

## MARKS DISTRIBUTION PATTERN

Bachelor of Pharmacy 1<sup>st</sup> year (1<sup>st</sup> Semester) WEF 2014 – 2015 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 101	Professional Communication – I	3	0	30	20	50	100	150	3
2	PHR – 102	Computer Fundamental & Programming	3	0	30	20	50	100	150	3
3	PHR – 103	Pharmaceutical Chemistry – I (Inorganic Pharmaceutical Chemistry)	3	0	30	20	50	100	150	3
4	PHR – 104	Pharmaceutics – I (Introduction to Pharmacy)	3	0	30	20	50	100	150	3
5	PHR – 105	Anatomy, Physiology & Pathophysiology – I	3	0	30	20	50	100	150	3
<b>Practical Day to Day Evaluation</b>										
6	PHR – 102P	Computer Fundamental & Programming	0	4	-	-	50	100	150	2
7	PHR – 103P	Pharmaceutical Chemistry – I (Inorganic Pharmaceutical Chemistry)	0	4	-	-	50	100	150	2
8	PHR – 104P	Pharmaceutics – I (Introduction to Pharmacy)	0	4	-	-	50	100	150	2
9	PHR – 105P	Anatomy, Physiology & Pathophysiology – I	0	4	-	-	50	100	150	2
			15	16			450	900	1350	

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE

Bachelor of Pharmacy 1<sup>st</sup> year (2<sup>nd</sup> Semester) WEF 2014 – 2015 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 201	Pharmaceutical Chemistry–II (Organic Chemistry- I)	3	0	30	20	50	100	150	3
2	PHR – 202	Pharmaceutics- II (Physical Pharmacy- I)	3	0	30	20	50	100	150	3
3	PHR – 203	Anatomy, Physiology and Pathophysiology- II	3	0	30	20	50	100	150	3
4	PHR – 204	Pharmaceutical Analysis–I	3	0	30	20	50	100	150	3
5	PHR – 205	Pharmaceutics – III (Unit Operation – I)	3	0	30	20	50	100	150	3
6	PHR – 206M / B	Remedial Mathematics	3	0	30	20	50	100	150	3
		OR Remedial Biology	3	0	30	20	50	100	150	3
Practical Day to Day Evaluation										
7	PHR – 201P	Pharmaceutical Chemistry–II (Organic Chemistry- I)	0	4	-	-	50	100	150	2
8	PHR – 202P	Pharmaceutics- II (Physical Pharmacy- I)	0	4	-	-	50	100	150	2
9	PHR – 204P	Pharmaceutical Analysis–I	0	4	-	-	50	100	150	2
10	PHR – 205P	Pharmaceutics – III (Unit Operation – I)	0	4	-	-	50	100	150	2
11	PHR – 206B (P)	Remedial Biology	0	4	-	-	-	-	-	-
			18	20			500	1000	1650	

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE

Bachelor of Pharmacy 2<sup>nd</sup> year (3<sup>rd</sup> Semester) WEF 2014 – 2015 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 301	Organic Chemistry – II	3	0	30	20	50	100	150	3
2	PHR – 302	Unit Operations-II	3	0	30	20	50	100	150	3
3	PHR – 303	Physical Pharmacy	3	0	30	20	50	100	150	3
4	PHR – 304	Pharmacognosy-I	3	0	30	20	50	100	150	3
5	PHR – 305	Anatomy, Physiology and Path Physiology- III	3	0	30	20	50	100	150	3
Practical Day to Day Evaluation										
6	PHR – 301P	Organic Chemistry – II	0	4	-	-	50	100	150	2
7	PHR – 302P	Unit Operations-II	0	4	-	-	50	100	150	2
8	PHR – 303P	Physical Pharmacy	0	4	-	-	50	100	150	2
9	PHR – 304P	Pharmacognosy-I	0	4	-	-	50	100	150	2
			15	16			450	900	1350	

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE

Bachelor of Pharmacy 2<sup>nd</sup> year (4<sup>th</sup> Semester) WEF 2014 – 2015 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 401	Pharmaceutical Analysis-II	3	0	30	20	50	100	150	3
2	PHR – 402	Anatomy, Physiology and Path physiology- IV	3	0	30	20	50	100	150	3
3	PHR – 403	Pharmacognosy -II	3	0	30	20	50	100	150	3
4	PHR – 404	Chemistry of Natural Products	3	0	30	20	50	100	150	3
5	PHR – 405	Pharmaceutical Jurisprudence & Ethics	3	0	30	20	50	100	150	3
Practical Day to Day Evaluation										
6	PHR – 401P	Pharmaceutical Analysis-II	0	4	-	-	50	100	150	2
7	PHR – 403P	Pharmacognosy -II	0	4	-	-	50	100	150	2
8	PHR – 404P	Chemistry of Natural Products	0	4	-	-	50	100	150	2
			18	12			400	800	1200	

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE

Bachelor of Pharmacy 3<sup>rd</sup> year (5<sup>th</sup> Semester) WEF 2014 – 2015 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 501	Pharmaceutical Chemistry	3	0	30	20	50	100	150	3
2	PHR – 502	Pharmaceutical Technology-I	3	0	30	20	50	100	150	3
3	PHR – 503	Medicinal Chemistry-I	3	0	30	20	50	100	150	3
4	PHR – 504	Pharmacology-I	3	0	30	20	50	100	150	3
5	PHR – 505	Pharmaceutical Microbiology	3	0	30	20	50	100	150	3
Practical Day to Day Evaluation										
6	PHR – 501P	Pharmaceutical Chemistry	0	4	-	-	50	100	150	2
7	PHR – 502P	Pharmaceutical Technology-I	0	4	-	-	50	100	150	2
8	PHR – 503P	Medicinal Chemistry-I	0	4	-	-	50	100	150	2
9	PHR – 504P	Pharmacology-I	0	4	-	-	50	100	150	2
10	PHR – 505P	Pharmaceutical Microbiology	0	4	-	-	50	100	150	2
			15	20			500	1000	1500	

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE

Bachelor of Pharmacy 3<sup>rd</sup> year (6<sup>th</sup> Semester) WEF 2014 – 2015 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 601	Pharmaceutical Biotechnology	3	0	30	20	50	100	150	3
2	PHR – 602	Pharmaceutical Technology-II	3	0	30	20	50	100	150	3
3	PHR – 603	Medicinal Chemistry-II	3	0	30	20	50	100	150	3
4	PHR – 604	Pharmacology-II	3	0	30	20	50	100	150	3
5	PHR – 605	Pharmacognosy-II	3	0	30	20	50	100	150	3
Practical Day to Day Evaluation										
6	PHR – 602P	Pharmaceutical Technology-II	0	4	-	-	50	100	150	2
7	PHR – 603P	Medicinal Chemistry-II	0	4	-	-	50	100	150	2
8	PHR – 604P	Pharmacology-II	0	4	-	-	50	100	150	2
9	PHR – 605P	Pharmacognosy-II	0	4	-	-	50	100	150	2
			15	20			450	900	1350	

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE

Bachelor of Pharmacy 4<sup>th</sup> year (7<sup>th</sup> Semester) WEF 2014 – 2015 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 701	Pharmaceutical Management	3	0	30	20	50	100	150	3
2	PHR – 702	Pharmaceutical Bio-pharmaceutics & Pharmacokinetics	3	0	30	20	50	100	150	3
3	PHR – 703	Medicinal Chemistry-III	3	0	30	20	50	100	150	3
4	PHR – 704	Pharmacology-III	3	0	30	20	50	100	150	3
5	PHR – 705	Pharmacognosy -IV	3	0	30	20	50	100	150	3
Practical Day to Day Evaluation										
6	PHR – 702P	Pharmaceutical Bio-pharmaceutics & Pharmacokinetics	0	4	-	-	50	100	150	2
7	PHR – 704P	Pharmacology-III	0	4	-	-	50	100	150	2
8	PHR – 705P	Pharmacognosy -IV	0	4	-	-	50	100	150	2
9	PHR – 706P	Report on Industrial visit	0	4	-	-	50	100	150	2
			15	16			450	900	1350	

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE

Bachelor of Pharmacy 4<sup>th</sup> year (8<sup>th</sup> Semester) WEF 2014 – 2015 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 801	Environment and Ecology	3	0	30	20	50	100	150	3
2	PHR – 802	Clinical Pharmacy & Drug Interaction	3	0	30	20	50	100	150	3
3	PHR – 803	Pharmaceutical Analysis-III	3	0	30	20	50	100	150	3
4	PHR – 804	Pharmacopoeial Standards	3	0	30	20	50	100	150	3
5	PHR – 805	Elective (A)- Standardization of Herbal Drugs and Cosmetics Or (B)- Drug Design Or (C)- Pharmaceutical Marketing Or (D)- Pharmaceutical Packaging Or (E)- Novel Drug Delivery Systems Or (F)-GMP, Quality Assurance & Validation Or (G)- Hospital Pharmacy Or (H)- Advanced Pharmacology Or (I)- Pharmaceutical Entrepreneurship	3	0	30	20	50	100	150	3
Practical Day to Day Evaluation										
6	PHR – 805P	Elective (A)- Standardization of Herbal Drugs and Cosmetics Or (B)- Drug Design Or (C)- Pharmaceutical Marketing Or (D)- Pharmaceutical Packaging Or (E)- Novel Drug Delivery Systems Or (F)-GMP, Quality Assurance & Validation Or (G)- Hospital Pharmacy Or (H)- Advanced Pharmacology Or (I)- Pharmaceutical Entrepreneurship	0	4	-	-	50	200	250	2
			15	4			300	700	1000	

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE



**B.PHARM. I YEAR  
SEMESTER-I**

**PHR-101**

**PROFESSIONAL COMMUNICATION-I**

**Unit-1.** Grammar: Sequences of tenses, voice, articles, direct and indirect speech; degrees of comparison and preposition. **[08]**

**Unit-2.** Letter writing, Précis and Essay writing Comprehension Speed reading, scanning & swimming. **[08]**

**Unit-3.** Role and importance of communication, verbal and non-verbal communication, Group communication, effective communication, barriers of communication, communication media, participating in discussions, conduct of seminars, conferences etc., interacting with learners and teachers, role of wit and humor in communication. **[08]**

**Unit-4.** Agreement and disagreements, how to use a dictionary; how to use a thesaurus; vocabulary development; synonyms; one word substitutes, use of appropriate words and vocabulary. **[08]**

**Unit-5.** Types and methods of learning and listening; learning and listening of knowledge, attitudes, skills, decision making, thinking, motivation and practices. **[08]**

**BOOKS RECOMMENDED: (Latest Edition)**

- 1.** Wren P.C and Martin H., **High School Grammar and Composition**, S. Chand & Co.
- 2.** Robbins, S **Organisational Behaviour** Prentice Hall of India New Delhi.
- 3.** Raman, Meenakshi and Sharma Sangeeta, **Technical communication principles and practice** Oxford University Press, New Delhi.

## PHR-102

### COMPUTER FUNDAMENTALS AND PROGRAMMING

**Unit-1.** Definition and Overview of Computer, Computer classification, Computer Organization, Computer code, computer classification of Boolean algebra. Input Devices, Output devices, Storage devices. Computer Software, Types of software. Overview of Computer Networks, LAN, MAN, WAN, Internet, Intranet, network topology. Internetworking: Bridges, Repeaters and Routers. [08]

**Unit-2. Introduction:** Operating system and function, Evolution of operating system, Batch, Interactive, Time sharing and Real Time System. Single user operating system and Multi-user operating system, Compare MS-DOS vs. UNIX, Various window features. Internal and External commands in MS-DOS.[08]

**Unit-3.** Introduction to MS-OFFICE, WORD Document creation, Editing, formatting table handling, mail merge, Excel, Editing, working Retrieval, Important functions, short cut keys used in EXCEL. [08]

**Unit-4.** MS-Power point -Job Profile, Elements of Power point, ways of delivering Presentation, concept of Four P's (Planning, Preparation, Practice and Presentation) ways of handling presentations e.g. creating, saving slides show controls, Adding formatting, animation and multimedia effects. Database system concepts, Data models schema and instance , Database language, Introduction to MS Access 2003, main components of Access tables, Queries, Reports, Forms table handling, working on Query and use of database. Fundamentals of Structured Query Language (SQL) [08]

**Unit-5.** Computer applications in Pharmaceutical and clinical studies, uses of Internet in Pharmaceutical Industry. Fundamentals of C programming, Data structure using C, Queue, FIFO etc, Internet History, Characteristics, uses. [08]

## PHR - 102P

### COMPUTER FUNDAMENTALS AND PROGRAMMING (LAB)

**Software Lab to be used for the following:-**

1. Windows, Managing Windows, Working with Disk , Folders and files.
2. MS-Office 2003 (MS Word, MS Power point, MS Excel, MS Access).
3. Computer Operating System Like DOS and Windows.
4. Internet Features (E- mail, Browser etc.)
5. Data Structure using C
6. Programming using C language.

