutralizing capacity, sodium bicarbonate\*, Potassium citrate, Aluminium hydroxide gel\*, Magnesium hydroxide\*, magnesium trisilicate, light and heavy magnesium carbonate, Calcium carbonate, Dimethicone, Magaldrate, Bismuth carbonate.

(iii) **Adsorbents and protectives:** Light Kaolin, Activated charcoal, Bismuth subcarbonate, Titanium dioxide.

(iv) **Saline cathartics:** Magnesium sulphate, Magnesium carbonate.

### **b. Topical Agents (9 hours)**

(i) **Protectives:** Talc, Zinc Oxide, Calamine, Zinc Stearate, Silicon Polymers and Dimethicone.

(ii) **Astringents:** Alum, Zinc Sulphate and Zinc chloride\*.

(iii) **Anti-microbials:** Hydrogen Peroxide\*, Potassium Permanganate, Chlorinated Lime, Boric Acid\*, Silver Nitrate, Povidone-Iodine, Selenium Sulphide\* and Zinc Undecenoate.

### **c. Dental products (3 hours)**

i. **Anti-caries Agents:** Role of Fluorides as anti-caries agents, Sodium fluoride\*.

ii. **Dentifrices:** Calcium carbonate, dibasic calcium phosphate, Zinc chloride.

### **d. Major intra and extra cellular electrolytes: ( 6 hours )**

i. Physiological role of Chloride, Phosphate, Bicarbonate, Sodium, Potassium, Calcium and Magnesium.

ii. **Electrolytes used for replacement therapy:** Sodium chloride, Potassium chloride, Calcium chloride, Calcium gluconate\*, Calcium lactate, Tribasic calcium phosphate.

iii. Physiological acid-base balance and its importance.



iv. **Electrolytes used in the acid-base therapy:** Sodium acetate, Potassium acetate, Sodium citrate, Potassium citrate, Sodium lactate, Ammonium chloride. Electrolyte combination therapy, Compound sodium chloride solution, Sodium chloride injection and Oral rehydration salt.

e. **Gases: (4 hours) Oxygen\***, Carbon dioxide, Nitrogen\* and Nitrous Oxide\*.

f. **Essential and Trace ions: (8 hours)** Definition, Physiological role of Iron, Copper, Zinc, Chromium, Manganese, Molybdenum, Selenium, Sulphur and Iodine. Ferrous fumarate, Ferrous gluconate, Ferrous sulphate\*, Iron and Ammonium citrate, Zinc chloride and Potassium iodide.

**Official formulation:** Iron dextran injection, Official solutions of iodine.

g. **Pharmaceutical Aids: (8 hours) Sodium** bisulphite, Sodium metabisulphite, oxide, Bentonite, Magnesium stearate, Aluminium sulphate, Sodium benzoate, Sodium carboxy methyl cellulose, Sodium methylparaben, Sodium lauryl sulphate, Purified water, Water for injection, sterile water for injection.

h. **Miscellaneous: (3 hours)**

i. **Sclerosing agents:** Hypertonic saline, Sodium tetra decyl sulphate.

ii. **Expectorants:** Ammonium chloride, Potassium iodide.

iii. **Sedative:** Potassium bromide.

iv. **Antidotes:** Sodium nitrite, Sodium thiosulphate, Charcoal.

v. **Respiratory stimulant:** Ammonium carbonate.

(Assay of compounds marked\* only)

5. Theory of co-ordination compounds with special reference to application in Pharmacy and Pharmaceutical analysis: EDTA, Dimercaprol, Penicillamine, 1, 10- phenanthroline

(3 hours)

## PHYSICAL CHEMISTRY

1. Solutions (**3 hours**): Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, Debye-Huckel theory.



2. Adsorption (**3 hours**): Definition, chemisorption, state of adsorbed molecule, factors influencing adsorption, types of adsorption isotherms, Freundlich, Langmuir's and Gibb's adsorption isotherms.

3. Behaviour of Gases (**3 hours**): Kinetic theory of Gases, Deviation from ideal behaviour and explanation

4. The Liquid state (**3 hours**): Physical Properties (Surface tension, Parachor, Refractive index, Optical rotation and Dipole moment)

### **PRACTICALS (3hrs/wk)**

I. Preparation of the following inorganic pharmaceuticals and their identification tests and other tests given in I.P.

a) Aluminium hydroxide b) Zinc oxide c) Barium sulphate d) Calcium carbonate e) Potassium citrate f) Boric acid g) Magnesium sulphate  
h) Ferrous sulphate.

II. Test for purity for the following:

a. Swelling property of bentonite.  
b. Acid neutralizing capacity of aluminium hydroxide gel.  
c. Ammonium salts in potash alum.  
d. Adsorption power in heavy kaolin.  
e. Presence of iodates in potassium iodide.  
f. Ferric ion and reducing sugars in ferrous gluconate.

III. Limit test for chlorides, sulphates, iron, heavy metals, arsenic and modified procedure for limit test for chloride, sulphate on potassium permanganate and sodium bicarbonate

IV. Assay of at least 5 pharmaceutically important inorganic compounds.

V. Determination of specific rotation of a compound.

VI. Determination of refractive index.

VII. Determination of partition co-efficient

**Books recommended:**



1. Bentley and Driver's Textbook of Pharmaceutical Chemistry.
2. Inorganic Medicinal and Pharmaceutical Chemistry by J.H. Block, E.B. Roche, T.O. Soine and C.O. Wilson.
3. Roger's Inorganic Pharmaceutical Chemistry by T.O. Soine and C.O. Wilson.
4. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake Vol. I.
5. Pharmaceutical Chemistry by M.L. Schroff.
6. Indian Pharmacopoeia

## 1.2 PHARMACEUTICAL CHEMISTRY-II (ORGANIC CHEMISTRY)

### THEORY (3hrs/wk)

I. **Structure and Activity of Organic Molecules:** (4hours) Shapes of organic molecules, bond lengths, bond angles and bond dissociation energies. Electronic effects in organic molecules: inductive effect, electromeric and mesomeric effect, hyperconjugation, concept of resonance. Hybridization – different types with examples.

II. **Study of the following organic compounds, including their reaction and reaction mechanisms**

a) **Hydrocarbons:** (25hours)

#### **Aliphatic/Alicyclic Hydrocarbons:**

**Alkanes:** Nomenclature, isomerism (chain, conformational and geometrical) relative stabilities (heats of combustion and hydrogenation), ring stabilities of cyclohexane, chair-boat conformation, Bayer's strain theory and Sachse-Mohr theory. Free radical substitution reactions (halogenation) of alkanes, selectivity of halogen.

**Alkenes:** Electrophilic addition reactions of alkenes, Markovnikov's rule, Kharasch effect, Bayer's oxidation (cis-hydroxylation, polymerisation).



**Alkadienes:** Stability & 1,4 addition reactions of conjugated alkadienes.

**Alkynes:** Acidity of 1-alkynes, formation of metal acetylides. Stereo specific reduction of alkynes. Addition of hydrogen halide (HCl) addition of water and keto-enol tautomerism.

**Aromatic Hydrocarbons:** Kekule's structure of benzene, bond lengths, heats of hydrogenation and stability, molecular orbital picture of benzene, aromaticity, Huckel's rule, nomenclature of benzene derivatives, characteristic reactions of benzene and theory of reactivity and orientation in monosubstituted benzenes

**b) Halogen Compounds:** ( 7 hours )

**Aliphatic:** Nomenclature, general methods of preparation, characteristic nucleophilic substitution reactions, Walden inversion, elimination reaction and Saytzeff's rule.

**Aromatic:** Nomenclature, low reactivity of halo benzenes towards nucleophilic substitution.

**c) Alcohols:** ( 5 hours ) Nomenclature, classification, general methods of preparation, physical properties, hydrogen bonding, characteristic nucleophilic substitution reactions (replacement of -

OH by -Cl), elimination reactions, Reimer Tiemann reaction and relative reactivities of 1°, 2° and 3° alcohols,

**d) Ethers:** ( 3 hours ) Nomenclature, Williamson's synthesis, action of hydro iodide acid on ethers (Ziesel's method).

**e) Phenols:** ( 5 hours ) Nomenclature, general methods of preparation, physical properties, acidity of phenols, stability of phenoxide ion, reactions of phenols, Kolbe-Schmidt reaction, stability of conjugated dienes, and Fries rearrangement.

**f) Carbonyl Compounds:** ( 12 hours ) Nomenclature, two important methods of preparation, polarity of carbonyl group, relative reactivities of carbonyl compounds, nucleophilic addition and addition-elimination reactions, oxidation-reduction reactions, aldol condensation, Cannizzaro reaction, benzoin condensation, Perkins reactions, Reformatsky reaction, Oppenauer oxidation.

**g) Carboxylic acids and their derivatives:** (7 hours)

**Carboxylic acids:** Nomenclature, intermolecular association, acidity, stability of carboxylate anion, two important methods of preparation, decarboxylation, functional groups reactions,



reduction of carboxylic acids. A note on dicarboxylic acids.

**Acid derivatives:** (acid chlorides, anhydrides, esters and amides). Nomenclature, reactions like hydrolysis, reduction of esters and amides, Hofmann's degradation of amides. Brief account of malonic and acetoacetic esters, their importance in synthesis.

**h) Nitrogen Compounds:** (7 hours)

Nitro compounds: - Nomenclature, acidity of nitro compounds containing reactions of aromatic nitro compounds.

Amines: Nomenclature, basicity of amines, classification, relative reactivity, Hinsberg method of separation, acylation reactions. Diazotisation and reactions of diazonium salts

### **PRACTICALS (3hrs/wk)**

1. Systematic qualitative analysis of organic compounds including preparation of derivative not less than 10 compounds with different functional groups.
2. Preparation of organic drugs or intermediate involving one-step reaction (at least 10 compounds).
3. Introduction to the use of stereo models.  
a) Methane b) Ethane c) Acetylene d) Ketone e) Benzene

### **BOOKS RECOMMENDED:**

1. T.R. Morrison and R.N. Boyd, Organic chemistry, Prentice Hall of India private limited, New Delhi.
2. Bruce, Organic chemistry.
3. Jerry March Advanced Organic Chemistry.
4. Practical Organic Chemistry by Mann & Saunders.
5. Jerry March, Reactions and Mechanism 4th ed.
6. I.L. Finar Vol. I. & Vol. II., The Fundamental Principles of Organic Chemistry, ELBS/Longman.P

## **1.3 -PHARMACEUTICS-I**



## (DISPENSING AND GENERAL PHARMACY)

### **THEORY (2 hours/week)**

1. Introduction to Pharmacopoeias (I.P, B.P, USP, B.P.C, NFI) with special reference to history & development of I.P. (4 hours)
2. Introduction to dosage forms- General classification, definitions and uses. (3 hours)
3. Principles of dispensing- Prescriptions, handling of prescription, Latin terms, General dispensing procedures including labeling, sources of error in prescriptions and legality of prescriptions (5hours)
4. Pharmaceutical calculations:  
Posology- Calculation of paediatric doses, enlarging and reducing recipes, percentage solutions, alligations, alcohol dilution, proof spirit. (7hours)
5. Principles involved and dispensing procedures adopted (Definition, advantages, disadvantages, ingredients, classification, theory, method (s) of preparation, containers and packaging, labeling requirements, storage) for prescription of powders, solutions, aromatic waters, mixtures, emulsions, lotions, liniments, ointments, paints, ozenges, jellies, pastes, suppositories.(19 hours)
6. Extraction and galenical products-Principles and methods of extraction, preparation of infusions, tinctures; Dry, soft and liquid extracts. (5hours)
7. Incompatibilities-Physical, chemical and therapeutic.(7hours)

### **PRACTICALS (6 hours/week)**

A minimum of 60 prescriptions should be dispensed, at least one prescription from each category.

Dispensing of prescriptions falling under the categories studied in theory maintaining complete record of each

Identification and rectification of incompatibilities in prescriptions



## **BOOKS RECOMMENDED:**

1. Dispensing for Pharmaceutical Student; S.J.Carter;12<sup>th</sup> edition; CBS publishers & distributors.
2. Ansel's Pharmaceutical Dosage Forms & Drug Delivery Systems; Loyd.V.Allen,Nicholas.G.Popovich,Howard.C.Ansel;8<sup>th</sup> edition; Lipincott Williams & Wilkins.
3. Remington: The Science & Practice of Pharmacy; 21<sup>st</sup> edition;Lipincott Williams & Wilkins.
4. Pharmaceutical Practice; Diana.M.Collett, Michael.E.Aulton, Churchill Livingstone.
5. Bentley's text book of Pharmaceutics: E.A.Rawlins;8<sup>th</sup> edition;English language book society.
6. Cooper and Gunn's Tutorial Pharmacy;S.J.Carter;6<sup>th</sup> edition; CBSPublishers & Distributors.
7. Pharmacopoeias (I.P, B.P, U.S.P, B.P.C, NFI, Martindale Extra Pharmacopoeia)

## **1.4 HUMAN ANATOMY AND PHYSIOLOGY**

### **THEORY (3hrs/week)**

(Discussion of anatomy with a brief overview of microscopy in each system)

#### **1. Introduction (1 hour)**

Definition, scope of anatomy and physiology, description of body and basic

Terminologies

#### **2. General anatomy and physiology (3 hours )**

Cell, cell junctions, transport mechanisms, homeostasis, ion channels, secondary messengers.

#### **3. Tissues (6 hours)**

Definition, classification of tissues, their location, characteristics and functions, electrophysiology of muscle.

#### **4. Human skeleton (5 hours)**

Structure, composition, classification and function of bones. Identification and few salient features of important bones of axial and appendicular skeleton. Classification of joints, types of movements, disorders of joints (Definitions only)

#### **5. Body fluids and blood (8 hours)**

Body fluids, composition and functions of blood including their disorders,



haemopoiesis, mechanism of coagulation, bleeding and clotting disorders, blood grouping and its significance, blood transfusion, lymphatic system and reticuloendothelial system.

**6. Cardio Vascular system (6 hours)**

Anatomy and physiology of heart, blood circulation, cardiac output, cardiac cycle, heart rate, blood pressure, electrocardiogram, heart sounds and Cardiovascular disorders. (Definitions only)

**7. Digestive system (6 hours)**

Gross anatomy of G.I. Tract and its physiology with special reference to liver, pancreas and stomach, digestion, absorption, movements of intestine, gastrointestinal hormones, disorders and disorders of digestive system (definitions only)

**8. Respiratory system (6 hours)**

Anatomy of respiratory tract, mechanism of respiration, regulation of respiration lung volumes and capacities, transport of oxygen and carbondioxide, artificial respiration, resuscitation methods and disorders of respiratory system (definitions only).

**9. Urinary system (5 hours)**

Structure and functions of kidney and urinary tract, physiology of urine formation, micturition reflex and acid base balance. Disorders of urinary system (definitions only).

**10. Reproductive system (6 hours )**

Structure and function of male and female reproductive system, sex Hormones, physiology and menstruation, coitus, fertilization, Spermatogenesis, oogenesis, pregnancy and parturition. Disorders of Reproductive system (definitions only).

**11. Endocrinology (7hours)**

Introduction, chemistry and action of hormones, basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenal and pancreas. Local hormones. Disorders of these glands (definitions only).

**12. Nervous system (13 hours)**

a. Introduction, neurons, classification and properties of nerve fibres, neuroglia, receptors, synapses and neurotransmitters.





b. Central nervous system – Structure and function of brain and spinal cord, functions of cerebrum, cerebellum, vital centers of medulla oblongata, CSF and cerebral ventricles, cranial nerves and their functions. Disorders of CNS (definitions only).

c. Autonomic nervous system-Anatomy, physiology and division of autonomic nervous system.

13. **Sense organs: (3 hours)** Anatomy and physiology of eye, ear, skin, nose and tongue.

Disorders related to sense organs (definitions only).

### **Human Anatomy and Physiology (Practical)**

#### **2 Hours/week**

1. Study of compound microscope.
2. Identification of bones and points of identification
3. Study of different systems with the help of charts and models.
4. General techniques in Haemocytometry
5. Enumeration of Red Blood Corpuscles(RBC)
6. Determination of White Blood Corpuscles (WBC)
7. Estimation of hemoglobin
8. Estimation of Differential Leukocyte Count(DLC)
9. Estimation of Erythrocyte Sedimentation Rate (ESR)
10. Determination of Blood groups.
11. Determination of Bleeding and Clotting time
12. To record human heart rate and pulse rate.
13. Measurement of blood pressure and to study the effect of posture and exercise on blood pressure.
14. Recording of human body temperature.
15. Determination of tidal volume & vital capacity.
16. Experiments related to special senses.

#### **Recommended Books**



1. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson.
2. Physiological basis of Medical Practice-Best and Tailor.
3. Text book of Medical Physiology-Guyton and Hall.
4. Principles of Anatomy and Physiology by Tortora Grabowski.
6. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje
7. Textbook of Human Histology by Inderbir Singh
8. Human Anatomy & Physiology by Tortora

### **1.5 PHARMACOGNOSY –I**

#### **THEORY [3 hrs/week]**

1. Significance of medicinal plants in Pharmacy. Introduction to Ayurvedic and Herbal Pharmacopoeas (1 Hour)
2. Microscopy- (2 Hours) Basic methods employed for preparation of plant material for microscopic examinations. Reagents, special staining techniques for various cell constituents including chromosomes, clearing agents and mountants
3. Definition, history, scope and development of pharmacognosy. (2 hours)  
Sources of drugs, biological, marine, mineral, plant and tissue culture as source of drugs.
4. Classification of drugs: alphabetical, morphological, taxonomical, chemical and pharmacological. (2 hours)
5. Plant taxonomy: (8 hours) Study of following families with special reference to medicinally important plants, Apocynaceae, Solanaceae, Umbelliferae, Leguminosae, Rubiaceae, and Labiatae.
6. 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- plant hormones and their applications- polyploidy, mutation, and hybridization with reference to medicinal plants. (12 hours)
7. Systematic pharmacognostic study of following. (10 hours)



- a) Carbohydrates and derived products: Agar, guar gum, acacia, Ispaghula, pectin, starch and tragacanth.
- b) Lipids: Coconut oil, Sesame oil, castor oil, cocoa butter, hydnocarpus oil, linseed oil, rice bran oil
8. Study of drugs containing resins and resin combinations: (10hours) colophony, podophyllum, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of peru, benzoin, turmeric, ginger.
9. Study of tannins and tannin containing drugs: (2 hours) Bahera, catechu and myrobalan.
10. Volatile oils: (10hours) General methods of obtaining volatile oils from plants and their classification, general properties, chemical nature and chemical tests. Study of volatile oil containing drugs - mentha, coriander, cinnamon, cassia, lemon peel, orange peel, lemon grass, caraway, dill, clove, fennel, nutmeg, eucalyptus, cardamom, valerian, sandal wood.
11. Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass wool, polyester and asbestos. (5 hours)
12. Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, and natural colours. (4 hours)
13. Drugs of animal origin: (7 hours) Shellac, cochineal, Cantharides, Spermaceti, Wool fat, Honey, Beeswax, Cod liver oil and shark liver oil.

### **PRACTICALS**

**(3hrs/wk)**

1. Identification and morphological study of drugs mentioned in theory. (Any 15)
2. Microscopic studies of cell constituents: starch grains, calcium oxalate crystals and Phloem fibres.
3. Chemical tests for the identification of following drugs and adulterants in them.
 

[a] Acacia	[b] Agar	[c] Tragacanth	[d] Starch
[e] Honey	[f] Asafoetida	[g] Benzoin	[h] Myrrh
4. Isolation of any one volatile oil mentioned in theory by hydrodistillation method
5. Preparation of Herbarium sheets (Two per students)



6. Tests for identification of adulterants in

- [a] Castor oil [b] Shark liver oil [c] Wool fat [d] Bees wax  
[e] Sesame oil

7. Taxonomical studies of following plant families mentioned in theory.

- [a] Apocynaceae [b] Solanaceae [c] Labiatae [d] Rubiaceae

8. Histological studies of following organised drugs mentioned in theory.

- [a] Cinnamon [b] Clove [c] Eucalyptus  
[d] Fennel [e] Ginger

9. Cultivation of any one medicinal plant

### **Books Recommended**

1. Wallis TE, Text book of Pharmacognosy, J&K Churchill limited, London.
2. Wallis TE, Analytical Microscopy, J & K Churchill limited, London.
3. Trease and Evans WC, Pharmacognosy, Bailliere Tindall, Eastbourne UK
4. Kokate CK, Purohit AP and Gokhale SB, Pharmacognosy (Degree), Nirali prakashan, Pune.
5. Kokate CK, Practical Pharmacognosy, Vallabh Prakasan, Delhi.
6. Harborns JB, Phytochemical methods, Chupman and Hall, International edition, London.
7. Atal CK and Kapoor BM, Cultivation and Utilisation of Medicinal Plants, RRL, Jammu.
8. Martindale, The Extra Pharmacopoeia, Pharmaceutical society of great Britain, London.
9. Indian Herbal Pharmacopoeia, Indian drug manufacturers association, Mumbai.
10. The Ayurvedic Pharmacopoeia of India volume : I – V, Government of India, Ministry of Family and Welfare, Department of Indian System of Medicine & Homeopathy, New Delhi.
11. Medicinal plants of India, Indian Council of Medical Research, New Delhi.



