

**BIJU PATNAIK UNIVERSITY OF TECHNOLOGY**

**SYLLABUS**

**FOR**

**FOUR-YEAR B.PHARMACY PROGRAMME**

**(UNDER SEMESTER PATTERN)**

**(w.e.f. 2007-08)**

**BIJU PATNAIK UNIVERSITY OF TECHNOLOGY**

**ROURKELA, ORISSA**

**2007-08**

### **CREDITS BREAK-UP**

<b>YEAR</b>	<b>SEMESTER-I</b>	<b>SEMESTER-II</b>	<b>TOTAL</b>
1st Year	26	26	52
2nd Year	26	26	52
3rd Year	28	28	56
4th Year	29	28	57
		<b>TOTAL:</b>	<b>217</b>

### **CONTACT HOURS/WEEK:**

<b>YEAR</b>	<b>SEM-I</b>	<b>SEM-II</b>
1st Year	32	31
2nd Year	30	30
3rd Year	33	33
4th Year	30	30

### **Weightage given to the subject groups:**

	<b>CREDITS</b>			
	<b>FOR REGULAR COURSE</b>		<b>FOR LATERAL ENTRY</b>	
	<b>MINIMUM</b>	<b>MAXIMUM</b>	<b>MINIMUM</b>	<b>MAXIMUM</b>
1. Basic Sciences (BS)	08	11	08	11
2. Basic Engineering (BE)	07	10	07	10
3. Humanities & Management (HM)	07	12	07	12
4. Professional subjects				
a. Professional Core (PC)	155	158	112	115
b. Professional Electives (PE)	07	10	07	10
c. Project Work (PW)	10	10	10	10
d. Compréhensive Viva-voce (CV)	06	06	06	06
	<b>TOTAL</b>	<b>200</b>	<b>157</b>	<b>174</b>

## SCHEME OF INSTRUCTIONS

### 1st SEMESTER

COURSE NO.	SUBJECT	L	T	P	CREDITS	SUBJECT GROUP
PH. 1.1	Communicative English	2	0	-	2	HM
PH. 1.2	Communicative English Practical	0	0	2	1	HM
PH. 1.3	HAP-I	3	0	-	3	PC
PH. 1.4	HAP-I Practical	-	-	3	2	PC
PH. 1.5.	Pharmaceutics-I (Dispensing Pharmacy)	3	0	-	3	PC
Ph. 1.6	Pharmaceutics-I Practical	-	-	3	2	PC
PH. 1.7	Pharm. Chemistry-I (Inorganic)	3	0	-	3	PC
PH. 1.8	Pharm Chemistry-I Practical	-	-	3	2	PC
PH. 1.9	Pharmacognosy-I	3	0	-	3	PC
PH. 1.10	Pharmacognosy-I Practical	-	-	3	2	PC
PH. 1.11	Remedial Biology* &	2	0	-	2	BS
PH. 1.12	Remedial Biology Practical* OR	-	-	2	1	BS
PH. 1.13	Remedial Mathematics*	3	1	-	3	BS

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TOTAL;      16/17    0/1    14/16      26

Contact hours: 32 /week

Credits: 26 (HM – 3, BS – 3, PC – 20)

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

### 2nd SEMESTER

COURSE NO.	SUBJECT	L	T	P	CREDITS	SUBJECT GROUP
PH. 2.1	Business communication in English	2	0	-	2	HM
PH. 2.2	Business communication in English practical	0	0	2	1	HM
PH. 2.3	HAP-II	3	0	-	3	PC
PH. 2.4	HAP-II Practical	-	-	3	2	PC
PH. 2.5	Pharm. Analysis – I	3	0	-	3	PC
PH. 2.6	Pharm. Analysis-I Practical	-	-	3	2	PC
PH. 2.7	Pharmacognosy-II	3	0	-	3	PC
PH. 2.8	Pharmacognosy-II Practical	-	-	3	2	PC
PH. 2.9	Hospital Pharmacy	3	0	-	3	PC
PH. 2.10	Pharm. Chemistry-II (Org. Chem-I)	3	0	-	3	PC
PH. 2.11	Pharm. Chemistry-II Practical	-	-	3	2	PC

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TOTAL :      17      00      14      26

Contact hours: 31/week

Credits: 26 (HM – 3, PC – 23)

### 3<sup>rd</sup> SEMESTER

Course No.	Subject	Contact Hrs L-T-P	Credits	Subject group
PH.3.1.	Pharmaceutics-II (Phy. Pharm-I)	3-0-0	3	PC
PH.3.2.	Pharmaceutics-II Practical	0-0-3	2	PC
PH.3.3.	Basic Engineering-I (Unit Operations - I)	3-0-0	3	BE
PH.3.4.	Basic Engineering-I ( Practical)	0-0-3	2	BE
PH.3.5.	Pharm. Chemistry-III (Org. Chemistry-II)	3-0-0	3	PC
PH.3.6.	Pharm. Chemistry-III Practical	0-0-3	2	PC
PH.3.7.	Pharmacognosy-III	3-0-0	3	PC
PH.3.8.	Pharmacognosy-III Practical	0-0-3	2	PC
PH.3.9.	Pathophysiology of Common Diseases	3-0-0	3	PC
PH.3.10.	Environmental Science	3-0-0	3	HM
Total		18-0-12	26	

Contact hours: 30/week Credits: 26 (BE – 5, HM – 3, PC – 18)

*Lateral Entry students with D.Pharm qualification are required to take course no. PH.1.1, PH.1.2*

*(Communicative English theory and practical) and Course No. PH.1.11(Remedial Biology Theory\*), PH. 1.12 (Remedial Biology Practical\*) OR PH.1.13 Remedial Mathematics\* as the case may be in addition to the above courses of 3<sup>rd</sup> Semester.*

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

### 4<sup>th</sup> SEMESTER

Course No.	Subject	Contact Hrs L-T-P	Credits	Subject group
PH.4.1.	Pharmaceutics - III (Phy Ph - II)	3-0-0	3	PC
PH.4.2.	Pharmaceutics - III Practical	0-0-3	2	PC
PH.4.3.	Basic Engineering-II (Unit Operations - II)	3-0-0	3	BE
PH.4.4.	Basic Engineering-II Practical	0-0-3	2	BE
PH.4.5.	Biochemistry	3-0-0	3	PC
PH.4.6.	Biochemistry Practical	0-0-3	2	PC
PH.4.7.	Computer Applications	3-0-0	3	BS
PH.4.8.	Computer Applications Practical	0-0-3	2	BS
PH.4.9.	Mathematics & Statistics	3-0-0	3	BS
PH.4.10.	Pharm. Chemistry-IV (Org. Chemistry-III)	3-0-0	3	PC
Total		18-0-12	26	

Lateral Entry students with D.Pharm qualification are required to take course no. PH.2.1 (Business Communication in English) in addition to the above courses of 4<sup>th</sup> Semester.

Contact hours: 30/week Credits: 26 (BS – 8, BE – 5, PC – 13)

#### 5<sup>th</sup> SEMESTER

Course No.	Subject	Contact Hrs L-T-P	Credits	Subject group
PH.5.1.	Pharmaceutics-IV (Pharm. Tech-I)	3-0-0	3	PC
PH.5.2.	Pharmaceutics-IV Practical	0-0-3	2	PC
PH.5.3.	Applied Microbiology	3-0-0	3	PC
PH.5.4.	Applied Microbiology Practical	0-0-3	2	PC
PH.5.5.	Pharm. Chemistry-V (Med. Chem-I)	3-0-0	3	PC
PH.5.6.	Pharm. Chemistry-V Practical	0-0-3	2	PC
PH.5.7.	Pharmacology-I	3-0-0	3	PC
PH.5.8.	Pharmacology-I Practical	0-0-3	2	PC
PH.5.9.	Pharm. Analysis-II	3-0-0	3	PC
PH.5.10.	Pharm. Analysis-II Practical	0-0-3	2	PC
PH.5.11.	Community Pharmacy and Health Education	3-0-0	3	PC
<b>Total</b>		<b>18-0-15</b>	<b>28</b>	
<b>Contact hours: 33/week</b>		<b>Credits: 28 ( PC – 28)</b>		

#### 6<sup>th</sup> SEMESTER

Course No.	Subject	Contact Hrs L-T-P	Credits	Subject group
PH.6.1.	Pharmaceutics - V (Pharm Tech - II)	3-0-0	3	PC
PH.6.2.	Pharmaceutics - V Practical	0-0-3	2	PC
PH.6.3.	Pharm. Chemistry-VI (Med. Chem-II)	3-0-0	3	PC
PH.6.4.	Pharm. Chemistry-VI Practical	0-0-3	2	PC
PH.6.5.	Phytochemistry	3-0-0	3	PC
PH.6.6.	Phytochemistry Practical	0-0-3	2	PC
PH.6.7.	Pharmacognosy-IV	3-0-0	3	PC
PH.6.8.	Pharmacognosy-IV Practical	0-0-3	2	PC
PH.6.9.	Pharmacology-II	3-0-0	3	PC
PH.6.10.	Pharmacology-II Practical	0-0-3	2	PC
PH.6.11.	Pharmaceutical Jurisprudence & Ethics	3-0-0	3	PC
<b>Total</b>		<b>18-0-15</b>	<b>28</b>	
<b>Contact hours: 33/week</b>		<b>Credits: 28 (PC – 28)</b>		

### 7<sup>th</sup> SEMESTER

Course No.	Subject	Contact Hrs L-T-P	Credits	Subject group
PH.7.1.	Pharmaceutics-VI ( <i>Bio-Pharmaceutics &amp; Pharmacokinetics</i> )	3-0-0	3	PC
PH.7.2.	Pharmacology-III	3-0-0	3	PC
PH.7.3.	Pharm. Chemistry-VII (Med. Chemistry-III)	3-0-0	3	PC
PH.7.4.	Pharm. Analysis-III	3-0-0	3	PC
PH.7.5.	Pharm. Analysis-III Practical	0-0-3	2	PC
PH.7.6.	Pharm. Biotechnology	3-0-0	3	PC
PH.7.7.	Elective-I	3-0-0	3	PE
PH.7.8.	Elective-I Practical	0-0-3	2	PE
PH.7.9.	Comprehensive Viva-voce	0-0-0	3	CV
PH.7.10.	Project Work (Seminar based on Literature Survey & Plan of Work)	0-0-6	4	PW
<b>Total</b>		<b>18-0-12</b>	<b>29</b>	
<b>Contact hours: 30/week</b>		<b>Credits: 29 (PC – 17, PE – 5, CV – 3, PW – 4)</b>		

### 8<sup>th</sup> SEMESTER

Course No.	Subject	Contact Hrs L-T-P	Credits	Subject group
PH.8.1	Pharmaceutics - VII ( <b>Pharmaceutical Technology III</b> )	3-0-0	3	PC
PH.8.2.	Pharmaceutics - VII Practical	0-0-3	2	PC
PH.8.3.	Clinical Pharmacy & Therapeutics	3-0-0	3	PC
PH.8.4.	Quality Assurance & GMP	3-0-0	3	PC
PH.8.5.	Pharmaceutical Management	3-0-0	3	HM
PH.8.6.	Elective-II	3-0-0	3	PE
PH.8.7.	Elective-II Practical	0-0-3	2	PE
PH.8.8.	Comprehensive Viva-voce	0-0-0	3	CV
PH.8.9.	Project Work & Viva-voce	0-0-9	6	PW
<b>Total</b>		<b>15-0-15</b>	<b>28</b>	
<b>Contact hours: 30/week</b>		<b>Credits: 28 (PC – 11, HM – 3, PE – 5, CV – 3, PW – 6)</b>		

#### **ELECTIVES**

- PH.E.1. Cosmetic Technology
- PH.E.2 Cosmetic Technology practical
- PH.E.3. Herbal Drug Technology
- PH.E.4 Herbal Drug Technology practical
- PH.E.5 Bioassays
- PH.E.6 Bioassays practical
- PH.E.7 Hospital Pharmacy Administration
- PH.E.8 Hospital Pharmacy Administration practical
- PH.E.9 Advanced Pharmaceutical Analysis
- PH.E.10 Advanced Pharmaceutical Analysis practical
- PH.E.11 Pharmacy Practice
- PH.E.12 Pharmacy Practice practical

# BACHELOR OF PHARMACY

## 1<sup>st</sup> SEMESTER

### COMMUNICATIVE ENGLISH

#### P.H.1.1. THEORY

2 hours/week

#### Rationale / Objectives:

#### Specific Objectives:

#### The course attempts to

- a) Familiarize the student with the sounds of English in a nutshell, particularly long and short vowels, some consonants stress and intonation.
- b) Provide adequate listening and speaking practice so that the learner can speak with ease, fluency and reasonable clarity in common everyday situation and on formal occasions
- c) Use grammar in meaningful contexts.
- d) Things with words, i.e. to perform functions like ordering, requesting, inviting and so on

#### UNIT – I      **Communication (6 hours)**

- 1.1. Verbal and non-verbal spoken and written
- 1.2. Language functions-descriptive, expressive and social
- 1.3. To inform, enquire, attract, influence, regulate and entertain
- 1.4. Bias-free and plain English
- 1.5. Formal and informal style

#### UNIT – II      **Communicative Grammar (9 hours)**

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

#### UNIT-III      **The Sounds of English (9 hours)**

- 1.1 Length of vowels-Long vowels//l; a ;), U; 3: / as in feel, card, court, food and first respectively.
- 1.2 Short vowels / e, x, n / as in pen, bag, and sun respectively
- 1.3 Consonants / f, v, Q, x, s, z, \_\_\_\_\_ / as in fine, vast, thought, them, song, zoo, shame, pleasure and judge respectively.
- 1.4 Stress pattern
- 1.5 Intonation-Rising and falling
- 1.6 Friendly communication-greeting, farewells, introduction, thanks, apologies, regrets, good wishes congratulations, condolences, offers

## **UNIT – IV    Doing things with words (6 hours)**

- 1.1.    To ask for information, help, permission
- 1.2.    To instruct, command, request, accept, refuse, prohibit, persuade, promise

### **RECOMMENDED BOOKS:**

1. Geoffrey Leach and Jan Svartvik, Longman, A communicative Grammar of English
2. J.D. O'connor, Better English Pronunciation, ELBS
3. J.K.Chand and B.C. Das, A Millennium Guide to writing and Speaking English, Friends' Publishers
4. John Sealy, Oxford Guide to Writing and Speaking, OUP.