**BOOKS RECOMMENDED: (Latest Edition)**

1. Sinha, R.K., **Computer Fundamentals**, BPB Publications.
2. Raja Raman, V, **Computer Programming** in 'C', PHI Publication.
3. Hunt N and Shelley J. **Computers and Common Sense** Prentice Hall of India.
4. G.N.Rao, **Biostatistics & computer Applications** .Pharmamed Press Hyderabad.
5. Sinha PK "Fundamentals of Computers".
6. Kanitkar Yashwant, Let us C.

**PHARMACEUTICAL CHEMISTRY-1  
(INORGANIC PHARMACEUTICAL CHEMISTRY)**

**Unit-1.** Sources of impurities & their control, limit test for iron, arsenic, lead, heavy metals, chloride & sulphate. [08]

**Unit-2.** An outline of methods of preparation, uses, sources of impurities, tests of purity and identification and special tests, if any, of the following classes of inorganic pharmaceuticals included in the latest Indian Pharmacopoeia.

**Gases and Vapors:** Inhalants (Oxygen), Anaesthetics (Nitrous oxide).

**Topical Agents:** Protective (Calamine, titanium dioxide, talc, kaolin), astringents (Zinc oxide, Zinc Sulphate) and anti infective (Boric Acid, Hydrogen peroxide, Iodine, Povidone Iodine, Potassium permanganate, Silver nitrate).

**Dental Products:** Dentrifices- anti-caries agents (Sodium fluoride). [08]

**Unit-3. Gastrointestinal Agents:** Acidifying agents (Dilute Hydrochloric acid), antacids (Bismuth subcarbonate, Aluminium hydroxide, Calcium carbonate, Magnesium hydroxide, Magnesium oxide { light and heavy }, Magnesium carbonate { light and heavy }, Magnesium trisilicate ), cathartics (disodium hydrogen phosphate, Magnesium sulphate and other Magnesium compounds), protective and adsorbents ( Activated Charcoal, Light Kaolin.)

[08]

**Unit-4. Major intra and extra- cellular electrolytes :** Physiological ions, Electrolytes used for replacement therapy, acid-base balance & combination therapy ( Calcium chloride, Calcium gluconate, Calcium lactate, Calcium levulinate, Sodium dihydrogen phosphate, sodium acetate, sodium bicarbonate, sodium chloride, potassium chloride, magnesium chloride). Cationic and anionic components of inorganic drugs useful for systemic effects.

[08]

**Unit-5. Essential and Trace Elements:** Transition elements and their compounds of pharmaceutical importance. Iron and haematinics (Ferrous fumarate, Ferrous gluconate, Ferrous sulphate, Ferric ammonium citrate, mineral supplements (Cu, Zn, Cr, Mn, Sb, S, I).

**Miscellaneous Agents:** Expectorants (Ammonium chloride, Potassium Iodide), antioxidants (Sodium metabisulphite, Sodium benzoate). [08]

## PHR-103P

### PHARMACEUTICAL CHEMISTRY-I (INORGANIC PHARMACEUTICAL CHEMISTRY) - LAB

#### Proposed list of experiments

1. To perform the limit test for chloride in the given sample (for e.g. Ammonium Carbonate calcium gluconate)
2. To perform the limit test for sulphate in the given sample (for e.g. Ammonium Chloride)
3. To perform the limit test for iron in the given sample (for e.g. calcium carbonate)
4. To perform the limit test for heavy metal in the given sample (for e.g. Calcium carbonate)
5. To perform the limit test for arsenic in the given sample (for e.g. Barium Sulphate)
6. To prepare Boric acid from borax and perform the limit test and identification test.
7. To prepare potash alum by using potassium sulphate and aluminium sulphate and perform the limit test and identification test.
8. To prepare calcium Carbonate by using calcium chloride and sodium carbonate and perform the limit test and identification test.
9. To prepare heavy magnesium carbonate by using sodium carbonate and magnesium sulphate and perform the limit test and identification test.
10. To prepare zinc sulphate by using zinc and sulphuric acid and perform the limit test and identification test.
11. To prepare Peritoneal Dialysis Solution.

#### BOOKS RECOMMENDED: (Latest Edition)

1. Block, J.H. Roche, E, Soine, T and Wilson, C., **Inorganic, Medicinal & Pharmaceutical Chemistry**, Lea & Febiger.
2. Discher, C.A., et.al **Modern Inorganic Pharmaceutical Chemistry**, waveland press.
3. The pharmacopoeia of India.
4. Atherden L.M., Bentley and Drivers' **Text Book of Pharmaceutical Chemistry**, Oxford University Press, London.
5. **Remington Pharmaceutical Sciences**, Mack Publishing Co., Pennsylvania

## PHR-104

### PHARMACEUTICS-I

#### INTRODUCTION TO PHARMACY

**Unit-1. HISTORY OF PHARMACY:** Origin & developments of pharmacy, scope of pharmacy, a brief review of development of Pharmaceutical Education and drugs, Pharmaceutical Industry in India, Pioneers who have contributed to the development of Pharmacy in India and Pharmaceutical legislations and ethics- a brief review. [08]

**Unit-2.** Introduction to pharmacopoeias with special references to I.P., B.P., U.S.P. & International Pharmacopoeia including general notices [08]

**Unit-3. PHARMACEUTICAL CALCULATIONS:** Posology, Latin terms, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipes percentage solution, alligation, alcohol dilution, proof spirit, Chelating agents. [08]

**Unit-4. PHARMACEUTICAL ADDITIVES:** Colouring, flavouring and sweetening agents, cosolvents, preservatives, surfactant and their applications, antioxidants, Natural and Semisynthetic Biopolymers. [08]

**Unit-5. INTRODUCTION OF PHARMACEUTICAL DOSAGE FORMS** –Definition, classification method of preparation, uses, advantages also including illustrative examples of equivalent Indian marketed formulations of the following- solutions, aromatic waters, mixtures, spirits, syrups, elixirs, powders, lotions, liniments, pastes, mucilage, glycerin, paints, , mouth washes, and inhalations. [08]

## PHR-104P

### INTRODUCTION TO PHARMACY (LAB)

The Practical based on the dosage forms, at least two experiments from each category mentioned below.

#### Preparation and Evaluation (Reference Present Edition)

##### 1. Aromatic waters:

- Concentrated Camphor Water BP
- Strong rose water USP/NF
- Peppermint water USP/NF

##### 2. Syrups:

- Syrup BP
- Paracetamol Syrup IP
- Codeine Syrup IP
- Chloroquine Syrup IP

##### 3. Linctus:

- Simple Linctus BP
- Pholcodine Linctus IP

##### 4. Sprits

- Peppermint spirit BP
- Aromatic sprit of Ammonia BP
- Lemon spirit BP

##### 5. Elixir

- Simple elixir BP
- Piperazine citrate elixir BP
- Ephedrine elixir IP
- Aromatic elixir USP/NF

##### 6. Solutions:

###### A. Oral

- Paediatric Ferrous sulphate solution BP
- Iodine oral solution aqueous BP
- Ascorbic acid oral solution USP/NF

###### B. Topical

- Hydrogen peroxide topical solution USP/NF
- Strong ammonium acetate solution BP
- Calcium hydroxide solution BP

- Povidone iodine solution IP
- Cresol with soap Solution IP
- Benzalkonium Chloride Solution IP

#### **7. Mixtures**

- Aromatic Magnesium Carbonate Mixture BP
- Ammonium Chloride mixture BP
- Magnesium hydroxide mixture BP
- Magnesium sulphate mixture BP

#### **8. Powders**

- Oral rehydration salts BP
- Compound magnesium trisilicate oral powder BP
- Talc dusting powder BP
- Sodium bicarbonate oral powder USP/NF
- Absorbable dusting powder USP/NF

#### **9. Pastes**

- Compound zinc paste BP
- Magnesium sulphate paste BP
- Salicylic acid and zinc paste USP/NF

#### **10. Poultices**

- Kaolin poultice BP

#### **11. Liniments**

- White liniment BP
- Methyl Salicylate liniment BP

#### **12. Lotions**

- Calamine lotion IP
- Zinc sulphate lotion BP
- Benzyl benzoate application IP

#### **13. Mouth washes**

- Compound sodium chloride mouthwash BP
- Chlorhexidine mouth wash BP
- Povidone iodine mouthwash BP

#### **14. Inhalations**

- Benzoin inhalation BP
- Menthol and benzoin inhalation IP

#### **Books Recommended:**

1. I.P. Latest Edition
2. B.P. Latest Edition
3. U.S.P. Latest Edition
4. International Pharmacopoeia
5. Ansel's HC, Pharmaceutical Calculations, 13<sup>th</sup> edition, Lipincott Williams and Wilkins
6. Ansel's HC, Pharmaceutical Dosage Forms and Drug Delivery Systems, 9<sup>th</sup> edition, Lipincott Williams and Wilkins
7. Cooper and Gunn's, Dispensing for Pharmaceutical Students, 12<sup>th</sup> edition, CBS Publishers & Distributors Pvt. Ltd.
8. Singh Harkishan, History of pharmacy in India and related aspects, Volume 1-6, Vallabh Prakashan, New Delhi

## PHR-105

### ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-I

#### Unit-I

- a) Introduction to human body and organization of human body.
- b) Functional and structural characteristics of cell.
- c) Detailed structure of cell membrane and physiology of transport process (Including enzymes and co-enzymes).
- d) Structural and functional characteristics of tissue: epithelial, connective, muscle and nerve. **(8)**

#### Unit-II

- a) Skeletal System-Structure, composition and functions of skeleton, classification of joints, types of movement of joints.
- b) Anatomy and physiology of skeletal muscle and smooth muscle, neurotransmission, physiology of skeletal muscle.
- c) Contraction, energy metabolism, types of muscle contraction, muscle tone. **(08)**

#### Unit-III

- a) Haemopoietic system: - composition, and function of blood elements, erythropoiesis, blood groups, blood coagulation.
- b) Lymphatic system: - composition, formation and circulation of lymph node and spleen. **(08)**

#### Unit-IV

**Endocrine System:** Basic anatomy and physiology of pituitary, thyroid, parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones and functions. **(08)**

#### Unit-V

**Sense organs:** Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin(superficial receptors). **(08)**

## PHR105-P

### APP-I Lab

Exp.1-3 Study of Human Skeleton

Exp.4-6 Microscopic study of different tissues.

Exp.7-10 Study of different systems of Human body with help of charts and Models.

Exp.11-15 Estimation of Haemoglobin and determination of clotting time and Bleeding time, RBC, WBC (Total), DLC and ESR

#### **Books Recommended: (Latest Edition)**

1. Ross and Wilson, Human anatomy and Physiology, Churchill Livingstone London.
2. Guyton AC, Hall JE, Text book of Medical Physiology, WB Saunders Company.
3. Robbins SL, Kumar V, Basic Pathology, WB Saunders.
4. Chatterjee,C.C, Human Physiology, Medical allied agency, Calcutta.
5. Shalya,Subhas, Human Physiology, CBS Publisher, New Delhi.
6. Chaurasia,B.D, Human anatomy, Regional and applied.Part-1,CBS publisher, New Delhi
7. Ranade VG, Test book of Practical Physiology, Pune Vidyarthi Griha Prakashan.

**B.PHARM. I YEAR  
SEMESTER-II  
PHR-201  
PHARMACEUTICAL CHEMISTRY- II  
(ORGANIC CHEMISTRY-I)**

Unit-1. Structure and Properties: Atomic Structure, atomic orbital, molecular orbital, hybridization, sigma and Pi bond, covalent, electrovalent and co-ordinate bond, inductive effect, resonance, Classification and Nomenclature of organic compounds. [08]

Unit-2. Isomerism, geometrical isomerism, Stereochemistry including optical activity, stereoisomerism, specification of configuration and conformational analysis. [08]

Unit-3. Important methods of preparation, reactions with special reference to mechanism of the following classes of compounds: Alkanes, alkenes, alkynes and dienes, free radical substitution reaction,

alkyl halides, Alcohols. [08]

Unit-4. Aromatic Compounds, aromatic character, structure of benzene, resonance, orientation of aromatic substitution, arenes, amines (aliphatic & aromatic), phenols, aryl halides. [08]

Unit-5. Aldehydes and ketones (aliphatic & aromatic), carboxylic acids & their derivatives, di & tricarboxylic acids, hydroxy acids. Organometallic Compounds- Grignard reagent, organolithium compounds, their preparation & synthetic application. [08]

**PHR-201P  
PHARMACEUTICAL CHEMISTRY- II  
(ORGANIC CHEMISTRY-I) LAB**

1. Identification of elements and functional groups in given organic compounds.
2. Purification of solvents like Toluene Chloroform, Acetone and preparation of absolute Alcohol.
3. Synthesis of compounds involving benzylation and acetylation.
4. Synthesis of Picric acid, Aniline, Acetanilide, Aspirin, Hippuric acid, p- Bromo acetanilide, Iodoform and Oxalic acid.