12. Ashutosh kar, Pharmacognosy & Pharmacobiotechnology, New age international publishers, New Delhi.
13. Tyler VE, Brady R, Pharmacognosy.
14. Ansari SH, Essentials of Pharmacognosy, Birla publications Pvt Ltd, Delhi.
15. Wagner SB, Zgainsky, Plant drug analysis.
16. Vinod D. Rangari, Pharmacognosy and Phytochemistry, Part I – II; Career Publications, Nashik.

## SECOND YEAR B PHARM

### 2.1 PHARMACEUTICAL CHEMISTRY - III (ADVANCED ORGANIC CHEMISTRY)

**THEORY 3 hrs/wk**

#### **1. Stereochemistry: (23 hours)**

a) Optical isomerism:

Stereoisomerism, Definition, Tetrahedral carbon, chirality, relative and absolute configurations and sequence rule. Conventions used in stereochemistry. Lexicon of elements of symmetry, racemic modifications, properties, resolution of racemic modifications and conformational analysis. Walden inversion and stereo mutation Asymmetric synthesis, stereospecific and stereoselective synthesis.

b) Geometrical isomerism:

Nature, rotation about a carbon-carbon double bond. Modern theory of double bonds, Nomenclature of isomers and determination of configuration.

c) Stereochemistry of cyclic compounds including Biphenyl compounds .

d) Stereochemistry of Nitrogen compounds, amines and oximes.

e)  $E_1$  &  $E_2$ ,  $SN_1$  &  $SN_2$  and Addition Reactions.



**2.A study of the mechanism and application in synthesis of the following named reactions:  
(23 hours)**

Catalytic hydrogenation, dehydrogenation, metal hydrate reduction. Reduction with hydrazine and its derivatives, Birch reduction, Mannich reaction, Michael addition reaction, Hoffmann rearrangement. Curtius rearrangement, Clemmenson's reduction. Meerwin – Pondroff reduction, oxidation with perchloric acid, lead tetra acetate, mercuric acetate and selenium oxide, Beckmann rearrangement, Schmidt rearrangement, Darzen's reaction.

**3.Heterocyclic chemistry: (23 hours)**

Classification of Heterocyclic compounds, nature and nomenclature. Preparation and important reactions of Pyrrole, furan, thiophene, pyrazole, Pyrazine, Pyridazine, imidazole, oxazole, isoxazole, thiazole, pyridine, pyrimidine, indole, quinoline, isoquinoline, acridine, phenothiazine, azepines, diazepines, dibenzazepines\*, Oxepines, Quinolones\* and Quinazolones\* (reactions of groups marked \* not required)

**4. Polynuclear aromatic hydrocarbons: (6 hours)**

Nomenclature, structure and aromatic character of naphthalene, anthracene, phenanthrene and naphthacene. Resonance structures, electron density and reactivity. Electrophilic substitution, oxidation and reduction reactions.

**PRACTICALS (3hrs/wk)**

I. Synthesis of some simple heterocyclic compounds.

- a. 3, 5-Dimethylpyrazole
- b. 1,2,3,4 - tetrahydrocarbazole
- c. Quinaxoline



d. Benzotriazole

e. 7-hydroxy, 4-methyl coumarin

## II Molecular rearrangements and named reactions

a. Benzimidazole from o-phenylenediamine (Phillip's Reaction).

b. o-hydroxyacetophenone from phenyl acetate (Fries migration)

c. Benzanilide from benzophenone oxime (Beckmann's rearrangement)

d. Preparation of 2-phenylindole from Phenylhydrazine by Fischer's method.

III. Workshop on molecular modelling of elements of symmetry, optically active compounds and geometrical isomers.

IV. Quantitative determination of organic compound via functional groups such as phenolic, carboxylic acid, aldehyde, amines, ketone, ester. Determination of equivalent weight of carboxylic acid.

### **BOOKS RECOMMENDED:**

1. R. Morrison and R. Boyd, Organic chemistry, Pub by Printice Hall of India, New Delhi.
2. I. L. Finar, Organic Chemistry, Vol. I. & II, 6th Pearson education
3. O.P. Agarwal, Reactions and Reagents
4. Eliel, Stereochemistry of Organic compounds.
5. Arun Bahl & S.S. Bahl, Advanced Organic Chemistry
6. Jerry March, Advanced Organic Chemistry 4th Ed.
7. Cram & Hammond. Organic Chemistry.
8. A.I. Vogel, A textbook of practical organic chemistry
9. Solomons, Organic Chemistry

## **2.2 -PHARMACEUTICAL ANALYSIS -I**



## THEORY (2 hrs/wk)

**Introduction:** ( 4 hours ) Importance of quality control, different techniques of analysis, preliminaries and definitions, significant figures, concept of error, precision, accuracy, mean and standard deviation, calibration of analytical equipments, fundamentals of volumetric analysis, methods of expressing concentrations, primary and secondary standards.

**1. Neutralization titrations:** ( 10 hours ) Acid-base concepts, relative strength of acids and bases, law of mass action, common ion effect, ionic product of water, pH, Henderson–Hasselbach equation, buffer solutions, theory of indicators, neutralization curves, choice of indicators, mixed and universal indicators, titration of polyprotic system

**2. Non-aqueous titrations:** (6 hours) Theoretical basis, types of solvents, scope, limitations, preparation and standardization of titrant solutions used in non-aqueous titrations of weak acid and weak bases.

**3. Precipitation titrations** (6 hours) Principles of precipitation titrations, solubility product, effect of acids, temperature and solvent on the solubility of precipitate. Argentometric titrations- different methods, and mercurimetric titrations.

**4. Complexometric titrations:** (6 hours) Complexation, chelation, Werner's co-ordination number, stability of complexes, titration curves, importance of buffer, types of complexometric titration, methods of end point detection. pM indicator, masking and demasking agents.

**5. Oxidation – reduction titrations:** ( 8 hours ) Concepts of oxidation–reduction, standard oxidation potential, Nernst equation, theory of redox titrations, redox indicators, titrations involving ceric ammonium sulphate, potassium permanganate, titanous chloride, sodium–2,6–dichlorophenol–indophenol, iodimetry, iodometry,

## 2.2 -PHARMACEUTICAL ANALYSIS -I

## THEORY (2 hrs/wk)

**Introduction:** ( 4 hours ) Importance of quality control, different techniques of analysis, preliminaries and definitions, significant figures, concept of error, precision, accuracy,





mean and standard deviation, calibration of analytical equipments, fundamentals of volumetric analysis, methods of expressing concentrations, primary and secondary standards.

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**6. Gravimetric analysis:**(6hours)Basic concepts, precipitation techniques, organic and inorganic precipitants, co-precipitation, post-precipitation. Various steps involved in gravimetric analysis. Thermogravimetry. Pharmaceutical applications.

Determination of barium sulphate as barium sulfate, calcium as calcium oxalates, Magnesium as magnesium pyrophosphate, silver as silver chloride.

**7. Miscellaneous methods:** ( 4 hours )1. Diazotisation titrations 2. Kjeldhal method of nitrogen estimation 3. Oxygen Flask combustion method 4. Gasometry 5.Karl Fischer method.

### **PRACTICALS (6hrs/wk)**

1. Standardization of analytical weights and calibration of volumetric apparatus.



2. Preparation and standardization of volumetric solutions and assay of official compounds involving Acidimetry, Alkalimetry, Permanganometry, Cerimetry, Iodimetry, Iodometry, Chromatometry, Argentometry, Complexometry and Gravimetry. At least 10 primary standard solution to be prepared and used for 10 different assays strictly as per IP including older editions.

#### **RECOMMENDED BOOKS:**

1. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake.
2. Quantitative analysis by V. Alexeyev.
3. Vogel's Textbook of Quantitative Inorganic Analysis.
4. Indian Pharmacopoeia.
5. Jenkins Quantitative Pharmaceutical Chemistry
6. Fundamentals of Analytical Chemistry by Skoog, West and James Holler.

### **2.3 PHARMACEUTICS II (PHYSICAL PHARMACY)**

#### **Theory: 2 hrs /week**

1. Diffusion and Dissolution – (5 hours) Fick's laws, Dissolution and dissolution test apparatus.
2. Surface and interfacial phenomena: (6 hours)
  - a) Liquid interfaces- surface and interfacial tensions, measurement, electrical properties of interface, surface free energy spreading coefficient
  - b) Surface active agents- HLB classification, solubilization, adsorption at liquid solid and gas interfaces
3. Dispersions systems: (12hours)
  - a) Colloids- Definition, types, optical, kinetic and electrical properties, preparation, purification, stability.
  - b) Coarse dispersions:



(i) Suspensions – Theory of sedimentation, wetting of particles, Flocculation, Deflocculation and controlled flocculation, Sedimentation parameters

(ii) Emulsions – Theories of emulsification, phase volume ratio, Stability stability problems and stabilization. Classification of emulsifying agents, evaluation of emulsions

4. Viscosity and Rheology: (7hours)

a) Newtonian systems- properties

b) Non Newtonian systems- Plastic, Pseudo plastic, Dilatant, Thixotropy

c) Measurement of viscosity- Viscometers- capillary, Falling sphere, Cup and Bob, Cone and Plate.

5. Kinetics and Drug Stability (10 hours)

Orders and rates of reaction, Half-life determination, Zero order, Apparent zero order, Pseudo first order and First order –Effect of temperature, light, solvent reaction kinetics.

Accelerated stability studies- Stability problems, stabilization technique of pharmaceutical dosage forms, Expiration dating.

6. Micromeritics and Power rheology(8 hours)

Particle size and size distribution, Methods of determination- Optical microscopy, Sieving, sedimentation

Particle volume-Coulter coulter

Particle surface area-Air permeability, Adsorption

Derived properties of powders- Porosity, Packing arrangement, Bulkiness, Flow properties, Densities-Carr's index, Hausner ratio, dosage form design.

7. Complexation methods for enhancement of solubility, Applications in Pharmacy Protein binding – Kinetics of protein –drug binding (2 hours)

**Practicals: 3 hrs/week**

Determination of interfacial properties-Surface tension,



HLB value, Critical micellar concentration.

Effect of viscosity on sedimentation rate. Preparation of various types of suspensions and determination of their sedimentation parameters.

Determination of particle size, size distribution and surface area using various methods of size analysis.

Determination of rates of reactions.

Study of derived properties of powders- Densities, porosity, compressibility, Angle of repose.

Study of emulsions- globule size analysis and stability.

Study of different types of complexes.

Accelerated stability testing, shelf life determination.

**References:**

1. Physical Pharmacy. Alfred Martin; Fourth edition; Lippincott Williams & Wilkins
2. Remington, The Science and practice of pharmacy; 21<sup>st</sup> edition; Lipincott williams & wilkins
3. Cooper and Gunn's Tutorial Pharmacy; S.J.Carter; 6<sup>th</sup> edition; CBS publishers & Distributors.
4. Pharmaceutics, The Science of dosage form design: Micheal.E.Aulton; 2<sup>nd</sup> edition ; English language book society/churchill livingstone.
5. Encyclopedia of Pharmaceutical technology; James.C.Boylan; 2<sup>nd</sup> edition; Marcel Dekker INC.

**2.4 - PATHOPHYSIOLOGY & HEALTH EDUCATION**

THEORY(2 hours/week)

**A: PATHOPHYSIOLOGY**

1. Basic principles of cell injury and adaptation: Causes of cellular injury, pathogenesis, morphology of cell injury, and cell death. Reversible and irreversible cell injury. Cellular



adaptations Ex: - Atrophy, Dysplasia, Hyperplasia, Metaplasia & hypertrophy. Intercellular alterations in lipids, proteins, and carbohydrates.(8 hours )

2.Inflammation and repair: Alterations in vascular permeability and blood flow. Migration of WBC, acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.(6 hours )

3. Etiology, Pathophysiology & clinical significance of common diseases: Hypertension, CCF, Angina, AMI, Atherosclerosis, Asthma, Diabetes Mellitus, Peptic ulcer, Ulcerative colitis, Hepatic disorders, Anemia, Acute and chronic renal failure, Rheumatoid arthritis, Gout, Epilepsy, Mania, Depression, Psychosis, Urinary tract infections, Tuberculosis, Sexually transmitted diseases.(8 hours )

4. Neoplasms: Brief account on the etiology and pathogenesis of cancer. Characteristic features that differentiate benign and malignant neoplasms. Classification of important categories of neoplasms (3 hours)

## **B:HEALTH EDUCATION**

1.Concept of health and disease: Definition of physical health, mental health, social health spiritual health, determinants of health, indicators of health, concept of disease, natural history of disease, the disease causing agents and prevention of diseases. (5 hours)

2.Nutrition: Classification of food requirements, Balanced diet, Nutritional deficiency disorders, their treatment and prevention.( 2 hours )

3.Environment and Health: Sources of water supply, specifications for drinking water, purification of water, water pollution, health and air, noise light – solid waste disposal and control – medical entomology, arthropod borne disease and their control, rodents, animals and diseases.(2 hours )

4.National immunization schedule, principles of disease control and prevention, hospital acquired infection, prevention and control. (2 hours)

5.Demography and Family planning: Demography cycle, Fertility, Family planning, Contraceptive methods. Legal aspects of Medical termination of pregnancy. (2 hours)



6. Communicable diseases: Causative agents, modes of transmission, Symptoms and prevention - Chicken pox, Measles, Influenza, Diphtheria, Whooping cough, Tuberculosis, Poliomyelitis, Hepatitis, Cholera, Typhoid, Food poisoning, Helminthiasis, Malaria, Filariasis, Rabies, Trachoma, Tetanus, Leprosy, Syphilis, Gonorrhoea and AIDS. (7 hours)

7. Non-communicable diseases: Etiology, preventive measures and control – Cancer, Diabetes Mellitus, Blindness, Cardiovascular diseases. (2 hours)

8. First aid: Emergency treatment of Shock, Snake bite, Burns, Heart diseases (AMI & LHF), Fractures and Resuscitation methods, General methods of treatment of Poisoning. (3 hours)

#### **BOOKS RECOMMENDED:**

1. Text book of Pathology and Therapeutics for Pharmacists Russel J Greene and Norman D Harris.

2. Text book of Basic pathology by Robbins S.L Kumar V & Cotran.

3. Text book of Preventive and Social Medicine by K. Park.

4. Text book of Clinical Pharmacy & Therapeutics by Roger Walker & Clive Edwards.

5. Text book of pathology – N C Dey and T K Dey.

6. Text book of Pharmacotherapeutics by Joseph T Dipiro.

7. Text book of Pathology by Harsh Mohan

### **2.5 MATHEMATICS, BIostatISTICS & COMPUTER APPLICATIONS**

**(4 hrs/week)**

1. CALCULUS: (20 hours)

a) DIFFERENTIAL: - Limits and functions, definition of differential coefficient, differentiation of standard functions, Logarithmic differentiation, Parametric differentiation and Successive differentiation.



b) INTEGRAL :- Integration as inverse of differentiation, indefinite integrals of standard forms, Integration by parts, substitution and partial fraction, formal evaluation of definite integrals.

c) DIFFERENTIAL EQUATIONS

Revision of integral calculus, Definition and formation of differential equations, equations of first order and first degree variable separable, homogenous and linear differential equations of higher order with constant coefficients, Complimentary function and particular integral.

2. LAPLACE TRANSFORM: (4 hours) Definition, Properties of Laplace Transform, Laplace Transform of certain function, Inverse Laplace Transform, Applications to differential equations.

3. BIOSTATISTICS: (10 hours) Collection and classification of data, Diagrammatic representation of data, Bar chart pie diagram, Frequency polygon, Frequency curve, and Cumulative frequency curves.

4. MEASURES OF CENTRAL TENDENCY :- (6 hours) Mean, Median, Mode, Measures of dispersion, Standard deviation, Coefficient of variation, Concept of probability and events, Bayes theorem, Probability distributions, Binomial and Poisson distribution, Normal distribution curve – correlation and regression analysis, Method of least squares, Statistical inferences, Student's t-test, F test and elements of ANOVA.

**COMPUTER APPLICATIONS**

1. Computer Hardware- Brief overview of input devices and output devices- Key board, Mouse, trackball, OCR, VDU, Printers, Plotters & Scanners, etc. (8 hours)

2. An outline of modern computing devices- Computer architecture, embedded systems and their applications. (2 hours)

3. Softwares: types of software – System, application and Custom software.  
Operating systems- Types of Operating systems and their functions.(3hours)



4. Programming languages – Machine language, Assembly language, High level Languages, Compilers and interpreters. (10 hours)
5. Computer Memory: Primary and secondary memory, Secondary storage devices-Floppy, CD, DVD, Flash Drive, etc. (4 hours)
6. Computer Networks – LAN, WAN, MAN, Inter and Intranet, wireless network, the World Wide Web, e-mails, web browsers, Search engines and servers. (15 hours)
7. Introduction to Office softwares- Use and illustration of Word processing, presentation, spreadsheet and database management softwares including RDBMS (7 hours)
8. Pharmacoinformatics: Information systems and virtual library, Drug and poison information services, Application of computers in Pharmacy – Drug design and development, manufacture and In-process and Quality Control, Pharmacokinetics, Hospital, Community and Clinical Pharmacy, medication history storage and retrieval, dispensing of prescriptions, Pharmaceutical Research and Education. (Theory should be supplemented with practical training)(11 hours)

#### BOOKS RECOMMENDED:

1. Pharmaceutical statistics, David Jones
2. Mathematics for B.Pharm students, Frank Publication.
3. Computer Science Sumitha Arora. Dhanpathraj & Co.
4. Fundamentals of Computers. V Rajaraman. Prentice-Hall of India.
5. Bioinformatics 2000, Higgins and Taylor, OUP
6. Chemical space navigation in lead discovery by Tudor I Opera
7. Database management and information systems, by Henry Korth

### **2.6 PHARMACEUTICS III ( PHARMACEUTICAL TECHNOLOGY )**

**Theory 2 hrs/ week**





1. Materials handling: (6 hours) Liquid handling- Different types of pumps. Reciprocating, Rotary, centrifugal and diaphragm pumps. Gas handling- various types of fans, blowers and compressors. Solid handling- Storage bins. Hoppers and conveyers.

2. Heat transfer: (6 hours) Sources and uses of heat in Pharmaceutical Industry. Use of steam as a heating medium. Conduction- Fourier's law of heat conduction through variable area like pipes, spheres etc. Convection- Natural and forced convection. Flow of heat through liquids and equation for rate of heat transfer. Concept of individual film co-efficient. Overall heat transfer coefficient. Log mean temperature difference. Heat exchangers

3. Mechanical separation: (7 hours)

(a) Filtration and centrifugation- theory of filtration, filter media. filter aids, industrial filters including filter press, filter leaf, rotary filter, edge filter etc.

Principles of centrifugation: Industrial centrifugal filters and centrifugal sedimenters.

(b) Size reduction and size separation: Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills including ball mill, hammer mill, fluid energy mills etc.

4. Evaporation (4 hours) Factors affecting evaporation- Types of evaporators- short tube, forced circulation and film evaporators. Single effect and multiple effect evaporators.

5. Distillation. (3 hours) Raoult's law, Volatility, simple, steam and flash distillation. Principles of rectification, azeotropic and extractive distillation.

6. Drying (4 hours) Moisture content and mechanism of drying, rate of drying and time of drying. Classification and types of dryers. tray, vacuum, tunnel, rotary, fluidized bed, spray, and drum dryers. Principles of freeze drying.

7. Humidification: (5 hours) Basic concepts and definition. Wet bulb and adiabatic saturation temperature. Humidity chart and measurement of humidity. Equipments for dehumidification operations.

8. Mixing: (4 hours) Theory of mixing. Mixers for powders, pastes and liquids



9. Materials of construction: (6 hours) Classification, Applications, Advantages and disadvantages. General study of composition, corrosion resistance & properties with special reference to stainless steel & glass. Brief overview of corrosion and its prevention.

10. Industrial hazards and safety precautions: (5 hours) Mechanical. Chemical & Electrical. Life and dust hazards, industrial dermatitis. Accident records etc.

### **PRACTICALS (3 hours/ week)**

1. Determination of rate of filtration and study of factors affecting filtration including filter aids.
2. Determination of humidity-Use of dry bulb and wet bulb thermometers and psychrometric charts
3. Determination of overall heat transfer co-efficients.
4. Experiments based on simple, steam and azeotropic distillation. Determination of vaporization efficiency.
5. Determination of rate of drying. Free moisture content and equilibrium moisture content.
6. Screen analysis of powders.
7. Sedimentation in liquids.
8. Particle size analysis using principles of settling (beaker decantation, pipette analysis)
9. Determination of rate of evaporation.
10. Experiments to illustrate solid -solid mixing, determination of mixing efficiency using different types of mixers.
11. Experiments to illustrate principles of size reduction, laws governing energy and power requirement of size reduction.