## **COMMUNICATIVE ENGLISH**

### **PH.1.2        PRACTICAL**

**2 hours/week**

#### **Some Tasks**

1. Make a list of nonverbal communication
2. How is body language casually conditioned?
3. Take passages of descriptive, expressive and social functions and analyse them.
4. Expressive (exposing feelings) language in English and your mother-tongue
5. Make a list of sexist language (e.g. poetess, chairman)
6. Mentally retarded should be replaced by mentally challenged. Make a list of similar expressions
7. Say formula expressions (Thank you, sorry, hallo, that's right) with proper Intonation
8. Make a list of words which should be avoided because they sound pompous. Which words would you use instead of them.
9. How to express pleasure, regret, approval?
10. Time and tense are not the same. Give some examples.
11. Take similar vowels and consonants and practice them in pairs of words.
12. Practice, stress and intonation in connected speech.
13. Conversation practice in familiar situations (Play the role of a tailor and a customer, for example)
14. Ask for specific information (can you tell me where the railway station is?)
15. Making a request (can I barrow your scooter, please?)
16. Asking for permission (Do you mind if I smoke?)
17. Say the following pairs of words.
  - a) Beg, Bag, full, fool, sit, seat, same, shame, judge, jazz, major, measure.
  - b) Progress as noun verb, similarly, object, record, supplement, perfect (adj), Perfect (v)
  - c) Say the following words with correct stress, Teacher, College, village, building, ago, above, apart, accuse, advice, education, examination, individual (The list is only illustrative and not exhaustive).



## **HUMAN ANATOMY AND PHYSIOLOGY – I (HAP-I)**

### **PH.1.3 THEORY**

**3 hours/week**

#### **UNIT – I**

Scope of anatomy and physiology and basic terminology used in these subjects.

Structure of cell, its components and their functions.

Elementary tissues of the human body: Epithelial, Connective, Muscular and Nervous tissues, their sub types and characteristics.

#### **UNIT – II**

**Osseous System:** Structure, composition and functions of skeleton, classification of joints, types of movements of joints, disorders of joints.

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

#### **UNIT – III**

**Haemopoietic System :** Composition and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.

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

#### **UNIT -IV**

**Cardiovascular System :** Basic anatomy of the heart, physiology, blood vessels and circulation. Basic understanding of cardiac cycle, heart sounds and electrocardiogram. Brief outline of cardiovascular disorders like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive cardiac failure and cardiac arrhythmias.

## **HUMAN ANATOMY AND PHYSIOLOGY-I (HAP-I)**

### **PH. 1.4 PRACTICAL**

**3 hours/week**

**(A minimum of 15 practicals shall be conducted)**

1. Study of human skeleton.
2. Study of the following systems with the help of charts and models.
3. Haemopoietic System
4. Lymphatic System
5. Cardiovascular System
6. Osseous System
7. Skeletal Muscles
8. Microscopic study of different tissues.
9. Estimation of haemoglobin in blood.
10. Determination of bleeding time and clotting time.
11. RBC count.
12. Total and differential leucocyte counts.
13. Determination of ESR.
14. Blood group determination.
15. Recording of body temperature, pulse rate and blood pressure.

### RECOMMENDED BOOKS:

1. Anatomy and Physiology in Health and Illness by Ross and Willson (Churchill living stone)
2. Concise Medical Physiology by S.K.Choudhury (New central book agency, Calcutta)
3. Guyton A C, Hall JE., Text book of Medical Physiology, W.B.Sandnders Company
4. Human Physiology, C C Chatterjee, Medical allied agency, Calcutta
5. Tortora G.J., S.R.Grabowski & Anagnodokos N.P., Principles of Anatomy & Physiology
6. Dorasari and Gandhi's elements of Human anatomy, Physiology and health education by Thakorebhai P.gandhi & R.K.Goyal (B.S.Shah Prakashan)

## PHARMACEUTICS - I (Dispensing Pharmacy)

### PH 1.5 THEORY

3 hours/Week

#### UNIT –I

1. **Evolution of Pharmacy and Pharmaceutical Literature:** History of Pharmacy, Historical background and importance of various Pharmacopoeias with special reference to Indian Pharmacopoeia, International Pharmacopoeia and Extra Pharmacopoeia.
2. Introduction and classification of pharmaceutical dosage forms.
3. **Pharmacopoeial Preparations:** Principles and methods of preparation of aromatic waters, spirits, elixirs, glycerin, linctus, solutions, milks and magmas, mucilages and special preparations like pyroxylin and flexible collodions.

#### UNIT –II

4. **Prescription:** Various parts of prescription and their functions, handling of prescriptions, sources of errors, care required in dispensing procedures including labeling of dispensed products. Preliminary knowledge of important Latin terms used in prescriptions and their translation into English
5. **Pharmaceutical calculations and metrology:** Metric and imperial systems of weights and measures used in prescriptions, posology, calculations of doses for infants, children, and elderly patients; reducing and enlarging formulae; percentage solutions; allegations methods; proof spirits; calculations involving alcohol dilutions.

#### UNIT –III

6. **Principles and procedures of dispensing prescriptions:** Principles involved and procedures adopted in dispensing of liquid preparations such as mixtures, suspensions, emulsions, solutions, lotions, and liniments; semisolid preparations such as ointments,

creams, pastes, jellies and suppositories; solid dosage forms such as powders, capsules, effervescent powders, tablet triturates and lozenges; paints, sprays, inhalations and poultices.

#### **UNIT –IV**

- 7. Incompatibilities:** Definitions, Types of incompatibility – Physical, Chemical and Therapeutic;. Study of examples of prescriptions containing incompatibilities, their correction and dispensing methods.
- 8. Galenicals:** Principles and methods of extraction, preparation of infusions, decoctions, tinctures, liquid, soft and dry extracts.

### **PHARMACEUTICS - I** **(Dispensing Pharmacy)**

#### **PH 1.6 PRACTICAL**

**3 hours/Week**

**(A minimum of 15 experiments shall be conducted)**

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

#### **RECOMMENDED BOOKS:**

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

### **PHARMACEUTICAL CHEMISTRY–I** **(Inorganic Pharmaceutical Chemistry)**

#### **PH. 1.7 THEORY**

**3 hours/week**

#### **UNIT –I**

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

Acids and Bases: Buffers, Water.

Gastrointestinal Agents: Acidifying agents (Dil HCl), Antacids(Aluminum hydroxide gel, Aluminum phosphate, Magnesium carbonate, Magnesium trisilicate, combination preparations), Protectives and Adsorbents, Cathartics (Magnesium sulphate), Emetics (Copper sulphate and Sodium potassium antimony tartrate).

#### **UNIT –II**

Essential and Trace Elements: Transition elements and their compounds of pharmaceutical importance, Iron and haematinics, mineral supplements.

Cationic and anionic components of inorganic drugs useful for systemic effects.

Topical Agents : Protectives (Calamine, Zinc oxide, Talc, Titanium dioxide), Astringents (Alum, Zinc sulphate) and Anti-infective (Iodine, Povidone iodine Hydrogen peroxide, Chlorinated lime, Potassium permanganate, Silver nitrate, Boric acid ).

#### **UNIT –III**

Gases and Vapours : Oxygen, Anaesthetics and Respiratory stimulants.

Dental Products: Dentifrices, Anti-caries agents.

Major Intra and Extra-cellular Electrolytes : Physiological ions, Electrolytes used for replacement therapy, acid-base balance and combination therapy.

#### **UNIT –IV**

Miscellaneous Agents: Sclerosing agents, expectorants, poisons and antidotes, sedatives etc. Pharmaceutical Aids - Anti-Oxidants, preservatives, filter aids, adsorbents, diluents, suspending agents, colorants etc.

Inorganic radio-pharmaceuticals: Nuclear radiopharmaceuticals, nomenclature, methods of obtaining their standards and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions.

### **PHARMACEUTICAL CHEMISTRY – I**

#### **(Inorganic Pharmaceutical Chemistry)**

#### **PH. 1.8 PRACTICAL**

**3 hours/week**

**(A minimum of 15 experiments shall be conducted)**

1. Limit test for chlorides and sulphates in some pharmacopoeial compounds including soluble, insoluble and coloured substances (6 compounds or 3 experiments)
2. Limit test for iron and lead.
3. Limit test for arsenic.
4. Identification of radicals in mixtures :
5. Acid radicals - at least two mixtures.
6. Basic radicals - at least two mixtures.
7. Preparation and identification tests of the following official (IP) compounds.
  - (i) Magnesium sulphate
  - (ii) Ferrous Sulphate
  - (iii) Alum
  - (iv) Aluminium hydroxide
  - (v) Di-sodium hydrogen citrate
8. Preparation and testing of purified water

#### **RECOMMENDED BOOKS:**

1. Inorganic Medicinal and Pharmaceutical Chemistry by Block, Roche, Soine, Wilson.

2. Bentley and Driver's Text Book of Pharmaceutical Chemistry.
3. Pharmaceutical Chemistry – Inorganic by G.R.Chatwal.

## **PHARMACOGNOSY – I**

### **PH. 1.9 THEORY**

**3 hours/week**

#### **UNIT -I**

1. Definition, history, scope and development of pharmacognosy.
2. Sources of drugs: Biological, marine, mineral and plant tissue culture as sources of drugs.
3. Classification of natural drugs: Alphabetical, Morphological, Taxonomical, Chemical, Pharmacological/ Therapeutical and Chemotaxonomical classification of drugs.

#### **UNIT-II**

4. Cultivation, collection, processing and storage of plant 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.

#### **UNIT-III**

5. Quality control of crude drugs: (General methods only) Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation.
6. General introduction to secondary metabolites of plant origin with their properties.

#### **UNIT-IV**

7. Systematic Pharmacognostic study of the following :
  - (a) Carbohydrates and derived products: Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch and Tragacanth.
  - (b) Lipids : Bees wax, Castor oil, Cocoa butter, Cod-liver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Shark liver oil and Wool fat.

## **PHARMACOGNOSY – I**

### **PH. 1.10 PRACTICAL**

**3 hours/week**

**(A minimum of 15 experiments shall be conducted)**

- Determination of leaf constants (Stomatal number and stomatal index, Palisade ratio, vein islet and veinlet termination number).
- Microscopic measurements of cells and cell contents – starch grains and phloem fibres.
- Identification of crude drugs belonging to carbohydrates (morphological and chemical).
- Identification of crude drugs belonging to lipids.

#### **RECOMMENDED BOOKS:**

1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
2. Trease G.E. and Evans W.C., Pharmacognosy (Balliere Tindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, New Delhi)

4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)

## REMEDIAL BIOLOGY

### PH. 1.11 THEORY

2 hours/week

#### UNIT-I

1. Morphology: Root and stem modifications, leaf, flower, fruit & seed.
2. Anatomy: Tissue system in root, stem, leaf, bark & wood.
3. Plant cell: Organelles, cell division, tissues and types.

#### UNIT-II

1. Methods of classification: Artificial, natural and phylogenetic.
2. Plant taxonomy: Families; *Apocyanaceae*, *Solanaceae*, *Rutaceae*, *Fabaceae*, *Rubiaceae*, *Apiaceae*, *Lamiaceae*, *Brassicaceae*, *Umbelliferae*, *Papaveraceae*, *Foaceae* and *Liliaceae*.

#### UNIT-III

1. Animal Kingdom: Structure and life history of Amoeba, Entamoeba, Trypanosoma, Ancylostoma, Plasmodium, Taenia, Ascaris, Fasciola and Oxyuris.