BOOKS RECOMMENDED: (Latest Edition)

1. Mann, F.G, & Saunders, B.C., Practical Organic Chemistry, ELBS/ Longman.
2. Vogel A.I., Textbook of Practical Organic Chemistry, ELBS/Longman.
3. Morrison, R.T., and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt. Ltd, New Delhi.
4. Finar, I.L., Organic Chemistry, Vol. I & II, ELBS/Longman.
5. Jain, M.K. Organic Chemistry, Sohan Lal Nagin Chand & Co. 60 B, Bunglaw Road, Delhi.
6. Hendrikson, Organic Chemistry.
7. Godly, E.W. Naming organic compounds.
8. Kalsi, Organic reactions Stereochemistry & Mechanism.



**PHR-202**  
**PHYSICAL PHARMACY – I**  
**(PHARMACEUTICS- II)**

Unit-1. MATTER, PROPERTIES OF MATTER: State of matter, change in the state of matter, latent heats and vapor pressure, sublimation critical point, Eutectic mixtures, gases, aerosols- inhalers, relative

humidity, liquid complexes, liquid crystals, glassy state, solids crystalline, amorphous and polymorphism. [08]

Unit-2. SOLUBILITY AND DISTRIBUTION PHENOMENON: solute – solvent interactions, solubility of gases in liquids, solubility of liquids in liquids, solubility of solids in liquids, factors affecting solubility. [08]

Unit-3. BUFFERS: Buffers equations and buffer capacity in general buffers in pharmaceutical systems, preparation, stability buffered isotonic solutions measurements of tonicity, calculations and methods of adjusting isotonicity [08]

Unit-4. SOLUTIONS: Ideal and real solutions, solutions of gases in liquids, colligative properties, partition

coefficient, conductance and its measurement Debye Huckel theory. [08]

Unit-5. CHEMICAL KINETICS: Zero, first and second order reactions, complex reactions, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid base and enzyme catalysis. [08]

**PHR-202P**  
**PHYSICAL PHARMACY – I**  
**(PHARMACEUTICS- II) LAB**

1. To determine the distribution coefficient (partition coefficient) of iodine between carbon tetrachloride and water.
2. To plot the mutual solubility curve of phenol- water system and report the critical solution temperature.
3. Determination of rate constant of simple reaction.
4. To determine the percent w/v composition of a sugar solution using polarimeter.
5. To compare theoretical pH values (using Henderson- Hasselbalch equation) with the experimental values (using ph meter).
6. Determine the pH given solution using universal indicator system.
7. To determine dissociation constant ( $K_a$  or  $pK_a$ ) of a weak acid (acetic acid) using conductivity meter
8. To determine the molecular weight of a nonvolatile substance by ebullioscopic method (Landsberger's method)
9. To determine the molecular weight of a substance using the principle of freezing point depression method (Rast- Camphor method).
10. To determine solubility of solids (benzoic acid) at different temperatures and to determine the molar heat of fusion of benzoic acid.
10. To determine solubilities of three liquids co-existing together (co-solvency effect).
11. To prepare buffer solution as given IP.

BOOKS RECOMMENDED: (Latest Edition)

1. Martin A, Bustamante P. & Chun A.H.C- Physical Pharmacy, Lea & Febiger, Philadelphia
2. Pali S.R., and Prabartak, S.K.D.E., Practical Physical Chemistry, Haltone Limited, Calcutta.
3. Shoemaker, D.P. Garland, C.W., Experiments of Physical Chemistry, MC Graw Hill Book Co.

4. Bahl B.S., Tuli G.D. & Bahl Arun, Essential of Physical Chemistry, S. Chand & Co.
5. Negi A.S. & Anand S.C. Textbook of Physical Chemistry Wiley Eastern Ltd.
6. Glasstone S. & Lewis D, Elements of Physical Chemistry, Macmillan Education.
7. Atkins P & Paula, J.D. Atkins Physical Chemistry Oxford University Press.

**PHR-203**  
**ANATOMY, PHYSIOLOGY AND PATHO PHYSIOLOGY -II**

Unit-1. ENDOCRINE SYSTEM: Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones and functions. [08]

Unit-2. URINARY SYSTEM: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base balance. [08]

Unit-3. REPRODUCTIVE SYSTEM: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization, Sex differentiation, spermatogenesis and oogenesis demography and family planning. [08]

Unit-4. SENSE ORGANS: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose

(smell) and skin (superficial receptors). [08]

Unit-5. a) Concepts of health & disease, agents causing communicable diseases & prevention of disease.

b) Classification of food requirements, Balanced diet, Nutritional deficiency disorders, their treatment & prevention, specification for drinking water. [08]

BOOKS RECOMMENDED: (Latest Edition)

1. Ranade VG, Text Book of Practical Physiology, Pune Vidyarthi Griha Prakashan, Pune.
2. Difore SH, Atlas of Normal Histology Lea & Febiger Philadelphia.
3. Guyton AC, Hall JE., Text book of Medical Physiology, WB Saunders Company.
4. Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
5. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
6. Tortora GJ, & Anagnostikos NP, Principles of Anatomy & Physiology, Harper & Rave Publishers, New Delhi.
7. Parmar N.S., Health Education & Community Pharmacy CBS Publishers, Delhi.
8. Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
9. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.

**PHR-204**  
**PHARMACEUTICAL ANALYSIS – I**

Unit -1. GENERAL CONCEPT OF ANALYSIS: Significance of quantitative analysis in quality control, different

techniques of analysis, preliminaries and definitions, precision and accuracy, Fundamentals of volumetric

analysis, methods of expressing concentration, primary and secondary standards. [08]

Unit 2. ACID BASE TITRATION: Acid-base concepts, role of solvent, relative strengths of acids and bases,

ionization, law of mass action, common-ion effect, ionic product of water, pH, hydrolysis of salts, Henderson-Hasselbach equation, buffer solution, neutralization curves, acid-base indicators, theory of

indicators, choice of indicators, mixed indicators, polyprotic system. [08]

Unit 3. 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, oxidation reduction curves, iodimetry and iodometry, titrations involving ceric sulphate,

potassium iodate, potassium bromate, potassium permanganate, potassium dichromate. [08]

Unit 4 (A). PRECIPITATION TITRATIONS: Precipitation reactions, solubility products; effect of acids, temperature

and solvent upon the solubility of precipitate. Argentometric titrations and titrations involving ammonium or

potassium thiocyanate, Gaylussac methods, Mohr's method, Volhard's method and Fajan's methods.

(B). GRAVIMETRIC ANALYSIS: Precipitation techniques, Solubility products; Digestional washing of the

precipitate, filtration, Filter papers and crucibles, Ignition, Thermogravimetric curves, Specific examples like

barium as barium sulphate, aluminium as aluminium oxide, Organic precipitants. [08]

Unit 5. Complexometric titrations: Introduction, titration curves, types of EDTA titrations, titration of mixtures, metal ion indicators, standard EDTA solutions. [08]

**PHR-204P**  
**PHARMACEUTICAL ANALYSIS-I (LAB)**

Proposed list of experiments

1. To study the analytical balance and calibrate the weights provided in the weight box
2. To calibrate the given volumetric flask of 100ml. and 50ml.

Acid base titration

3. To prepare 1 N HCL and standardize it.
4. To prepare 0.1N H<sub>2</sub>SO<sub>4</sub> and standardize it.
5. To prepare 0.1 N NaOH and standardize it against succinic acid / oxalic acid.
6. To prepare 0.1N H<sub>2</sub>SO<sub>4</sub> and standardize it against previously standardize NaOH.
7. To perform the assay of Boric Acid.
8. To perform the analysis of mixture of boric acid and borax.
9. To perform the analysis of mixture of Sodium bi carbonate and Sodium carbonate.
10. To perform the analysis of mixture of Sodium carbonate and Sodium Hydroxide.

Oxidation – reduction titration

11. To prepare 0.1NKMnO<sub>4</sub> and standardize it against oxalic acid / sodium oxalate.
12. To perform assay of FeSO<sub>4</sub>.7H<sub>2</sub>O
13. To prepare 0.1N Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> solution and standardize it.
14. To prepare and standardize 0.05N iodine solution.

15. Assay of ascorbic acid.

Precipitation and Complexometric methods

16. To prepare 0.1N AgNO<sub>3</sub>. And standardize it.

17. To prepare 0.1 N NH<sub>4</sub>SCN / NaCl solution and standardize it against previously standardized AgNO<sub>3</sub> solution.

18. Preparation and standardization of 0.05M disodium EDTA solution.

19. Determination of the percentage of CaCO<sub>3</sub> / MgSO<sub>4</sub>

BOOKS RECOMMENDED: (Latest Edition)

1. Beckett, A.H. and Stanlake, J.B. Practical Pharmaceutical Chemistry, Athlone Press, London.

2. Barner, J.D., Thomas, M.J.K., Mendham J. and Denney, R.C., Vogel's Textbook of Quantitative Inorganic Analysis including Elementary Instrumental Analysis. The ELBS and Longman London,

3. Atherden, I.M. Bentley and Driver's Text book of Pharmaceutical Chemistry. Oxford University Press, Delhi.

4. Gary, D.C. Analytical Chemistry. John Wiley and Sons, New York,

5. Alexeyev, V., Quantitative Analysis . Mir Publishers, Moscow.

**PHR-205**  
**PHARMACEUTICS-III**  
**(Unit Operation- I)**

Unit-1. Stoichiometry : Unit processes material and energy balances, molecular units, mole fraction, tie

substance, gas laws, mole volume, primary and secondary quantities, equilibrium state, rate process, steady and unsteady states, dimensionless equations, , dimensionless formulae, dimensionless groups,

different types of graphic representation. [08]

Unit-2. Basis of Unit Operations: Mechanism of Fluid flow, Significance of Reynolds Number, Distribution of Velocities across the Tube, Heat Transfer, Methods of Heat Transfer, Combination of Heat Transfer Methods, Mass Transfer, Solid / Fluid Mass Transfer, Application in Unit Operation.

[08]

Unit-3. (A) Size Reduction: Objectives, Factors Affecting, Energy Requirements, Mechanisms, Methods of Size Reductions. Equipments used- Principle, material of construction , Applications advantages and disadvantages of cutter mill, hammer mill, roller mill, ball mill, fluid energy mill, wet grinding .

(B) Size Separation: Standards for Powders, Pharmacopoeal classification , Sieves, Materials used for

Sieves, Sieving Methods, Fluid Classification Methods, Sedimentation and Elutriation, Equipments used: Principle, material of construction , Applications advantages and disadvantages of cyclone separator, sedimentation tank . [08]

Unit-4. Mixing: Definition and objectives, Type of Mixtures, Liquid Mixing, powder Mixing, Semi solids, mixing equipment: Principle, material of construction, Applications advantages and disadvantages of shaker mixer, propeller mixer, turbine mixer ,paddle mixer, planetary mixer, double cone mixer, V mixer, sigma mixer and colloid mill, ultrasonic mixer. [08]

Unit-5. Filtration: Factors Affecting, Rate of Filtration, Properties of the filter medium and filter cake, Mechanism of Filtration, Filter Media and aids, Principle, material of construction , Applications advantages and disadvantages of Industrial Filters, Filter Leaf, Filter Press, Rotary Filter ,membrane filter, ultra filter, Edge Filter and filters for gases .

Centrifugation: principle, factor affecting , Principle, material of construction , Applications advantages and disadvantages of perforated basket centrifuge , tubular bowl centrifuge conical disc centrifuge , ultra centrifuge [08]

**PHR-205P**  
**PHARMACEUTICS – III**  
**(Unit Operation- I)**  
**PRACTICAL**

1. Measurement of rate of flow of fluids and pressure by:

a) Simple and differential manometers

b) Venturimeter

c) Orifice meter

2. Determination of Reynold Number.

3. Study of factors affecting rate of filtration

a) Effect of different filter media

b) Effect of viscosity of filtrate

c) Effect of pressure

d) Effect of thickness of cake

e) Effect of filter aids.