### **BOOKS RECOMMENDED:**

1. Unit Operations of Chemical Engineering. McCabe and Smith
2. Introduction to Chemical Engineering. Badger and Banchero.
3. Cooper and Gunn's Tutorial Pharmacy; S.J.Carter; 6<sup>th</sup> edition ;CBS publishers & Distributors.



4. Pharmaceuticals, The Science of dosage form design: Micheal.E.Aulton; 2<sup>nd</sup> edition ; English language book society/Churchill Livingstone.
5. Remington, The Science and practice of pharmacy; 21<sup>st</sup> edition; Lipincott williams& Wilkins

## 2.7. APPLIED BIOCHEMISTRY AND MOLECULAR BIOLOGY

### THEORY (3hrs/week)

#### 1. Introduction to biochemistry: (2hours)

- a. Cell organelles and its biochemical functions
- b. Transport process across the cell membranes

#### 2. Bioenergetics: (5 hours)

- a. Concept of free energy: determination of change in free energy from equilibrium constant; Redox potential.
- b. Energy rich compounds; ATP, Cyclic AMP, their production and biological significance

#### 3. Enzymes (12 hours)

- a. Definition; Nomenclature; IUB classification
- b. Properties of enzymes
- c. Factor affecting enzyme activity
- d. Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)
- e. Enzyme inhibitors with examples
- f. Mechanism of enzyme action and theories of enzyme action
- g. Allosteric enzymes, Enzyme induction and repression



- h. Isoenzymes and their diagnostic applications
- i. Industrial, therapeutic and diagnostic applications of enzymes
- j. Coenzymes –Vitamins as co enzymes and their biochemical significance, Metals as co enzymes and their biochemical significance

#### **4. Biological oxidation (5 hours)**

- a. Enzymes and co-enzymes involved in Biological oxidation.
- b. Electron transport chain (its mechanism and role).
- c. Oxidative phosphorylation (its mechanism) and substrate level phosphorylation
- d. Inhibitors ETC and Uncouplers or inhibition of oxidative phosphorylation

#### **5. Carbohydrate metabolism (13 hours)**

- a. Definition, classification, chemistry (Structures and chemical tests for identification) of glucose, fructose, sucrose, lactose and maltose should be discussed.) Biological role of carbohydrates. Biological conversion of polysaccharides to glucose-1- phosphate.
- b. Glycolysis and significance
- c. Citric acid cycle- significance, reactions and energetics of the cycle, amphibolic role of the cycle, glyoxalic acid cycle.
- d. HMP shunt and its significance
- e. Glycogen metabolism (Glycogenolysis and glycogenesis)
- f. Gluconeogenesis and its significance
- g. Various shuttle systems (glycerol – phosphate & malate - aspartate)
- h. Hormonal regulation of carbohydrate metabolism
- i. Diabetes mellitus and glycogen storage diseases

#### **6. Lipid metabolism (13 hours)**



- a. Definition, classification, chemistry and biological role of lipids
- b.  $\beta$ -Oxidation of saturated and unsaturated fatty acids
- c. Ketone bodies metabolism (Ketogenesis and ketolysis) and ketosis
- d. Biosynthesis of fatty acids (*De novo*), essential fatty acids, eicosanoids ( prostaglandins, thromboxanes, and leukotrienes.)
- e. Metabolism of cholesterol (Biosynthesis and degradation)
- f. Atherosclerosis, fatty liver and hypercholesterolemia
- g. Phospholipids and Sphingolipids (Chemistry, biosynthesis, significance)

#### **7. Amino acid metabolism (10 hours)**

- a. Definition, classification, biosynthesis and biological role of amino acids
- b. Transamination, deamination & decarboxylation, assimilation of ammonia
- c. Urea cycle and its metabolic disorders, Nitrogen balance
- d. Metabolism of sulfur containing amino acids
- e. Catabolism of tyrosine, tryptophan, phenylalanine and their metabolic disorders
- f. Synthesis and significance of biological substances; creatine, histamine,
- g. 5-hydroxy Tryptophan (5-HT), dopamine, noradrenaline, adrenaline
- h. Bile pigments; hyperbilirubinemia (Metabolism of heme)

#### **8. Nucleic acid metabolism (5 hours)**

- a. Definition, chemistry and biological role of nucleosides, nucleotides
- b. Biosynthesis of purine and pyrimidine nucleotides
- c. Catabolism of purine and pyrimidine nucleotides

#### **9. Molecular Biology (10 hours)**



- a. Informational macromolecules
- b. Structure of DNA and significance as genetic material
- c. Central Dogma of Molecular Biology
- d. RNA, structure, types and significance in protein synthesis
- e. DNA replication, types and details on semi conservative model
- f. Transcription, Translation and regulation of gene expression
- g. Mutation and DNA damage and repair mechanism
- h. A brief account of genetic engineering and polymerase chain reaction.
- i. Structure and function of chromosomes and a brief account of its disorders
- j. Genetic code
- k. Molecular basis of disease diagnosis-DNA detection methods, Immunological methods

### **Practicals ( 3hrs/wk)**

#### Qualitative experiments

1. Qualitative analysis of carbohydrates (Glucose, fructose, lactose, maltose, sucrose).
2. Qualitative analysis of Proteins (Casein, Albumin, Gelatin, and Peptone)
3. Qualitative analysis of normal constituents of urine.
4. Qualitative analysis of abnormal constituents of urine.

#### Quantitative experiments

5. Quantitative estimation of proteins by Biuret method.
6. Quantitative estimation of urine sugar by Benedict's reagent method.
7. Quantitative estimation of urine chlorides by Volhard's method.
8. Quantitative estimation of urine creatinine by Jaffe's method.
9. Quantitative estimation of urine calcium by precipitation method.
10. Quantitative estimation of blood sugar Folin-Wu tube method.



11. Quantitative estimation of blood creatinine by Jaffe's method
12. Quantitative estimation of serum cholesterol.
13. Estimation of Urea in Serum.
14. Estimation of SGOT in serum.
15. Estimation of SGPT in serum.
16. Determination of Salivary amylase activity.
17. Study the effect of pH and temperature on salivary amylase activity.
18. Preparation of standard buffer solutions (citrate, phosphate, and carbonate) and its pH measurements

**Recommended Books:**

1. Principles of Biochemistry by Lehninger.
2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayan and U.Chakrapani
5. Outlines of Biochemistry by Conn and Stumpf
6. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
7. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
8. Practical Biochemistry by Harold Varley.
9. Laboratory manual of Biochemistry by Pattabiraman and Sitaram Acharya

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**THIRD YEAR B PHARM**

**3.1.PHARMACEUTICS IV**

**(PHARMACEUTICAL MICROBIOLOGY AND BIOTECHNOLOGY)**

**Theory 2 hrs/Week**



1. Introduction to the scope of microbiology. (1 hour) Microscopy-compound, dark field, phase contrast, UV, fluorescence and electron microscopy.

2. Classification of microbes and bacterial taxonomy. (12 hours) Elementary study of important pathogenic microorganisms, biochemical methods for identification.

a) Structure of bacterial cell. Endospores and mechanism of spore formation. L forms.

Identification methods of microbes; stains and types of staining techniques.

b) Bacterial Nutrition, cultivation of bacteria. Culture media, its classification with examples. Aerobic and anaerobic culture methods. Isolation of Pure culture.

c) Classification & Structure of Viruses. Cultivation of Viruses, Viral replication. Virus-Host interactions. Bacteriophages, phage typing. Bacteriocins.

d) Introduction to fungi of Medical and pharmaceutical importance. Fungal reproduction and cultivation.

3. Microbial genetics and variation. (6 hours) Isolation of mutants, factors influencing rate of mutation. Genetic recombination: Transformation, Conjugation, Transduction, Protoplast fusion. Gene Cloning and their Applications, introduction to the methods of rDNA technology, Introduction to transgenesis and its applications.

4. Immunity.(9 hours) Primary and Secondary defensive mechanisms of body, microbial resistance. Interferons.

a) Immunological Preparations: Principles, Antigens and Haptens, Immune System, Cellular and Humoral Immunity, Antibodies, Immunological Tolerance. Hypersensitivity.

Active and Passive immunization, Vaccines and Sera, their preparation, standardization and storage. Development of Hybridoma for Monoclonal Antibodies.

b) Antigen – Antibody reactions and their applications.

5. Control of microbes by Physical and Chemical methods: (8 hours)





a) Disinfection, factors influencing disinfectants, dynamics of disinfection, Evaluation of Disinfectants.

b) Sterilisation- different methods, validation of sterilisation methods and equipments.

Sterility testing of pharmaceutical products as per the I.P.

6. a) Antibiotics:(3 hours) Antimicrobial Spectrum and methods used for standardization. Microbial assay of antibiotics.

b) Fermentation technology; (5 hours) Basic principles of fermentation, isolation and screening of industrially important microbes, types of fermentation, downstream process, Fermenter design and control of different parameters. Fermentation process. Screening of soil for organisms producing antibiotics. Extraction of fermentation products with special reference to Penicillin, alcohol, amylase and Vitamin B<sub>12</sub>.

7. Enzyme immobilization:(3 hours) Techniques of immobilization of enzymes.

8. Microbial transformation(3 hours) Introduction, Types of reactions mediated by microorganisms, selection of organisms, Biotransformation process and its improvements with special reference to steroids.

### **Practicals: 3 hrs/week**

1. Experiments devised to prepare different types of culture media, distribution of microorganisms in the environment, sub culturing of various aerobic and anaerobic bacteria.

2. Aseptic transfer and isolation of pure culture.

3. Demonstration of bacterial motility by hanging drop experiment

4. Various staining methods-Simple, Gram, Negative staining.

5. Demonstration of biochemical activities of microorganisms

6. Antigen-Antibody reaction.

7. Sterility testing as per I.P



8. Microbial sensitivity testing and assay of antibiotics.

**Books recommended:**

1. "Prescott, Harley & Klein's Microbiology"
2. "Pharmaceutical Microbiology" W.B Hugo and A.D Russel.
3. "Text book of Microbiology" R. Anantha Narayanan and C.K Panicker.
4. "Industrial microbiology" L E Casida.
5. "Pharmaceutical Biotechnology" O Kayser, R H Muller.
6. "Industrial Microbiology: Fundamentals and applications" Agarwal and Purohit.
7. "Microbiology- A Laboratory Manual" James G Cappuccino
8. "Laboratory manual in microbiology" P Gunasekharan

**3.2. PHARMACEUTICAL CHEMISTRY –IV  
(CHEMISTRY OF NATURAL PRODUCTS)**

**THEORY 3hrs/wk**

**1. Carbohydrates: ( 13 hours )** Definition, classification, nomenclature, relative configuration of some important monosaccharides, mutarotation, structure determination of glucose and fructose , ring structure of glucose, determination of ring size oxidation-reduction reactions, osazone formation, action of barium hydroxide, epimerization, Lobry De Bruyn – Van Ekenstein reaction, structure of sucrose, maltose, lactose, properties of sucrose, glycosidic linkage, non-reducing nature; structure of starch, cellulose, cellulose derivatives and deoxy sugars.

A brief account on pharmaceutical importance of various carbohydrates.

**2. Proteins and Amino acids: (10 hours)** Amino acids: Definition, classification, essential amino acids, configuration, important methods of preparation of amino acids, physical properties-



Zwitter ionic nature, isoelectric point, chemical properties, peptides, peptide synthesis and determination of structure of peptides [End group analysis]

Proteins: Definition, classification, denaturation, primary, secondary and tertiary structure of proteins. pharmaceutical importance of amino acids, polypeptides and proteins.

**3.Terpenoids: (4 hours)**Introduction,classification, isoprene rules, chemistry and uses of geraniol, alpha-terpineol,camphor, ionones.

**4.Alkaloids: (7 hours)**Introduction, Chemical classification, general isolation, Structural elucidation of alkaloids-General methods, chemistry  
Structural elucidation and pharmacological activity of  
Atropine, morphine, &ephedrine

**5.Glycosides: (3 hours)**Introduction, Chemistry of Cardiac glycosides including their chemical structures with SAR, Chemistry of saponins.

**6.Vitamins: (8 hours)**Classification, structural elucidation, chemistry and pharmaceutical uses of vitamin A, D, B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub> and C.

**7.Purines: (4 hours)** Chemistry and structural elucidation of uric acid &caffeine.  
Inter-relationship of caffeine, theobromine and theophylline.

**8. Fats &Oils: (4 hours)**Introduction, Analytical constant of fats &oils, methods for their determination & significance.

**9. Steroids: (5hours)** Introduction, Nomenclature of steroids, stereochemistry and numbering the ring system. Chemistry of cholesterol, ergosterol, &bile acids.

**10. Hormones: (15hours)**



**a)** Estrogens – Structures & inter-relationship of estrone, oestradiol, & oestriol. Synthesis and uses of non-steroidal estrogenic compounds

**b)** Progesterone – structure and uses. Synthesis of Progesterone from cholesterol.

Steroidal oral contraceptive agents

**c)** Androgens – Structure and biological activities & uses of Testosterone and synthetic anabolic steroids

**d)** Hormones of Thyroid: Skeletal structure, biological activities of Thyroxine and triiodothyronine

**e)** Adrenal Cortex Hormones:

Mineralocorticoids: Structure, biological activities and uses of Aldosterone,

Glucocorticoids: Cortisone & Hydrocortisone – Structure, biological actions and uses of important synthetic corticosteroids.

**f)** Hormones of Pancreas:

Insulin – Introduction, structural features – some sequence differences in insulins of some species like humans, pork, beef.

Glucagon – Structure and Physiological role.

**11. Prostaglandins-** (2hours) Introduction, biological importance and structures of Prostaglandins

### **PRACTICALS (3hrs/wk)**

1. Identification of alkaloids by specific colour tests.
2. Tests for steroids and cardiac glycosides. Liberman- Burchard test, Salkowski reaction, etc.
3. Tests for flavanoids and their glycosides.
4. Determination of chemical constituents of fats & oils  
(Acid value, Saponification value, Iodine value, Acetyl value and peroxide value of fixed oils)



5. Analysis of proteins: C-terminal & N- terminal analysis.
6. Synthesis of simple peptides
7. Estimation of drugs coming under alkaloids, antibiotics, vitamins & other pharmaceutically significant products of natural origin.

### **BOOKS RECOMMENDED**

1. O.P. Agarwal, Natural products Vol.1 & 2, Goel publications – Meerut.
2. JB Harborne, Phyto Chemical methods.
3. I. L Finar, Organic chemistry, Vol. II, the English language book society, London, New Delhi.
4. RT Morrison and R.N BOYD, Organic chemistry, Allyn and Bacon, inc., Boston
5. Me – Wolf, ed., Burger's medicinal chemistry, J. Wiley & sons, NY.
6. F.G. Mann & B. Saunders, Practical Organic chemistry Longmans green & Co. Ltd., UK.
7. RM. Acheson, an introduction to the chemistry of heterocyclic compounds

### **3.3. PHARMACOLOGY I**

#### **Theory(3hrs/wk)**

#### **A) General pharmacology**

##### *a. Introduction ( 2 hours )*

History of pharmacology, definitions of Drugs,proprietary name,non-proprietary name, pharmacotherapeutics, pharmacokinetics, pharmacodynamics, posology, toxicology, bioequivalence,(Definition only) chemotherapy, drug interaction, adverse drug reactions & pharmacovigilance (Defenition only),Pharmacoeconomics (Definition only), pharmacoepidemiology,orphan drugs



*b. Routes of drug administration ( 3 hours )*

Routes of drug administration and factors governing choice of routes: Oral, parenteral, and local routes, transdermal drug administration, Newer drug delivery systems, targeted delivery and drug eluting stents

*c. Pharmacokinetics:(7hours)*

1.Absorption -Absorption of drugs- Biological membranes, different membrane transport mechanism, Transmembrane transporters,Bioavailability, factors influencing drug absorption&bioavailability.

2. Distribution - distribution of drugs,volume of distribution ,redistribution.  
Barriers of distribution .Plasma protein binding of drugs& clinical importance.  
Tissue storage of drugs

3.Biotransformation- Biotransformation of drugs, microsomal enzyme induction and inhibition.Factors affecting metabolism. Prodrugs, first pass metabolism, enterohepatic cycling of drugs

4.Excretion- Excretion of drugs.

*d. Pharmacodynamics:(10hours)*

1.General mechanism of drug action,Molecular mechanism of drug action  
Enzymes as targets of drug action, dose response relationship  
Structure activity relationship.



2. Drug receptors-Receptor theories, affinity, efficacy, agonists, antagonists, partial agonists, inverse agonists; spare receptors, silent receptors, receptor up regulation & down regulation, desensitization

3. Receptor subtypes: Types of receptors-Ionotropic, metabotropic, kinase linked, gene transcription regulating receptors

4. Dose response relationship-graded and quantitative relationship, LD50, ED50, therapeutic index, therapeutic window, margin of safety

Combined effect of drugs-Additive effect, synergism, drug receptor antagonism.

Factors modifying drug action

*e) Drug dose & dosage: (1 hour) Fixed dose combination-Advantages & disadvantages. Banned drugs*

*f) Rational use of medications, rational prescribing irrationalities in prescription P drug concept and P treatment, essential drugs, spurious drugs, expiry dates of medication (1 hour)*

*g). Pharmacogenetic variation in drug action (1 hour)*

*h) Principles of Toxicology (2 hours)*

1. Definition of poison, general principles of treatment of poisoning.

2. Heavy metals and their antagonists.

3. Definition for acute, sub-acute and chronic toxicity, genotoxicity, Carcinogenicity, teratogenicity and mutagenicity studies. Acute, subacute and chronic toxicity and genotoxicity studies, various organ toxicities



*i. Drug interactions(3 hours) .Definition, epidemiology, classification & pharmacological mechanisms of drug interactions with suitable examples and management*

*j. Adverse effects of drugs (3hours)*

Adverse drug reactions: Definition and classification, epidemiology, predisposing factors, mechanism of adverse drug reactions,

Drug allergy-Mechanism, types and treatment

Drug dependence: Tolerance, habituation, addiction, treatment

*k. Pharmacology of drugs in special groups- (1hour)*

Pregnancy, lactation pediatrics and elderly

*l. Chronopharmacology (1hour)*

Definition of rhythm and cycles, Biological clock and their significance leading to chronotherapy

## **B) Pharmacology of following classes of drugs**

Emphasize on classification, molecular mechanism of action, pharmacological actions, pharmacokinetics, adverse effects, contraindications, drug interaction, clinical uses, preparation and dosages

*1. Drugs acting on autonomic nervous system (13hours)*

a. Cholinergic system –Neurotransmitters of cholinergic transmission, receptors of acetylcholine, cholinergic drugs, anticholineesterases, anticholinergic drugs, ganglionic stimulants and blockers, neuromuscular blocking drugs,drugs in myasthenia gravis

b. Adrenergic system –Nor adrenergic transmission& neurotransmitters,Adrenergic receptors, adrenergic drugs , antiadrenergic drugs





c. Ocular pharmacology: Mydriatics, miotics and drugs used in glaucoma

*2. Autocoids and their antagonists: (3hours)*

Histamin, antihistamins, 5HT, 5HT blockers. Renin -Angiotensin system and drugs modifying it.  
Kinins, enkephalins, prostaglandins and other polypeptides

*3. Cardiovascular drugs (8 hours)*

a. Cardiac glycosides, management of digitalis toxicity, drugs for heart failure, Pharmacotherapy of heart failure.

b. Antiarrhythmic drugs and pharmacotherapy of cardiac arrhythmias.

c. Vasodilators and antianginal drugs and pharmacotherapy of angina pectoris.

d. Hypolipidemic drugs and plasma expanders

e. Anti-hypertensive drugs and pharmacotherapy of hypertension

*4. Drugs acting on respiratory tract: (3hours)*

Mucolytic agents, Antitussives, Expectorants, Drugs for bronchial asthma, Pharmacotherapy of bronchial asthma.

*5. Drugs acting on endocrine system: (13hours)*

Anterior pituitary hormones, Thyroid hormones & antithyroid drugs, Parathyroid hormones. Insulin & oral antidiabetic agents, Pharmacotherapy of diabetes mellitus. Adrenal cortical steroids, Gonadotropins, Oestrogens & Progesterones. Antifertility agents & ovulation inducing agents. Androgens, antiandrogens & anabolic steroids

**Pharmacology I (Practical)**



### 3 Hours/Week

1. Commonly used instruments in experimental pharmacology.
2. Common laboratory animals and anesthetics used for animal studies.
3. Physiological salt solutions and their preparation
4. Preparation of stock solutions of drugs and their dilutions
5. Handling of experimental animals, weighing and calculation of dose of a drug to be administered.
6. Some common and standard techniques.
  - a. *Bleeding (blood withdrawal), and intravenous injection, intramuscular injection, intraperitoneal injection, intragastric administration*
  - b. *Procedures for rendering animal unconscious (CPSCEA guideline) and chemical euthanasia.*
7. Study of different routes of drugs administration in mice/rats.
8. To study the effect of hepatic microsomal enzyme inhibitors and inducers on the phenobarbitone sleeping time in mice.
9. Effect of autonomic drugs on rabbit's eye.
10. To record CRC of acetylcholine by using suitable skeletal / smooth muscle preparations.
11. Study of agonistic/potential of drug action using suitable isolated tissue preparation
12. Study of drug antagonism using suitable isolated tissue preparations.
13. Experiments based on computer models like Expharm.
14. Estimation of bioavailability parameters viz AUC, Tmax, Kel from blood and urine samples in laboratory animals (rabbits)
15. Study of the effect of drugs on dog blood pressure using graphical recordings using computer models like Expharm
16. Study of the effect of drugs on frog heart using computer models/ graphical recordings.