#### UNIT-IV

General structure and life history of insects like Mosquito, Housefly, Mites and Silk worm.

## REMEDIAL BIOLOGY

### PH. 1.12

### PRACTICALS

2 hours/week

**(A minimum of 15 experiments shall be conducted)**

1. Care, use and types of microscope
2. Morphology of plant parts indicate in theory, Preparation and microscopic examination of the following;
3. Stem of monocot and dicot plant
4. Root of monocot and dicot plant
5. Leaf of monocot and dicot plant
- 6 - 10 Gross identification of slides and structure and life cycle of lower plants and animals mentioned in theory.
- 11-14. Structure of parasites and insects infecting human as mentioned in the theory.

### RECOMMENDED BOOKS:

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

## REMEDIAL MATHEMATICS

### PH. 1.13 THEORY

3 hours/week

#### UNIT –I

1. **Algebra** : Equations reducible to quadratic, simultaneous equation (linear and quadratic). Determinants, properties of solution of simultaneous equations by Cramer's rule, matrices, definition of special kinds of matrices, arithmetic operations on matrices, inverse of a matrix, solution of simultaneous equations by matrices, pharmaceutical applications of determinants and matrices. Evaluation of En1, En2 and En3 mensuration and its pharmaceutical applications.
2. **Measures of Central Value** : Objectives and pre-requisites of an ideal, measure mean, mode and median.

#### UNIT -II

3. **Trigonometry**: Measurement of angle, T-ratios, addition, subtraction and transformation formulae, T-ratios of multiple, sub-multiple, allied and certain angles. Application of logarithms in pharmaceutical computations.

#### UNIT -III

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

#### UNIT -IV

5. **Calculus** :  
(I) **Differential** : Limits and functions, definition of differential coefficient, differentiation of standard functions, including function of a function (chain rule). Differentiation of implicit functions, logarithmic differentiation, parametric differentiation, successive differentiation.  
(II) **Integral** : Integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, substitution and partial fractions, formal evaluation of definite integrals.

### RECOMMENDED BOOKS:

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

- (Part-I & II) (Kalyani Publisher, New Delhi)
4. Intermediate Mathematics (Vol.-I & II) by V.Venkateswara Rao, N.Krishnamurthy, B.V.S.S.Sarma. (S.Chand, New Delhi)
  5. Higher Engineering Mathematics by Dr.J.S.Grewal.(Khanna publishers, New Delhi)

## **2<sup>nd</sup> SEMESTER**

### **BUSINESS COMMUNICATION IN ENGLISH**

#### **PH.2.1 THEORY**

**2 hours/week**

#### **Objectives:**

**The objectives are to prepare the student to**

- a) Produce written communication of different forms such as paragraph, report letter etc.
- b) Make notes/ Summarize from a given passage
- c) Organize Meetings, prepare agenda, draft resolutions and write minutes
- d) Make presentations and face interviews.
- e) Document sources and prepare bibliographies.
- f) The objectives of management oral communication, improving the facility of oral Communication. Both transmission and reception in six managerial situations such as.  
(i) Information sharing (ii) Conversation (iii) interview (iv) Committee (v) Negotiation  
(vii) Presentation

#### **UNIT -I**

##### **WRITING-I**

**(7 hours)**

- 1 Paragraph writing – topic sentence, cohesion and coherence – sentence linkers (so, however etc.)
2. Preparation of a business report – writing a business proposal – format, length, structure

#### **UNIT -II**

##### **WRITING-II**

**(7 hours)**

3. Preparing notes – writing business letters and E-Mail messages
4. Documentation: References, notes and bibliographies

#### **UNIT -III**



### **WRITING-III**

**(7 hours)**

5. Writing curriculum vitae (both chronological and functional) along with an application for a job.
6. Public relations – concept and relevance-PR in a business organization-handling the media.

### **UNIT -IV**

#### **Meeting and presentation**

**(9 hours)**

7. Organizing a meeting, preparing an agenda, chairing a meeting drafting resolutions, writing minutes
8. Making an oral presentation
9. Facing an interview

#### **RECOMMENDED BOOKS:**

1. (John Sealy) Oxford Guide to Writing and Speaking English, OUP.
2. (Bovee et al) Business Communications Today Pearson Education.
3. (Rovi and Rai) Business Communication
4. (J.V.Cilanilam) More effective Communication, Saga Publications
5. (J.K.Chand and B.C. Das), A Millennium Guide to writing and Speaking English, Friends' Publishers)
6. The Chicago manual of style (Part 2 Section 15) Prentice-Hall of India
7. (Sushil Bahl) Business communication Today, Sage Publications.

## **BUSINESS COMMUNICATION IN ENGLISH**

**PH.2.2**

**PRACTICAL**

**2 hours/week**

#### **Some tasks**

1. Write a paragraph with the topic sentence “Protection of environment should not be at the cost of development”. Identify the supporting details and sentence connectors.
2. Make notes from a given passage.
3. Prepare a short bibliography on the list of books prescribed in this course.
4. Write a letter complaining to a firm, which supplied defective computers.
5. Write a functional CV of your town.
6. Prepare an agenda of Mock meeting.
7. Imagine that you are chairing the meeting. How would you go about it?
8. How would you propose a vote of thanks?

9. Make an oral presentation on a new product your company has brought out/ make a seminar presentations
10. Make a checklist for preparing for an interview.
11. Hold a mock job interview.
12. Prepare the agenda for a meeting you are organizing.  
(The list is only illustrative and not exhaustive)

## **HUMAN ANATOMY AND PHYSIOLOGY-II**

### **(HAP-II)**

**PH 2.3. THEORY**

**3 hours/Week**

#### **UNIT -I**

1. **Digestive System:** Gross anatomy of the gastro-intestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food. Disorders of digestive system.
2. **Respiratory system:** Anatomy of respiratory organs & its functions, respiration mechanism & regulation of respiration, respiratory volumes & vital capacity.

#### **UNIT -II**

3. **Central Nervous System:** Functions of different parts of brain & spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain, cranial nerves & their functions.
4. **Autonomic Nervous System:** Physiology & functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.

#### **UNIT -III**

5. **Urinary System:** Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base balance. Diseases of the urinary system.
6. **Reproductive System:** Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, oogenesis, spermatogenesis & organogenesis. Pregnancy, its maintenance and parturition.

#### **UNIT -IV**

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

Diseases in hypo and hyper secretions.

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

**RECOMMENDED BOOKS:**

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

**HUMAN ANATOMY AND PHYSIOLOGY-II  
(HAP-II)**

**PH 2.4 PRACTICAL**

**3 hours/Week**

**(A minimum of 15 practicals shall be conducted)**

Study of the following systems with the help of charts and models:

1. Digestive system
2. Respiratory system
3. Central nervous system
4. Autonomic nervous system
5. Urinary system
6. Reproductive system
7. Endocrine system
8. Sense organs
9. Determination of vital capacity
10. Physiological experiments on nerve-muscle preparation
11. Microscopic study of different tissues
12. Study and preparation of permanent slides

**PHARMACEUTICAL ANALYSIS –I**

**PH 2.5 THEORY**

**3 hours/week**

**UNIT –I**

1. Significance of qualitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Significance of figures. Rules for retaining significant digits. Types of errors, minimization of error, selection of sample, precision and accuracy. Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.
2. **Acid Base Titration:** Acid base concepts role of solvers, Relative strength of acids and bases, Ionization, Law of mass action, Common ion effect, ionic product of water,

pH, Hydrolysis of salts, Henderson-Hasselbalch equation, Buffers solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, Mixed indicators, Polyamine and amino acid systems. Amino acid titration, applications in assay,  $\text{H}_3\text{PO}_4$ ,  $\text{NaOH}$ ,  $\text{CaCO}_3$  etc.

#### **UNIT –II**

**3. Precipitation Titrations:** Precipitation reactions, solubility product, effect of acids, temperature and solvent upon the solubility of a precipitate, Argentometric titration and titrations involving ammonium or potassium thiocyanate, mercuric nitrate and barium sulphate, Indicators, Gay-Lussac method; Mohr's method, Volhard's method and Fajan's method.

#### **UNIT –III**

**4. Non-aqueous titrations:** Acidimetry & Alkalimetry. Basic principles, solvents involved indicators. Typical examples of Acidic & Basic drug molecules.

**5. Complexometric titration:** Types of complexometric titrations, Metal ion indicators, Complexometric titrations involving EDTA. Typical examples of complexometric titration.

#### **UNIT -IV**

**6. Gravimetric Analysis:** Precipitation techniques, solubility products. The colloidal state, supersaturation, co-precipitation, post precipitation, Digestion, washing of the precipitate, Filtration, Filter papers, and crucibles, Ignition. Thermo gravimetric curves, specific examples like barium sulphate, aluminum as aluminum oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants.

#### **RECOMMENDED BOOKS:**

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

### **PHARMACEUTICAL ANALYSIS –I**

**PH 2.6 PRACTICAL 3 hours/week**  
**(A minimum of 15 experiments shall be conducted)**

1. Standardization of analytical weights and calibration of volumetric apparatus.
- 2--6. Preparation and standardization of sodium carbonate, potassium hydrogen phthalate, sodium bicarbonate, oxalic acid, arsenic trioxide.
- 7-10. Assay of boric acid, zinc oxide, ammonium carbonate and amino acids.
- 11-12. Preparation and standardization of silver nitrate and ammonium thiocyanate.
- 13-14. Titration according to Mohr's and Volhard's methods.
- 15-16. Preparation and standardization of perchloric acid and sodium methoxide and assay of one official drug under each type.
- 17-18. Preparation and standardization of EDTA solution and assay of calcium gluconate.

19. Assay of calcium by gravimetric analysis.

## PHARMACOGNOSY – II

PH 2.7 THEORY

3 hours/week

### UNIT -I

1. **Resins:** Study of Drugs Containing Resins and Resin Combination like colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of Peru, benzoin, turmeric, ginger.
2. **Tannins:** Study of tannins and tannin containing drugs like gambir, black catechu, gall and myrobalan.

### UNIT -II

3. **Volatile Oils:** General methods of extraction of volatile oils from plants, Study of biological source, chemical constituents, chemical tests and uses of volatile oils of Mentha, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Nutmeg, Chenopodium, Valerian, Musk, Palmarosa, Gaultheria.. Detailed Pharmacognosy of Clove, Coriander, Fennel, Sandal wood, Cardamom, Cinnamon and Eucalyptus.

### UNIT -III

4. Natural allergens and photosensitizing agents.
5. Antioxidants from plant origin.

### UNIT -IV

6. **Fibres:** Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass wool, polyester and asbestos.
7. **Pharmaceutical aids:** Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors (Turmeric, Saffron, Anato, Caramel, Cocheneal).

### RECOMMENDED BOOKS:

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

## PHARMACOGNOSY – II

PH 2.8 PRACTICAL

3 hours/week

(A minimum of 15 experiments shall be conducted)

- 1-4 Identification of crude drugs mentioned in theory (at least 5)

6-7. Study of fibres

8-9. Study of pharmaceutical aids.

10-16. Microscopic studies of seven selected crude drugs and their powders mentioned in theory and their chemical tests.

## HOSPITAL PHARMACY

PH 2.9 THEORY

3 hours/week

### UNIT-I

1. **Organization and Structure:** Organization of a hospital and hospital pharmacy, responsibilities of a hospital pharmacist, Pharmacy and Therapeutic Committee, budget preparation and implementation.
2. **Hospital Formulary:** Contents, preparation and revision of hospital formulary.

### UNIT-II

3. **Drug Store Management and Inventory Control:** (a) Organization of drug store, Types of materials stocked, storage conditions. (b) Purchase and Inventory Control principles, purchase procedures, Purchase order, Procurement and stocking.
4. **Drug distribution System in Hospitals:** (a) Outpatient dispensing, methods adopted. (b) Dispensing of drugs to in-patients. Types of drug distribution systems. Changing policy, labeling.

### UNIT-III

5. **Central Sterile Supply Unit and their Management:** Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.
6. **Manufacture of Sterile and Nonsterile Products:** Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, master formula card, production control, manufacturing records.
7. **Surgical Products:** Definition, Primary wound dressing, absorbents, surgical cotton, surgical gauzes, bandages, adhesive tape, protective cellulosic hemostatics, dressings, absorbable and nonabsorbable sutures, ligatures and catguts.

### UNIT-IV

8. **Drug Information Services:** Sources' of information on drugs, disease, treatment schedule, procurement of information, computerized services (e.g. MEDLINE), retrieval of information, medication error.

9. **Records and Reports:** Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc.