4. Study principle of centrifugation for

a) Liquid –Liquid separation and stability of emulsions.

b) Solid – liquid separation and stability of suspension.

5. Experiments to illustrate principles of size reduction using Ball Mill. Effect of size of balls, number of balls and time on the efficiency of ball mill.

6. Experiments to illustrate mixing efficiency. Solid-Solid mixing.

7. Particle size analysis by sieving and microscopy.

BOOKS RECOMMENDED: (Latest Edition)

1. Badger W.L. and Banchero J.T. Introduction to Chemical Engineering Mc Graw Hill International Book Co., London.

2. Perry R.H. & Chilton C.H. Chemical Engineers Handbook, Mc Graw Kogakusha Ltd.

3. McCabe W.L. and Smith J.C. Unit Operation of Chemical Engineering Mc Graw Hill International Book Co., London.

4. Sambhamurthy, Pharmaceutical Engineering, New Age Publishers.

5. Gavhane, K.A. Unit Operation-I, Nirali Prakashan.

6. Cooper and Gunn's Tutorial Pharmacy, CBS Publishers, New Delhi

**PHR-206M**  
**REMEDIAL MATHEMATICS**

Unit-1. ALGEBRA: Equations reducible to quadratics, simultaneous equations (linear & quadratic). Determinants, Properties of determinants, solution of simultaneous equations by Cramer's rule, matrices, properties of matrices, solution of simultaneous equations by matrices, pharmaceutical applications of determinants and matrices. [08]

Unit-2. TRIGONOMETRY: Measurement of angle, T-ratios, addition, subtraction and transformation formulae, T-ratios of multiple, submultiples, allied and certain angles, application of logarithms in pharmaceutical computations. [08]

Unit-3. ANALYTICAL PLANE GEOMETRY: Certain co-ordinates, distance between two points, area of triangle,

locus of a point, straight line, slope and intercept form, double intercept form normal (perpendicular form), slope-point and two point form, general equation of first degree. [08]

Unit-4. CALCULUS: Differential Limits and functions, definition of differential coefficient, differentiation of

standard functions including function of a function (chain rule). Integral: Integration as inverse of differentiation, indefinite integrals of standard form, integration by parts. [08]

Unit-5

Introduction to statistics : Mean, Types of means, Median, Mode-Measure of dispersion, Quartile, deviation, Mean deviation, Standard error of Mean (SEM) [08]

BOOKS RECOMMENDED: (Latest Edition)

1. A textbook of Mathematics for XI-XII Students, NCERT Publication Vol. I-IV.
2. Loney, S.L, Plane Trigonometry AITBS Publishers.
3. Loney, S.L, The elements of coordinate geometry AITBS Publishers.
4. Gupta S.P., Statistical Methods , Sultan Chand and Co., New Delhi
5. Narayan Shanti, Integral calculus , Sultan Chand & Co.
6. Prasad Gorakh ,Text book on differential calculus , Pothishala Pvt. Ltd., Allahabad.
7. Narayan Shanti, Differential calculus , Shyamlal Charitable Trust, New Delhi.
8. Prasad Gorakh, Text book on integral calculus , Pothishala Pvt. Ltd., Allahabad.
9. Vishal Mehta, Remedial Mathematics for Pharmacy, Kamini Publication, Kanpur



**PHR-206B**  
**REMEDIAL BIOLOGY**

Unit-1. Methods of classification of plants. [08]

Unit-2 Plant cell: It's detailed structure, mitosis, meiosis different types of plant tissues and their functions. An introduction to R.N.A and D.N.A. [08]

Unit-3. Simple and compound microscopes used in biology, section cutting, staining and mounting of sections. Morphology and histology of root, stem, bark, wood leaf, flower, fruit and seed. Modification of root and stem. [08]

Unit-4. General survey of animal kingdom; structure and life history of parasites illustrated by amoeba,

Entamoeba, Trypanosoma, Plasmodium, Taenia, Ascaris, Schistosoma, Oxyuris and Ancylostoma. [08]

Unit-5. General structure of life history of insects including their relation to medicinal crops as illustrated by grasshopper, mite, silkworm and pests. [08]

**PHR-206B(P)**  
**REMEDIAL BIOLOGY (Practical)**

(The Practical is based on demonstration only)

Morphology of plant parts indicated in theory.

Care, use and type of microscope.

Study of slides of structure and life cycle of lower plants/animal mentioned in theory.

Morphology, Preparation and study of slides of stem, root and leaf of monocot and dicot plants.

Study of structure and life cycle of human parasites mentioned in theory with the help of specimens.

**BOOKS RECOMMENDED**

1. Dutta A.C. Botany for Degree students Oxford University Press, New Delhi
2. Marshall & Williams Text Book of Zoology CBS Publishers & Distributors, Delhi.
3. Fahn Plant Anatomy Aditya Books Private Limited, New Delhi.
4. Weiz, Paul B Laboratory Manual in Science of Biology Mc Graw-Hill Book Company.

**B. Pharm. 2<sup>nd</sup> year (SEMESTER-III)**  
**PHR-301**  
**ORGANIC CHEMISTRY-II**  
**(PHARMACEUTICAL CHEMISTRY-III)**

**UNIT-I:**

**METHODS OF PREPARATION WITH MECHANISM, PROPERTIES AND MECHANISM OF NAME REACTION ASSOCIATED WITH: -**

- (i) Active methylene compounds (acetoacetic ester and malonic ester) and their synthetic importance.
- (ii)  $\alpha$ ,  $\beta$ -unsaturated carbonyl compounds.
- (iii) Polynuclear hydrocarbons-Napthalene, anthracene and phenantherene.
- (iv) Polymers and polymerisation. (8)

**UNIT-II:**

Carbohydrate: Monosaccharide:- Glucose (mutarotation, ring structure of glucose,) configuration of monosaccharides), (08)

**UNIT-III:**

Disaccharides (Sucrose and maltose), Polysaccharides (Starch and cellulose) (08)

**UNIT-IV:**

**HETEROCYCLIC COMPOUNDS:** Nomenclature, Chemistry, preparation, properties of- 5-membered heterocycles with one hetero atom (Pyrrole, Furan and Thiophene), 5-membered heterocycles with two hetero atom ( Imidazole, Thiazole, Oxazole, Pyrazole) (08)

**UNIT-V:**

Nomenclature, Chemistry, preparation, properties of 6-membered heterocycles with one hetero atom (Pyridine, Pyran), 6-membered heterocycles with two hetero atoms (Pyrimidine, Piperazine) Benz fused heterocycles (Quinoline, Isoquinoline, Indole) (08)

**PHR-301P**  
**PRACTICAL**  
**ORGANIC CHEMISTRY-II**  
**(PHARMACEUTICAL CHEMISTRY-III) LAB.**

1. Identification of organic compounds and their mixture with derivatization. (Not more than two)
2. Synthesis of Organic Compounds involving two steps.

**BOOKS RECOMMENDED:-**

1. March Jerry, Advance organic Chemistry 4th ed. A Wiley
2. Jenkins, The Chemistry of Organic Medicinal Products 4th Ed, Pharma Medpress
3. Finar I.L. Organic chemistry, Pearson education, New Delhi
4. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
5. Furniss B A, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic
6. Chemistry, The ELBS/ Longman, London.
7. Morrison, R.T., and Boyd R.N., **Organic Chemistry**, Prentice Hall of India Pvt. Ltd, New Delhi.
8. Joule J.A., Mills K. and . Smith G.F, Hetrocyclic Chemistry, Staanley Thornes Ltd., U.K.

**PHR- 302**  
**UNIT OPERATIONS - II**

**UNIT-I:**

- a) Selection of plant and equipments in unit operations
- b) A study of the following Valves – Plug Cocks, Globe, Gate, Diaphragm, QO, Check valves
- c) A study of the following Pumps- Air lift, Jet, Piston, Plunger, Diaphragm, Reciprocating, Rotary, Centrifugal pumps. **(08)**

**UNIT-II:**

**HUMIDITY, VENTILATION AND AIR CONDITIONING SYSTEMS (HVAC):-** Basic concepts & definitions, Wet bulb & Dry bulb thermometer, Adiabatic saturation temperature, Psychometric charts & Measurement of humidity, Application of humidity measurement in pharmacy, Equipment for dehumidification operations.

Principles, Materials of constructions and Applications of Refrigeration and Air-conditioning. **(08)**

**UNIT-III:**

**DRYING:** - Moisture content , Equilibrium relative humidity & Mechanism of drying, Rate of drying & time of drying calculations, Classifications of dryers, Principle , material of construction, applications advantages and disadvantages of tray , fluidized bed , Rotary , Drum , Vacuum , Spray and Freeze dryer.

**EVAPORATION:** - Basic concepts of phase equilibrium, Factors affecting evaporation, principle, materials of construction, Applications, advantages and disadvantages of Climbing and falling film evaporators , Evaporating pan , Vacuum evaporators, Horizontal and Vertical evaporators. **(08)**

**UNIT-IV:**

**DISTILLATION:-** Raoult's law, Phase diagrams, Simple, Steam, & Flash distillation, Principle of McCabe Thiele method of calculation of number of theoretical plates, Equipment for rectification, Azeotropic, Extractive & molecular distillation . **(08)**

**UNIT-V**

**CRYSTALLIZATION:** Characteristics of Crystals- purity, size, shape, geometry, habit, forms and factors affecting them. Miers super-saturation theory & caking of crystals and its prevention Classification of crystallizers, Principle, Materials of construction, applications, advantages and disadvantages of Swenson Walker, Agitated batch, Vacuum, Tank and Krystal Crystallizer.

**PHR-302P**  
**UNIT OPERATIONS-II**

**(08)**

Experiments based on drying, distillation, evaporation, crystallization, and humidity charts to be performed.

**BOOKS RECOMMENDED:-**

1. D V Derle, Essentials of Pharmaceutical Engineering, PharmaMed Press
2. McCabe W.L, Smith J.C. & Peter Harriot. Unit operations of chemical engineering. 5<sup>th</sup> Ed.
3. International student addition, McGraw hills international book co. New Delhi. 1993.
4. Cooper J.W. & Gunn G., Tutorial Pharmacy, CBS Publisher & distributors New Delhi
5. Perry R.H. & Don Green, Chemical engineering's hand book, McGraw hill book company, New
6. Delhi.
7. 4. Walter. I. Badger & Julius. T. Banchero, Introduction to chemical engineering, McGraw hill book
8. Company, New Delhi.
9. 5. Subramanian C.V.S, Pharmaceutical engineering, Vallabh Prakashan, Delhi.
10. 6. Remington's Pharmaceutical Sciences, Vol. I & Vol. – II, Mack Publishing Co., U.S.A

## **PHR- 303**

### **UNIT-I:**

#### **PHYSICAL PHARMACY-II (PHARMACEUTICS-III)**

**MICROMERETICS AND POWDER RHEOLOGY:** Average particle size, Particle size distribution, number and weight distribution, particle number; methods for determining particle size – optical microscopy, sieving, sedimentation , particle volume measurement , shape, specific surface; methods for determining surface area- air permeability, adsorption; derived properties of powders- porosity, packing arrangement, densities, bulkiness and flow properties, pore size. **(08)**

#### **UNIT-II:**

**RHEOLOGY:** Newtonian systems-Newton's Law, kinematics viscosity, effect of temperature; non- Newtonian systems- plastic ,pseudo plastic, dilatant; thixotropy- thixotropy in formulation; determination of viscositychoice of viscometer ,capillary, falling sphere, cup & bob ,plate & cone viscometers, application of rheology in pharmacy. **(07)**

#### **UNIT-III:**

**SURFACE AND INTERFACIAL PHENOMENON :** Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions(capillary rise method, drop number method, drop weight method, Wilhelm plate method), spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid gas and solid- liquid interfaces, complex films, electrical properties of interface. **(08)**

#### **UNIT-IV:**

##### **DISPERSION SYSTEMS:**

**(a) COLLOIDAL DISPERSIONS:** Definition, types, properties of colloids-optical, kinetics , electrical; protective colloids, applications of colloids in pharmacy.

**(b) SUSPENSIONS:** Interfacial properties of suspended particles, settling in suspensions- theory of Sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation Parameters; wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, stability.