#### **Recommended Books:**

1. Pharmacology by Rang. M.P. Dale, M.M, Reter J.M.
2. Pharmacology and Pharmacotherapeutics by Satoskar R.S and Bhandarkar S.D.



3. Goodman and Gilman's, The pharmacological basis of therapeutics by Gillman G, Rall T.W., Nies A.I.S, and Taylor P.
4. Hand book of Experimental Pharmacology by Kulkarni.S.K.
5. Chronopharmacology by B. Lammer.
6. Topics of Molecular Pharmacology I and II by Nurger and Roberts.
7. Essentials of medical pharmacology by K.D.Tripathi.
8. Essentials of Pharmacotherapeutics by F. S. K. Barar.
9. Basic & Clinical Pharmacology by Katzung B.G.
10. Lippincott's illustrated Reviews- Pharmacology by Mycek M.J, Gelnet S.B and Perper M.M.
11. Fundamentals of Experimental Pharmacology by M. N. Ghosh.
12. Pharmacological Experiments on intact preparations by Macleod L.J.
13. Drug Discovery and evaluation by Vogel H.G.

### **3.4 -PHARMACEUTICS V**

#### **(BIOPHARMACEUTICS AND PHARMACOKINETICS)**

**Theory 2 hrs/week**

*1. Introduction to Biopharmaceutics and Pharmacokinetics.( 16 hours )*

Biopharmaceutics – Biopharmaceutical classification system

Significance of plasma – drug concentration.

Absorption – passage of drugs across biological barriers.

(Passive diffusion, Active transport, Facilitated diffusion, Endocytosis and Pinocytosis)

Pharmacokinetics of drug absorption-zero order and first order absorption rate constants

Method of residuals. Factors influencing absorption –physicochemical and pharmaceutical.

*2. Distribution – (6hours)*



Factors affecting distribution, physiological barriers for distribution, volume of distribution. Plasma protein binding.

### 3. Elimination- (18hours)

Biotransformation – phase I and phase II reactions

Excretion –Mechanism of renal clearance, Concept of clearance, Clearance ratio, Determination of renal clearance, Dosage adjustment in patient with renal failure, Extraction ratio, Hepatic clearance, Biliary excretion, Entero Hepatic Circulation. Factors affecting elimination.

4. Compartment models- ( 10 hours ) Definition, One compartment model- IV Bolus, IV Infusion, Extra-Vascular administration. Determination of pharmacokinetic parameters from plasma and urine data. Two compartment model- IV Bolus- determination of pharmacokinetic parameters

Non-linear pharmacokinetics- One compartment model IV Bolus administration, Michaelis-Menten equation.

Measurement of Bioavailability-  $C_{max}$ ,  $t_{max}$ , AUC.

Design of single dose Bioequivalent study, dissolution and disintegration testing

*In vitro-in vivo* correlation.

## **PRACTICALS**

**3 hrs/week**

1. Determination of partition coefficient of drugs with different buffer/ solvent systems
2. Diffusion study of drugs using egg membrane and artificial membrane
3. Dissolution study of tablets as per the official monographs



4. Experiments to illustrate mechanism of absorption using isolated organs
5. Experiments to study transdermal permeation of drugs using Franz diffusion
6. In vitro study of protein binding of drugs
7. In vitro study of one compartment model for I V bolus and oral administration of drugs
8. In situ absorption study of drugs using animal model
9. In vivo absorption / bioavailability study of oral liquid dosage forms using animal models
10. Determination of pharmacokinetic parameters using given data of plasma/ urine concentration – time profile.

**Books recommended:**

1. Shargel L and Yu AB, Applied Bio-Pharmaceutics and Pharmacokinetics, Appleton & Lange
2. Rowland M and Tozer TN, Clinical Pharmacokinetics concepts and applications, 3<sup>rd</sup> Edn, Lea & Febiger
3. Rodney J Y Ho, Milo Gibaldi “Biotechnology & Biopharmaceuticals”
4. Gibaldi M, Bio-Pharmaceutics and Clinical Pharmacokinetics, 4<sup>th</sup>edn. Lea and Febiger
5. Brahmkar and Jaiswal, Bio-Pharmaceutics and Pharmacokinetics – A Treatise, 2<sup>nd</sup> Edn, Vallabh Prakashan

### **3.5- PHARMACEUTICAL JURISPRUDENCE**

**Theory: 2 hrs/ week**

*1. Introduction: (3hours)*

Definition and scope of Forensic Pharmacy.

Pharmaceutical legislation in India. Historical developments.



Pharmacist's role in drug treatment and drug usage.

Pharmacist as a member of the Health Care Scheme.

Professional ethics in Pharmacy practice. Legal and ethical responsibilities of pharmacists.

*2. A detailed study of the following Acts and their significance to the profession of Pharmacy(23 hours)*

(a) Pharmacy Act.

(b) Drugs and Cosmetics Act.

(c) Medicinal and Toilet preparations (Excise Duties) Act and Rules.

(d) Narcotic Drugs and Psychotropic Substances Act.

(e) Drugs and Magic Remedies (Objectionable Advertisements) Act.

*3. A brief study of the following Acts and their significance in Pharmacy(16hours)*

(a) Drugs Prices Control Order.

(b) A.I.C.T.E. Act.

(c) Patents Act.

(d) Trade and Merchandise marks Act.

(e) States Shops and Establishments Act.

(f) Minimum Wages Act.

(g) Factories Act.

(h) Prevention of Food Adulteration Act and Rules.

(i) Prevention of Cruelty to Animals Act.

(j) Medical Termination of Pregnancy Act.

(k) The Poisons Act.

*4. Assignment Topics: (8hours)*



Drug tragedies. Drug poisoning, drug accidents and drugs in suicides. Committee reports on drug accidents.

Trade names. Combination preparations, banned drugs & combinations.

Newly introduced and out dated drugs.

Important case decisions published in drug cases relating to various topics covered in the subject.

#### **REFERENCES:**

- 1.All Acts and Rules including the latest amendments as per syllabus. Published by the Government of India
- 2.A Textbook of Forensic Pharmacy by N K Jain.
- 3.A Textbook of Forensic Pharmacy by B M Mithal.

### **3.6- PHARMACOGNOSY-II**

#### **THEORY [3 hrs/week]**

1.Study of the biological sources, cultivation, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic, macroscopic and microscopic features and specific chemical tests of the following groups of drugs containing glycosides: ( 12 hours )

Saponins: Liquorice\*#, Ginseng, Dioscorea\* and Sarasparilla

Cardioactive sterols: Digitalis\*#, Squill\*, Strophanthus, Thevetia#

Anthraquinone cathartics: Aloes\*, Senna\*#, Rhubarb and Cascara.

Others: Psorelea, Gentian\*, Saffron\* and Quassia.



2. Studies of traditional drugs, common vernacular names, botanical sources, morphology, and chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of indigenous drugs: (8 hours)

Amla, Kantakari, Satavari, Tylophora, Bhilwa, Arjuna, Asokha, Kalijiri, Rasna, Punarnava, Apmarg, Gokhru, Shankapushpi, Brahmi, Methi, Lahsun, Palash, Guggal, Gymnema, Shilajit, Chitrak, Sida and Neem.

3. Introduction to alternative systems of medicine. (4 hours) The Holistic concept of drug administration in traditional system of medicine. Introduction to Ayurvedic preparations like Asavas, Gutikas, Tailas, Choornas, Lehyas and Bhasmas.

4. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid containing drugs: (16 hours)

Tropane: Belladonna\*#, Hyoscyamus, Datura\*#, Coca and Withania.

Quinoline & Isoquinoline: Cinchona\*#, Ipecac#, Opium\*.

Indole: Ergot\*, Rauwolfia\*#, Catharanthus# and Physostigma.

Imidazole: Pilocarpine.

Steroidal: Veratrum and Kurchi\*.

Alkaloidal amines: Ephedra\*# and Colchicum\*.

Glycoalkaloid: Solanum

Purines: Coffee\* and Tea\*

(Cultivation, collection of drugs marked \* only)(Detailed microscopical studies of drugs marked # only)

5. General techniques of biosynthetic studies and basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance. Shikimic acid pathway, Acetate mevalonate Pathway, Isoprenoid synthesis(7 hours)





6.Introduction, classification and study of different chromatographic methods and their application in evaluation of herbal drugs. (10hours)

7.Preparation of the extracts and various extraction techniques including super critical fluid extraction. (6hours)

8.Chemotaxonomy of medicinal plants.(2hours)

9.Marine pharmacognosy, novel medicinal agents from marine sources. (3hours)

10.Plant allergens and allergenic substances. (4 hours) Classification and preparation of allergenic extracts.

11.Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, Papain, Bromalein, Maltase ( 2 hours )

12.Protein containing drugs: Gelatin, Collagen, spirulina ( 1 hour )

### **PRACTICALS**

**[3 hrs/week]**

1. Identification & morphological study of crude drugs listed in theory. (Any15)
2. Microscopic study (T.S.) of crude drugs listed in theory (at least 5)
3. Standardization of some traditional drugs and their formulations – Asavas, arishtas, churnas, lehyas, gutikas.
4. Chromatographic techniques (demonstration only)

[a] Paper chromatography



[b] Thin layer chromatography

[c] Column chromatography

5. Identification of following crude drugs by powder microscopy studied in theory.

[a] Cinchona

[b] Ephedra

[c] Digitalis

[d] Senna

[e] Valerian

[f] Vinca

[g] Rauwolfia

[h] Quassia

7. General and specific chemical test for

[a] Alkaloids

- Atropine, Quinine, Caffeine

[b] Cardiac glycosides

- Digitoxin, Digoxin

[c] Saponins

- Glycyrrhizin

[d] Anthraquinon Glycosides -

- Sennosides, Aloin

[e] Flavonoid Glycosides

[f] Cynogenetic Glycosides

8. Chemical Assays:

a) Aldehyde content of volatile oil.

b) Ester value of volatile oil.

c) Phenol content of volatile oil.

d) Alkaloidal assay.

9. Phytochemical screening of formulations

**Books Recommended:**



1. Bain KR, and Turner TD, Practical Evaluation of Phytopharmaceuticals  
"Wright scintechica Bristol"
2. Trease and Evans WC, Pharmacognosy Lea & Febiger. Philadelphia.
3. Wallis TE. Analytical microscopy. J & A Churchill limited London.
4. Tyler VC, Brady LR and Robert JE, Pharmacognosy, Lea & Febiger Philadelphia.
5. Atal CK and kapur BM, cultivation and utilization of medicinal plants, RRL, Jammu.
6. Harborne JB. Biochemistry of phenolic compounds. Acadmic press  
New York.
7. Harborne JB, Phytochemical methods, Chapman and Hall, International Edition,  
London.
8. Iyengar MA study of crude drugs. Manipal power press. Manipal
9. Iyengar MA and Nayak SGK. Anatomy of crude drugs. Manipal power press. Manipal
10. Iyengar MA, Pharmacognosy of powdered crude drugs, Manipal press.  
Manipal.
11. Kokate CK, Practical Pharmacognosy. Vallabh Prakashan. Delhi.
12. Kokate CK, Purohit AP and Gokhale SB. Pharmacognosy (Degree)  
Nirali Prakashan, Pune.
13. Agarwal SS, Paridhavi M, Herbal Drug Technology. Orient Longmann  
Pvt. Ltd. Hyderabad.
14. Ansari S. H, Essentials of Pharmacognosy. Birla publications Pvt Ltd.  
Delhi.
15. Ashutosh kar, Pharmacognosy & Pharmaco biotechnology, New age  
international publishers, New Delhi.
16. Zafar R, Medicinal Plants of India, CBS Publisher, New Delhi.
17. Indian Herbal Pharmacopoeia, Indian drug manufacturers association,  
Mumbai.
18. The Ayurvedic Pharmacopoeia of India volume : I – V, Government of  
India, Ministry of Family and Welfare, Department of Indian System of  
Medicine & Homeopathy, New Delhi.



19. Medicinal plants of India, Indian Council of Medical Research, New Delhi.

### **3.7- PHARMACEUTICAL MANAGEMENT**

(PHARMACEUTICAL INDUSTRIAL MANAGEMENT AND REGULATORY AFFAIRS)

#### **Theory 2hrs/week**

1. Accountancy- (3hours) Accounting concepts and conventions, Preparation of journals, ledgers, cashbooks.
2. Trade- (9hours) Different types of trade. Procedure for import and export of goods. Pharmaceutical Marketing. Functions, buying and selling, transportation, storage, feedback information, channels of distribution, wholesale, retail, departmental stores, multiple shops and mail order business.
3. Salesmanship – (6 hours) Principles of sales promotion, advertising ethics of sales, merchandising, literature, detailing, recruitment, training, Evaluation, compensation to the pharmacist.
4. Management –(9hours) Principles of management, administrative and productive management, HR and Financial management, Market research. Measuring and forecasting market demand.
5. Industrial material management- (8 hours) Basic principles, purchase, raw material stores, inventory control.



6. Good Manufacturing Practice-(7 hours )Definition. cGMP in manufacturing, facilities, quality audit, design, development and process validation methods for Pharmaceutical operations involved in production of tablets.

7. Stability testing protocols –for various pharmaceutical products.  
Protocols- for bioavailability and bio equivalence studies (5hours)

8. Intellectual property rights, New Drug Applications and Abbreviated New Drug Applications.  
(3hours)

#### **REFERENCES:**

1. Pharmaceutical Marketing in India by S.V Subba Rao
2. Marketing Management by Philip Kotler, Printice Hall publication
3. Accountancy and Commerce by T. Krishna Rao and V V Varma
4. Principles and methods of Pharmacy Management by Smit
5. Principles of Pharmaceutical Marketing by Smith. Lea and Febiger
6. Pharmaceutical Industrial Management by R M Mehta

### **FINAL YEAR B PHARM**

#### **4.1. PHARMACEUTICAL CHEMISTRY - V (MEDICINAL CHEMISTRY)**

**THEORY (3hrs/wk)**

**1.Physicochemical properties in relation to biological action: (5hours)**



Ionization, Drug distribution and pKa, Hydrogen bonding, Protein binding, Chelation, Isosterism, Optical and Geometrical isomerism, Steric Effect and Redox potential.

## 2. Principles of Drug Design (5 hours)

Traditional analog, Quantitative structure activity relationship (QSAR) and mechanism based approaches. Applications of Quantum mechanics, Computer aided drug Designing (CADD) and Molecular modeling.

## 3. Basic Concepts and Applications of Prodrug Design( 2 hours )

4. Study of Classification, Mechanism of Action, Structure activity relationship, uses and Synthesis of selected drugs (Only drugs marked with asterisk) on the following categories of drugs:

- a) **General Anaesthetics:** (2 hours) Halothane\*, Diethyl ether, Thiopentone Sodium, Thiamylal sodium\*, Ketamine.
- b) **Local Anaesthetics:** (2 hours)Benzocaine, Procaine, Lignocaine\*, Mepivacaine, Dibucaine\*, Phenacaine.
- c) **Anxiolytics, Sedatives and Hypnotics:**(3 hours)Chlordiazepoxide, Diazepam\*, Oxazepam, Alprazolam, Triclofos Sodium, Buspirone.
- d) **Antipsychotics:** (3 hours)Chlorpromazine\*, Thioridazine, Prochlorperazine\*, Chlorprothixene, Thiothixene, Haloperidol, Risperidone.
- e) **Anticonvulsants:**( 2 hours ) Phenytoin\*, Fosphenytoin, Trimethadione, Ethosuximide, Carbamazepine, Sodium Valproate\*, Clonazepam
- f) **Antidepressants:** (2 hours)Imipramine\*, Amitryptiline, Doxepine\*, Fluoxetine.
- g) **Adrenergic agents:**(3hours) Adrenaline \*, Isoprenaline, Salbutamol\*, Naphazoline, Xylometazoline.
- h) **Adrenergic antagonists:**(1 hour)Tolazoline, Prazosin, Propranolol\*, Metoprolol\*.



- i) **Cholinergic Drugs:**(2hours) Acetylcholine, Carbachol\*, Neostigmine, Pyridostigmine\*.
- j) **Cholinergic Blocking agents**(2hours)Cyclopentolate\*, Dicyclomine\*, Clidinium bromide, Propantheline bromide.
- k) **Antipyretics:** (1 hour ) Aspirin, Salsalate, Paracetamol\*
- l) **Narcotic Analgesics:**(2hours) Morphine, Codeine, Levorphanol, Pethidine\*, Pentazocine.
- m) **Non-steroidal anti-inflammatory agents:**(3hours)Oxyphenbutazone, Indomethacin\*, Ibuprofen\*, Diclofenac, Naproxen, Piroxicam\*, Nimesulide.
- n) **Antihistaminic agents:**(3hours) Diphenhydramine\*, Tripelenamine, Chlorpheniramine, Triprolidine, Promethazine\*, Cyclizine\*, Cetrizine, Astemizole.
- o) **H<sub>2</sub> Receptor antagonist and Proton Pump Inhibitors:**(1hour) Cimetidine, Ranitidine, Famotidine, Omeprazole, Pantoprazole.
- p) **Diuretics (3Hours)** Acetazolamide, Hydrochlorothiazide, Furosemide\*, Ethacrynic acid, Spironolactone, Triamterene\*, Indapamide\*.
- q) **Antihypertensive agents ( 2 hours )**Methyl dopa\*, Hydralazine, Diazoxide, Enalapril, Nifedipine, Losartan.
- r) **Antihyperlipidemic Agents:**(1hour)Clofibrate, Niacin, Lovastatin, Ezetimibe.
- s) **Oral Hypoglycemic agents and Antithyroid drugs:** ( 2 hours ) Tolbutamide\*, Glipizide, Metformin\*, Glimepride, Rosiglitazone, Carbimazole\*.
- t) **Local Anti infective agents:**(1hour) Liquified Phenol, Benzalkonium chloride, Chlorhexidine.
- u) **Antifungal agents:** (1 hour)Griseofulvin, Clotrimazole, Fluconazole, Tolnaftate\*.
- v) **Antitubercular agents:**(1hour) INH\*, PAS\*, Pyrazinamide, Ethionamide.
- w) **Antiprotozoal agents:**(1hour) Metronidazole\*, Tinidazole, Diloxanide.
- x) **Anthelmintics:**(1hour) DEC\*, Mebendazole\*, Niclosamide, Ivermectin.
- y) **Antimalarials:**(2hours) Chloroquine\*, Hydroxychloroquine, Mefloquine, Trimethoprim, Sulfadoxine.
- z) **Sulfonamides and Sulfones:** (3hours) Sulfacetamide\*, Sulfapyridine, Sulfamethoxazole, Sulfamethizole, Silver Sulfadiazine\*, Sulfasalazine, Dapsone\*, Solapsone.



aa) **Antibiotics:** ( 7 hours )

Chloramphenicol \*

Penicillin and Cephalosporins: Methicillin, Ampicillin\*,

Carbencillin, Cephalexine, Cefaclor, Cefotaxime.

Tetracyclines

Fluoroquinolones: Ciprofloxacin, Norfloxacin.

Macrolide Antibiotics: Azithromycin.

**bb) Antiviral agents:**(2hours) Amantadine, Idoxuridine, Acyclovir\*, Zidovudine, Saquinavir, Ribavirin.

**cc) Antineoplastic agents:**(4 hours) Chlorambucil, Cyclophosphamide, Carmustine, Thiotepea, Busulfan, Dacarbazine, Methotrexate\*,

6-mercaptopurine, 5-flourouracil\*, Tamoxifen, Cisplatin, Azathioprine.

**PRACTICALS (3 hrs/wk)**

- 1) Synthesis of selected drugs involving two or more steps and study spectral analysis of drugs synthesized ( At least SIX drugs)
- 2) Establishing the Pharmacopoeial Standards of drugs synthesized.
- 3) Identification and estimation of drug metabolites from biological fluids ( 3 Experiments)
- 4) Determination of Partition coefficient, Dissociation constant and Molar refractivity of compounds for QSAR analysis ( At least 3 experiments)
- 5) Workshop on drug design softwares.

**Books recommended:**

- 1) Burger's Medicinal Chemistry Volume 1-6.
- 2) Remington's Pharmaceutical Sciences 20th Edition.
- 3) Medicinal Chemistry by Wilson and Gisvold.
- 4) The Organic Chemistry of Drug Synthesis by Lednicer Volume 1-5.