**RECOMMENDED BOOKS:**

1. Hassan William E., Hospital Pharmacy (Lea & Febiger, Philadelphia)
2. Nand P., Khar R.K., Text book of Hospital & Clinical Pharmacy (Birla publication, Delhi)
3. Dandiya P.C. & Mathur M., A text book of Hospital & Clinical Pharmacy. (Vallabh Prakashan, Delhi)

**PHARMACEUTICAL CHEMISTRY –II**  
**(Organic chemistry-I)**

**PH. 2.10 THEORY**

**3 hours/week**

**UNIT-I**

Bohr' atomic structure, Atomic and Molecular orbital concepts, Quantum numbers, Chemical bonding: Ionic bond, Covalent bonds, Coordinate covalent bonds, Type of covalent bonds, Tetravalency of carbon, Hybridization:  $sp^3$ ,  $sp^2$ ,  $sp$ . Bond energy, Bond length, Bond angle, Electronegativity, Polarity in Covalent bonds, Hydrogen bonding.

I.U.P.A.C. Nomenclature of Organic compounds.

**UNIT-II**

**Organic Reactions and their Mechanisms:**

Reaction mechanism, Electron Displacement Effects: Inductive Effect, Mesomeric Effect, Electromeric Effect, Hyperconjugative Effect. Homolytic bond fission, Heterolytic bond fission. Structure and Stability of: Carbonium ions, Carbanion ions and Free radicals. Attacking Reagents: Electrophilic reagents, Nucleophilic reagents.

Brief Concept of Organic reactions: Substitution reactions, Addition reactions, Elimination reaction and Rearrangement reactions.

**UNIT-III**

**Alkanes:** Nomenclature, General methods of preparation, physical properties, combustion, Free radical substitution reactions (Chain reaction: halogenation.)

**Cycloalkanes:** Nomenclature, General methods of preparation, Chemical reactions, Relative stabilities: Bayer strain theory, Sachse-Mohr concept of strainless rings. Conformational analysis of cyclohexane.

**Alkenes:** Nomenclature, general methods of preparation, Electrophilic addition reactions, Markovnikov rule, Antimarkovnikov rule, Catalytic hydrogenation, Oxidation, Combustion.

Brief introduction to alkadienes, Diel's Alder reaction.

**Alkynes:** Nomenclature, general methods of preparation, Electronegativity of  $sp$ -hybridized carbon and acidity of acetylene, Substitution and Addition reactions.

**UNIT-IV**

**Haloalkanes:** Nomenclature general methods of preparation, Nucleophilic Substitution reactions:  $SN^1$  &  $SN^2$  reactions.

**Alcohols:** Nomenclature, General methods of preparation, Physical properties (Hydrogen bonding) Nucleophilic substitution reactions and Elimination reaction, Saytzeff rule.

**Ethers:** Nomenclature, General methods of preparation, Physical and Chemical properties.

**Amines:** Nomenclature, General methods of preparation, Physical and Chemical properties, Basicity.

## **PHARMACEUTICAL CHEMISTRY –II** (Organic chemistry-I)

**PH. 2.11                  PRACTICAL    3 hours/week**  
**(A minimum of 15 experiments shall be conducted)**

1. Determination of Melting Point and Boiling Point
2. Identification of mono-functional organic compounds by a study of their physical properties, detection of characteristic functional group reactions and preparations of the rational derivative.  
The following type of compounds are included for the study:  
Carboxylic acids, phenol, aldehydes, ketones, amides, esters. hydrocarbons and carbohydrates.
3. Esterification of alcohol.

### **RECOMMENDED BOOKS;**

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

## **3<sup>rd</sup> SEMESTER**

### **PHARMACEUTICS-II** (Physical Pharmacy - I)

**PH. 3.1                  THEORY    3 hours/week**

#### **UNIT -I**

1. **Matter, Properties of Matter :** State of matter, change in the state of matter, latent heats and vapour pressure, sublimation, critical point, eutectic mixtures, gases, aerosols,



inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solids-crystalline, amorphous and polymorphism.

## UNIT –II

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

## UNIT -III

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

## UNIT -IV

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

## PHARMACEUTICS-II (Physical Pharmacy - I)

**PH. 3.2 PRACTICAL 3 hours/ week**  
**(A minimum of 15 experiments shall be conducted)**

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

## RECOMMENDED BOOKS:

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

## **BASIC ENGINEERING - I** (Unit Operations – I)

**PH.3.3            THEORY**

**3 hours/ week**

### **UNIT -I**

1. **Heat Transfer:** Heat transfer, overall heat transfer coefficient, sources of heat, steam and electricity as heating media, determination of requirement of amount of steam/ electrical energy, steam pressure, heat exchangers.
2. **Drying:** Moisture content and mechanism of drying, rate of drying and time of drying calculations. Classification and types of dryers, dryers used in pharmaceutical industries and special drying methods.

### **UNIT -II**

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

### **UNIT -III**

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

### **UNIT -IV**

6. **Distillation:** Raoult's law, phase diagrams, volatility, simple, steam and flash distillations, principles of rectification, McCabe Thiel method for calculation of number of theoretical plates, Azeotropic and extractive distillation.
7. **Filtration:** Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter. Factors affecting filtration, optimum cleaning cycle on batch filters.

## **BASIC ENGINEERING-I** (Unit Operations – I)

**PH.3.4            PRACTICAL**

**3 hours/ week**

**(A minimum of 15 experiments shall be conducted)**

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

#### RECOMMENDED BOOKS:

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

### PHARMACEUTICAL CHEMISTRY-III (Organic Chemistry-II)

PH.3.5 THEORY

3 hours/ week

#### UNIT –I

##### **Stereochemistry:**

Isomerism: Different types of isomerism, their nomenclature and associated physicochemical properties, Structural Isomerism: Chain isomerism, Positional isomerism, Functional isomerism and Metamerism, Keto-Enol tautomerism.

Conformational Isomerism: Conformations of Ethane and Butane.

Geometrical Isomerism: Cis-Trans Isomers and E-Z Isomers, Physical and Chemical properties, Stability of Cis and Trans Isomers.

Optical Isomerism:

Optical activity, Specific rotation, Asymmetric carbon, Chirality, Fischer projection, Enantiomerism, Diastereoisomerism.

Specification of configuration:

Absolute and Relative configuration (D, L system and R, S system).

External and Internal compensation, Racemic mixture and Resolution of racemic mixture, Racemization, Walden inversion.

#### UNIT – II

**Aldehydes and Ketones:** General methods of preparation, acidity of  $\alpha$ -hydrogen Nucleophilic addition reactions, Aldol condensation reaction, Cannizzaro reaction, Clemmensen reduction.

**Carboxylic acids:** Acid halides and anhydrides: Nomenclature, general methods of preparation, physical and chemical properties, Effect of substituent on acidity.

**Esters:** Nomenclature, preparations with special emphasis on synthesis of Malonic and acetoacetic esters and their synthetic applications.

#### UNIT – III

**Benzene and its homologues:**Structure of benzene, Resonance, Aromatic character, Huckel Rule.

General methods of preparation, Physical properties, Chemical properties: Electrophilic substitution reactions, Friedel crafts reaction, Catalytic hydrogenation.

Orientation of aromatic substitution in mono-substituted benzene

Phenols:General methods of preparation, Acidity, Characteristic reactions

#### **UNIT – IV**

Nucleophilic aromatic substitution reactions,  $\alpha,\beta$ -unsaturated carbonyl compounds, stereoselective and stereospecific reactions, organic reagents used in drug synthesis (e.g,(Aluminium tert-butoxide, Lithium Aluminium Hydride, Grignard reagent, N-Bromo-succinimide (NBS), Diazomethane)

### **PHARMACEUTICAL CHEMISTRY-III (Organic Chemistry-II)**

**PH.3.6. PRACTICAL 3 hours/ week  
(A minimum of 15 experiments shall be conducted)**

1. Preparation of organic compounds and their derivatives, crystallization and determination of their melting points(minimum three).
2. Estimation of organic compounds using functional groups (minimum three).
3. At least four experiments. on analysis of organic compounds containing two functional groups

#### **RECOMMENDED BOOKS:**

1. Organic Chemistry by R.T. Morrison and R.N.Boyd.(Prentice Hall of India, New Delhi)
2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl.(S.Chand, New Delhi)
3. Bentley and Driver's Text Book of Pharmaceutical Chemistry.(Oxford University Press, New Delhi)
4. Organic Chemistry – Reactions and Reagents by O.P.Agarwal.(Krishna Prakashan, Meerut)
5. Organic Chemistry by I.L. Finar Vol. I & Vol. II.(Longman, Singapore)

### **PHARMACOGNOSY-III**

**PH.3.7 THEORY 3 hours/ week**

### **UNIT -I**

1. General methods of isolation and preliminary phytochemical screening of glycosides.
2. Study of the biological source, cultivation, collection, chemical constituents, adulterants, uses, macroscopic, microscopic features and chemical tests of following group of drugs containing –
  - i) Saponins : Liquorice, ginseng, dioscorea, sarasparilla and senega.
  - ii) Cardioactive sterols : Digitalis, squill and strophanthus
  - iii) Anthraquinone cathartics : Aloes, senna, rhubarb and cascara.
  - iv) Others : Psoralea, gentian, saffron, chirata and quassia

### **UNIT -II**

3. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.
4. General techniques of biosynthetic studies and basic metabolic pathways. Biogenesis of aromatic aminoacids, steroidal glycosides , tropane alkaloids and indole alkaloids.

### **UNIT -III**

5. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Application of plant tissue cultures with special reference to production of secondary metabolites.

### **UNIT -IV**

6. An introduction to poisonous plants in India.
7. Marine pharmacognosy, novel medicinal agents from marine sources.

## **PHARMACOGNOSY-III**

**PH. 3.8**

**PRACTICAL**

**3 hours/ week**

**(A minimum of 15 experiments shall be conducted)**

1. Identification of crude drugs listed in theory (Any five)
2. Microscopic study of at least four drugs including the powder study listed in theory.
3. Specific identification tests for some crude drugs listed in theory

### **RECOMMENDED BOOKS:**

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

## **PATHOPHYSIOLOGY OF COMMON DISEASES**

**PH. 3.9 THEORY**

**3 hours/ week**

**UNIT -I**

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

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

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

**UNIT -II**

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

**UNIT -III**

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

**UNIT -IV**

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

**RECOMMENDED BOOKS:**

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

**ENVIRONMENTAL SCIENCE**

**PH. 3.10 THEORY**

**3 hours/week**

**UNIT – I**

Ecological Concepts and Natural Resources: Ecological perspective and value of environment. Environmental auditing, biotic components, Ecosystem Process: Energy, Food Chain, Water cycle, Air cycle etc.

Chemistry and Microbiology in Environmental Engineering: Physical and chemical properties of water, Atmospheric chemistry, Soil chemistry, Microbiology, Chemical and biochemical reactions.

Concept in Hydrology : Hydrological cycle, Water balance, Energy budget, Precipitation, Infiltration, evaporation and evapotranspiration, Rainfall-runoff relationships, Urban hydrology, Ground water, Ground water chemistry.

## **UNIT – II**

Water Pollution: water quality standards and parameters, Assessment of water quality, Transformation process in water bodies, Oxygen transfer by water bodies, Turbulent mixing, Water quality in lakes and preservers, Ground water quality.

Water Treatment: Water quality standards, Water sources and their quality, Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.

Waste Water Treatment: Water flow rate and characteristics, Design of waste water network, Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion and its application.

## **UNIT – III**

Solid Waste Management

Sources classification and composition of MSW ; properties and separation, storage and transportation, MSW Management, Waste minimization, Reuse and recycling, Biological treatment, Thermal treatment, Landfill, Integrated waste management.

Hazardous Waste Management, Hazardous waste and their generation, Medical hazardous waste. Household waste, Transportation and treatment of hazardous waste: incinerators, Inorganic waste treatment, Treatment systems for hazardous waste, handling of treatment plant residue.

Industrial Air Emission Control:

Air Pollution: Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change - green house gases, non-criteria pollutants, emission standard from industrial sources, air pollution metereology, Atmospheric dispersion.

Noise Pollution : Physical Properties of sound, Noise criteria, Noise Standards, Noise measurement, Noise control.

## **UNIT – IV**

Waste Minimization: Concept, Life Cycle Assessment, Elements of waste minimization strategy, benefits of waste minimization, Elements of waste minimization programme, Waste reduction techniques.

Environment Impact Assessment, Origin and procedure of EIA, Project Screening of EIA, Scope studies, Preparation and review of EIS.

### RECOMMENDED BOOKS:

1. Environmental Engineering Irwin/McGraw Hill International Edition, 1997 , G. Kiely,
2. Principles of Environmental Engineering and Sciences, K.L. Davis and S.J. Masen, McGraw Hill International Edition, 2004.
3. Principles of Environmental Science inquiring & applications, Cunningham & Cunningham (TMH, New Delhi)
4. Introduction to Environmental Science, Y. Anjaneyalu, B.S. Publication. Hyderabad

## 4<sup>th</sup> SEMESTER

### PHARMACEUTICS-III (Physical Pharmacy – II)

PH. 4.1 THEORY

3 hours/week

#### UNIT -I

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

#### UNIT -II

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

#### UNIT -III

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

#### UNIT -IV

4. **Kinetics and Drug Stability:** General considerations & concepts, half-life determination, Influence of temperature, light, solvent, catalytic species, Accelerated stability study, determination of expiry date.
5. **Solubility & related phenomenon** : Solubility expression, Determination of solubility, Solubility of gases in liquids, Solubility of liquids in liquids, Solubility of solids in liquids.