**(c) EMULSIONS:** Types, theories of emulsification, physical stability, preservation, rheological properties, pharmaceutical applications of emulsions, microemulsions. **(10)**

#### **UNIT-V:**

**STABILITY:** Decomposition of medicinal agents- Influence of light, temperature and medium, half life, shelf life; stabilization of medicinal agents , accelerated stability and stress testing, ICH guidelines . **(07)**

## **PHR- 303P**

#### **PHYSICAL PHARMACY-II (PHARMACEUTICS-III) LAB.**

Practicals based on the above mentioned theory topics.

##### **BOOKS RECOMMENDED:**

1. Martin Alfred, Physical Pharmacy, 5<sup>th</sup> ed. B.I. Waverly Pvt. Ltd., New Delhi.
2. Modern Dispensing Pharmacy, N K Jain/J D Gupta, PharmaMed Press
3. Rawlins E.A, Bentley's textbook of Pharmaceutics 8<sup>th</sup> ed. Bailliere Tindall, London.
4. Gennaro A.R, Remington Pharmaceutical Sciences and practice of Pharmacy, vol. I & II, 20<sup>th</sup> Ed.
5. Lippincott, William and Wilkins, Philadelphia.
6. Aggarwal S.P., Khanna Rajesh, Physical Pharmacy, CBS Publishers & Distributors, New Delhi.

## PHR-304

### Unit-I:

#### PHARMACOGNOSY-I

A) The origin of Pharmacognosy, Present status and scope.

B) **Sources of Drug:** Biological and geographical sources of drugs.

C). **Classification of Drugs:** Alphabetical, Morphological, taxonomical, chemical & Pharmacological, chemo taxonomical. (08)

### Unit-II :

**Plant Taxonomy:** - Study of the following families with special reference to medicinally important plants: Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, and Papaveraceae, Compositae. (08)

### Unit-III :

**Cultivation, Collection, Processing & Storage of crude drugs :**

A.- Factors influencing cultivation of medicinal plants, humidity, rainfall, irrigation, Type of Soils & fertilizers, fertilization, pest and pest control.

B.- Plant growth regulators. (08)

### Unit-IV :

**Adulteration and Quality Control of crude drugs:**

A.- Causes and types of Adulteration, Organoleptic, Microscopic, Biological, Chemical and Physical method of evaluation.

B. -WHO and current Indian Pharmacopoeial guidelines for the standardization of medicinal plants. (08)

### Unit-V :

**Systematic Pharmacognostic Study of the Following:**

a) Carbohydrates and derived products: Agar, Guar gum, Xanthum gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia, Tragacanth, Alginates, and Katir. (08)

## PHR-304P

### PHARMACOGNOSY-I LAB.

1. Study of Plants belonging to families Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, and Papaveraceae, Compositae
2. Microscopical measurement of starch grains (wheat, maize, starch, potato),
3. Various types of calcium-oxalate crystals, their study and microscopical measurements (Rhubarb, Senna, Liquorice etc.)
4. Determination of leaf constant such as Stomatal index, Stomatal numbers, Veinlet numbers, Vein termination numbers and Palisade ratio
5. Chemical Tests of Agar, Acacia, Sterculia and Tragacanth, Pectin, Starch and Honey.
6. Swelling factor and average wt. of Isapaghula husk.
7. Physical characteristics of fixed oils.
8. Preparation of herbarium sheets.

#### BOOKS RECOMMENDED:

1. Trease. GE & Evans WC, Pharmacognosy, Bailliere Tindall Eastbourne. UK.

a. 6

2. Wallis. TE, Text book of Pharmacognosy, JA Churchill Ltd.

3. Wallis, Practical Pharmacognosy 4th Ed, PharmaMed Press

4. Sengar, Text Book of Pharmacognosy, PharmaMed Press

5. Kokate. CK, Practical Pharmacognosy, Vallabh Prakashan, Delhi.

6. Wallis. T.E, Analytical Microscopy, J & A Churchill Limited London.

7. Brain, KR and Turner, TD, The practical evaluation of phyto pharmaceutical, Wright, Scientifica- Bristol.

8. Kokate, CK, Pharmacognosy, Nirali Prakashan. Pune.

9. Schewar, PJ, Marine Natural Products, Academic Press, London.

**10.** . United States Pharmacopoeia (National Formulary). (latest edition)

**11.** Pharmacopoeia of India, The Controller of Publications, Delhi. (latest edition)

**12.** British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge. (latest edition)

**PHR -305**  
**ANATOMY, PHYSIOLOGY AND**  
**PATHOPHYSIOLOGY – III**

**Unit -I**

**Digestive system** –Parts of digestive system, their structure and functions. Various gastrointestinal secretions & their role. **(08)**

**Unit -II**

Pathology of disorders related to digestive system Peptic Ulcer, Ulcerative colitis, Crohns disease, Zollinger- Ellison syndrome, Amoebiasis, typhoid, Hepatitis, Cirrhosis of liver, Pancreatitis.

**(08)**

**Unit-III**

**Central Nervous System** : Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain. Cranial nerves and their functions. **(08)**

**Unit-IV**

**Autonomic Nervous System** : Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission the A.N.S. **(08)**

**Unit-V**

**Demography and Family Planning**, Medical termination of pregnancy.

**First Aid** : Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods. **(08)**

**BOOKS RECOMMENDED**

1. Tortora, Principles of Anatomy & Physiology, Wiley
2. Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
3. Guyton AC, Hall JE., Text book of Medical Physiology, WB Saunders Company.
4. Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
5. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
6. Zdanowich Martin, Essentials of Pathophysiology for Pharmacy, CRC
7. Parmar N.S., Health Education & Community Pharmacy CBS Publishers, Delhi.
8. Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
9. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.
10. Dipiro JL, Pharmacotherapy – A Pathophysiological Approach, Elsevier.
11. Robbins SL, Kumar V, Basic Pathology, WB Saunders.
12. Ranade VG, Text Book of Practical Physiology, Pune Vidyarthi Griha Prakashan, Pune. 8

## **B.Pharm 2<sup>nd</sup> year (IV Semester)**

### **PHR-401**

#### **PHARMACEUTICAL ANALYSIS-II**

Theoretical considerations and application in drug analysis and quality control by the following analytical techniques (assays included in the latest edition of Indian Pharmacopoeia).

##### **UNIT-I:**

A. Non-aqueous titration

B. Diazotisation titrations **(08)**

##### **Unit-II :**

Miscellaneous methods of analysis:., Karl-Fischer titration, Oxygen flask combustion, Kjeldahl method of nitrogen estimation. **(08)**

##### **Unit-III :**

Principle, Instrumentation and Applications of: Potentiometry, Conductometry, Polarography, Amperometry, Electrophoresis. **(08)**

##### **Unit-IV :**

Theory, Instrumentation and Applications of: Atomic absorption spectroscopy, Flame Photometry. **(08)**

##### **Unit-V :**

Principle, instrumentation and pharmaceutical applications of chromatography such as Paper column, Chromatography, TLC. **(08)**

### **PHR-401P**

#### **PHARMACEUTICAL ANALYSIS-II LAB**

1. Non-aqueous titrations: Preparation and standardization of perchloric acid. Estimation of some pharmacopoeial products.

2. Exercises based on paper, column and thin- layer chromatography.

3. Exercises involving diazotization, Karl-Fischer methods.

4. Determination of Sodium, Potassium and Calcium ion by Flame Photometry.

##### **BOOKS RECOMMENDED:**

1. Connors KA, A text book of Pharmaceutical Analysis, Wiley

2. Vidya Sagar, Basics of Drug Analysis, PharmaMed Press

3. Beckett, A H and Stenlake, J.B, Practical Pharmaceutical Chemistry, Vol I and II, The Athlone Press of the University of London.

4. Y Anjaneyulu, A Textbook of Analytical Chemistry, PharmaMed Press

5. Pharmacopoeia of India, published by The Controller of Publications, Delhi.

6. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.

7. Mendham J. Denny RC Barnes, J.D. Thomas M.J.K. "Vogel's Text Book of Quantitative Chemical

8. Analysis" Pearson Education Asia.9



**ANATOMY PHYSIOLOGY AND PATHOPHYSIOLOGY –IV**

**Unit-I –**

**Respiratory System –** Anatomy & function of respiratory structures, Mechanism of respiration, regulation of respiration, pathophysiology of Asthma, Pneumonia, Bronchitis, Emphysema, Tuberculosis. **(08)**

**Unit-II –**

**Cardiovascular System –** Functional Anatomy of heart, conducting system of heart, cardiac cycle, ECG (Electro cardiogram). Pathophysiology of hypertension, Angina, CHF, myocardial infarction, cardiac arrhythmias, Ischaemic heart disease, Arteriosclerosis. **(08)**

**Unit-III –**

**Cell injury & Adaptation –** Courses of cell injury, pathogenesis & morphology of cell injury.

**Cellular Adaptation –** Atrophy, hypertrophy, aplasia, metaplasia, & dysplasia, intracellular accumulation & pathophysiology of Neoplasm. **(08)**

**Unit IV –**

Basic mechanisms involved in the process of inflammation and repair Alterations in vascular permeability and blood flow, migration of WBC's , mediators of inflammation. Brief outline of the process of repair **(08)**

**Unit-V Pathophysiology**

of Joints disorder – Arthritis, gout, myasthenia gravis, spasticity, tetany, fatigue.

Pathophysiology of anaemia, AIDS, hypersensitivity, allergic conditions, psychosis, epilepsy, Parkinson & Alzheimer's diseases pathophysiology of cataract, glaucoma etc. **(08)**

**BOOKS RECOMMENDED**

1. Tortora GJ, & Anagnostoukos NP, Principles of Anatomy & Physiology, Wiley
2. Mc Corry, Essentials of Human Physiology for Pharmacy, 2<sup>nd</sup> Ed, CRC
3. Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
4. Guyton AC, Hall JE., Text book of Medical Physiology, WB Saunders Company.
5. Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
6. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
7. Parmar N.S., Health Education & Community Pharmacy CBS Publishers, Delhi.
8. Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
9. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.
10. Dipiro JL, Pharmacotherapy – A Pathophysiological Approach, Elsevier.11

**PHR-403**  
**PHARMACOGNOSY-II**

**Unit-I –**

STUDY OF THE SOURCES, PHYSICAL AND CHEMICAL TEST OF IDENTITY, SALIENT MICROSCOPIC FEATURES AND USES OF THE FOLLOWING:

- a) Fibres: Wool, Cotton wool, Jute, Silk, Nylon, Terylene and Polyesters. Pharmaceutical aid: Talc, Asbestos, Bentonite, Kaolin and Prepared Chalk.
- b) Fixed oil, Fats and Waxes: Almond, Castor oil, Cotton seed oil, Sesame oil, Olive oil, Cord liver oil, Arachis oil, Chaulmoogra oil, Neem oil, Fish liver oil, Lard, Lanolin, Bees wax, Lard, Cocoa butter, Kokum butter and wool fat. **(08)**

**Unit-II –**

PHYTOCHEMICAL SCREENING:

- (a) Preparation of extract
- (b) Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and poly phenols, anthraquinones, cyanogenic glycoside, amino acid in plant extracts. **(08)**

**Unit-III –**

SYSTEMATIC PHARMACOGNOSTIC STUDY OF THE FOLLOWING DRUGS: Resins: Colophony, Podophyllum, Jalap, Cannabis, Capsicum, Myrrh, Asafoetida, Balsam of Peru, Benzoin, Turmeric, Ginger, Guggule, myrrh, storax. **(08)**

**Unit-IV –**

Utilization and role of aromatic plant in national economic Volatile oil: Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandalwood, cumin, jatamansi. Cellulose and Cellulose derivative. **(08)**

**Unit-V –**

Tannins: Gambir, Black & Pale catechu, Gall, Myrobalam, Bahera, Arjuna, Tannic Acid, Amla, Ashoka Bark and Terocarpus. **(08)**

**PHR-403P**  
**PHARMACOGNOSY-II LAB**

1. Study of fibers, along with chemical test.
2. Morphology and Microscopic evaluation of some medicinal crude drugs and their powders mentioned in theory with their chemical test.
3. General chemical test for alkaloids, glycosides, steroids, flavonoids and tannins.
4. To prepare a report on an allotted topic.
5. Study and chemical test of pharmaceutical aids

**BOOKS RECOMMENDED:**

1. Trease. GE & Evans WC, Pharmacognosy, Bailliere Tindall Eastbourne. UK
2. Fischer, Modern Phytochemical Methods, Springer
3. Wallis. TE, Text book of Pharmacognosy, J & A Churchill Ltd.
4. Kokate. CK, Practical Pharmacognosy, Vallabh Prakashan, Delhi.
5. Wallis. TE, Analytical Microscopy, J & A Churchill Limited London.
6. Brain, KR and Turner, TD, The practical evaluation of phyto pharmaceutical, Wright, Scientifica- Bristol.
7. Kokate, CK, Pharmacognosy, Nirali Prakashan. Pune.
8. Harborne. JB, Phytochemical method, Chapman & Hall international edition, London.
9. Atal. CK, & Kapoor. BM, Cultivation & Utilization of medicinal plants, RRL, Jammu.
10. Tyler. VE, Pharmacognosy, Le & Febiger, Philadelphia. 13

## PHR-404

### CHEMISTRY OF NATURAL PRODUCTS

Different techniques of extraction and isolation of natural compounds. Introduction, classification and chemistry of the mentioned compounds.