- 5) Medicinal Chemistry by W. A. Foye.
- 6) Indian Pharmacopoeia 2007, Volume I – III.

#### 4.2. PHARMACEUTICAL ANALYSIS II (MODERN METHODS OF PHARMACEUTICAL ANALYSIS)

##### **THEORY (2 HRS /WK)**

Theoretical consideration and application in drug analysis and quality control of the following analytical techniques.

##### **1.Chromatography (15hours)**

- i) **Column chromatography:** Adsorption and Partition theory, preparation, procedure and methods of detection.
- ii) **Thin layer chromatography:** Theoretical consideration, preparation, procedure and detection of compounds.
- iii) **Paper chromatography:** Theory of partition, different techniques employed and different grades of papers used, quantitative and qualitative detection.
- iv) **Gas Chromatography:** Introduction, fundamentals of column operation and detection.
- v) **Ion Exchangers:** Types of exchangers, mechanism of ion exchange and column operation.
- vi) Counter current extraction, ultra centrifugation and gel filtration.
- vii) HPLC and HPTLC.

**2.Potentiometric titrations:** (1hour)Introduction, Electrochemical cells, half-cells, electrodes, measurement of potential and application in pharmaceutical analysis.

**3.Conductometric titrations:** (1hour) Basic concepts, different types of conductometric titrations, apparatus used and applications in Pharmaceutical Analysis.



**4. Thermal Analysis:**(1hour) Basic Concepts and Applications in Pharmaceutical Analysis.

5. **Polarography:** (1hour)Basic concept, theoretical considerations, Basic instrumentation, apparatus, principles, general polarography analysis and applications in pharmaceutical analysis.

**6. Amperometry:** (1hour)Amperometric titrations with one polarized electrode, general procedure, titration curves and applications.

**7. Electrophoresis:** (1hour)Principle, instrumentation and application.

**8. Turbidimetry and Nephelometry:** (1hour) Theory of light scattering, Nephelometry, Turbidimetry for Practical Analysis of dispersions, study of the working principles of instrument used for analysis and applications in Pharmacy.

**9. Theoretical aspects, basic instrumentation, elements of interpretation of spectra and applications of the following analytical techniques should be discussed.**(24Hours)

- a. UV and Visible Spectrophotometry.
- b. Fluorimetry.
- c. Infrared Spectrophotometry.
- d. Nuclear Magnetic Resonance Spectroscopy including  $^{13}\text{C}$ -NMR.
- e. Mass Spectrometry.
- f. Flame Photometry.
- g. Emission Spectroscopy.
- h. Atomic Absorption Spectroscopy.
- i. X-ray diffraction.
- j. Radio Immuno Assay.



## 10. Quality Assurance (4 hours)

- a. GLP, ISO 9000, TQM, Quality Review, quality documentation and International Conference of Harmonization (ICH).
- b. Regulatory control, regulatory drug analysis and interpretation of analytical data.
- c. Validation, quality audit, quality of equipment, validation of equipment and validation of analytical procedures.

## PRACTICALS (3 hrs/wk)

1. Quantitative estimation of at least ten formulations containing single drug or more than one drug, using instrumental techniques.
2. IR of samples with different functional groups (-COOH, -COOR, -CONHR, -NH<sub>2</sub>, -NHR, -OH, etc.).
3. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS.
4. Chromatographic analysis of some pharmaceutical products.

## Books recommended:

1. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake.
2. Vogel's textbook of Quantitative Inorganic Analysis.
3. Indian Pharmacopoeia
4. Fundamentals of Analytical Chemistry by Skoog, West and James Holler.
5. Textbook of Quantitative Analysis by Kenneth.A.Connors
6. Instrumental Methods of Analysis by Willard.H.H, Meritt J. A.g

## 4.3 -PHARMACOGNOSY III

### THEORY [2hrs/week]



1. Chemical and spectral approaches to simple molecules of natural origin (2 hours)
2. Concept of stereoisomerism taking example of natural products (1 hour)
3. Chemistry, biogenesis (general pathway) and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes and Triterpenoids. (2 hours)
4. Glycosides: Chemistry and biosynthesis of Digoxin and Sennosides (2 hours)
5. Alkaloids: Chemistry, biogenesis and pharmacological activity of atropine and related compounds Quinine, Morphine, Papaverine, Ephedrine, Ergot and Vinca alkaloids. (8 hours)
6. Chemistry and biogenesis (general pathway) of medicinally important lignans, Quassinoids and Flavanoids. (4 hours)
7. World-wide trade in medicinal plants and derived products with special reference to Diosgenin (Dioscorea), Taxol (Taxus sp), Digitalis, Tropane alkaloid containing plants, Papain, Cinchona, Ipecac, Liquorice, Ginseng, Aloe, Valerian, Rauwolfia and plants containing laxatives, Role of medicinal and aromatic plants in national economy. (7 hours)
8. A brief account of plant based industries and Institutions involved in work on medicinal and aromatic plants in India. (1 hour)
9. Biodiversity and its conservation. In situ conservation of biodiversity. Threats to biodiversity. Endangered and endemic species of India, germ plasm conservation (2 hours)
10. Plant tissue culture, Totipotency, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. (5 hours)



11. Gene transfer, Gene mapping of plants, transgenic plants, introduction to DNA finger printing (3hours)

12. Introduction to herbal drug technology. Development and evaluation of herbal formulations (2hours)

13. Adulteration and evaluation of crude drugs. Standards for herbal formulations. WHO guidelines in evaluation of drugs (6hours)

14. Herbaceous health foods. (2hours)

15. Herbal cosmetics – including classifications with examples, standards and biological sources, chemical constituents and uses of at least 10 drugs used in herbal cosmetics ( 2 hours )

16. Patenting of Herbal Drugs (1hour)

#### **PRACTICALS [3hrs/week]**

1. Laboratory experiments on isolation, separation and purification of various groups of chemical constituents of pharmaceutical significance.
2. Isolation of some selected constituents studied in theory: Aloin, Andrographolide, Quinine, Ammonium Glycyrrhinate, Ca-Sennosides, Caffeine.
3. Estimation of phytopharmaceuticals : Atropine, Quinine, Curcumine, Aloin, Caffeine
4. Physicochemical evaluation of crude drugs and formulations including ash values, extractive values, refractive index



5. Quantitative microscopy experiments

6. Initiation of callus culture

7. Preparation of herbal cosmetics and herbaceous health foods

8. Simple experiments in TLC and paper chromatography

9. Analysis of fixed oils

[a] Iodine value

[b] Saponification value

[c] Ester value

[d] Acid value

**Books Recommended:**

1. Bain KR and Turner TD, Practical Evaluation of Phytopharmaceuticals. Wright – Suintechnica, Bristol.
2. Trease GE and Evans WC, Pharmacognosy, Lea and Febiger, Philadelphia.
3. Wallis TE, Test Book of Pharmacognosy, J & A Churchill Limited, London.
4. Tyler VC, Bready IR and Robert JE, Pharmacognosy, Lea and Febiger, Philadelphia.
5. Manitto P, The Biosynthesis of Natural Products. Ellis Horwood Chichester.
6. Robbers JE, Speedle MB and Tyler VE, Pharmacognosy and Pharmacobiotechnology, Williams and Wilkins, Philadelphia.
7. Harbone JB, Phytochemical methods, Chapman and Hall, International Edition, London.
8. Kokate CK, Practical Pharmacognosy, Vellabh Prakashan, Delhi.
9. Kokate CK, Purohit AP and Gokhale SB. Pharmacognosy (Degree) Nirali Prakashan, Pune.
10. Clark, ECG, Isolation and Identification of Drugs, The Pharmaceutical Press,



London.

11. Indian Herbal Pharmacopoeia, Indian drug manufacturers association, Mumbai.
12. Ansari SH, Essentials of Pharmacognosy. Birla publications Pvt Ltd. Delhi.
13. Ashutosh kar, Pharmacognosy & Pharmaco biotechnology, New age International publishers, New Delhi.
14. Dewik, Medicinal Natural Products- A Biosynthetic Approach.
15. Agarwal SS, Paridhavi M, Herbal Drug Technology. Orient Longmann Pvt. Ltd. Hyderabad.
16. Stahl E, Thin layer chromatography – A Laboratory hand book, Springer – Verlag, Berlin.
17. Rajpal V, Standardization of Botanicals, Vol- I & II.
18. Chatwal, Organic Chemistry of Natural Products, Vol- I & II.
19. Medicinal plants of India, Indian Council of Medical Research, New Delhi.

#### **4.4. PHARMACEUTICS VI (FORMULATIVE & INDUSTRIAL PHARMACY)**

##### **Theory 3hrs/week**

1. Tablets (6hours) Characteristics, advantages and disadvantages. Types of tablets, excipients, granulation methods and machinery involved.

Tablet compression operation-single punch and rotary tablet presses, processing problems, evaluation, packaging.



2. Tablet coating: (5hours) Types-sugar coating, film coating, compression coating, electrostatic and enteric coating. Film forming materials, formulation of coating solution, equipments for coating, Processing problems in coating, evaluation.

3. Capsules: (5hours) Advantages and disadvantages of capsules. Materials and method of production of hard gelatin capsule, size of capsules, Formulation, method of filling, equipments involved, finishing techniques and evaluation. Storage of capsules.

Soft gelatin capsules-shell and capsule content, manufacture, processing and control.

4. Sterile products: (15hours)

a) Injections- classification, routes and volume of administration, methods of production and storage, vehicles-water for injection, non aqueous vehicles. Isotonicity and methods of adjustment of Isotonicity.

b) Formulation details, containers, closures and their selection.

c) Prefilling treatment, washing of containers and closures-relevant standard operating procedures, preparation of solutions and suspensions, filling and sealing of ampoules and vials. Manufacture of large volume parenterals. Equipments for large scale manufacture, quality control tests for parenterals.

d) Lyophilisation and preparation of sterile powders and dry mixtures.

e) Aseptic techniques, source of contamination and methods of prevention, design and maintenance of aseptic area-classification, air handling units, laminar airflow units.

f) Total parenteral nutrition and dialysis fluids.





g) Ophthalmic preparations-ideal requirements, types, components, formulation, methods of preparation, containers, closures and evaluation.

5. Pharmaceutical aerosols-( 6 hours ) components, propellants, containers, valves and actuators, types of aerosol systems, manufacture, quality control, pharmaceutical applications.

6. Surgical ligatures and sutures, types, Catgut-preparation and standardization. Cotton- absorbent and non absorbent.( 3 hours )

7. Blood products and plasma substitutes. (3hours)

8. Packaging materials. ( 3 hours ) Types of glasses and plastics employed for packing and their evaluation.

9. Cosmetics. (12hours) Introduction, fundamentals of cosmetic science. Formulation, preparation, packaging and evaluation of following Cosmetics:

a) cosmetics for skin and face-vanishing cream, cold cream, face powder.

b) Nail polish, lipstick, rouge

c) Hair preparation-Shampoo, Hair dyes, depilatories, shaving cream, after shave lotion.

d) Oral hygiene preparation-dentifrices, mouth washes.

10. Controlled drug delivery systems-( 12 hours )Advantages of controlled drug delivery systems.

a) An introduction to novel drug delivery systems- Liposomes, niosomes, nanoparticles and osmotically controlled systems.

b) Micro encapsulation

c) Transdermal drug delivery systems-Formulation and evaluation.



11. Process validation and performance evaluation ( 5 hours )

**Practicals 6hrs/week**

1. Formulation and evaluation of different types of tablets
2. Coating of tablets and their evaluation
3. Hard gelatin capsule filling and evaluation
4. Formulation of small volume parenterals and evaluation
5. Formulation of ophthalmic products
6. Formulation of Total parenteral nutrition
7. Evaluation of containers.
8. Evaluation of water for injection as per monographs.
9. Short term stability studies of various formulations
10. Formulation of various types of cosmetic preparations studied in the theory portions.
11. Formulation and evaluation of microencapsulated products and other controlled drug delivery systems.

**Books recommended:**

1. Theory and practice of industrial pharmacy; by Leon Lachman, Herbert.A.Liebertman, Joseph.L.kanig; Third edition; Lea & Febiger.
2. Pharmaceutics, The Science of Dosage Form Design: Michael.E.Aulton; Second edition; English language book society/Churchill Livingstone.
3. Bentley's text book of Pharmaceutics: E. A. Rawlins; Eighth edition; English language book society.
4. Modern Pharmaceutics: Gilbert.S.Banker, Christopher.T.Rhodes; Third edition; Marcel Dekker, INC.



5. Pharmaceutical dosage forms: Tablets, Volume 1,2,3; Herbert.A.Lieberman, Leon Lachman & Joseph.B.Schwartz; Marcel Dekker INC.
6. Remington, The Science and Practice of pharmacy; 21<sup>st</sup> edition; Lipincott Williams & Wilkins.
7. Novel Drug Delivery Systems; Yie.W.Chein; Second edition; Marcel Dekker INC.
8. Cosmetics: Science and Technology; M.S.Balsam and Edward Sagarin; second edition; John Wiley & Son's Newyork.
9. Ansel's Pharmaceutical Dosage forms and Drug Delivery Systems; Loyd.V.Allen, Nicholas.G.Popovich, Horward.C.Ansel; eighth edition; Lipincott Williams & Wilkins.
10. Pharmaceutical Dosage Forms: Parenteral Medications Volume 1 & 2; Kenneth.E.Avis, Leon Lachman & Lieberman; Marcel Dekker INC.
11. Encyclopedia Of Pharmaceutical Technology; James.C.Boylan; 2<sup>nd</sup> edition; Marcel Dekker INC.

## **4.5 PHARMACOLOGY II**

### **THEORY (3 Hrs/wk)**

#### **A). Measurements in pharmacology: ( 3 hours )**

Bioassay:- Principles, indications types and requirements of bioassay

Bioassay of insulin, digitalis, adrenaline, acetyl choline, histamine, oxytocin, d-tubocurarine, Antihemophilic fraction, Heparin Sodium, Diphtheria anti toxin, Anti rabies vaccine.

Radioimmunoassay: principles and application

#### **B. Drug discovery and new drug development:(2hours)**

a) Approaches to drug discovery, preclinical studies, clinical trials, design, phases and conduct of clinical trial, ethical issues, informed consent, role of placebo, different terminologies related to clinical trial



b) Bioinformatics- definition, aim and applications in drug development

**C) Pharmacology of the following groups of drugs** -with emphasis on

Classification, Mechanism of action, Pharmacokinetics, Pharmacodynamics, Adverse effects, Drug interactions, Contra indications, Clinical uses & Preparations and dosages. And pharmacotherapy of the following mentioned diseases.

1) Drugs acting on central nervous system (23hours)

a. Neurohumoral transmitters in CNS

b. General anaesthetics, sedatives & hypnotics, management of barbiturate poisoning

c. Alcohols, management of methanol poisoning

d. Analgesics-antipyretics, narcotic analgesics, Non-steroidal anti-inflammatory agents, anti-gout remedies, drugs in rheumatoid arthritis.

e. Management of Paracetamol poisoning, morphine poisoning, salicylate poisoning.

f. Pharmacotherapy of gout and hyper-uricemia, rheumatoid arthritis

g. Antiepileptics and pharmacotherapy of epilepsy

h. Drugs used in Parkinsonism & Pharmacotherapy of Parkinsonism

i. CNS stimulants

j. Psychopharmacological agents- antipsychotics, antidepressants, anti-anxiety agents, pharmacotherapy of psychosis and depression

k) Drugs in Alzheimer's disease

2) Local anaesthetics ( 1 hour )

3) Drugs acting on uterus- (1hour) Oxytocics, uterine relaxants

4) Drugs affecting renal function (2hours) Diuretics & antidiuretics

5) Drugs acting on the blood and blood forming organs ( 5 hours )



- a. Drugs effective in different types of anaemia – Iron deficiency anaemia, aplastic anaemia, megaloblastic anaemia. Pharmacotherapy of anaemias
- b. Drugs effecting coagulation of blood -coagulants, anticoagulants, thrombolytic agents, drugs affecting platelet function, Blood products and plasma volume expanders
- c. Drugs used in shock, Pharmacotherapy of shock

6) Pharmacology of vitamins: ( 1 hour ) Source, absorption, fate, action, therapeutic uses and adverse effects

7) Heavy metals and heavy metal antagonists ( 1 hour )

8) Enzyme in therapy-( 1 hour ) Hyaluronidase, L-asparaginase, seratiopeptidase

9) Therapeutic gases: ( 1 hour ) Oxygen, Helium, CO<sub>2</sub>, water vapour

10) Drugs acting on gastro-intestinal tract-Appetizers,( 3 hours )`digestants,carminatives,appetite suppressants , Emetics,antiemetics,antidiarrhoeals, Cathartics, Antacids &Drugs used in the treatment of peptic ulcer. Pharmacotheraapy of constipation, diarrhea, vomiting, peptic ulcer disease.

11) Drugs acting on Skin: ( 1 hour ) Drugs used in skin disorders, sclerosis, melanizing and demelanizing agents

#### **D) Antimicrobial drugs & Chemotherapy**

i. History of Chemotherapy. Bacterial resistance, combined use of antimicrobials, prophylactic use of antimicrobials.( 1 hour )

Classification based on mechanism of action of antimicrobial agents

ii. Classification including recent drugs, Mechanism of action, Spectrum of activity, Pharmacokinetics, Pharmacodynamics, Adverse effects , Drug interactions, Contra indications, Clinical uses & Preparations and dosages of the following :- ( 19 hours )



Sulphonamides, quinolones, pencillins, cephalosporins, Monobactams, tetracyclines, Chloramphenicol, polypeptide antibiotics, macrolide antibiotics, Aminoglycoside antibiotics, Monobactams, Lincosamides, Oxazolidinones, Urinary antiseptics., Antiseptics and disinfectants

iii. Pharmacotherapy of Urinary tract infection, Upper respiratory tract infection, Enteric infection.

iv. Antifungal agents

v. Antiviral agent-Drugs in different viral infections, non selective antiviral drugs

vi. Anti HIV agents and therapy of AIDS

vii. Antitubercular agents and Pharmacotherapy of tuberculosis

viii. Anti protozoal agents

ix. Anthelmintics

Chemotherapy of neoplastic disease: Cell cycle kinetics, Genesis of cancer cells, Characteristics of cancer cells, Antineoplastic agents.

#### **E) Immunopharmacology: (5hours)**

i. Immunity & hypersensitivity.

Chemical mediators of immune response and drugs that block their actions

ii. Immunosuppressant and immunostimulant drugs.



iii. Vaccine therapy-Different types&mechanism of action

Indications,dosage schedule & adverse effects of typhoid vaccine,BCG vaccine,Oral polio vaccine,Rabies vaccine,Hepatitis vaccine,Tetanus toxoid

iv.Immunoglobulins in therapy- Indications,dosage schedule & adverse effects of Human Immunoglobulins,tetanus Immunoglobulins,rabies Immunoglobulins.

**F.Gene therapy: (3hours)**

1.Approaches in gene therapy (gene transfer, gene modification), applications of gene therapy.

Gene delivery, viral and non-viral vectors

2. Proteins and polypeptides as therapeutic agents

3. Stem cell therapy-General terminologies, stem cells, cell potency types, types of stem cells, potential uses of stem cells.

**G.Free radical pharmacology. ( 2 hours )**

a. Generation of free radicals.

b. Role of free radicals in etiopathology of various diseases.

c. Protective activity of certain important antioxidants.

**Pharmacology – II (Practicals)**

**3 Hours/Week**

1. To estimate the strength of the test sample of agonist/ drug (e.g. Acetylcholine, Histamine, 5HT, Oxytocin) using a suitable isolated smooth muscle preparation (rat/ guinea pig) employing matching bioassay



2. To estimate the strength of the test sample of agonist/ drug (e.g. Acetylcholine, Histamine, 5HT, Oxytocin) using a suitable isolated smooth muscle preparation (rat/ guinea pig) -interpolation bioassay,
3. To estimate the strength of the test sample of agonist/ drug (e.g. Acetylcholine, Histamine, 5HT, Oxytocin) using a suitable isolated smooth muscle preparation (rat/ guinea pig) - three point bioassay
4. To estimate the strength of the test sample of agonist/ drug (e.g. Acetylcholine, Histamine, 5HT, Oxytocin) using a suitable isolated smooth muscle preparation - four point bioassay (demonstration only).
5. To study the effect of Ach, Histamine, BaCl<sub>2</sub>, Atropine, mepyramine, papaverine using rat/ guinea pig ileum/ chick ileum
6. Identification of unknown drug (spasmogens/ spasmolytics) using rat/ guinea pig ileum/ chick ileum
- 7.To study the diuretic activity of a compound in rats
- 8.To study the Antiulcer activity of various drugs by shay rat model.
9. Experiments on Central nervous system: Evaluation of following activities of drugs:
  - a)Spontaneous motor activity,
  - b) Stereotype activity,
  - c) Anti-catatonic activity,
  - d)Analgesic activity,
  - e)Anticonvulsant activity,





- f) Anti-inflammatory activity and
- g) Skeletal muscle relaxant activity .