6. **Complexation:** Classification of complexes, methods of preparation, analysis and applications.

### **PHARMACEUTICS-III** **(Physical Pharmacy – II)**

**PH. 4.2 PRACTICAL 3 hours/ week**  
**(A minimum of 15 experiments shall be conducted)**

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

**RECOMMENDED BOOKS:**

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

### **BASIC ENGINEERING – II** **(Unit Operations II)**

**PH. 4.3 THEORY 3 hours/week**  
**UNIT -I**

1. **Fluid Flow:** Type of flow, Reynold's number, Viscosiy, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.
2. **Dehumidification and Humidity Control:** Basic concepts and definition, wet bulb and adiabatic saturation temperature, psychrometric chart and measurement of humidity, application of humidity, measurement in pharmacy, equipments of dehumidification operations.

**UNIT -II**

3. **Material Handling Systems:**  
Liquid handling – different types of pumps.  
Gas handling – various types of fans, blowers and compressors.  
Solid handling – Conveyers

**UNIT -III**

- Centrifugations:** Principles of centrifugation, industrial centrifugal filters and centrifugal sedimenters.
- Crystallization:** Characteristics of crystals like – purity, size shape, geometry, habit, forms size and factors affecting them. Solubility curves and calculation of yields, material and heat balances around Swenson Walker Crystalizer. Supersaturation theory and its limitations, nucleation mechanisms, crystal growth, study of various types of crystallizer, tanks, agitated batch, Swenson Walker, single vacuum, circulating magma and Krystal crystallizer, caking of crystals and its prevention, numerical problems on yields.

#### UNIT -IV

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

### BASIC ENGINEERING – II (Unit Operations II)

#### PH. 4.4          PRACTICAL                                  3 hours/week (A minimum of 15 experiments shall be conducted)

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

#### RECOMMENDED BOOKS:

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

### BIOCHEMISTRY

#### PH.4.5          THEORY                                  3 hours/week UNIT -I

- Biochemical organization of the cell and transport processes across cell membrane. Outlines of biochemistry of cell division and metastasis.

2. The concept of free energy, determination of change in free energy from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance.

#### **UNIT -II**

3. **Enzymes:** Nomenclature, factors affecting enzyme action, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.
4. **Co-enzymes:** Vitamins as co-enzymes and their significance, metals as co-enzymes and their significance.

#### **UNIT -III**

5. **Carbohydrate Metabolism:** Glycolysis and fermentation and their regulation, Gluconeogenesis, Glycogenolysis, Glycogenesis, and Pentose phosphate Pathway.
6. **The Citric Acid Cycle:** Significance, reactions and energetic of the cycle, Amphibolic role of the cycle and Anaplerosis.

#### **UNIT -IV**

7. **Lipid Metabolism:** Oxidation of fatty acids;  $\beta$ -oxidation & energetics,  $\alpha$ -oxidation,  $\omega$ -oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, control of lipid metabolism, Essential fatty acids & Bio synthesis of eicosanoids (prostaglandins, thromboxanes and leukotrienes), phospholipids and sphingolipids.
8. **Proteins and Nucleic acids:** Outlines of the mechanism of protein and nucleic acid synthesis and catabolism. Principles of biological oxidation and detoxification mechanisms.

## **BIOCHEMISTRY**

**PH 4.6**

**PRACTICAL**

**3 hours/week**

**(A minimum of 15 experiments shall be conducted)**

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Colorimetric estimation of blood glucose.
3. Estimation of cholesterol, creatinine, urea and uric acid in biological fluids.
4. Qualitative test for normal and abnormal constituents of urine.
5. Estimation of reducing sugars in urine.
6. Estimation of bilirubin content the blood.
7. Enzymatic hydrolysis of glycogen by alpha and beta amylases.
8. Effect of temperature on the activity of alpha amylases.
9. Estimation of Blood Cholesterol
10. Estimation of SGOT, SGPT by UV Spectrophotometer.
11. Estimation of serum alkaline phosphate and acid phosphatase levels.
12. Estimation of serum sodium, potassium and calcium levels.

#### **RECOMMENDED BOOKS:**

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

## COMPUTER APPLICATIONS

**PH. 4.7      THEORY**

**3 hours / week**

### UNIT -I

1. **Computer fundamentals:**

**History:** Introduction to Computer, Computer classifications (According to generation, size and use).

**Hardware:** Introduction to hardware, CPU, Mother board, Input devices, Output devices, Storage Devices and Memory. Various ports and slots available with mother board – ISA, PCI Serial, Parallel, PS/2 and USB and their uses.

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

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

**Number systems** – Binary, Octal, Hexadecimal and their uses in computer

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

### UNIT -II

2. **Application of computers in pharmacy**

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

3. **Operating systems:**

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

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

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

### UNIT-III

4. **Programming Language (Programming with C)**

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

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

Operators and expression, input and output statement in C.

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

Arrays: One dimensional

Two dimensional

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

Preprocessor directives: **# include, # define**

#### **UNIT -IV**

##### **5. Internet:**

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

## **COMPUTER APPLICATIONS**

#### **PH. 4.8**

#### **PRACTICAL**

**3 hours/week**

**(A minimum of 15 experiments shall be conducted)**

1. Demonstration of hardware.
2. Operating system: DOS, WINDOWS & LINUX  
Searching directories or folders  
Creating and deleting files and folders  
Copying and Moving files and folders / directories  
Saving in floppies and CD Writing.  
Formatting and checking by floppy disks and Bootable CD.
3. Simple programming in C or C++: at least five programs.
4. Create and save a document in a word processor program like MS WORD. Type few paragraphs, format them, and paste an image.
5. Create and save presentations in POWERPOINT
6. Create and save a work sheet using MS EXCEL. Input data in cells, copy and move the data, make calculations, plot a graph from X and Y sets of data.
7. Internet (Search Engine, email, groups)

#### **RECOMMENDED BOOKS:**

1. Computer and common sense, 4<sup>th</sup> edn., Hunt & Shelly, Prentice-Hall India.
2. DOS 6 & 6.22: An Introduction with computer fundamentals. Pradeep Nair, Payal Lotia, BPB Publications.
3. DOS 6 & 6.22 Instant Reference, 2<sup>nd</sup> Edn. Robert M. Thomas, BPB Publications.

4. Windows 98 Instant Reference, Peter Dyson, BPB Publications.
5. ABCs of Windows 98, Sharon Crawford & Neil J. Salkin, BPB Publications.
6. Programming in ANSI C by E.Balguruswamy (TMH, New Delhi)
7. Programming in C++ by D.Ravichandran (TMH, New Delhi)
8. Complete Reference MS- Office
9. Complete Reference Windows XP.
10. Complete Reference Internet
11. Linux OS

## MATHEMATICS AND STATISTICS

**PH. 4.9          THEORY**

**3 hours/week**

### UNIT -I

**Integration** :- Integration as inverse process of differentiation, Definite integrals (simple cases). Integration by (i) Decomposition (ii) by substitution (iii) by parts. Integration of Logarithmic, Trigonometric, Algebraic and exponential functions.

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

### UNIT -II

**Laplace transforms:** Theorem, properties and uses (problems)

### UNIT -III

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

### UNIT -IV

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

**RECOMMENDED BOOKS:**

1. Integral Calculus by Shanti Narayan.
2. Statistical Methods by S.P.Gupta. (S.Chand, New Delhi)
3. Higher Engineering Mathematics by B.S. Grewal. (Khanna Publishers, Delhi)
4. Mathematical Methods by Potter & Gold Berg.(Prentice Hall of India, New Delhi)

## PHARMACEUTICAL CHEMISTRY-IV (Organic Chemistry-III)

**PH. 4.10      THEORY**

**3 hours/week**

### UNIT-I

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

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

### UNIT-II

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

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

### UNIT-III

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

**Nucleic acids:** Composition, general concept on the structure of RNA and DNA.

### UNIT-IV

**Study the following reactions with mechanism.**

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

### RECOMMENDED BOOKS:

1. Organic Chemistry by R.T. Morrison and R.N.Boyd.(Prentice Hall of India, New Delhi)
2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl.(S.Chand, New Delhi)
3. Bentley and Driver's Text Book of Pharmaceutical Chemistry.(Oxford University Press, New Delhi)
4. Organic Chemistry – Reactions and Reagents by O. P.Agarwal.
5. Organic Chemistry by I.L. Finar Vol. I & Vol. II.(Longman, Singapore)

## 5<sup>th</sup> SEMESTER

### PHARMACEUTICS-IV (Pharmaceutical Technology – I)

#### PH.5.1. THEORY

3 hours / week

##### UNIT -I

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

##### UNIT -II

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

##### UNIT -III

#### 4. Tablets:

Types of tablets, excipients used, and different granulation techniques used for preparation of tablets, types of tablet press, manufacturing defects and evaluation of tablets.

Coating of Tablets: Types of coating- sugar coating, film coating, enteric coating, film defects, materials used and evaluation of coated tablets.

##### UNIT –IV

5. **Capsules:** Advantages and disadvantages of capsule dosage forms, materials used for production of hard gelatin capsules, different sizes of capsules, methods of capsule



filling. Soft gelatin capsules, capsule shell and content of capsules, importance of base absorption and minim/gm filling of soft gelatin capsules. Quality control and storage of capsule dosage forms.

## **PHARMACEUTICS-IV** **(Pharmaceutical Technology – I)**

**PH. 5.2                  PRACTICAL    3 hours / week**  
**(A minimum of 15 experiments shall be conducted)**

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

### **RECOMMENDED BOOKS :**

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

## **APPLIED MICROBIOLOGY**

**PH. 5.3                  THEORY    3 hours/ week**

### **UNIT -I**

1. Introduction to the scope of microbiology.
2. Classification of microbes and their taxonomy. Morphological study of Bacteria, Actinomycetes, Fungi, rickettsiae, spirochetes and viruses.
3. Identification of Microbes : Stains and types of staining techniques, electron microscopy.
4. Nutrition, cultivation and isolation bacteria, actinomycetes, fungi and viruses. Preservation microbial cultures.

### **UNIT -II**

5. Microbial genetics – Mutations, Isolation of mutants, factors influencing rate of mutation, mutagens. Transformation, conjugation, transduction and protoplast fusion.
6. Control of microbes by physical and chemical methods.
  - a) Disinfection, factors influencing disinfectants and antiseptics and their evaluation.

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

#### **UNIT -III**

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

#### **UNIT -IV**

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

### **APPLIED MICROBIOLOGY**

#### **PH. 5.4 PRACTICAL**

**3 hours/ week**

**(A minimum of 15 experiments shall be conducted)**

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

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

#### **RECOMMENDED BOOKS:**

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

### **PHARMACEUTICAL CHEMISTRY-V**

(Medicinal Chemistry – I)

PH. 5.5 THEORY

3 hours/ week

UNIT -I

1. **Basic Principles of Medical Chemistry:** Physico-chemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action; Drug receptor interaction including transduction mechanisms.
2. **Brief concept on QSAR:** Free Wilson model, Hansch analysis – its derivation and discussion on different parameters like electronic parameters, steric factor, and partition coefficient. Comparison between Free Wilson model and Hansch analysis, Molecular Connectivity Index.

UNIT -II

3. Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.  
A. Drugs acting on autonomic nervous system :
  - (i) Cholinergics and Anticholinesterases : Acetylcholine, Carbachol, Bethanechol, methacholine and Neostigmine.
  - (ii) Adrenergic drugs and adrenergic blocking agents : Adrenaline, Salbutamol, Phenylephrine, Naphazoline
  - (iii) Antispasmodic and anti ulcer drugs : Homatropine, Cyclopentolate, Diclomine, Tropicamide.
  - (iv) Neuromuscular blocking agents : Gallamine, succinylcholine

UNIT -III

B. Autacoids :

- (i) Antihistamines: Diphenhydramine, Mepyramine, Chlorpheniramine, Promethazine, Chlorcyclizine, Cimetidine, Ranitidine.
- (ii) Eicosanoids : Occurrences, Chemical nature, Medicinal applications
- (iii) Analgesic – antipyretics, anti-inflammatory (non-steroidal) agents : Aspirin, Paracetamol, Ibuprofen, Phenylbutazone, Naproxan, Diclofenac sodium.

UNIT -IV

- C. Drugs affecting uterine motility :Oxytocics (including oxytocin, ergot alkaloids and prostaglandins) Their Occurrence, Chemical nature, Medicinal applications.