#### UNIT-I:

**A:**-Glycosides: Salicin, amygdalin, digitalis & stropanthus (Structural features)

**B:** - Alkaloids: Atropine, Nicotine, Quinine. Structural features of morphine & reserpine. (10)

#### UNIT-II:

Steroids: Structural elucidation of cholesterol & Vit D, Structural features of corticoids, sex hormones, ergosterol, and saponin. (08)

#### UNIT-III

**B:**-Lipids and fatty acids: Physicochemical properties and significance of lipids and fats, Determination of acid, saponification, ester and iodine value and their significance in pharmacy. (06)

#### UNIT-IV

Terpenoids : Citral, menthol and camphor. (08)

#### UNIT-V

Amino acids, proteins: Preparation, properties and end group analysis. Protein structure (Primary, Secondary, tertiary and quaternary polypeptides) (08)

## PHR-404P

### CHEMISTRY OF NATURAL PRODUCTS

1. Isolation of natural organic compounds from medicinal plants (Isolation of caffeine from Tea leaves,
2. Isolation of piperine from Black Pepper, Isolation of Hesperidin from Orange Peel, Isolation of Clove oil from clove, Isolation of Caraway oil from caraway, Isolation of cumin oil from cumin.)
3. Extraction of essential oils
4. Analysis of fixed oils (acid value, saponification value, ester value, and iodine value)
5. Identification test of cholesterol.

#### BOOKS RECOMMENDED:

1. Manitto, Biosynthesis of Natural Products, Wiley India
2. Praveen Kumar, Natural Products a Practical Manual, PharmaMed Press
3. Finar I.L, Organic chemistry, Vol. II,, Pearson Education Pvt Ltd, New Delhi,2002.
4. Agarwal O.P., Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.
5. Indian Pharmacopoeia (Latest Edition)
6. Morrison, R.T., and Boyd R.N., **Organic Chemistry**, Prentice Hall of India Pvt. Ltd, New Delhi.14

**PHR- 405**  
**PHARMACEUTICAL JURISPRUDENCE & ETHICS**

**UNIT-I:**

**INTRODUCTION:**

- a) Pharmaceutical Legislations – A brief review.
- b) Drugs and Pharmaceutical Industry – A brief review.
- c) Pharmaceutical Education – A brief review.
- d) Pharmaceutical Ethics – A brief review.
- e) Pharmacy Act 1948. **(08)**

**UNIT-II:**

**AN ELABORATE STUDY OF THE FOLLOWING:**

- a) Drugs and Cosmetics Act 1940 and rules 1945- Manufacturing , distribution and marketing , approval of manufacturing and quality control chemist, schedules .
- b) Drugs Price Control Order 1995. **(08)**

**UNIT-III :**

**AN ELABORATE STUDY OF THE FOLLOWING:**

- a) Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
- b) Drugs and Magic remedies (Objectionable Advertisements) Act 1954. **(08)**

**UNIT-IV:**

**A BRIEF STUDY OF THE FOLLOWING WITH SPECIAL REFERENCE TO THE MAIN PROVISIONS.**

- a) Medicinal & Toilet preparations (Excise duties Act 1955)- relevant to drug and pharmaceuticals
- b) Poisons Act 1919.
- c) Medical termination of Pregnancy Act 1970 & Rules 1975.
- d) Prevention of Cruelty to Animals Act 1961.
- e) A.I.C.T.E. Act 1987. **(08)**

**UNIT-V:**

- a) Patents Act 1970, Trade mark and copyrights acts.- main provisions.
- b) U.S Food and Federal D&C Act – CFR -21, CGMP; EuGMP, WHO, Orange book **(08)**

**Note :** The teaching of all the above Acts should cover the latest amendments.

**BOOKS RECOMMENDED:**

1. CK Kokate, Text Book of Forensic pharmacy, PharmaMed Press
2. Mittal B.M, Textbook of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta.
3. Relevant Acts & Rules Published by the Govt. of India.
4. Jain N.K, A Textbook of Forensic Pharmacy, Vallabh Prakashan, New Delhi.
5. Singh, Harkishan “History of Pharmacy in India – Vol. I, II & III” Vallabh Prakashan.
6. Relevant websites.15

## B.Pharm 3<sup>rd</sup> year (V Semester)

### PHR-501 PHARMACEUTICAL CHEMISTRY-V (BIOCHEMISTRY)

#### Unit-I:

**a. Enzymes:** Nomenclature, enzymes-kinetics and mechanism of action, mechanism of inhibition of enzymes and isoenzymes in chemical diagnosis.

**b. Co-enzymes:** Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance. [08]

#### Unit-II

**a. Carbohydrate metabolism:** Glycolysis, Gluconeogenesis and Glycogenolysis.

Metabolism of galactose. [08]

#### Unit-III

**a.** Role of sugar nucleotides in biosynthesis and pentose phosphate pathway.

**b.** The citric acid cycle, significance, reactions and energetics of the cycle. [08]

#### Unit-IV

**a. Lipid metabolism:** Oxidation of fatty acid & energetics, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, regulation of lipid metabolism, essential fatty acids.

**b. Biological Oxidation:** The respiratory chain, its role in energy capture & control, energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation. [08]

#### Unit-V

**a. Protein metabolism:** Biosynthesis of amino acids, metabolism of amino acids and conversion of amino acids to specialized products, biosynthesis of purine and pyrimidine, formation of deoxyribonucleotides.

**b.** Biosynthesis of RNA, DNA replication, Biochemical aspects of Carcinogenesis & DNA repair mechanism.[08]

### PHARM- 501P PHARMACEUTICAL CHEMISTRY-V (BIOCHEMISTRY) PRACTICAL

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
3. Separation of amino acids by chromatography.
4. Separation of lipids by TLC.
5. Quantitative estimation of amino acids.
6. Determination of glucose by means of the enzyme glucose oxidase.
7. Enzymatic hydrolysis of glycogen by  $\alpha$  &  $\beta$  amylase.
8. Effects of temperature on the activity of alpha amylase.
9. Estimation of cholesterol in Blood.
10. Estimation of Glucose in blood & urine.
11. Estimation of Urea in blood.
12. Estimation of ketone bodies in blood.
13. Qualitative analysis of inorganic as well as organic constituents of Urine.

#### BOOKS RECOMMENDED:

1. "Harpers Review of Biochemistry" Lange Medical Publication.
2. Boyer, modern experimental biochemistry, Pearson education
3. Sharad chand bose, Biochemistry. a practical manual, PharmaMed Press, Hyderabad
4. Shrinivas, Text book of Biochemistry, PharmaMed Press, Hyderabad
5. Moore, Biochemistry and physiology of plants,
6. Jayaraman J., Laboratory Manual of Biochemistry, Wiley Eastern Limited.
7. Plummer, David J., An Introduction to Practical Biochemistry, Mc Graw Hill, New Delhi.
8. Singh S.P., Practical Manual to Biochemistry, CBS Publisher, New Delhi.

**PHR-502**  
**PHARMACEUTICS**  
**(PHARMACEUTICAL TECHNOLOGY -I)**

**Unit-I: Preformulation studies:**

Study of physical properties of drug like physical form, polymorphism, particle size, shape, density, wetting, dielectric constant, dissociation constant, distribution coefficient Solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability. [08]

**Unit-II: Liquid Dosage Forms:** Introduction, types of permissible additives, formulation, manufacturing, evaluation and packaging of clear liquids, suspensions permissible and emulsions. [08]

**Unit-III: Semisolid Dosage Forms:** Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection, permissible additives, manufacturing procedure, evaluation and packaging and general formulation of semisolids, clear gels, permissible additives [08]

**Unit-IV: Suppositories:** Ideal requirements, bases, manufacturing procedure, evaluation and packaging [08]

**Unit-V:**

**Pharmaceutical Aerosols:** Definition, Propellants, general formulation and evaluation, manufacturing and packaging methods, pharmaceutical applications.

**Cosmetology and cosmetic Preparations:** Formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, sunscreen lotion, antiperspirants, deodorant. Shampoos, Conditioner, Shaving and after shaving products, Dentifrice Lipstick, Nail lacquer. [08]

**PHR-502P**  
**PHARMACEUTICS**  
**(PHARMACEUTICAL TECHNOLOGY-I)**  
**PRACTICAL**

1. Preformulation studies of API. (As per pharmacopoeial requirements)
2. Preparation, evaluation and packing of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, eye drops, eye ointments etc.
3. Preparation and evaluation of cold cream, vanishing cream, cleansing lotion and creams. Moisturizing creams, Skin tonics, Hair creams, Hair Conditioners, Shampoos, Shaving creams and sticks. Tooth powder, Tooth pastes, After shave lotion, Lipsticks.

**BOOKS RECOMMENDED**

1. Remington's Pharmaceutical Sciences, Vol. I & Vol. – II, Mack Publishing Co., U.S.A.
2. Dinda, SC, Advances in pharmaceutical Technology, pharmaMed Press, Hyderabad.
3. Lachman L., Lieberman H.A, Kanig J.L, Theory and Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.
4. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.
5. Harrys Cosmetology
6. Balsam and Sagarin, Cosmetics: Science and Technology.
7. Thomssen E.G. Modern Cosmetics, Universal Publishing Corporation.
8. Mittal B.M. & Saha R.N.-A handbook of cosmetics, Vallabh Prakashan.
9. Swarnlata saraf, Cosmetics a practical manual, 2<sup>nd</sup>.ed, PharmaMed Press, Hyderabad
10. Drugs and Cosmetics Act and Rules
11. Poucher "Cosmetics".pharmamed press,hyderabad

**PHR-503**  
**PHARMACEUTICAL CHEMISTRY-VI**  
**(MEDICINAL CHEMISTRY –I)**

**Unit-I: Basic Principles of Medicinal Chemistry:** Physicochemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action. Drug-receptor interaction including transduction mechanism, concept of prodrug. [08]

**Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic and assay procedures of individually mentioned drugs only) included in the latest edition of pharmacopoeia.**

**Unit-II: Drugs acting at Synaptic and neuro-effector junction sites:**

Cholinergic, Anticholinergic & Anticholinesterases- Neostigmine, Physostigmine, Pilocarpine, Atropine. Adrenergic Drugs- Ephedrine, Salbutamol, Adrenaline.  
[08]

**Unit-III: Drugs acting on the Central Nervous System:** [08]

General Anaesthetics-Thiopental, Ketamine  
Local Anaesthetics- Lignocaine, Benzocaine.  
Sedatives and Hypnotics- Phenobarbitone, Alprazolam.  
Opioid Analgesics-Pethidine, Methadone, Pentazocine.

**Unit-IV:** [08]

Anticonvulsants-Phenytoin, Carbamazepine, Ethosuximide, Valproic Acid.  
Antiparkinsonism drugs- Carbidopa, Levodopa.  
CNS Stimulants-Caffeine, Nikethamide.

**Unit-V: Psychopharmacological Agents:** [08]

Antianxiety drugs- Diazepam, chlordiazepoxide.  
Antidepressants – Imipramine, Amitriptyline Fluoxetine.  
Skeletal muscle Relaxants– Gallamine Mephenesin,  
Antipsychotic- Chlorpromazine, Haloperidol.

**PHR -503P**  
**PHARMACEUTICAL CHEMISTRY-VI**  
**(MEDICINAL CHEMISTRY-I)**  
**PRACTICAL**

1. Synthesis of atleast five drugs from the course content involving two or more steps. eg Benzocaine, Phenytoin, Barbituric acid, Nikethamide etc
2. Establishing the pharmacopoeial standards of the drugs synthesized.