10. Study of local anaesthetic property of procaine and lignocaine by -Surface anaesthesia( corneal reflex-rabbit), Infiltration anesthesia( guinea pig)

11. Statistical calculations in experimental pharmacology by giving suitable data.

- a) SEM, Students-t-test, b). ANOVA

### **Recommended Books**

1. Modern Pharmacology by Craig C.R. and Stitzel R.R.
2. Fundamentals of experimental Pharmacology by Ghosh M. N.
3. Basic and clinical Pharmacology by Katzung B.G.
4. Clinical Pharmacology by Laurence D.R. and Bennet P.N.
5. Lippincott's illustrated Reviews- Pharmacology by Mycek M.J, Gelnet S.B and Perper M.M.
6. Pharmacology by Rang M.P., Dale M.M., Reter J.M.
7. Pharmacology and Pharmacotherapeutics by Satoskar R.S. and Bhandarkar S.D.
8. Goodman and Gilman's, The pharmacological basis of therapeutics by Gillman G, Rall T.W., Nies A.I.S., and Taylor P.
9. Chronopharmacology by B. Lammer.
10. Topics of Molecular Pharmacology I and II by Nurger and Roberts.
11. Essentials of Medical Pharmacology by K.D.Tripathi.
12. Pharmacological Experiments on isolated preparations by Macleod L.J.
13. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.

### **4.6. PHARMACY PRACTICE**



## **THEORY(2 hours/week)**

### **A: HOSPITAL PHARMACY**

1. Hospital( 2 hours )Definition, Classification, Objectives, Functions, Organization of Hospital.
2. Hospital Pharmacy: ( 2 hours ) Definition, Objectives, Functions, Organization of Hospital pharmacy. ( 2 hours )Qualifications & Responsibilities of a hospital pharmacist.
3. Pharmacy and therapeutic committee: (1 hour ) Objectives, composition and functions, budget preparation and implementation.
4. Hospital Formulary: ( 3 hours ) Contents, preparation and revision of hospital pharmacy.
5. Drug store management and Inventory control: ( 3 hours ) a). Organization of Drug store, types of materials stocked, storage conditions. b). Purchase and inventory control: Principles, purchases, procedures, purchase order, procurement and stocking.
6. Drug distribution system in hospitals: ( 2 hours ) a). Out patient dispensing – methods adopted. b).Dispensing of drugs to inpatients, types of drug distribution systems, charging policy, labeling. c). Dispensing of drugs to ambulatory patients. d). Dispensing of controlled drugs.
7. Central sterile supply unit and their management: ( 3 hours ) (details of manufacturing not required) Definition, organization, layout, functioning and types of materials for sterilization equipments, supply of sterile materials.

### **B. CLINICAL PHARMACY & THERAPEUTICS**

1. Clinical pharmacy: ( 1 hour ) Introduction & Scope of clinical pharmacy.
2. Professional activities of clinical Pharmacist: ( 5 hours ) Pharmacists in therapeutics, role of clinical pharmacists in patient care, pharmaceutical care, patient counseling and interviewing techniques, Drug therapy monitoring (Medication chart review, clinical review and pharmacist interventions), ward round participation, adverse drug reaction



monitoring and management, medication history review . Patient compliance, factors affecting compliance, methods of measuring and improving compliance. Detecting medication errors.

3. Interpretation of clinical laboratory tests and its significance: ( 1 hour ) liver function tests, pulmonary function tests, renal function tests and hematological tests.

4. Drug & Poison information services ( 1 hour ) Introduction, sources of information, design of literature searches, critical evaluation of drug information and literature. Preparation of written and verbal reports.

5. Clinical pharmacokinetics & individualization of drug therapy: ( 3 hours )

a. Drug use in special population:- infants ,elderly , pregnancy & lactation-therapeutic consideration

b. Dosage adjustments in renal failure, hepatic failure.

Therapeutic Drug Monitoring. TDM indications for measuring drugs in blood, choice of drugs to be monitored. Timings of measurements, measuring techniques. Clinical applications – Estimation of serum concentration of Digoxin, Theophylline, Gentamycin, Lithium, Phenytoin, Cyclosporin & Amiodarone ( 2 hours )

6. Adverse drug reactions: ( 1 hour ) Detection, monitoring & reporting of ADRs.

7. Definition and implications of Evidence based medicine, Practice based research & laboratory based research ( 1 hour )

8. Preparation of drug profiles, leaflets, packaging inserts.( 1 hour )

9. Pharmacoepidemiology: ( 1 hour ) Definition and scope, methods & systems of monitoring drug effects.

10. Pharmacoeconomics: ( 1 hour ) Definition and scope, types, cost models and cost effectiveness analysis.

11. Drug interactions: ( 1 hour ) clinical significance, potentially dangerous interactions, role of pharmacist in identification, assessment and ways to overcome interactions.

12. Concept of Essential drugs and rational drug use. ( 1 hour )



13. Clinical management (including clinical manifestations, clinical investigations/ assessment, treatment algorithms, management of adverse effects of therapy, and patient education)of the following organ disorders: ( 9 hours )

- a) Cardiovascular disorders : Hypertension, Congestive heart failure, Angina, Acute Myocardial infraction , Cardiac arrhythmias
- b) Central nervous disorders : Epilepsy, Parkinsonism, Schizophrenia, Depression
- c) Respiratory disorders : Asthma , COPD
- d) Gastro intestinal disorders : Peptic ulcer, Ulcerative colitis, Hepatitis, Cirrhosis
- e) Endocrine disorders : Diabetes mellitus, Thyroid disorders
- f) Infectious disorders : Tuberculosis, Urinary tract infections, Enteric infection, Upper respiratory tract infection & HIV
- g) Hemopoietic disorders : Anaemias,
- h) Joint & connective disorders : Rheumatic diseases, Osteoporosis
- i) Neoplastic disorders : Acute leukaemias, Hodgkins disease& carcinoma of breast

### **C:COMMUNITY PHARMACY**

1.Community Pharmaceutical Services, Organization structure of retail & whole sale – location, legal requirements for establishments. Maintenance of records. Community Pharmacy management, finance, personnel, materials.( 3 hours )

2.Communication skills: (1 hour) model of communication, verbal and non-verbal communication, questioning skills, explaining skills, listening skills & counseling skills.

### **PRACTICALS (2 hrs/week)**

- 1. Case study analysis (Hypertension, CHF, AMI, Asthma, Epilepsy, DM, PUD, RA).
- 2. Patient counseling (Hypertension, CHF, AMI, Asthma, Epilepsy, DM, PUD, RA)



3. Identification and correction of incompatibilities in prescriptions.
4. Analysis of prescriptions of drug interactions, over dosage.
5. Preparation of drug profiles, packaging inserts, leaflets etc.
6. Drug information queries & Answering- for health professionals and patients.- on diseases and therapy mentioned in the theory
7. Dosage adjustment in geriatrics, pediatrics, hepatic failure, renal failure & heart failure cases.
8. Familiarity with Hospital equipments and surgical accessories.
9. Drug store management & Inventory control (ABC Aalysis).
10. Evaluation of surgical dressings & surgical instruments, glass wares and other hospital supplies.

#### **BOOKS RECOMMENDED**

1. Text book of Clinical Pharmacy by Tipnis
2. Text Book of Clinical Pharmacy by Lassan.
3. Roger Walker & Clive Edwards: Clinical Pharmacy & Therapeutics by Clive Edwards.
4. Text Book of Pharmacotherapeutics by Joseph T Dipiro.
5. Text book of Pharmacotherapeutics by Herfindal.
6. Text book of Biopharmaceutics and Clinical Pharmacokinetics By Brahmankar.
7. Remington: The Sciences and Practices of Pharmacy
8. Text Book of Hospital Pharmacy by William E Hassan. Lea & Febiger, Philadelphia.
9. Text book of Hospital Pharmacy by S.H.Merchant & Dr. J S Quadry.

#### **PROJECT WORK (B Pharm)**

A project work based on literature survey on a current topic of relevance, consisting of about 30 pages (Times New Roman, Font size 14, line space 1.5), spirally bound should be submitted to the Principal/Head of the Department. The candidate should present the work with the help of



audiovisual aids, which will be evaluated by a team of senior faculty members of the college. The criteria for evaluation:

- Relevance of the topic : 5 marks
- Content : 25 marks
- Scripting and editing : 20 marks
- Presentation and slides: 40 marks
- Discussion and defence: 10 marks

#### **4.2. List of journals recommended**

Indian Journal of Pharmaceutical Sciences

Medicinal and Aromatic Plants Abstracts

Indian Journal of Pharmacology

Indian Journal of Chemistry

Indian Journal of Pharmaceutical Education and Research

Phytopharm

Pharma Times

Indian Pharmacist

Indian Journal of Hospital Pharmacy

Pharmacognosy Magazine

Indian Drugs

Pharma Biz

MIMS India

Fitoterapea

International Journal of Pharmaceutics

Journal of Pharmacy Practice and Research

International Journal of Pharma Research and Review

Drug Designing : Open access



Journal of Applied Pharmacy Research and Reviews : Journal of Pharmacognosy & Phytochemistry  
International Journal of Pharmacy and Biological Sciences  
Journal of Pharmaceutical Sciences  
Planta Medica  
Journal of Pharmacy and Pharmacology  
Drug discovery Today : Therapeutic Strategies  
Journal of Ethnopharmacology  
Drug development & Industrial Pharmacy  
Drugs  
Journal of Organic Chemistry  
Journal of Pharmaceutical and Biomedical Analysis  
Journal of Pharmaceutical Sciences  
Journal of Pharmacology and Exp. Therapeutics  
Journal of Pharmacy and Pharmacology  
Manufacturing Chemist  
Pharmacological Reviews  
Pharmacy Education  
Phytochemistry  
Medicinal chemistry  
Organic chemistry: current research  
Pharmaceutical Analytical Chemistry  
International Journal of Pharmaceutical Chemistry  
International Journal of Research in Pharmacy and Chemistry

**2.11. No: of hours per subject**

As given in 2.10

**2.12. Practical training**

Not applicable



**2.13. Records**

To be maintained as per requirement.

**2.14. Dissertation:**

Not applicable

**2.15. Speciality training if any**

As given in curriculum

**2.16. Project work to be done if any**

As given in curriculum

**2.17. Any other requirements [CME, Paper Publishing etc.]**

As decided by HOD of the institution

**2.18. Prescribed/recommended textbooks for each subject**

As given in curriculum

**2.19. Reference books**

As given in curriculum

**2.20. Journals**

As given in curriculum

**2.21. Logbook**

**3 EXAMINATIONS**

**3.1 Eligibility to appear for exams**

- A candidate is eligible for registering for the examinations only if he/she secures a minimum of 50% marks in internal assessment in theory and practical separately.
- Partial appearance for the examinations : A candidate is allowed partial appearance for the University examinations, including practical examinations, provided he/ she has 80% attendance in all subjects, in theory and practical separately.
- Eligibility for appearance for supplementary examinations: A candidate can register for supplementary examinations if he/she has 80 % attendance in theory and practical





separately for that subject/s and has minimum 35% Internal Assessment marks in theory and practical separately in that subject/s.

### 3.2 Schedule of Regular/Supplementary exams

There will be one main examinations and one supplementary examination six months apart.

### 3.3 Scheme of examination showing maximum marks and minimum marks

The scheme of examinations is as per the regulations of the respective Board of Studies and statutory council.

#### First year:

The first year will ordinarily start in and October/ November, the first year examination shall be at the end of one academic year of first year

The first year examination shall be held in the following subjects:

S l. N o	Subject		Theory			Practical			Total		Res ult
	Paper		Max	Min	Awarde d	Max	Min	Awarde d	Max	Min	
1	Pharmaceutic al Chemistry I (Inorganic	IA	50	25		50	25		300	150	
		Universit y	100	50		80	40.00				



	and Physical Chemistry)	Viva	-	-		20	-					
2	Pharmaceutical Chemistry II (Organic Chemistry)	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
		Viva	-	-		20	-					
3	Pharmaceuticals I (Dispensing and General Pharmacy)	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
		Viva	-	-		20	-					
4	Human Anatomy & Physiology	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
		Viva	-	-		20	-					
5	Pharmacognosy I	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
		Viva	-	-		20	-					
Grand Total									1500	750		



**Second year:**

The second year examination shall be held in the following subjects (2012 admission onwards):

Sl. No	Subject		Theory			Practical			Total			Result
	Paper		Max	Min	Awarded	Max	Min	Awarded	Max	Min	Awarded	
1	Pharmaceutical Chemistry III (Advanced Organic Chemistry)	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
		Viva	-	-		20	-					
2	Pharmaceutical Analysis-I	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
		Viva	-	-		20	-					
3	Pharmaceuticals II	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					



		Viva	-	-		20	-					
4	Pathophysiology, Health Education, & Community Pharmacy	IA	50	25		-	-		150	75		
		University	100	50		-	-					
		Viva	-	-		-	-					
5	Mathematics, Biostatistics & Computer Application	IA	50	25		-	-		150	75		
		University	100	50		-	-					
		Viva	-	-		-	-					
6	Pharmaceutics –III (Pharmaceutical Tecnology)	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
		Viva	-	-		20	-					
7	Applied Biochemistry & Molecular Biology	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
			-	-		20	-					
Grand Total									1800	900		



**Third year:**

The third year examination shall be held in the following subjects (2012 admission onwards):

S l. No	Subject		Theory			Practical			Total			Res ult
	Paper		Max	Min	Awa rded	Max	Min	Awa rded	Max	Min	Awar ded	
1	Pharmaceutics- IV (Pharmaceutical Microbiology and Biotechnology)	IA	50	25		50	25		300	150		
		Unive rsity	100	50		80	40.00					
		Viva	-	-		20	-					
2	Pharmaceutical Chemistry IV (Chemistry of Natural Products)	IA	50	25		50	25		300	150		
		Unive rsity	100	50		80	40.00					
		Viva	-	-		20	-					
3	Pharmacology I	IA	50	25		50	25		300	150		
		Unive rsity	100	50		80	40.00					



		Viva	-	-		20	-					
4	Pharmaceutics -V (Biopharmaceutics & Pharmacokinetics)	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
		Viva	-	-		20	-					
5	Pharmaceutical Jurisprudence	IA	50	25		-	-		150	75		
		University	100	50		-	-					
		Viva	-	-		-	-					
6	Pharmacognosy II	IA	50	25		50	25		300	150		
		University	100	50		80	40.00					
		Viva	-	-		20	-					
7	Pharmaceutical Management	IA	50	25		-	-		150	75		
		University	100	50		-	-					
			-	-		-	-					
Grand Total									1800	900		



**Fourth year:**

The fourth year examination shall be held in the following subjects (2012 admission onwards):

S I. N o	Subject		Theory			Practical			Total			Res ult
	Paper		Max	Min	Awar ded	Max	Min	Awa rded	Max	Min	Awa rded	
1	Pharmaceutic al Chemistry V (Medicinal Chemistry)	IA	50	25		50	25		300	150		
		Univer sity	100	50		80	40.00					
		Viva	-	-		20	-					
2	Pharmaceutic al Analysis II	IA	50	25		50	25		300	150		
		Univer sity	100	50		80	40.00					
		Viva	-	-		20	-					
3	Pharmacogno sy III	IA	50	25		50	25		300	150		
		Univer sity	100	50		80	40.00					
		Viva	-	-		20	-					
4		IA	50	25		50	25		300	150		



	Pharmaceutics VI (Formulative & Industrial Pharmacy)	University	100	50		80	40.00					
		Viva	-	-		20	-					
5	Pharmacology II	IA	50	25		50	25					
		University	100	50		80	40.00		300	150		
		Viva	-	-		20	-					
6	Pharmacy Practice (Hospital Pharmacy and Clinical Pharmacy)	IA	50	25		50	25					
		University	100	50		80	40.00		300	150		
		Viva	-	-		20	-					
7	Project Work	IA	100	35		-	-		100	50		
Grand Total									1900	950		





### 3.4 Papers in each year

#### I Year B.Pharm

Sl. No.	Subjects	Lecture (hrs)	Practical (hrs)	Total (hrs)
1	Pharmaceutical chemistry I ( Inorganic and Physical chemistry )	50	75	125
2	Pharmaceutical chemistry II ( Organic chemistry )	75	75	150
3	Pharmaceutics I (Dispensing and General pharmacy )	50	150	200
4	Human Anatomy & Physiology	75	75	150
5	Pharmacognosy-I	75	75	150
	Tutorials	100		100
	Total number of hours	<b>425</b>	<b>450</b>	<b>875</b>

#### II Year B.Pharm

Sl No.	Subjects	Lecture (hrs)	Practical (hrs)	Total (hrs)
1	Pharmaceutical chemistry –III (Advanced organic chemistry)	75	75	150
2	Pharmaceutical Analysis -I	50	150	200
3	Pharmaceutics –II (Physical Pharmacy)	50	75	125
4	Pathophysiology , Health Education & Community Pharmacy	50	-	50



5	Mathematics, Biostatistics & Computer applications	100	-	100
6	Pharmaceutics- III (Pharmaceutical Technology)	50	75	125
7	Applied Biochemistry & Molecular Biology	75	75	150
	<b>Total</b>	<b>450</b>	<b>450</b>	<b>900</b>

### III Year B.Pharm

Sl No.	Subjects	Lecture ( hrs )	Practical ( hrs )	Total ( hrs )
1	Pharmaceutics -IV ( Pharmaceutical Microbiology & Biotechnology)	50	75	125
2	Pharmaceutical Chemistry IV (Chemistry of Natural Products)	75	75	150
3	Pharmacology – I	75	75	150
4	Pharmaceutics- V (Biopharmaceutics & Pharmacokinetics)	50	75	125
5	Pharmaceutical Jurisprudence	50	-	50
6	Pharmacognosy -II	50	75	125
7	Pharmaceutical Management	50	-	50
	Tutorials	100	-	100
	<b>Total</b>	<b>500</b>	<b>375</b>	<b>875</b>



#### IV Year B.Pharm

Sl No.	Subjects	Lecture ( hrs )	Practical ( hrs )	Total ( hrs )
1	Pharmaceutical chemistry –V ( Medicinal Chemistry )	75	75	150
2	Pharmaceutical Analysis -II	50	75	125
3	Pharmacognosy-III	50	75	125
4	Pharmaceutics VI ( Formulative & Industrial pharmacy)	75	150	225
5	Pharmacology –II	75	75	150
6	Pharmacy Practice (Hospital Pharmacy & Clinical Pharmacy)	50	50	100
7	Project work	25	-	25
	<b>Total</b>	<b>400</b>	<b>500</b>	<b>900</b>

#### 3.5 Details of theory exams

#### BPharm Theory Examination Question Paper Pattern

#### **Theory Examinations:**

14 questions of 5 marks each = 70 marks

3 questions of 10 marks each = 30 marks

**Total = 100 marks**



**Practical examinations:**

Synopsis - 20 marks  
 Major experiment/s - 35 marks  
 Minor experiment/s - 25 marks  
 Viva-voce - 20 marks

**Total - 100marks**

NAME OF EXAMINATION: First Year BPharm Degree Examinations (2012 admission), September 2013

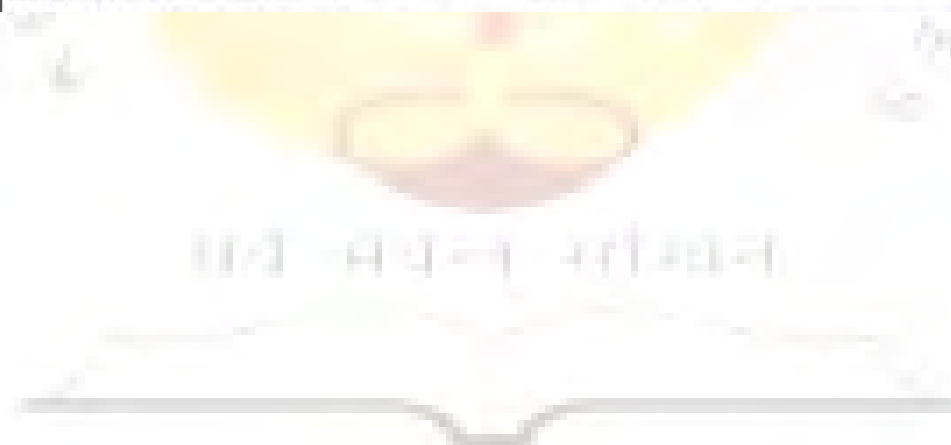
Sl. No	Subject	Sub Code	Theory				Theory Group		Practical				Practical Group		Total			
			Internal		University		Max	Min	Internal		University		Max	Min	Max	Min		
			Max	Min	Max	Min			Max	Min	Max	Min						
1	Pharmacognosy I	Sub1	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
2	Pharmaceutical Chemistry I	Sub2	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
3	Pharmaceutical Chemistry II	Sub3	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
4	Pharmaceutics I	Sub4	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
5	Human Anatomy and Physiology	Sub5	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
<b>GRAND TOTAL</b>																<b>1500</b>	<b>750</b>	