PHARMACEUTICAL CHEMISTRY-V

(Medicinal Chemistry – I)

PH. 5.6 PRACTICAL

3 hours/week

(A minimum of 15 experiments shall be conducted)

1. Synthesis of selected drugs and intermediates from the course content.

2. Monographs of selected official drugs including identification tests and tests for purity.

### RECOMMENDED BOOKS

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

## PHARMACOLOGY – I

### PH. 5.7 THEORY

3 hours / week

#### UNIT -I

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

#### UNIT -II

2. **Pharmacology of drugs acting on Peripheral Nervous System:**
  - A. Neurohumoral transmission (autonomic and somatic)
  - B. Cholinergic drugs, Cholinergic blockers, Adrenergic drugs, Adrenergic blockers, Ganglionic stimulants and blocking agents
  - C. Skeletal Muscle Relaxants
  - D. Local anaesthetic agents

#### UNIT -III

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

#### UNIT -IV

- H. Psychopharmacological agents – Antipsychotics (Neuroleptic drugs), Antidepressants, Psychomimetics, Anti-anxiety drugs,
- I. Anti-parkinsonian drugs
- J. C.N.S.stimulants

## PHARMACOLOGY – I

### PH. 5.8 PRACTICAL

3 hours/week

**(A minimum of 15 experiments shall be conducted)**

1. Introduction to Experimental Pharmacology
  2. Preparation of different solutions for experiments
  3. Common Laboratory animals and their maintenance
  4. Study of commonly used instruments in experimental pharmacology  
Procedures for rendering animals unconscious – stunning of rodents, pithing of frogs, chemical anaesthesia
- 2. Experiments on intact preparations;**  
Study of different routes of administration of drugs in mice / rats. To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone/hexobarbitone/thiopental sodium sleeping time in mice.
- 3. Experiments on Central Nervous System:**  
Recording of spontaneous motor activity, stereotypy, analgesia, anticonvulsant activity and muscle relaxant activity of drugs using simple experiments.
4. Effects of autonomic drugs on rabbit's eye.
- 5. Pharmacology of Cardiovascular System:**  
(a) To study the inotropic and chronotropic effects of drugs on isolated frog heart.  
(b) To study the effects of drugs on normal and hypo dynamic frog heart.

### RECOMMENDED BOOKS:

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

## PHARMACEUTICAL ANALYSIS-II

### PH. 5.9 THEORY

3 hours/ week

#### UNIT -I

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

1. **Oxidation Reduction Titrations** : Concepts of oxidation and reduction, Redox reactions, strengths and equivalent weights of oxidizing and reducing agents, Theory of

redox titrations, Redox indicators, cell representations, Measurement of electrode potential, Oxidation-reduction curves, Iodometry and Iodometry, Titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate, Titanous chloride and sodium 2, 6-dichlorophenol indophenol.

#### **UNIT -II**

- Miscellaneous Methods of Analysis :** Diazotisation titrations, Kjeldahl method of nitrogen estimation, Karl-Fischer titration, Oxygen flask combustion gasometry.
- Potentiometry and pH Meter

#### **UNIT -III**

- Conductometry
- Coulometry
- Polarography and Amperometry

#### **UNIT -IV**

- Nephelometry and Turbidimetry.
- Radioimmuno Assays.
- Electrophoresis

## **PHARMACEUTICAL ANALYSIS-II**

### **PH. 5.10 PRACTICAL**

**3 hours/ week**

**(A minimum of 15 experiments shall be conducted)**

- Miscellaneous Determinations:** Exercise involving diazotization, Kjeldahl, Karl-Fischer, shall be covered.
- Exercises based on acid base titration in aqueous and non-aqueous media, oxidation reduction titrations using potentiometric technique. Determination of acid-base dissociation constants and plotting of titration curves using pH meter.
- Exercises involving conductometric titrations.
- Oxidation Reduction Titrations:** Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, sodium 2, 6-dichlorophenolindophenol, and ceric ammonium sulphate.

#### **RECOMMENDED BOOKS:**

- Vogel's Text Book of Quantitative Chemical Analysis.
- Practical Pharmaceutical Analysis by Beckett and Stenlake Vol. I & II.
- Indian Pharmacopocia Vol. I & II

4. Instrumental methods chemical analysis by B.K. Sharma
5. Bently and Driver's Text Book of Pharmaceutical Chemistry.

## COMMUNITY PHARMACY AND HEALTH EDUCATION

**PH. 5.11      THEORY**

**3 hours/ week**

### UNIT -I

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

### UNIT -II

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

### UNIT -III

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

### UNIT -IV

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

### RECOMMENDED BOOKS:

- 1) Role of Pharmacist in the Health care system, WHO/ PHArm/94.569
- 2) Remington's sciences and practice of Pharmacy; 20<sup>th</sup> edition Lippin cott. Williams and Welkens.
- 3) Medicare scenario in India; Perceptions and Perspectives – Delhi society foir promotion of rational use of drugs

## 6<sup>th</sup> SEMESTER

### PHARMACEUTICS – V (Pharmaceutical Technology II)

**PH. 6.1      THEORY**

**3 hours / Week**

## UNIT -I

- 1. Micro-encapsulation:** Types of microcapsule, applications of microencapsulation in pharmacy, microencapsulation by co-acervation phase separation, multi orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique and pan coating, evaluation of microcapsules.
- 2. Pharmaceutical Aerosols:** Definition, applications, components of aerosol package: Propellants, container, valve, general formulation, manufacturing and filling methods, evaluation.

## UNIT-II

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

## UNIT -III

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

## UNIT -IV

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

### **PHARMACEUTICS – V (Pharmaceutical Technology II)**

**PH. 6.2            PRACTICAL                                    3 hours/week**  
**(A minimum of 15 experiments shall be conducted)**

Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like, parenterals, micro capsules, Ophthalmic products etc.



Evaluation of materials used in pharmaceutical packaging.

**RECOMMENDED BOOKS :**

Bentley's Textbook of pharmaceuticals edited by E.A. Rawlins  
The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig  
Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich  
REMINGTON : The Science and Practice of Pharmacy, 20<sup>th</sup> Edition  
Pharmaceuticals : The Science of Dosage Form Design by Aulton

**PHARMACEUTICAL CHEMISTRY – VI**  
**(Medicinal Chemistry – II)**

**PH. 6.3 THEORY**

**3 hours/week**

**UNIT -I**

1. Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

**Steroids and Related Drugs:** General study on Steroidal nomenclature and stereochemistry, Androgens and anabolic agents, Estrogens and progestational agents, : synthesis of Progesterone from diosgenin, Diethyl stilboestrol, Synthesis of Testosterone from Cholesterol, General study of structural formula and therapeutic uses of steroidal antiinflammatory agents.

**UNIT -II**

2. **Drugs acting on the Central Nervous System:**

General Anaesthetics : Anesthetic ether, Halothane, Thiopental sodium.  
Local Anaesthetics : Benzocaine, Procaine, Lignocaine, Dibucaine.  
Hypnotics and Sedatives: Phenobarbitone, Cyclobarbitone, Glutethimide, Diazepam  
Opioid analgesics : Pethidine, Methadone.

**UNIT -III**

Anticonvulsants : Phenytoin, Ethosuximide, Primidone, Carbamazepine  
Antiparkinsonism drugs: Levodopa, Amantidine  
CNS stimulants : Nikethemide, Ethamivan, Amphetamine

3. **Psychopharmacological agents** (neuroleptics, antidepressants, anxiolytics): Chlorpromazine, Haloperidol, Imipramine, Phenelzine, Chlordiazepoxide, Alprazolam.

**UNIT -IV**

4. **Diuretics:** Acetazolamide, Chlorthiazide, Furosemide, Mersalyl.  
**Cardiovascular drugs:** Clonidine, Methyldopa, Procainamide, Nifedipine,

Isosorbide dinitrate, Prazocin, clofibrate.

**PHARMACEUTICAL CHEMISTRY – VI**  
(Medicinal Chemistry – II)

**PH. 6.4 PRACTICAL 3 hours/week**  
(A minimum of 15 experiments shall be conducted)

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

**RECOMMENDED BOOKS:**

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

**PHYTOCHEMISTRY**

**PH. 6.5 THEORY 3 hours/ week**  
**UNIT -I**

Chemical and spectral approaches to simple molecules of natural origin. Application of I.R., N.M.R. and Mass spectroscopy in the structural elucidation of organic compounds. Concept of stereoisomerism taking examples of natural products (citral, menthol, camphor, ephedrine and atropine).

**UNIT -II**

**Cardiac Glycosides:** Source, structures, Pharmacological properties and study of interrelationship between cardinolides and bufadienolides (Chemistry of digoxin & digitoxin ). Introduction to Scillaren A and ouabain.

**Terpenes :** Classification, General methods of extraction and separation ( Mono and sesquiterpenes), special isoprene rule and Structural elucidation of citral carvone, menthol & camphor

**UNIT -III**

**Vitamins :** Classification, Chemistry of vitamin A, B<sub>1</sub>, Folic acid and vitamin C.

**Alkaloids :** Classification, isolation, structural elucidation of atropine, ephedrine, reserpine and morphine.

**UNIT -IV**

Chemistry and therapeutic activity of penicillin (includes structural elucidation), streptomycin and tetracyclines.

**Flavonoids:** Classification, pharmacological properties and chemistry of quercetin .

## PHYTOCHEMISTRY

### PH. 6.6 PRACTICAL

3 hours/ week

(A minimum of 15 experiments shall be conducted)

1. Analysis of fixed oils including acid value, saponification value, iodine value.
2. Determination of hydroxyl compounds (phenolic and alcoholic).
3. Isolation of active principles from natural sources (at least four).
4. Determination of aldehydes and ketones in essential oils.
5. Exercises on paper and thin layer chromatographic evaluations of herbal drug constituents.

### RECOMMENDED BOOKS :

1. Chemistry of Organic Natural Products (Vol.-1 & 2) by O.P. Agarwal.
2. Organic Chemistry of Natural Products (Vol.-1 & 2) by Gurdeep Chatwal.
3. Organic Chemistry (Vol.-2) by I.L. Finar.

## PHARMACOGNOSY-IV

### PH. 6.7 THEORY

3 hours/ week

#### UNIT -I

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

Pyridine-Piperidine	Tobacco, arica and lobelia
Tropane	Belladonna, hyoscyamus, daturas coca and withania.
Quinoline and Isoquinoline	Cinchona, Ipecac, opium
Indole	Ergot, rauwolfia, catharanthus nux-vomica and physostigma
Imidazole	Pilocarpus
Steroidal	Veratrum and kurchi
Alkaloid amines	Ephedra and colchicum
Glycoalkaloid	Solanum
Xanthine alkaloid	Coffee, tea and coca

#### UNIT -II

3. Study of traditional drugs, common vernacular names, botanical source, chemical constituents, uses and marketed formulations (any two) of the following drugs :
4. Amla, Satavari, Bhilwua, bael, bach, rasna, punarnava, gokhru, shankhapusphi, brahmi adusa, arjuna, lahsun, guggul, gymnema, neem ,tulsi, Shilajit and Spirulina.

#### UNIT -III

5. Holistic concept in traditional system of medicine. Introduction of ayurvedic preparation like asvas, aristas, guticas, tailas, lehyas and bhasmas.

#### UNIT -IV

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

## PHARMACOGNOSY-IV

**PH. 6.8 PRACTICAL 3 hours/week**  
**(A minimum of 15 experiments shall be conducted)**

1. Identifications of crude drugs listed in theory. (any five)
2. Microscopic study of characters of six – selected drugs given in theory in entire and powder form.
3. Specific chemical tests of some alkaloidal crude drugs listed in theory.
4. Standardization of some traditional drug formulations.
5. Chromatographic study of some herbal constituents.

### RECOMMENDED BOOKS:

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

## PHARMACOLOGY – II

**PH. 6.9 THEORY 3 hours / week**  
**UNIT -I**

### 1. Pharmacology of drugs acting on Cardiovascular System:

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

### UNIT -II

### 2. Drugs Acting on the Haemopoetic System:

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

### 3. Drugs acting on urinary system:

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

### UNIT -III

### 4. Autacoids :

- (a) Histamine, 5-HT and their antagonists

- (b) Prostaglandins, thromboxanes and leukotrienes.
- (c) Pentagastrin, Cholecystokinin, Angiotensin, Bradykinin and substance P

**5. Drugs Acting on the Respiratory System:**

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

**UNIT -IV**

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

**PHARMACOLOGY – II**

**PH. 6.10 PRACTICAL 3 hours / week**  
**(A minimum of 15 experiments shall be conducted)**

Experiments on Isolated Preparations;

- (a) To record the dose response curve (DRC) of acetylcholine using rectus abdominis muscle of frog.
- (b) To study the effects of physostigmine and d-tubocurarine on the DRC of acetylcholine using rectus abdominis muscle preparation of frog.
- (c) To record the DRC of histamine on isolated loop of guinea pig ileum.
- (d) To calculate the pA<sub>2</sub> value of mepyramine or chlorpheniramine using histamine as agonist on isolated loop of guinea pig ileum.
- (e) To estimate the strength of the test sample of agonist/drug (e.g. Acetylcholine, Histamine) using a suitable isolated muscle preparation employing matching bioassay, Bracketing assay. Three point assay and four point bioassay.