**BOOKS RECOMMENDED:**

1. Degado J.N. and Remers W A R, 10th eds., Wilson and Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
2. Foye W C. Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
3. Wolff ME. Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
4. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
5. Norgady, Medicinal chemistry, biochemical approach, PharmaMrd press, Hyd.
6. Rama rao nadendla, Medicinal chemistry, PharmaMed Press, Hyd,
7. Vardanayan R. Synthesis of Essential Drugs, Academic press an imprint of Elsevier
8. Wermuth C G. The practice of Medicinal Chemistry-III, Academic press an imprint of Elsevier
9. Pharmacopoeia of India, Ministry of Health, Govt. of India 2010
10. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
11. Furniss B A, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.

**PHR-504**  
**PHARMACOLOGY – I**

**Unit-I: General Pharmacology** – Introduction to pharmacology, routes of drug administration, combined effect of drugs, factors modifying drug action. [07]

**Unit-II:** Basic Concepts of Pharmacokinetics- Absorption, Distribution, Metabolism, Excretion Pharmacodynamics, Principles of drug action, Mechanism of drug action, Receptors, Dose Response curve, Therapeutics index -LD 50 & ED50,. [07]

**Unit-III: Pharmacology of ANS**

Drug acting on autonomic nervous system

**I-Cholinergic system-**

Parasympathomimetic (Cholinergic) drugs.

Parasympatholytic (anti Cholinergic) drugs.

Drug acting on autonomic ganglia (Stimulants and blocking agents)

**II-Adrenergic system**

Sympathomimetic (Adrenergic) drugs

Sympatholytic (Anti-adrenergic) drugs [08]

**Unit-IV: Pharmacology of CNS**

General Anaesthetics, Alcohols & disulfiram, Sedative hypnotics,

Psychopharmacological agents-anti anxiety agents, antipsychotics, antidepressants. Antiepileptic drugs, Antiparkinsonism drugs, Analgesics & antagonists. [12]

**Unit-V: Drugs acting on PNS**

Local anesthetics [06]

Skeletal muscle Relaxants Peripherally and centrally acting muscle Relaxants

**PHR-504P**  
**PHARMACOLOGY- I**  
**PRACTICAL**

Use of computer simulated CDs or Video cassettes for pharmacology practical where possible.

1. Preparation of different solutions for experiments. Drug dilutions, use of molar and w/v solutions in experimental pharmacology. Common laboratory animals and anesthetics used in animal studies. Commonly used instruments in experimental pharmacology. Some common and standard techniques.

2. Study of different routes of administration of drugs in mice/rats. Practical related to DRC

**BOOKS RECOMMENDED:**

1. Goodman & Gilman, The Pharmacological basis of Therapeutics, Editors: J.G. Hardman, McGraw Hill Pub Co.,

2. Friedman, Fundamentals of clinical trials, 3<sup>rd</sup>, ed., Springer Intl

3. Turley, Understanding pharmacology, 3<sup>ed</sup>, ed, Pearson educations.

4. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.

5. Bothara Sunil, Essentials of Experimental pharmacology, vol. 1. PharmaMed Press

6. Satoskar & Bhandarkar; Pharmacology & Pharmacotherapeutics., Popular Prakashan Pvt. Ltd. Bombay.

7. Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.

8. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.

9. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.

10. Turner, Screening Methods in pharmacology, Elsevier



**PHR-505**  
**PHARMACEUTICAL MICROBIOLOGY**

**Unit-I:**

Introduction to the scope of microbiology and microscopy

Structure of bacterial cell.

Classification of microbes and their taxonomy: Bacteria, fungi and viruses. [08]

**Unit-II:**

Identification of Microbes: Stains and types of staining techniques.

Nutrition, cultivation, isolation and purification of bacteria, fungi & viruses.

Different culture media and their classification-

Microbial growth and their curve, measurement of microbial growth, factor influencing

Microbial growth [08]

**Unit-III:**

Control of microbes by physical and chemical methods.

Disinfection, factors influencing disinfectants, dynamics of disinfection,

Disinfectants and antiseptics and their evaluation.

Preservative efficacy [08]

**Unit-IV:**

Sterilization, different methods, validation of sterilization methods & equipments.

Sterility testing as per I.P. Isolation and identification of contaminants in sterile and non-sterile

Products, Microbiological standards of non-sterile products, Equilibrium related to humidity

(ERH) in microbiological testing. [08]

**Unit-V:**

Microbial assays as per I.P. of antibiotics and vitamins. [08]

**PHR-505P**  
**PHARMACEUTICAL MICROBIOLOGY**  
**PRACTICAL**

1. Various staining methods, 2. Experiments designed to prepare various types of culture media sub-culturing of common aerobic and anaerobic bacteria, fungus and yeast, 3. Various methods of isolation and identification of microbes 4. Sterilization techniques and their validation, validation of sterilization techniques 5. Evaluation of antiseptics and disinfectants 6. Testing the sterility of pharmaceutical products as per I.P. requirements, 7. Microbial assay of antibiotics and vitamins, 8. preservative efficacy, 9. Microbiological testing of non-sterile products.

**BOOKS RECOMMENDED:**

1. Stanier R.Y., Ingraham, J.L., Wheelis M.L. & Painter P.R. General Microbiology, Macmillan Press Limited.
2. Malathi, Manual of Practical Microbiology, PharMAMED Press, Hyderabad
3. Tortora, Microbiology An Introduction, 9<sup>TH</sup>. Ed, Pearson education
4. Glazer, "Microbial Biotechnology' Cambridge Univ. Press
5. Pelczar & Reid, Microbiology, Tata Mc Graw Hill, Delhi.
- 6 Ananthanarayan R & Paniker CKJ, Textbook of Microbiology, Orient Longman.
- 7 Aneja K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom Cultivation, Vishwa Prakashan.
- 8 Gunasekaran P, Lab Manual of Microbiology, New Age Publishers.
9. Latest edition of USP
10. Latest edition of IP
11. Latest edition of B.P.

## ***B.Pharm 3<sup>rd</sup> year (VI Semester)***

**PHR –601**

### **PHARMACEUTICAL BIOTECHNOLOGY**

#### **Unit-I: Immunology and Immunological preparations:**

Principles, Antigen and haptens, immune system, Cellular, and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, standardization and storage of BCG. Complementary system, Immunological disorder, Hypersensitivity reaction, Immunosuppression, Autoimmune disorders, immunodeficiency disorders

[08]

#### **Unit-II: Genetic Recombination**

Genetic Code and inhibition of protein synthesis. Regulation of gene expression (Prokaryote and Eukaryote)

Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications, development of hybridoma for monoclonal antibodies, study of drugs produced by biotechnology such as Human Insulin, Somatotropin, Streptokinase, Urrokinase. Isolation and uses of mutants and factors affecting mutation and genetic analysis of mutants [08]

#### **Unit-III:**

##### **Microbial Transformation:**

Introduction, types of reactions mediated by microorganisms, Design of Bio-transformation process, selection of organisms, biotransformation processes and its improvements with special reference to steroids [08]

#### **Unit-IV:**

##### **Enzyme immobilization:**

Techniques of immobilization of enzymes, factors affecting enzyme kinetics, multistep immobilized enzyme system. Application and future of enzyme engineering [08]

#### **Unit-V:**

##### **Antibiotics:**

Historical development of antibiotics, Screening of soil for organisms producing antibiotics Antimicrobial spectrum and methods used for their standardization. Fermentor, its design and control of different parameters [08]

#### **BOOKS RECOMMENDED:**

1. S.P. Vyas and V.K. Dixit, Pharmaceutical Biotechnology, CBS Publication, New Delhi.
2. Nagori, Foundations in pharmaceutical biotechnology, PharmaMed Press, Hyderabad
- 3 Thieeman, introduction to biotechnology, Pearson education.
- 4 P.F. Standury & A. Whitaker & Hall S.J. Principles of Fermentation, Aditya Book Private Limited, New Delhi.
- 5 Crueger W. & Crueger A, Biotechnology-A Textbook of Industrial Microbiology,
- 6 Smith J.E., Biotechnology, 3<sup>rd</sup> edition, Cambridge university press
7. IP (Latest edition)
8. BP (Latest edition)
9. USP (Latest edition)

**PHR-602**  
**PHARMACEUTICS-VII**  
**(PHARMACEUTICAL TECHNOLOGY - II)**

**Unit-I: Tablets: (A)** Formulation of different types of tablets, granulation technology on largescale by various techniques, physics of tablets making, machinery and tooling and the equipments employed, evaluation of tablets including stability testing as per ICH guidelines

**(B) Coating of Tablets:** Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablet. [09]

**Unit-II: 1. Capsules:** Introduction to capsules as a dosage form, hard and soft gelatin capsules, formulation and evaluation, machinery, packaging, stability testing and storage

**2. Micro-encapsulation:** Types of microcapsule, importance of micro-encapsulation in pharmacy, micro-encapsulation techniques, evaluation of micro capsules. [8]

**Unit-III: (A)** Approaches to Sustained and controlled release dosage forms. In-vitro methods of evaluation. [08]

**Unit-IV: Parenteral Products:**

Preformulation factors, routes of administration, water for injection, pyrogenicity, nonaqueous vehicles. Formulation and evaluation, equipments, containers and closures and their selection. [07]

**Unit-V:**

**(A)** Sterile products (ISI/ BS specification)

**(B)** Formulation and evaluation of Ophthalmic, Nasal and Ear products. [08]

**PHR-602P**  
**PHARMACEUTICS-VII**  
**(PHARMACEUTICAL TECHNOLOGY - II)**  
**PRACTICAL**

1. Experiments to illustrate preparation, stabilization and evaluation of pharmaceutical products as per the theory syllabus

2. Evaluation of Materials used in pharmaceutical packaging (ISI/ BS specification)

**BOOKS RECOMMENDED**

1. Remington: The Science and Practice of Pharmacy Pharmaceutical Sciences Vol. I & II  
Lippincott William Wilkins

2. R.E. Avis, Pharmaceutical Dosage Forms: Parenteral Medication, Vol-I, Marcel  
Dekker-Inc, New York & Basel.

3. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lippincott William Wilkins

4. Herbert A. Liebermann & Leon Lachman, Theory & Practice of Industrial Pharmacy,

5. Manohar A.Potdar, 'CGMP for Pharmaceuticals".PharmaMed Press,Hyderabad

6. Augsburger Larry L."Pharmaceutical Doasage Forms: tablets  
" 3<sup>rd</sup> edition Informa healthcare

7. IP (Latest edition)

8. BP (Latest edition)

9. USP (Latest edition)

10. Tutorial Pharmacy by Cooper and Gunn, CBS Publisher do

11. Senger, A primer on dosage form design, PharmaMed Press, Hyd,

**PHR –603**  
**PHARMACEUTICAL CHEMISTRY-VII**  
**(MEDICINAL CHEMISTRY - II)**

**Unit-I-Drug Design**

Basic concept of drug design, Introduction to Analogues based drug design, Structure based drug design, and Introduction to QSAR & Computer aided drug design. [08]

**Unit- II Mode of action, uses, SAR of the following classes of drugs included in latest edition of pharmacopoeia (synthetic procedures and assay of individually mentioned drugs only)**

Cardiac glycosides & drug used for CHF- Digitoxin

Antiarrhythmic drugs- Propranolol, Procainamide

Antianginal drugs- Isosorbide mononitrate

Antihypertensive drugs-Captopril, methyl dopa, Nifedipine. [08]

Anticoagulants- Heparin, warfarin

Antihyperlipidemics- Lovastatin, Clofibrate

**Unit-III**

Antispasmodic and Antiulcer drugs- Dicyclomine, Ranitidine, Omeprazole.

Antitussives- Dextromethorphen.

[08]

**Unit-IV: Analgesics and Antipyretics** – Aspirin, Mefenamic Acid, Ibuprofen, Diclofenac, Paracetamol [08]

**Unit-V: Diuretics** – Acetazolamide, Chlorthiazide; Furosemide, Spironolactone. [08]

**PHR-603P**  
**PHARMACEUTICAL CHEMISTRY -VII**  
**(MEDICINAL CHEMISTRY-II)**  
**PRACTICAL**

1. Synthesis of atleast five selected drugs from the course content involving two or more steps.
2. Establishing the pharmacopoeial standards of the drugs synthesized.
3. Simple experiment demonstrating microwave assisted synthesis

**BOOKS RECOMMENDED:**

1. Thomas J..Perun," Computer –aided Drug Design methods applications'.PharmaMed Press, Hyderabad
- 2 Delagado J N and Remers W A R, Eds., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
- 3 Foye W C, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
- 4 Shri ram,/ Yogeewari, medicinal chemistry, 2<sup>nd</sup>. Ed, Pearson education
- 5 Singh Harkishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Korolkovas, Essentials of medicinal chemistry, Wiley India
7. 8. Wermuth C G. The practice of Medicinal Chemistry-III, Academic press an imprint of Elsevier
- 9 Pharmacopoeia of India 2010, Ministry of Health, Govt. of India.
- 10.Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.
11. Furniss B S, Hannaford A J, Smith P W G and Tathell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
12. Latest edition of B.P.
13. Latest edition of U.S.P.