*[Handwritten signature]*



NAME OF EXAMINATION: Second Year B Pharm Degree Regular Examinations-2013 Admission, July 2015

Sl. No	Subject	Sub Code	Theory				Theory Group	Practical						Practical Group	Total			
			Internal		University			Internal		University		Viva			Max	Min	Max	Min
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min				
1	Pharmaceutical Chemistry III( Advanced Organic Chemistry)I	Sub1	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
2	Pharmaceutical Analysis	Sub2	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
3	Pharmaceutics II	Sub3	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
4	Pathophysiology & Health Education	Sub4	50	17.50	100	50.00	150	75	-	-	-	-	-	-	-	-	150	75
5	Mathematics, Biostatistics & Computer Applications	Sub5	150	52.50	-	-	150	75	-	-	-	-	-	-	-	-	150	75
6	Pharmaceutical Technology	Sub6	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
7	Applied Biochemistry & Molecular Biology	Sub7	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
<b>GRAND TOTAL</b>																<b>1800</b>	<b>900</b>	



NAME OF EXAMINATION: Third Year B Pharm Degree Regular Examinations (2012 admission) August 2015

Sl. No	Subject	Sub Code	Theory				Theory Group		Practical						Practical Group		Total	
			Internal		University		Max	Min	Internal		University		Viva		Max	Min	Max	Min
			Max	Min	Max	Min			Max	Min	Max	Min	Max	Min				
1	Pharmaceutics III (Pharmaceutical Microbiology and Biotechnology)	Sub1	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
2	Pharmaceutical Chemistry IV (Chemistry of Natural Products)	Sub2	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
3	Pharmacology I	Sub3	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
4	Pharmaceutics IV (Biopharmaceutics and Pharmacokinetics)	Sub4	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
5	Pharmaceutical Jurisprudence	Sub5	50	17.50	100	50.00	150	75	-	-	-	-	-	-	-	-	150	75
6	Pharmacognosy II	Sub6	50	17.50	100	50.00	150	75	50	17.50	80	40.00	20	-	150	75	300	150
7	Pharmaceutical Industrial Management	Sub7	50	17.50	100	50.00	150	75	-	-	-	-	-	-	-	-	150	75
<b>GRAND TOTAL</b>																<b>1800</b>	<b>900</b>	

NAME OF EXAMINATION: Final Year B Pharm Degree Supplementary Examinations (2011 admission) December 2015

Sl. No	Subject	Sub Code	Theory				Theory Group		Practical						Practical Group		Total	
			Internal		University		Max	Min	Internal		University		Viva		Max	Min	Max	Min
			Max	Min	Max	Min			Max	Min	Max	Min	Max	Min				
1	Pharmaceutical Chemistry - V (Medicinal Chemistry)	Sub1	50	17.50	100	45.00	150	75	50	17.50	70	31.50	30	-	150	75	300	150
2	Pharmaceutical Analysis - II	Sub2	50	17.50	100	45.00	150	75	50	17.50	70	31.50	30	-	150	75	300	150
3	Pharmacognosy - III	Sub3	50	17.50	100	45.00	150	75	50	17.50	70	31.50	30	-	150	75	300	150
4	Pharmaceutics - VI (Formulative & Industrial Pharmacy)	Sub4	50	17.50	100	45.00	150	75	50	17.50	70	31.50	30	-	150	75	300	150
5	Pharmacology - II	Sub5	50	17.50	100	45.00	150	75	50	17.50	70	31.50	30	-	150	75	300	150
6	Pharmacy Practice (Hospital Pharmacy & Clinical Pharmacy)	Sub6	50	17.50	100	45.00	150	75	50	17.50	70	31.50	30	-	150	75	300	150
7	Project work	Sub7	100	50.00	-	-	100	50	-	-	-	-	-	-	-	-	100	50
<b>GRAND TOTAL</b>																<b>1900</b>	<b>950</b>	



### 3.6 Model question paper for each subject with question paper pattern

QP Code : .....

Reg No:.....

#### FIRST YEAR B.PHARM DEGREE EXAMINATION

(Model Question Paper -2012 Scheme)

#### Pharmaceutical Chemistry - I

(Inorganic & Physical Chemistry )

Time : 3 hours

Max Marks : 100

- Answer all questions
- Write equations wherever necessary

#### Essay:

(3x10=30)

1. Discuss the limit test for arsenic and sulphate.
2. Describe the various sources of impurities in pharmaceutical substances.
3. Outline the method of preparation , assay and uses of aluminium hydroxide gel and ammonium chloride.

#### Short Notes:

(14x5=70)

4. Explain the method of preparation and assay of hydrogen peroxide.
5. Explain the assay of carbon dioxide
6. Physiological role of iron and copper.
7. Define surface tension and viscosity.
8. Explain the method of preparation, assay and uses of ferrous sulphate.
9. Define refractive index. Explain the working principle of Abay's refractometer.
10. Explain the various methods and importance of quality control.
11. Explain Debye – Huckel theory.
12. Explain optical activity. Describe the working of Polarimeter.
13. Define antidote. How sodium nitrite is used in some specific poisoning.
14. Define electrolytes used in replacement therapy.
15. Define assay of chlorinated lime.
16. Explain method of preparation , assay and uses of ferrous Sulphate.
17. Complete and balance the following equations –
  - Boric acid + glycerol
  - $\text{Ca (OCl) Cl} + \text{H}_2\text{O} + \text{CH}_3\text{COOH}$
  - $\text{Cu SO}_4 + \text{KI}$
  - $\text{NAF} + \text{H}_2\text{O}$
  - $\text{NH}_4 \text{Cl} + \text{HCHO}$



QP Code : .....

Reg No:.....

**FIRST YEAR B.PHARM DEGREE EXAMINATION**

(Model Question Paper -2012 Scheme)

**Pharmaceutical Chemistry - II**

(Organic Chemistry)

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary

**Essay:**

**(3x10=30)**

1. Explain the electrophilic reactions of alkenes with any two examples.
2. Explain on resonance , hyperconjugation , mesomeric effect and inductive effect with examples.
3. Explain the mechanism and synthetic application of Cannizaro's reaction and Hoffmann's degradation

**Short Notes:**

**(14x5=70)**

4. Discuss three methods of preparation of alcohols and how do you distinguish between 1 – propanol and 2 – propanol
5. Explain Walden's inversion with example.
6. What is Williamson's synthesis. Explain the action of hydroiodic acid on ethers.
7. Explain Kolbe – Schmidt reaction.
8. Mention two methods of synthesis of nitriles and explain their reactivity.
9. Explain the effects of substituents in electrophilic aromatic substitution.
10. Mention two methods of synthesis and three chemical reactions of carboxylic acids.
11. Explain the aldol and crossed aldol condensation reaction.
12. Describe the functional reactions of nitriles
13. Explain why acyl halides are more reactive than alkyl halides towards nucleophilic substitution reaction.
14. Describe the Fries arrangement and its mechanism.
15. Comment on the basicity of amines.
16. Explain the Bayer's strain theory.
17. Explain the effect of halogen on electrophilic aromatic substitution reaction.

\*\*\*\*\*





QP Code : .....

Reg No:.....

**FIRST YEAR B.PHARM DEGREE EXAMINATION**

(Model Question Paper -2012 Scheme)

**Human Anatomy and Physiology**

**Time : 3 hours**

**Max Marks : 100**

- **Answer all questions**
- **Write equations wherever necessary**

**Essay:**

**(3x10=30)**

1. Describe the outflow and functions of autonomic nervous system with reference to its sympathetic division.
2. Describe the structure of cell with and its components with their functions.
3. Explain the histology of nervous tissue with the help of a neat labeled diagram.

**Short Notes:**

**(14x5=70)**

4. Draw a neat labeled diagram of normal ECG. Correlate the ECG waves with atrial and ventricular systole.
5. Describe the metabolic , antiinflammatory and immune functions of glucocorticosteroids.
6. Summarize the functions of medulla oblongata.
7. Describe the bones of upper limb.
8. Briefly describe the structure and functions of respiratory system.
9. Define and explain vital capacity and anoxia.
10. Describe the process of spermatogenesis.
11. Describe the digestion and absorption in small intestine.
12. Discuss the mechanism of blood coagulation.
13. Describe briefly the mechanism of micturition.
14. Explain the physiology of menstruation.
15. Explain the physiology of hearing.
16. Discuss the anatomy and physiological functions of liver.
17. What are the types of leucocytes and their function.

\*\*\*\*\*



QP Code : .....

Reg No:.....

**FIRST YEAR B.PHARM DEGREE EXAMINATION**

(Model Question Paper -2012 Scheme)

**Pharmacognosy- I**

**Time : 3 hours**

**Max Marks : 100**

- **Answer all questions**
- **Write equations wherever necessary**

**Essay:**

**(3x10=30)**

1. Describe the various factors affecting cultivation of medicinal plants.
2. Discuss about the plant families Labiatae and Rubiaceae.
3. Narrate a pharmacognostical report on clove

**Short Notes:**

**(14x5=70)**

4. Mention source , constituents and uses of cinnamon and podophyllum.
5. Outline the classification of volatile oils with examples.
6. Pharmaceutical aids.
7. Write the source, chemical constituents , uses and chemical tests for beeswax.
8. Define tannins and classify with examples. Add a note on Goldbeater's skin test for tannins.
9. Explain about polyploidy.
10. What are plant growth regulators. Discuss about auxins and gibberellins.
11. Animal and microbiological sources of drugs.
12. What are the methods of drying crude drugs.
13. Describe a natural fibre obtained from animal source used in Pharmacy .
14. Resin containing drug.
15. Discuss about the morphological classification of crude drugs.
16. Mention the source , method of preparation , uses and chemical tests for cod liver oil.
17. Differentiate between Cinnamon and cassia.

.....



QP Code : .....

Reg No:.....

**FIRST YEAR B.PHARM DEGREE EXAMINATION**

(Model Question Paper -2012 Scheme)

**PHARMACEUTICS I**

(Dispensing and general Pharmacy )

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary

**Essay:**

**(3x10=30)**

1. Explain the different parts of a prescription. Write a model prescription.
2. Describe the Soxhlet apparatus and explain the extraction taking place in it.
3. Define emulsion and mention about creaming and cracking. Add a note on phase inversion.

**Short Notes:**

**(14x5=70)**

4. What are the reasons of formulating drug in a dosage form.
5. Define proof spirit. Find out the proof spirit of an elixir containing 30% v/v alcohol.
6. Discuss any five reasons for therapeutic incompatibility.
7. Define maceration. Differentiate double and triple maceration.
8. Discuss the history of Indian Pharmacopoea.
9. Mandle's paint.
10. How much of a 2 % ointment should be added to 30g of a 15 % ointment to make a 5 % ointment
11. Explain the principle involved in the preparation of Liniment of Turpentine IP.
12. Mention the types of suppository bases. Add a note on the advantages and disadvantages of each.
13. Explain the different methods of preparation of ointments.
14. Explain the ingredients , method of preparation , use and dose of strong ammonium solution IP.
15. How will you dispense powders with volatile substances and powders with potent drugs.
16. Classify different types of mixtures.
17. Mention three examples of liquid dosage forms for internal use and define them.

\*\*\*\*\*



**Q.P. CODE:**

**Reg. No:** .....

**Second Year B. Pharm Degree Examinations**

**Model Question**

**Pharmaceutical Chemistry - III**

(Advanced Organic Chemistry)

**Time: 3 Hrs**

**Max. Marks: 100**

- Answer all questions
- Write equation wherever necessary

**Essay:**

**(3×10=30)**

1. Define and classify configuration. Explain the sequence rules with examples
2. Explain the various named reduction reactions with examples and their mechanism
3. Mention heterocyclic compounds. Explain the methods of preparation and reactions of imidazole

**Short notes:**

**(14×5=70)**

4. Explain asymmetric synthesis with examples
5. Explain stereochemistry of biphenyl compounds
6. Discuss the various rearrangement reactions
7. Mention the various methods of preparation of furan
8. Discuss the important reactions of pyrazole
9. Discuss the aromaticity of naphthalene
10. Explain the electrophilic substitution reactions of pyridine
11. Explain Mannich reaction and Darzan's reaction
12. Walden Inversion
13. List the various methods for the resolution of racemic mixture
14. Modern theory of double bonds
15. Explain the method of preparation for • Phenothiazine • Acridine
16. Discuss the chemical nature of • Azepines • Oxepines
17. Comment on quinolones and quinazolones

\*\*\*\*\*



**Q.P. CODE:**

**Reg. No:** .....

**Second Year B. Pharm Degree Examinations**

**Model Question**

**Pharmaceutical Analysis - I**

**Time: 3 Hrs**

**Max. Marks: 100**

- Answer all questions
- Write equation wherever necessary

**Essay:**

**(3×10=30)**

1. Explain the various steps involved in gravimetric analysis, citing the estimation of barium as barium sulphate as an example.
2. Why the non-aqueous titrations are of immense importance in pharmaceutical analysis. Mention the principle and types of solvents employed in non-aqueous titrimetry.
3. Explain the different methods used in the detection of endpoint in argentometry.

**Short notes:**

**(14×5=70)**

4. State and explain the Law of mass action.
5. "A precise analytical method need not be accurate". Comment.
6. Why arsenic trioxide is regarded as a primary standard in analysis.
7. Define pH .in the titration between std.HCl and std.NaOH what will be the pH at equivalence point and give reason.
8. Mention the role of buffers in pharmaceutical analysis. How will you prepare an acidic buffer.
9. Titration of a polyprotic acid.
10. List the use of dimercaprol and formaldehyde in complexometry.
11. State Nernst equation. Explain an application of 2,6-dichlorophenol-indophenol in analysis.
12. Explain the factors to be considered in the preparation and storage of standard sodium thiosulphate solution.
13. Explain in detail the principle involved in Karl-Fischer titration.
14. Explain the chromophore theory of pH indicators with examples.
15. Explain the construction of Hempel burette and pipette.
16. Differentiate co precipitation and post precipitation.
17. Mention the steps to be taken to minimise systematic errors in an analytical procedure.

\*\*\*\*\*



**Q.P. CODE:**

**Reg. No:** .....

**Second Year B. Pharm Degree Examinations**

**Model Question**

**Pathophysiology , Health Education & Community Pharmacy**

**Time: 3 Hrs**

**Max. Marks: 100**

- Answer all questions
- Write equation wherever necessary

**Essay:**

**(3×10=30)**

1. Describe the etiology, pathophysiology and clinical significance of diabetes mellitus & rheumatoid arthritis.
2. List the different causes of cellular injury. Explain in detail about the morphology of irreversible cell injury.
3. Define demography and explain the various methods adopted for family planning in a developing country like India.

**Short notes:**

**(14x5=70)**

4. Differentiate between metaplasia and dysplasia.
5. Causes of acute inflammation.
6. Steatosis
7. Syphylis
8. UTIS
9. Ulcerative colitis
10. Etiology of leukemia
11. CPR
12. National immunisation schedule
13. Dots therapy
14. Indicators of health
15. Etiology, prevention and control of blindness
16. Causative organism and mode of transmission of the following:
  - . Malaria • .Chicken pox • . Influenza • . Ascariasis • .. Plaque.
17. Balanced diet

\*\*\*\*\*



**Q.P. CODE:**

**Reg. No:** .....

**Second Year B. Pharm Degree Examinations**

**Model Question**

**Pharmaceutics –II**

(Physical Pharmacy)

**Time: 3 Hrs**

**Max. Marks: 100**

- Answer all questions
- Write equation wherever necessary

**Essay:**

**(3×10=30)**

1. Define order of a reaction. What is shelf life. How do you calculate shelf life of a pharmaceutical product which under go first order degradation. Discuss the effect of temperature on reaction rate.
2. Define surface tension. Classify surfactants with examples write on their pharmaceutical application.
3. Explain reology of pseudoplastic system.

**Short notes:**

**(14×5=70)**

4. Explain working of one multipoint viscometer.
5. Discuss plug flow.
6. Discuss the principles of controlled flocculation in the formulation of suspension.
7. Define emulsions and explain the theories of emulsification.
8. Explain specific surface. Discuss the determination of surface area by air permeability method.
9. Describe passive diffusion in the transport of drugs.
10. Describe drug dissolution process and add a note on sink condition.
11. Describe Type-I dissolution apparatus with a labeled diagram.
12. Explain electrical properties of colloids.
13. Describe derived properties of powders.
14. Define thixotropy and mention its importance in pharmaceutical formulations.
15. Classify complexes with suitable examples and add note on complexation & drug action.
16. Explain the method of particle size determination using Andreason pipette method.
17. What is Angle of Repose and mention its applications.

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Reg. No: .....

**Second Year B. Pharm Degree Examinations**  
**Model Question**

**Mathematics, Biostatistics & Computer Applications**

Time: 3 Hrs

Max. Marks: 100

- Answer all questions
- Write equation wherever necessary
- Write **SECTION A** and **SECTION B** in separate Answer books. Do not mix up questions from Section A and Section B.

**Q.P. CODE:**

**Section A**

**Marks:50**

**Essay:**

**(1×10=10)**

1. Six pairs of husbands and wives selected at random and their intelligent quotients were recorded as follows

Pair	1	2	3	4	5	6
IQ of husband	105	112	90	92	116	110
IQ of wife	102	108	100	96	112	110

Does the data suggest that there is no significant difference in average IQ between the husband and wife. Use 1% level of significance

**Short notes:**

**(8×5=40)**

2. Find the derivative with respect to  $x$  of the following  $\bullet \sqrt{x} + \frac{1}{\sqrt{x}} \bullet a^{\cos ax}$
3. Find  $\frac{dy}{dx}$  when  $x = a [\cos t + \log \tan \frac{t}{2}]$  and  $y = a \sin t$
4. Evaluate  $\bullet \int \frac{x^k}{\sqrt{1+x^2}} dx \bullet \int x \log(1+x) dx$
5. Solve  $(x^2 + 1) \frac{dy}{dx} + 2xy = 4x^2$
6. Solve  $\frac{d^2y}{dx^2} - 5 \frac{dy}{dx} + 6y = e^{2x}$
7. Find the laplace transform of  $\sin 2t \sin 3t$
8. Find the mean, median and coefficient of variation of the following data – 8, 6, 10, 4, 12, 9, 7, 8.
9. Calculate the coefficient of variation between height ( in inches ) and weight ( in kilograms ) from the data given below

Height	60	63	65	66	68
Weight	50	54	60	67	70

**P.T.O**





**Q.P. CODE:**

**Section B**

**Marks:50**

**Essay:**

**(2×10=20)**

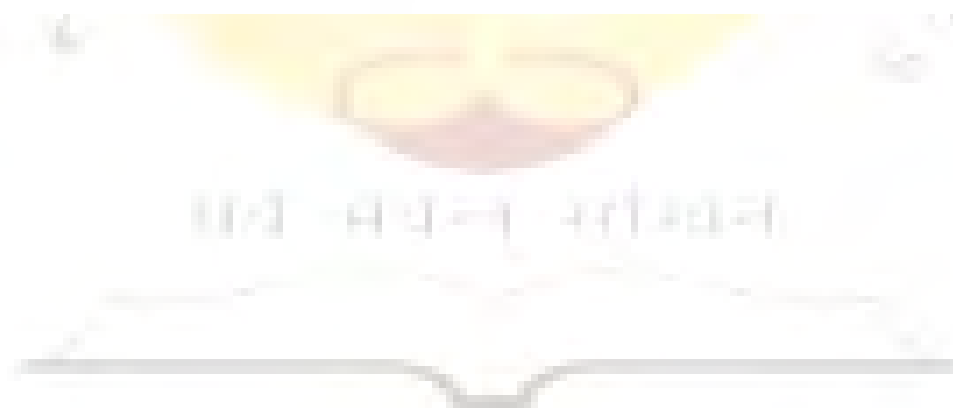
1. Discuss in detail about different computer networking systems
2. Explain in detail about the application of computers in pharmacy

**Short notes:**

**(6×5=30)**

3. Explain briefly about optical character recognition ( OCR )
4. Mention the types of operating systems
5. Describe the computer embedded systems and their applications briefly.
6. Printers as output devices
7. Differentiate between primary and secondary memory
8. Discuss assembly languages .

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**Q.P. CODE:**

**Reg. No:** .....

**Second Year B. Pharm Degree Examinations**

**Model Question**

**Pharmaceutics III**

(Pharmaceutical Technology)

**Time: 3 Hrs**

**Max. Marks: 100**

- Answer all questions
- Write equation wherever necessary

**Essay:**

**(3×10=30)**

1. Describe the principle and construction of a centrifugal pump. Compare centrifugal pump with reciprocating pump.
2. Describe the construction, working, advantages and disadvantages of a fluid energy mill.
3. Explain the term multiple effect evaporation. Discuss the methods of feeding multiple effect evaporators.