**RECOMMENDED BOOKS:**

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

## PHARMACEUTICAL JURISPRUDENCE & ETHICS

PH. 6.11

THEORY

3 hours/week

### UNIT -1

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

### UNIT -2

4. Drugs and Cosmetics Act 1940 and Rules 1945

### UNIT -3

5. Medicinal & Toilet Preparations (Excise Duties) Act 1955
6. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules
7. Drugs Price Control Order 1995
8. Drugs and Magic Remedies (Objectionable Advertisements) Acts 1954

### UNIT -4

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

### RECOMMENDED BOOKS:

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

## 7<sup>th</sup> SEMESTER

### PHARMACEUTICS-VI (Biopharmaceutics & Pharmacokinetics)

PH. 7.1

THEORY

3 hours/ week

### UNIT -I

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

**2. Biopharmaceutics :**

Passage of drugs across biological barrier (passive diffusion, active transport facilitated Diffusion and pinocytosis.

Factors influencing absorption-Physicochemical, physiological and pharmaceutical.

**UNIT -II**

Drug distribution in the body, plasma protein binding.

Metabolism of drugs.

**3. Pharmacokinetics:**

Different Pharmacokinetic models and their significance.

Compartment model- Definition and scope.

Significance of Plasma drug concentration measurement.

**UNIT -III**

Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant.

Volume of distribution and distribution coefficient.

Compartment kinetics – One compartment and two compartment models.

Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.

**UNIT -IV**

Clearance concept, Mechanism of renal clearance, clearance ratio, determination of renal clearance.

Extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation.

**4. Bioavailability and bioequivalence:**

Measures of bioavailability ,  $C_{max}$ ,  $t_{max}$  and area under the curve (AUC)

**RECOMMENDED BOOKS :**

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

**PHARMACOLOGY – III**

**PH. 7.2 THEORY**

**3 hours / week**

**UNIT -I**

**1. Drugs Acting on the Gastrointestinal Tract.**

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

(b) Laxatives and antidiarrhoeal drugs

(c) Appetite stimulants and suppressants

(d) Emetics and anti-emetics

(e) Miscellaneous – carminatives, demulcents, protectives, adsorbents,

astringents, digestants, enzymes and mucolytics.

#### **UNIT -II**

#### **2. Pharmacology of drugs affecting Endocrine System:**

- (a) Hypothalamic and pituitary hormones
- (b) Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and Vitamin D
- (c) Insulin, oral hypoglycaemic agents and glucagon
- (d) ACTH and corticosteroids
- (e) Androgens and anabolic steroids
- (f) Estrogens, progesterone and oral contraceptives.

#### **UNIT -III**

#### **3. Chemotherapy**

- (a) General principles of Chemotherapy
- (b) Sulfonamides and cotrimoxazole, Quinolones
- (c) Antibiotics-pencillins, Cephalosporins, Tetracyclines, Amino glycoside antibiotics, Chloramphenicol, Erythromycin and Miscellaneous Antibiotics.
- (d) Chemotherapy of tuberculosis, leprosy fungal diseases, viral diseases
- (e) Chemotherapy of malignancy and immunosuppressive agents
- (f) Antiprotozoal drugs and anthelmintics

#### **UNIT -IV**

#### **4. Principles of Toxicology**

- (a) Definition of poisons, Adverse drug reactions, general principles of treatment of poisoning with particular reference of barbiturates, opioids, organophosphorous and atropine poisoning.
- (b) Heavy metals and heavy metal antagonists.

## **PHARMACEUTICAL CHEMISTRY - VII** **(Medicinal Chemistry – III)**

### **PH. 7.3      THEORY**

**3 hours / Week**

#### **UNIT -I**

1. Drug metabolism and Concepts of Prodrugs.
2. Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

- (i) Sulphonamides                   : Sulphadiazine, Sulphamethoxazole, Sulphacetamide sodium.
- (ii) Antibiotics                    : : General study including classification, synthesis of Methicillin, Ampicillin, Amoxicillin and Chloramphenicol

#### **UNIT – II**



- (iii) Antifungal agents: Griseofulvin, Nystatin, Ketoconazole, Amphotericin B, Miconazole.
- (iv) Anti Malarial Drugs : Chloroquine, Pamzquine, Mepacrine, Proguanil, Pyrimethamine.
- (v) Antineoplastic agents: Chlorambucil, Thiotepa, Busulfan, 5-Fluorouracil
- (vi) Anti-TB and anti-leprosy Drugs: Isoniazid, Ethambutol, Pirazinamide, Dapsone
- (vii) Antiamoebic agents: Metronidazole Diloxamide furoate

### **UNIT -III**

- (viii) Anthelmintics : Thiabendazole, Mebendazole, Niclosamide
- (ix) Anti-viral including anti-HIV agents; Acyclovir, Zidovudine
- (x) Immunosuppressives and immunostimulants: To study only the general concept
- (xi) Diagnostic Agents: Propylidone, Sodium diatrizoate, Fluorescein sodium.
- (xii) Anticoagulants: Heparin, Coumarins, Phenindione derivatives.

### **UNIT -IV**

- (xiii) Amino acids, Peptide, nucleotides and related drugs.

Thyroid and Anti thyroid drugs: Thyroxine, Liothyronine, Propylthiouracil, Carbimazole

Insulin, Insulin preparations and oral hypoglycaemic agents: Chlorpropamide, Tolbutamide, Glibenclamide, Phenformin.

### **RECOMMENDED BOOKS:**

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

## **PHARMACEUTICAL ANALYSIS-III**

### **PH. 7.4 THEORY**

**3 hours/ week**

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

#### **UNIT -I**

1. Ultraviolet and visible spectrophotometry
2. Fluorimetry
3. Infrared spectrophotometry
4. Flame Photometry

## UNIT -II

5. Nuclear Magnetic resonance spectroscopy including C<sup>13</sup> NMR.
6. Mass Spectrometry

## UNIT -III

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

**TLC, Paper Chromatography and Column Chromatography,**

## UNIT-IV

**HPLC, GLC, and HPTLC**

## PHARMACEUTICAL ANALYSIS-III

**PH 7.5 PRACTICAL 3-hours/ week**  
**(A minimum of 15 experiments shall be conducted)**

1. Quantitative estimation of at least ten formulations containing single or more than one drug, using instrumental techniques like spectrophotometry, fluorimetry etc. (at least 5 experiments).
2. Estimation of Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>++</sup> ions using flame photometry. 3 Expts.
3. Chromatographic analysis of some pharmaceutical products, (Paper chromatography of Amino acids, TLC of alkaloids, sulphonamides etc)
4. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS. 3 demons.

### RECOMMENDED BOOKS:

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

## PHARMACEUTICAL BIOTECHNOLOGY

**PH. 7.6 THEORY 3 hours/week**

### UNIT -I

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

### UNIT -II

2. **Genetic Code and Protein synthesis:** Genetic code, components of protein synthesis, inhibition of protein synthesis. Brief account of protein engineering and polymerase chain reactions. Regulation of gene expression.
3. **Genetic Recombination :** Gene cloning and its applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as Activase, Humulin, Humatrope etc.

#### **UNIT -III**

4. **Microbial Transformation :** Introduction, types of reactions mediated by micro-organisms, design of biotransformation process, selection of organisms, biotransformation process and its improvements with special reference to steroids.
5. **Antibiotics :** Historical development of antibiotics. Antimicrobial spectrum and methods used for their standardization. Fermenter, its design, control of different parameters. Design of fermentation process, Isolation of fermentation products with special reference to penicillin, streptomycin, tetracycline and vitamin B12.

#### **UNIT -IV**

6. **Enzyme immobilization :** Techniques of immobilization of enzymes, factors affecting enzyme kinetics, study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylases and proteases etc. Immobilization of bacteria and plant cells.
7. **Blood Products and Plasma Substitutes :** Collection, processing and storage of whole human blood, concentrated human RHCs, dried human plasma, human fibrinogen, human thrombin, human normalimmunoglobulin, human fibrin, foam plasma substitutes, ideal requirements, PVP, dextran etc. for control of blood pressure as per I.P.

#### **RECOMMENDED BOOKS :**

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

<b>PH.7.7</b>	<b>ELECTIVE - I</b>
<b>PH. 7.8</b>	<b>ELECTIVE – I PRACTICAL</b>
<b>PH. 7.9</b>	<b>COMPREHENSIVE VIVA-VOCE</b>
<b>PH. 7.10</b>	<b>PROJECT WORK (Seminar based on Literature Survey &amp; Plan of Work)</b>

## **SEMESTER - VIII**

### **PHARMACEUTICS-VII (Pharmaceutical Technology III)**

**PH. 8.1            THEORY**

**3 hours / week**

#### **UNIT -I**

**1.    Preformulation studies: Principal areas like**

- a. Bulk Characterization: Crystallinity and Polymorphism, hygroscopicity, bulk density, powder flow properties.
- b. Solubility analysis: pKa, pH solubility profile, Common ionic effect , thermal effects, solubilization ,partition coefficient and dissolution.

#### **UNIT -II**

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

#### **UNIT -III**

- 3.    Brief introduction to controlled release dosage forms.  
Design and evaluation of transdermal drug delivery systems.  
Basic concepts of liposomes, nanoparticles, resealed erythrocytes, osmotic pump, implants, IUDs and ocuserts,**

#### **UNIT -IV**

- 4.    Cosmetics:** Fundamentals of cosmetic science, Formulation, preparation and packaging of cosmetics like anti-perspirants & deodorants, creams, lotions, shampoos, hair conditioners & dyes, nail polish and lipsticks. Special formulation considerations for baby care products.

### **PHARMACEUTICS-VII (Pharmaceutical Technology III)**

**PH. 8.2**

**PRACTICAL**

**3 hours / week**

**(A minimum of 15 experiments shall be conducted)**

1. Solubility enhancement by different techniques (at least 2).
2. Dissolution testing and data evaluation for oral solid dosage forms.
3. Determination of pharmacokinetic parameters from the given plasma drug concentration - time and urinary excretion data.
4. Preparation (at least 6) and evaluation (at least 2) of cosmetic products.

**RECOMMENDED BOOKS :**

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

**CLINICAL PHARMACY & THERAPEUTICS****PH.8.3 THEORY****3 hours/week****UNIT -I**

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

**UNIT -II**

4. Important disorders of organ systems and their management:  
Cardiovascular Disorders – Hypertension, Congestive Heart, Failure, Angina, Acute Myocardial infarction, Cardiac arrhythmias,  
CNS Disorders : Epilepsy Parkinsonism, Schizophrenia, Depression  
Respiratory Diseases – Asthma  
Gastrointestinal Disorders – Peptic ulcer, Ulcerative colitis, Hepatitis, Cirrhosis  
Endocrine Disorders – Diabetes mellitus and Thyroid Disorders.

**UNIT – III**

- Infectious Diseases – Tuberculosis, Urinary Tract Inflection, Enteric inflections, Upper Respiratory Inflections  
Haematopoietic Disorders – Anemias  
Joint and Connective Tissue Disorders – Rheumatic Disease, Gout and Hyperuricemia  
Neoplastic Diseases – Acute Leukemias, Hodgkin's diseases

**UNIT -IV**

5. Therapeutic Drug Monitoring.
6. Concept of Essential Drugs and Rational Drug use.
7. Adverse drug reactions and approaches to minimize them

**RECOMMENDED BOOKS:**

1. Remington the Science and Practice of Pharmacy
2. Clinical Pharmacology by Laurence, Bennett and Brown
3. Medical diagnosis and treatment by Tierney, Mc phee and Papadakis

4. Clinical Pharmacy & Therapeutics by Roger Walker, Edwards.
5. Clinical Pharmacy and Therapeutics by Herfindal, Gourley and Lloyd Hart.
6. Physiological basis of Medical Practice by John B. West
7. Drug Interactions by Ivan Stockley

## QUALITY ASSURANCE & GMP

**PH. 8.4      THEORY**

**3 hours/week**

### UNIT -I

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

### UNIT -II

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

### UNIT -III

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

### UNIT -IV

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

### RECOMMENDED BOOKS:

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

## PHARMACEUTICAL MANAGEMENT

**PH. 8.5      THEORY**

**3 hours/week**

### UNIT – I

1. **Concept of Management:** Administrative management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space,

Margin/Morale). Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, innovation, creativity, delegation of authority/responsibility and record keeping) Identification of Key points to give maximum thrust for development and perfection.

#### **UNIT – II**

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

#### **UNIT – III**

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

#### **UNIT – IV**

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

#### **RECOMMENDED BOOKS:**

1. M. J. Etazel , B. J. Walker and W. J. Stanton, Marketing, Tata McGraw Hill, 13<sup>th</sup> Edition, 2004.
2. R. Saxena, “Marketing Management” Tata McGraw Hill, second Edition, 2003.





- d) Skin creams
  - e) Nail polish
  - f) Face powders
  - g) Tooth pastes
  - h) Tooth powder
  - i) Shaving cream
  - j) After shave lotion
2. Evaluation of any two products mentioned above
  3. Collection of various packaging materials used for cosmetics and their description (Each student shall collect at least 10 different types of containers.)

#### **RECOMMENDED BOOKS:**

1. Cosmetics: Formulation, manufacturing, and Quality control by P.P.Sharma
2. A Handbook of Cosmetics by B.M. Mithal, R.N. Saha
3. The Theory and Practice of Industrial Pharmacy by Lachman L., Liberman, H.A.
4. Modern Cosmetics by Thomson, E.G.
5. Paucher's Perfumes, cosmetics & soaps by W.A.Paucher.
6. Hary's cosmeticology by J.B.Wilkimsson.

## **HERBAL DRUG TECHNOLOGY**

### **PH. E.3 THEORY**

**3 hours/week**

#### **UNIT -I**

Definition of Herbal drug, Importance of Herbal therapies, Herbal verses conventional drugs, Safety in herbal drugs, Toxicity in Herbals and their interactions.

#### **UNIT -II**

Herbs used as nutraceuticals and healing agents  
Herbal cosmetics.

#### **UNIT -III**

Making and using herbal medicines for common ailments like cold, skin infections and diarrhoea.

Analytical Profiles of selected herbs – Brahmi *Aradrographis paniculata*, Aegle marmelos and *Gymnema sylvestre*.

#### **UNIT -IV**

Quality Control and Quality Assurance of Herbal ingredients as per W.H.O. guidelines – Determination of tannins, Ash value, Extractable matter and Pesticide residues.

## **HERBAL DRUG TECHNOLOGY**

### **PH. E.4 PRACTICAL**

**3 hours/week**

**(A minimum of 15 experiments shall be conducted)**

1. Identification of sugar from plant extracts
2. Preparation of plant extracts and their standardization by analytical profiles (any five)
3. Quality Control tests for raw materials used in Herbal preparation

**RECOMMENDED BOOKS:**

1. Trease and Evan's Pharmacognosy 15<sup>th</sup> edition
2. Indian Herbal Pharmacopeia Vol-I and II
3. Quality Control methods for medicinal plant material by W.H.O., Geneva.
4. Quality Control of Herbal drugs by Dr. Pulak K. Mukherjee
5. Botanical safety hand book by Michael Meguffin, Christopher Hobbs published by American Herbal Product Association.
6. Herbal drugs by P.Mukherjee

**BIOASSAYS**

**PH. E.5 THEORY**

**3 hours/week**

**UNIT -I**

Definition , principles , and design of Bioassays.

Requirements applications, importance advantages and disadvantages of Bioassays

**UNIT -II**

Types of Bioassay (quantal and graded response Bioassays), Bioassay of agonists and antagonists, Biological variation, Biological standardization, Microbiological assay (antibiotics, vitamin B12), Bioassay in Humans

**UNIT -III**

Bioassay of some important drugs like Digitalis, Adrenaline, Noradrenaline, acetylcholine, Histamine, 5-hydroxy tryptamine, d-tubocurarine, Heparin, antibiotics, Vitamin-D,

**UNIT -IV**

Bioassay of Insulin, Oxytocin, Vassopressin, Growth Hormone, FSH, LH, Prolactin, Thyrotrophin, Corticotrophin, Androgen, Progesterone, Estrogen..

**BIOASSAYS**

**PH. E.6 PRACTICAL**

**3 hours/week**

**(A minimum of 15 experiments shall be conducted)**

1. To find out the strength of the given sample of acetylcholine by comparative bioassay using rectus abdominis muscle of frog.
2. To find out the strength of the given sample of acetylcholine by interpolation bioassay using rectus abdominis muscle of frog.
3. To find out the strength of the given sample of acetylcholine by three-point bioassay using rectus abdominis muscle of frog.
4. To find out the strength of the given sample of acetylcholine by four-point bioassay using rectus abdominis muscle of frog.
5. To find out the strength of the given sample of d-tubocurarine by graphical bioassay using rectus abdominis muscle of frog.
6. To find out the strength of the given sample of acetylcholine by four-point bioassay using guinea pig ileum.
7. To find out the strength of the given sample of histamine by four-point bioassay using guinea pig ileum.
8. To find out the strength of the given sample of oxytocin by four-point bioassay using rat uterus.
9. To find out the strength of the given sample of 5-hydroxy tryptamine by four-point bioassay using rat fundus.
10. To find out the strength of the given sample of 5-hydroxy tryptamine by comparative bioassay using rat fundus.

#### **RECOMMENDED BOOKS:**

1. Sharma, H.L.; Sharma, K.K. General Pharmacology Basic Concepts
2. Barar, F.S.K. Essentials of Pharmacotherapeutics
3. Rang, H.P.; Dale, M.M.; Ritter, J.M.; Moore, P.K. Pharmacology
4. Satoshkar, R.S.; Bhandarkar, S.D.; Ainapure, S.S. Pharmacology and Pharmacotherapeutics
5. Sharma, V.N. Essentials of Pharmacology
6. Derasari and Gandhi's Elements of Pharmacology
7. Remington's Pharmaceutical Sciences
8. Indian Pharmacopeia
9. Pillai, K.K. Experimental Pharmacology
10. Kulkarni, S.K. Hand Book of Experimental Pharmacology

### **HOSPITAL PHARMACY ADMINISTRATION**

#### **PH. E.7 THEORY**

**3 hours/week**

#### **UNIT -I**

1. The role of hospital pharmacy department and its relationship to other hospital departments and staff.
2. Hospital drug policy – Drug Committee, formulary and guidelines, other hospital committees such as infection control committee and research & ethics committee.

#### **UNIT -II**

3. Hospital Pharmacy management – Staff (Professional and non-professional), Materials (drugs, non-drugs consumables), Financial (drug budget, cost centers,

Planning infrastructure requirements (building, furniture and fitting, specialized Equipment, maintenance and repairs), Work load statistics, Hospital formulary.

4. Organization of Hospital Pharmacy Services,

#### **UNIT -III**

5. Drug Distribution: Purchasing, warehousing (Storage conditions, expiry date control, recycling of drugs, stock-taking, drug recalls), Drug distribution methods (ward stock, individual patient dispensing, unit doses), specific requirements for inpatients, causality / emergency theatre, ICU/CCU, Drugs of dependence.

#### **UNIT -IV**

6. Manufacturing: Sterile and non sterile production, including total parenteral nutrition, IV additive service, Pre-Packing and labeling Quality control.

### **HOSPITAL PHARMACY ADMINISTRATION**

**PH. E.8**

**PRACTICAL**

**3 hours/week**

**(A minimum of 15 experiments shall be conducted)**

1. Experiments based on sterilization of various types of materials used in Hospitals.
2. Practicals designed on the use of computers in Drug information Centre,.
3. Prescription filling documentation of information of drug interaction.
4. Manufacture of LVP used in hospitals.
5. Observing Drug distribution pattern in a local hospital and writing report.
6. Any other experiments to Substantiate theory.

#### **RECOMMENDED BOOKS:**

1. Hospital Pharmacy-Hassan WE, Lec and Febiger Publication ., 1999.
2. Text book of Hospital Pharmacy-Allowood MC and Blackwell, 1980, 1<sup>st</sup> ed.
3. Avery's Drug Treatment, 4<sup>th</sup> edition, Adis international limited
4. Managing Drug Suppl-2<sup>nd</sup> Edition, Management Sciences for health, Kumarian press, 1997.

### **ADVANCED PHARMACEUTICAL ANALYSIS**

**PH. E.9**

**THEORY**

**3 hours/week**

#### **UNIT -I**

1. Theory, instrumentation and applications of the following Instrumental Methods of Analysis.
  - (i) X-ray fluorescence spectrometry
  - (ii) X-ray diffraction
  - (iii) Electron spin resonance spectroscopy (ESR)
  - (iv) Advanced chromatographic techniques like super critical fluid chromatography, size exclusion chromatography.
  - (v) Differential scanning calorimetry, Differential thermal analysis and Thermal gravimetric analysis,

## UNIT - II

2. Theory and procedure involved in the qualitative and quantitative analysis of pharmaceutical properties and dosage forms containing the following drugs: (Biological and microbiological method excluded).
- NSAID - Analgesics and antipyretics ( Diclofenac sodium, Ketoprofen, Oxyphenebutazone, Paracetamol, Allopurinol, Aspirin + Caffeine )
  - Barbiturates (Phenobarbitone sodium)
  - Steroids (Nandrolone, Cortisone acetate, Fludrocortisone acetate, Prednisolone, Dexamethasone)
  - Antihistaminics (Mepyramine maleate, Chlorpheniramine maleate, promethazine hydrochloride, Cyclazine hydrochloride, Astemizole)
  - Alkaloids (Codeine, Opium, Vincristine, Ergotamine and Ergometrine)

## UNIT -III

3. Theory and procedure involved in the qualitative and quantitative analysis of pharmaceutical properties and dosage forms containing the following drugs: (Biological and microbiological method excluded).
- Antibiotics (Cycloserine, Chloramphenicol, Ampicillin, Rifampicin, Cefotaxim sodium)
  - Vitamins (Riboflavin, Nicotinamide, Pyridoxine hydrochloride, Folic acid, Cyanocobalamine )
  - Cardiovascular agents (Digoxin, Isosorbide dinitrate, nifedipine, Verapamil hydrochloride, Propranolol hydrochloride, Timolol maleate, Atenolol)
  - Hypoglycaemic agents (Insulin and its different forms, Chlorpropamide, glibenclamide, Metformine)
  - Sulphonamides (Sulphadiazine, Sulphamethoxazole, Sulphacetamide)

## UNIT - IV

4. Theory and procedure involved in the qualitative and quantitative analysis of pharmaceutical preparations and dosage forms using the following reagents / reactions.
- (i) Diazotisation followed by coupling.
  - (ii) Oxidation followed by complexation.
  - (iii) Condensation reactions using the reagents Para Dimethyl Amino Benzaldehyde (PDAB), Folin's reagent, Gibb's reagent and para Dimethyl Amino Cinnamaldehyde (PDAC) reagent.

## ADVANCED PHARMACEUTICAL ANALYSIS

P.H. E.10

PRACTICAL

3 hours/week

**(A minimum of 15 experiments shall be conducted)**

1. Estimation of following classes of drugs using different analytical methods.
  - NSAID - Analgesics and Antipyretics.
  - Barbiturates.
  - Sulphonamides.
  - Antibiotics.
  - Steroidal hormones
  - Vitamins
  - Alkaloids
  - Cardiovascular drugs
  - Hypoglycaemic agents
  - Antihistaminics
2. Estimation of different classes of drugs using the following reagents.

- (i) Feric chloride.
- (ii) Perchloric acid.
- (iii) 2,6-Dichlorophenol indophenol.

**RECOMMENDED BOOKS:**

Instrumental methods of analysis by Scoog and West.  
 Chemical Analysis – Modern Instrumentation methods and techniques by Wiley.  
 Instrumental methods of analysis by Willard Den & Merrit.  
 Hand book of Instrumental techniques for analytical chemistry edited by Frank Settle by Prentice Hall Inc.  
 A text book of Pharmaceutical analysis by K.A.Conners (John Wiley)  
 Spectrometric identification of organic compounds by silverstein (7<sup>th</sup> Edition) 1981.  
 IP.BP.USP.

## PHARMACY PRACTICE

**PH. E.11      THEORY**

**3 hours/week**

**UNIT-I**

Rational use of drugs: Problems of irrational drug use, prescribing indicators, patient care indicators, health facility indicators, role of pharmacist in promotion of rational use of drugs.

Essential drugs concept, selection, quantification, procurement and distribution of essential drugs, WHO model list of essential drugs, Pharmaceutical policy

**UNIT-II**

Pharmacoepidemiology, Pharmacoeconomics: types of health economic evaluations  
 Therapeutics in practice – decision making in drug therapy

**UNIT-III**

Drug Information system: Introduction to drug information resources, Drugs and poisons information, design of literature searches, development of a drug and poison information database, emergency treatment of poisoning.

**UNIT-IV**

Public health policy and Health care system.

**RECOMMENDED BOOKS:**

1. Role of Pharmacist in the Health care system, WHO/ PHARM/94.569
2. Remington's sciences and practice of Pharmacy; 20<sup>th</sup> edition Lippin cott. Williams and Welkens.
3. Medicare scenario in India; Perceptions and Perspectives – Delhi society for promotion of rational use of drugs.
4. WHO publications on essential drugs and medicines.
5. Relevant review articles from recent medical and pharmaceutical journals

## PHARMACY PRACTICE

**PH. E.12      PRACTICAL      3 hours/week  
(A minimum of 15 experiments shall be conducted)**

1. Patient medication history, interview, answering drug information questions, patient medication counseling, participation in ward rounds. Case studies related to laboratory investigations covering the topics dealt in theory classes.
2. The students are required to be posted in various clinical wards for their exposure with therapeutic management and other clinical aspects. There will be tutorial and case presentation in various clinical conditions.