**Short notes:**

**(14×5=70)**

4. State and explain Fourier's law of heat conduction
5. Differentiate between black body and grey body and add a note on Stefan Boltzmann law
6. Describe the principle of pneumatic conveyor with the help of a neat sketch.
7. Describe the five factors that influence size reduction.
8. Discuss filter aids with suitable examples and add a note on precoat filter
9. List five pharmaceutical applications of industrial centrifuges and describe the theory of centrifugation.
10. Describe the principle of steam distillation.
11. Describe the construction and working of any one type of film evaporator.
12. Explain the principles of nucleation and crystal growth in crystallization
13. Discuss the principle of freeze drying and mention its advantages .
14. List the reasons for vortex formation. Drawbacks of vortex and to suggest solutions for this problem.
15. List the possible industrial hazards and how can it be prevented.
16. Explain the importance of stainless steel in pharmaceutical industry.
17. Define – absolute humidity, percentage humidity, dew point , wet bulb temperature

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**Q.P. CODE:**

**Reg. No: .....**

**Second Year B. Pharm Degree Examinations**

***Model Question***

**Applied Biochemistry and Molecular Biology**

**Time: 3 Hrs**

**Max. Marks: 100**

- Answer all questions
- Write equation wherever necessary

**Essay:**

**(3×10=30)**

1. Describe the metabolism of sulphur containing amino acids with their metabolic disorders
2. Classify lipids and discuss in detail with their structure
3. Explain Protein Biosynthesis in detail.

**Short notes:**

**(14×5=70)**

4. Briefly explain the urea cycle.
5. Discuss enzymes and classify it.
6. Classify amino acids.
7. Enumerate the TCA cycle with its energetics.
8. Describe the biosynthesis of heme.
9. Explain: • Transamination • Deamination
10. Molecular methods of disease diagnosis
11. Explain the mechanism of oxidative phosphorylation.
12. Discuss briefly the de novo synthesis of purine nucleotides
13. Elaborate on beta oxidation of fatty acids.
14. DNA replication
15. Describe polymerase chain reaction with its applications
16. Various factors affecting enzyme action.
17. Explain the HMP shunt with its biochemical significance

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QP Code : .....

Reg No:.....

**THIRD YEAR B.PHARM DEGREE EXAMINATION**

(Model Question Paper – 2010 Scheme)

**Pharmaceutics IV**

(Pharmaceutical Microbiology & Biotechnology)

**Time : 3 hours**

**Max Marks : 100**

- **Answer all questions**
- **Write equations wherever necessary**

**Essay:**

**(3x10=30)**

1. Explain the various antigen-antibody reactions. Discuss briefly on immune fluorescence.
2. What are the different parameters to be considered in a fermentation process. Explain the production, harvest and recovery of penicillin.
3. Classify the thermal methods of sterilization and explain any two of them.

**Short Notes:**

**(14x5=70)**

4. Anaerobic culture methods.
5. Structure of bacterial cell.
6. Isolation of pure culture.
7. Cultivation of viruses.
8. Methods of gene transfer.
9. Interferons.
10. Standardisation of immunological products.
11. Techniques of enzyme immobilisation.
12. Microbial assay of antibiotics by diffusion.
13. Sterility testing by Membrane filtration.
14. Sterilisation by radiation.
15. Rideal Walker coefficient.
16. Industrially important microorganisms.
17. Steps in gene cloning.

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QP Code : .....

Reg No:.....

**THIRD YEAR B.PHARM DEGREE EXAMINATION**

(Model Question Paper -2010 Scheme)

**Pharmaceutical Chemistry - IV**

(Chemistry of Natural Products)

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary

**Essay:**

**(3x10=30)**

1. Discuss the structure elucidation and pharmacological activity of morphine.
2. What are steroids. Explain the nomenclature and stereochemistry of steroids.
3. How was it found that glucose has a ring structure and how was the ring size determined.

**Short Notes:**

**(14x5=70)**

4. Discuss the chemistry and uses of camphor.
5. What are anabolic steroids. Mention the structure and uses of testosterone.
6. Give the chemical structures and biological importance of therapeutically useful prostaglandins
7. Cellulose derivatives used in pharmacy.
8. Isoelectric point and denaturation of proteins.
9. Discuss the structural features and uses of insulin.
10. Chemical structures of various aglycones of cardiac glycosides.
11. Structural elucidation of caffeine.
12. Outline the synthesis of progesterone from cholesterol.
13. Explain Hofmann exhaustive methylation method. Illustrate with examples.
14. Chemical structures and biological importance of Vitamin B2 and Vitamin A.
15. Show the inter relationship between oestrone, oestradiol and oestriol structures.
16. Explain the significance of analytical constants of fats and oils.
17. Explain the primary structure of proteins.

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QP Code : .....

Reg No!.....

### THIRD YEAR B.PHARM DEGREE EXAMINATION

(Model Question Paper -2010 Scheme)

#### Pharmacology I

Time : 3 hours

Max Marks : 100

- Answer all questions
- Write equations wherever necessary

#### Essay:

(3x10=30)

1. Define tolerance. Classify with examples. What are the mechanisms of drug tolerance. How addiction is treated.
2. Classify antihypertensive drugs with examples. Explain the mechanism of action of ACE inhibitors. Mention the adverse effects and contraindications of ACEI.
3. Classify antidiabetic drugs. Explain the pharmacotherapy of type I diabetes mellitus. Enumerate different insulin preparations.

#### Short Notes:

(14x5=70)

4. Name four anticholine esterase drugs. Mention their general therapeutic uses.
5. What is drug allergy. Name different types of allergic reactions with examples.
6. Name some prostaglandin analogues. Mention its therapeutic uses.
7. What is biotransformation. What is the clinical significance of microsomal enzyme induction.
8. What is rational use of medications. Define P drug concept and P treatment.
9. Name different drug interactions. Write a brief note on pharmacogenetic drug interactions
10. What are the steps to be taken to minimize drug exposure to babies during lactation.
11. Explain transdermal drug administration.
12. Name different receptor theories. What is meant by receptor up regulation and down regulation.
13. Explain the following with examples: Enterohepatic cycling , Therapeutic index
14. What are the general methods of management of poisoning.
15. Classify antihistaminic drugs with examples.
16. What are the therapeutic uses and adverse effects of glucocorticoids.
17. Discuss briefly about : Astemizole , Granisetron

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QP Code : .....

Reg No:.....

**THIRD YEAR B.PHARM DEGREE EXAMINATION**  
(Model Question Paper -2010 Scheme)  
**Pharmaceutics V**

( Biopharmaceutics & Pharmacokinetics)

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary

**Essay:**

**(3x10=30)**

1. Describe the physico-chemical properties of drugs which influence their gastrointestinal absorption.
2. What are the reasons for non-linearity in pharmacokinetics of drugs. Explain the methods for determination of Michaelis constant in non-linear kinetics.
3. Derive expressions for the concentration in plasma ( $C_p$ ),  $C_{max}$ ,  $T_{max}$  and elimination rate constant ( $K_e$ ) of a drug following first order absorption and one compartment kinetics when given by oral route.

**Short Notes:**

**(14x5=70)**

4. Glucuronidation in biotransformation of drugs.
5. Explain the determination of first order elimination rate constant of a constant rate intravenous infusion assuming one compartment model.
6. Plasma protein binding of drugs.
7. How will you determine first order absorption rate constant ( $K_a$ ) by method of residuals. Assume one compartment open model.
8. How dose adjustment is done in patients with renal failure.
9. Explain the various pharmacokinetic parameters useful for assessment of bioavailability.
10. Describe briefly enterohepatic cycling of drugs.
11. Physiological barriers to distribution of drugs.
12. Explain biopharmaceutics classification system for drugs with examples.
13. Describe any official dissolution test methodology and acceptance criteria for immediate release solid dosage forms.
14. Explain the determination of elimination half life of a one compartment IV bolus model from urinary excretion data by rate of excretion method.
15. Explain the various mechanisms of renal clearance.
16. Vitro - in vivo correlation.
17. Describe passive diffusion transport mechanism of drug absorption.

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QP Code : .....

Reg No:.....

**THIRD YEAR B.PHARM DEGREE EXAMINATION**

(Model Question Paper -2010 Scheme)

**Pharmaceutical Jurisprudence**

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary

**Essay:**

**(3x10=30)**

1. Explain the constitution of the pharmacy council of India. Discuss its functions in detail.
2. State the salient features of the drugs and magic remedies act 1955 and explain its significance in the prohibition of advertisements of drugs.
3. Define "Medicinal preparation" and "toilet preparation". Explain the manufacture of Alcoholic preparations in bond and outside bond.

**Short Notes:**

**(14x5=70)**

4. Constitution, powers and functions of A.I.C.T.E.
5. Conditions of import license of drugs.
6. Loan license and repacking license.
7. Retail sale of drugs.
8. Drugs technical advisory board.
9. Powers and duties of drugs inspectors.
10. Define •"factory" • "pharmacy" • "cannabis" • "food".
11. Opium poppy cultivation.
12. Retail pricing of formulations.
13. Salient features of the poisons act 1919.
14. Institutional animal ethics committee.
15. Salient features of the patents act 2001.
16. Explain "Adulterated drugs" and "Spurious drugs".
17. Pharmacist in relation to his trade and profession.

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QP Code : .....

Reg No:.....

**THIRD YEAR B.PHARM DEGREE EXAMINATION**

(Model Question Paper -2010 Scheme)

**Pharmacognosy - II**

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary

**Essay:**

**(3x10=30)**

1. Briefly describe the different chromatographic methods and its application in the evaluation of crude drugs.
2. What is marine pharmacognosy. Which are the novel medicinal agents from marine sources.
3. Discuss about alternative systems of medicine prevailing in India.

**Short Notes:**

**(14x5=70)**

4. Chemotaxonomy.
5. Chemical tests and adulterants of *Senna*.
6. *Shikimic* acid pathway.
7. Differentiate between *Asava* and *arishta*.
8. Morphology and microscopy of *Liquorice*.
9. Aromatherapy.
10. Chemical tests for *Datura* and *Neem*.
11. Diastase.
12. Transverse section of *Thevetia*.
13. Supercritical fluid extraction method.
14. Chemical constituents of *Rauwolfia*.
15. Any two protein containing drugs.
16. Plant allergens.
17. Preparation of *Lehyas*.

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QP Code : .....

Reg No:.....

**THIRD YEAR B.PHARM DEGREE EXAMINATION**

(Model Question Paper -2010 Scheme)

**Pharmaceutical Management**

Time : 3 hours

Max Marks : 100

- Answer all questions
- Write equations wherever necessary

**Essay:**

(3x10=30)

1. Explain the different channels of distribution with special reference to retail sale of drugs.
2. State and explain the different functions of pharmaceutical marketing.
3. Explain in detail on planning as a part of management.

**Short Notes:**

(14x5=70)

4. Leadership.
5. Communication.
6. Training and evaluation.
7. New drug applications.
8. Intellectual property rights.
9. Levels of management.
10. Export of drugs.
11. Market research.
12. ABC analysis.
13. Qualities of a salesman.
14. Bioequivalence study protocols.
15. Functions of Wholesaler.
16. Books of original entry.

17. Enter the following transactions of Mr. Mahesh Sharma in a two columnar cash book:

2013 July		Rs.
1	Started business with cash	50,000/-
2	Purchased goods for cash	30,000/-
7	Received cash from Reghu	15,000/-
10	Paid into Bank	7,000/-
15	Cash sales	2,500/-
28	Paid to Vijay Discount allowed	3,000/- 200/-
29	Received from Thomas Discount allowed	3,900/- 100/-
30	Paid rent for the month Paid Salaries	1,500/- 2,000/-



QP Code : .....

Reg No:.....

**FINAL YEAR B.PHARM DEGREE EXAMINATIONS**

(Model Question Paper – 2010 Scheme)

**Pharmaceutical Chemistry V**

(Medicinal Chemistry)

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary
- Draw diagram wherever necessary

**Essay:**

**(3x10=30)**

1. What are diuretics. Mention the synthesis, mechanism of action and clinical uses of furosemide.
2. Discuss in detail the chemistry of betalactum antibiotics. Outline the synthesis and specific uses of chloramphenicol.
3. Classify antineoplastic agents giving suitable examples for each category. Outline the synthesis and mechanism of action of methotrexate.

**Short Notes:**

**(14x5=70)**

4. Antiviral agents.
5. QSAR.
6. How do optical and geometric isomerisms influence the biological actions of drugs.
7. Enumerate the differences between local and general anesthetics. Mention the chemical synthesis of an amide type of local anesthetic.
8. Structure activity relationship of cholinergic drugs.
9. Outline the synthesis of diazepam and mention its uses.
10. Synthesis, mechanism of action and uses of methyl dopa.
11. Classify antihistamines based on chemical structure with examples. Mention the structure of promethazine.
12. Mechanism of action and synthesis of mebendazole.
13. Beta adrenergic blockers.
14. Chemical structure and uses of the following – Pentazocin and Gri seofulvin.
15. Local antiinfective agents.
16. Structure and therapeutic applications of any two antipsychotics of phenothiazine group.
17. What are prodrugs. Mention the application of prodrug design with suitable examples.

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QP Code : .....

Reg No:.....

**FINAL YEAR B.PHARM DEGREE EXAMINATIONS**

(Model Question Paper -2010 Scheme)

**Pharmaceutical Analysis - II**

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary
- Draw diagram wherever necessary

**Essay:**

**(3x10=30)**

1. Explain the origin of UV spectra. Define Beer- Lamberts law and arrive at an expression relating absorbance, path length and concentration.
2. Explain the theory of thin layer chromatography. Add a note on the methods of detection of spots on the plate.
3. Using a block diagram illustrate the working of an Infra red spectrophotometer. Add a note on the usefulness of IR spectra in the structural elucidation of organic compounds.

**Short Notes:**

**(14x5=70)**

4. Detectors used in gas chromatography.
5. Applications of potentiometric titrations.
6. Jabalonski diagraph.
7. Ionization techniques in mass spectrometry.
8. ICH guidelines
9. Principle of radio-immuno assay.
10. Precessional frequency.
11. Dropping mercury electrode.
12. Use of HPTLC in plant drug research.
13. Construction of a standard hydrogen electrode.
14. Use of X-Ray diffraction in pharmacy.
15. Construction and working of a hollow cathode lamp.
16. Importance of validation of analytical equipments.
17. Use of differential scanning calorimetry in pharmacy.

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QP Code : .....

Reg No:.....

**FINAL YEAR B.PHARM DEGREE EXAMINATIONS**

(Model Question Paper -2010 Scheme)

**Pharmacognosy III**

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary
- Draw diagram wherever necessary

**Essay:**

**(3x10=30)**

1. Classify terpenes with examples. Explain its biogenesis & sources, chemistry and pharmacology of sesquiterpenes.
2. What are the threats to biodiversity and explain the measures to conserve biodiversity.
3. Explain the WHO guidelines for evaluation of crude drugs in detail

**Short Notes:**

**(14x5=70)**

4. Biogenesis of cardiac glycosides.
5. Gene transfer methods.
6. Uses of lignans
7. Chemistry of flavonoids.
8. Tissue culture media.
9. Trade of ginseng.
10. Applications of UV spectroscopy in herbal drug analysis.
11. Optical isomerism of phytochemicals.
12. Two research institutions in India working on medicinal plants.
13. Classify herbal cosmetics with examples.
14. What are prebiotics and probiotics.
15. Chemistry and pharmacology of opium alkaloids.
16. Evaluation methods for herbal tablets
17. Requirements of a tissue culture laboratory

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QP Code : .....

Reg No:.....

**FINAL YEAR B.PHARM DEGREE EXAMINATIONS**  
(Model Question Paper -2010 Scheme)  
**Pharmaceutics VI**

( Formulative & Industrial Pharmacy)

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary
- Draw diagram wherever necessary

**Essay:**

**(3x10=30)**

1. List the objectives of tablet coating. Explain its different types and list its advantages.  
Explain in detail the steps involved in sugar coating.
2. What are pharmaceutical aerosols. Explain the formulation and packaging of aerosols with special reference to valve systems, types of propellants and filling methods.
3. What is microencapsulation. State its advantages over conventional dosage forms. Explain any two techniques employed in the preparation of microcapsules.

**Short Notes:**

**(14x5=70)**

4. Production of hard gelatin capsule shell.
5. Tablet excipients.
6. Containers used in parenterals.
7. Quality control tests of capsules.
8. Any three defects in tablet manufacture and its correction.
9. Total parenteral nutrition.
10. Eye drops.
11. Shampoos.
12. Dentifrices.
13. Liposomes.
14. Advantages of transdermal drug delivery.
15. Process validation.
16. Preparation of catgut.
17. Plasma substitutes.

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QP Code : .....

Reg No:.....

**FINAL YEAR B.PHARM DEGREE EXAMINATIONS**

(Model Question Paper -2010 Scheme)

**Pharmacology - II**

**Time : 3 hours**

**Max Marks : 100**

- **Answer all questions**
- **Write equations wherever necessary**
- **Draw diagram wherever necessary**

**Essay:**

**(3x10=30)**

1. Define bioassay. Mention when bioassay is preferred over physical and chemical methods of assay. Elaborate on various methods of bioassay.
2. Classify antineoplastic agents with suitable examples of each class. Mention the common adverse effects of these agents. Add a note on alkylating agents.
3. Define antibiotics. Classify them based on its mechanism of action. Add a note on the rationale behind combination of antibiotics.

**Short Notes:**

**(14x5=70)**

4. List the advantages of atypical antipsychotics from typical antipsychotics.
5. Outline the principle and protocol for bioassay of digitalis.
6. Management of methanol poisoning.
7. Newer anti-epileptic drugs.
8. Principles and applications of RIA.
9. Various neurotransmitters present in the CNS and its role in the pathogenesis of diseases.
10. Comment on the therapeutic potential of MAO inhibitors.
11. Mechanism of action and therapeutic use of loop diuretics.
12. Pharmacological actions of oxytocin. Compare ergometrine and oxytocin as ecbolics.
13. Various phases of clinical trials in drug development.
14. Mention the modalities in the management of drug poisoning using paracetamol as an example.
15. Compare SSRIs and TCAs as anti depressants.
16. Role of fibrinolytic agents in the management of acute stroke.
17. What is bioinformatics. Mention its role in drug discovery.

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QP Code : .....

Reg No:.....

**FINAL YEAR B.PHARM DEGREE EXAMINATIONS**

(Model Question Paper -2010 Scheme)

**Pharmacy Practice**  
(Hospital Pharmacy & Clinical Pharmacy)

**Time : 3 hours**

**Max Marks : 100**

- Answer all questions
- Write equations wherever necessary
- Draw diagram wherever necessary

**Essay:**

**(3x10=30)**

1. What is inventory control. Explain the significance of inventory control in managing drugs in the hospitals. Discuss the various methods of inventory control.
2. What do you mean by congestive cardiac failure. Mention the clinical manifestations and treatment of CCF.
3. What are the infrastructure requirements of a community pharmacy. Add note on the professional responsibility of community pharmacist.

**Short Notes:**

**(14x5=70)**

4. In-patient drug distribution system.
5. Pharmacy and therapeutic committee.
6. Hospital formulary.
7. Procurement of drugs in a tertiary care hospital.
8. CSSR.
9. Duties and responsibilities of clinical pharmacist
10. Liver function tests.
11. TDM.
12. ADR monitoring methods.
13. Pharmacological and non pharmacological management of diabetes.
14. TB management and DOTS programme.
15. Pharmacoeconomics
16. Treatment algorithm for rheumatoid arthritis
17. Real function tests.

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### **3.7 Internal assessment component**

As per clause 1.15

### **3.8 Details of practical/clinical practicum exams**

Practicals and Viva voce shall be conducted by one external and one internal examiner.

### **3.9 Number of examiners needed (Internal & External) and their qualifications**

Examiner – From within this University or other Universities with 3 years teaching experience, after acquiring M.Pharm qualification

There shall be two examiners for practical examination, one internal and one external, who will jointly evaluate the performance of the candidate and conduct viva voce examination and award marks.

### **3.10 Details of viva:**

Practicals and Viva voce shall be conducted by one external and one internal examiner.

## **4. INTERNSHIP**

### **4.1 Eligibility for internship**

### **4.2 Details of internship Training**

Every candidate shall undergo practical training in a Pharmaceutical manufacturing House / a Hospital with at least three specialties (Training in dispensing, inventory control, patient counseling, medication history, ward pharmacy, clinical pharmacy practice)/ National



research laboratory for a period of not less than 30days (150 hours) after third year B. Pharm or fourth year B. Pharm. B Pharm degree will be awarded only after the training certificate from the training institute of having undergone the training successfully, is forwarded to the university by the Principal/Head of the department.

#### **4.3 Model of Internship Mark lists**

#### **4.4 Extension rules**

#### **4.5 Training given**

As given under 1.25

### **5. ANNEXURES**

**5.1 Check Lists for Monitoring:** Log Book, Seminar Assessment etc. to be formulated by the curriculum committee of the concerned Institution