**PHR-604  
PHARMACOLOGY-II**

**Unit-I:**

**Pharmacology of CVS:** Cardiac glycosides, Antihypertensive drugs, Antianginal drugs, Antiarrhythmics, Antihyperlipidemics [09]

**Unit-II:**

**Drugs Acting on Haemopoietic System**

Haematinics, Vit. K & anticoagulants, Fibrinolytics & antiplatelet drugs, Plasma Volume expanders

**Drugs Acting on Respiratory System**

Anti-asthmatic drugs, Anti-tussives & Expectorants, Respiratory Stimulants [08]

**Unit-III: NSAIDS & Anti-gout Drugs. Diuretics [08]**

**Unit-IV: Autocoids:** Histamine, 5HT and their antagonists, Prostaglandins, Thromboxane, Leukotrienes, Angiotensin and Bradykinin [08]

**Unit-V: Drugs acting on GIT**

Antacids and Antiulcer drugs, Laxatives and antidiarrhoeal Agents, Emetics and antiemetics [07]

**PHR-604P  
PHARMACOLOGY-II  
PRACTICAL**

1. Relevant experiments based on theory syllabus

**BOOKS RECOMMENDED:**

1. Goodman & Gilman, The Pharmacological basis of Therapeutics, Editors:-JG Hardman, Le Limbird,PB Molinoss, RW Ruddon & AG Gil, Pergamon Press.
2. Bothara Sunil, Essentials of experimental in pharmacology, vol. 1, PharmaMed Press,Hyd.
3. Laurence, DR & Bannet PN; Clinical Pharmacology, Churchill Livingstone.
4. Rang MP, Date MM, Riter JM, Pharmacology Churchill Livingstone.
5. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
5. Barar FSK: Text Book of Pharmacology, Interprint, New Delhi.
7. Satoskar & Bhandarkar; Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.
8. Turner,Screening methods in pharamacology, PharmaMed Press, Hyderabad
9. Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
- 10.Grover J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
- 11.Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.

**PHR--605**  
**PHARMACOGNOSY – III**

**Unit-I: (A)** Study of the biological sources, Commercial varieties cultivation, collection adulterants, uses, diagnostic macroscopic and microscopic features and chemical constituents, substitutes and specific chemical tests of following groups of drugs containing.

**Glycosides:**

1. **Saponins:** Liquorice, Ginseng, Dioscorea, Coleus species. [04]
2. **Cardioactive sterols:** Digitalis, Squill, & Thevetia [03]
3. **Anthraquinone Cathartics:** Aloe, Senna, Rhubarb & Cascara. [03]

**Unit-II: Others:** Psoralea, majus, Ammi visnaga, Gentian, Saffron, Quassia and Andrographis paniculata. [03]

**(B)** Production and Utilization of phytoconstituents such as calcium sennosides, Diosgenin, Solasodine & Podophyllotoxins [03]

**Unit- III: Studies on traditional drugs:** Common Vernacular name, Biological sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and toxicological activity of marketed formulations of following indigenous drugs : Amla, Kantkari, Satavari, Bhilwa, Vach, Rasna. [08]

**Unit-IV:** Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Brahmi, Methi, Lehsun, Guggul, Gymnema, Shilajit, Tulsi and Neem. [08]

**Unit-V:** Brief Introduction and principles of Ayurvedic, Unani, Siddha and Homeopathic systems of medicines. Introduction to Herbal Pharmacopoeia, study of Arishtas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas. [08]

**PHR-605 P**  
**PHARMACOGNOSY - III**  
**PRACTICAL 11**

1. Identification of atleast 10 crude drugs mentioned in theory
2. Powder microscopic study of atleast 5 drugs
3. Evaluation and standardization of atleast 3 marketed Ayurvedic formulations

**BOOKS RECOMMENDED:**

1. Trease, G.E., & Evans, W.C., Evans, W.C., "Pharmacognosy" Bailliere Tindall east Baorne, U.K.
2. Tyler V.E. et al : "Pharmacognosy" Lea & Febiger, Philadelphia.
3. Wallis. T.E, Practical pharmacognosy, 4rt. Ed, PharmaMed Press, Hyderabad.
4. Senger, A Texbook of pharmacognosy, PharmaMed Press
5. Nadkarni A.K. Indian Materia Medica 1-2, Popular Prakashan (P) Ltd. Bombay.
6. Atal C.K. & Kapur BM. "Cultivation & utilization of Medicinal plants, RRL, Jammu.
7. Harborne A J, Phytochemical methods, a guide to modern technics og plant analysis, PharmaMed Press, Hyderabad
8. The wealth of India, Raw Materials (All volumes) Council of Scientific & Industrial Research, New Delhi.
9. Compendium of Indian Medicinal Plants I-VII, Rastogi & Malhotra.
10. Indian Ayurvedic Pharmacopoeia, Govt. of India.
11. Kokate CK, Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan
12. Indian Pharmacopoeia.
13. Kokate C.K. "Practical Pharmacognosy" Vallabh Prakashan, New Delhi.
14. Wallis T.E. "Analytical Microscopy" J&A Churchill Ltd., London.
15. Harborne J.B.- "Phytochemical methods" Springer International
16. WHO guidelines
17. BP (Latest edition)
18. Standard botanicals by P. Mukharejee

## B.Pharm 4<sup>th</sup> year (VII Semester)

PHR- 701

### PHARMACEUTICAL INDUSTRIAL MANAGEMENT

#### Unit-I

**Concept of Management:** Administrative Management (Planning, Organizing Staffing Directing and Controlling). Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/ Morale) [08]

#### Unit-II

Principles of Management (Coordination, Communication, Motivation, Decision making, leadership, Innovation Creativity, Delegation of Authority / Responsibility. Record Keeping), Identification of key points to give maximum thrust for development and perfection. [08]

#### Unit-III

**Economics:** Principles of economics with special reference to the Laws of demand and supply, demand schedule, demand curves labor welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.

**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 cheques bills of exchange, promissory notes and bundles documentary bills.

**DPCO Act:** Cost Accounting, Formulation record rules [10]

#### Unit-IV

**Pharmaceutical Marketing:** Functions, buying, selling, transportation, storage financed feedback information, channels of distribution, wholesale, retail, department store, multiple shop and mail order business.

**Salesmanship:** Principle of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, Recruitment, training, evaluation, compensation to the pharmacist. [08]

#### Unit-V

**Supply Chain Management:** Procurement, Receipt, Analysis, Approval, Issuance, Production, Quality control, Distribution & Marketing [06]

#### BOOKS RECOMMENDED:

1. Koontz H, Wehrich H, Essentials of Management, Tata Mc Graw Hill.
2. Massie L. Joseph Essentials of Management / PHI.
3. Vidya sagar Pharmaceutical Industrial Management, Pharma Book Syndicate
4. Mukopadhyay Sekhar, Pharmaceutical Selling, Sterling Publishers.
5. Chary S.N, Production and Operative Management / Tata Mc Graw Hill.
6. Datta A.K., Material Management / PHI.
7. Chadwick Leslie, The essence of management accounting / PHI.
8. Barthwal R.R, Industrial Economics –/ New Age International.

**PHR– 702**  
**PHARMACEUTICS -VIII**  
**(BIOPHARMACEUTICS & PHARMACOKINETICS)**

**Unit-1:**

Introduction to Biopharmaceutics and Pharmacokinetics, Biopharmaceutical Classification System

- Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
- (B) Factors influencing absorption
- (C) Distribution, metabolism and excretion [08]

**Unit-II:**

**Pharmacokinetics:**

- Significance of plasma drug concentration measurement.
- Compartment model and Non-compartment model. Definition and Scope
- (C) Pharmacokinetics of drug absorption – zero order and first order absorption rate constant using Wagner – Nelson, Loo-Reigelman method. [08]

**Unit-III:**

- Volume of distribution and distribution coefficient.
- Compartment kinetics – One compartment and Preliminary information of multicompartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.
- Clinical Pharmacokinetics: Definition and scope [08]

**Unit-IV:**

- (A) Dosage adjustment in patients with and without renal and hepatic failure.
- (B) Pharmacokinetic drug interactions and their significance in combination therapy. [08]

**Unit-V: Bioavailability and Bioequivalence:**

- (A) Measures of bioavailability, C-max, and area under the curve (AUC).
- (B) Review of regulatory requirements for conduction of bioequivalent studies. [08]

**PHR-702P**  
**PHARMACEUTICS-VIII**  
**(BIOPHARMACEUTICS & PHARMACOKINETICS)**  
**PRACTICAL**

1. Experiments designed for the estimation of various pharmacokinetic parameters with given data.
2. In *vitro* evaluation of different dosage forms for drug release.
3. Absorption studies – in vitro.
4. Bioavailability and Bioequivalence studies
5. Permeability studies
6. Protein binding
7. Statistical treatment of pharmaceutical data.

**BOOKS RECOMMENDED:**

1. Notari, R.E, Biopharmaceutics and Pharmacokinetics – An introduction Marcel Dekker Inc. N.Y.
2. Rowland M, and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, N.Y.
3. Wagner J.G. Fundamentals of Clinical Pharmacokinetics, Drugs Intelligence Publishers, Hamilton.
4. Gibaldi, Milo' Biopharmaceutics & Clinical pharmacokinetics.
5. John. G.Wagner," Pharmacokinetics for the Pharmaceutical Scientist'.



**PHR –703**  
**PHARMACEUTICAL CHEMISTRY –VIII**  
**(MEDICINAL CHEMISTRY - III)**

**Unit-I:**

Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Steroids and related drugs:** Special emphasis on Nomenclature, Stereochemistry

- (A) Androgens and Anabolic steroids – Testosterone, Stanozolol.
- (B) Estrogens and Progestogens – Progesterone, Estradiol.
- (C) Adrenocorticoids – Prednisolone, Dexamethasone, Betamethasone.
- (D) Anti-Fertility Drugs [08]

**Unit-II:**

Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Antibiotics-** Penicillin, Amoxicillin, Methicilin, Streptomycin, Tetracyclines, Cephalosporins, Chloramphenicol, Gentamycin, Clavulanic acid

**Antimycobacterial Agents:** PAS, Ethambutol, Isoniazid, Dapsone

**Quinolones:** Nalidixic acid, Norfloxacin [08]

**Unit-III:**

Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Antimalarials:** Chloroquine, Primaquine, Artemisinin

**Antiamoebics:** Metronidazole, Tinidazole, Diloxanide

**Antiseptics & Disinfectants** – Benzalkonium chloride

**Anthelmintics-** Mebendazole

**Antifungals:** Griseofulvin, Clotrimazole Amphotericin B

**Antibacterials** – Sulphamethoxazole, Sulphadiazine, Sulphacetamide. [08]

**Unit-IV:**

Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Anti- HIV agents-**Zidovudine, Zalcitabine, Saquinavir.

**Antivirals** – Amantadine, Acyclovir, Lamivudine.

Prostaglandins – Misoprostol, Carboprost.

**Anti-cancer drugs**

Alkylating Agents- Chlorambucil, Carmustine

Antimetabolites- Methotrexate

6-Mercaptopurine

5-Fluorouracil [08]

**Unit-V:**

Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Thyroid and Antithyroids** – Carbimazole, Levothyroxine, Propylthiouracil, Methimazole.

**Hypoglycaemics** - Insulin Chlorpropamide, Metformin, Tolbutamide, Glibenclamide. [08]

**BOOKS RECOMMENDED:**

1. Delgado J N and Remers W A R, Eds., Wilson And Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
2. Foye W C, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
3. Wolff ME, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
4. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
5. Patrick G L. Medicinal Chemistry, Oxford University Press NY
6. Vardanayan R. Synthesis of Essential Drugs, Academic press an imprint of Elsevier
7. Pharmacopoeia of India, Ministry of Health, Govt. of India.
8. Razdan B.K. Medicinal Chemistry, CBS Publication, New Delhi

**PHR- 704**  
**PHARMACOLOGY –III**

**Unit-I: Pharmacology of Endocrine System**

Hypothalamic & pituitary hormones, Thyroid hormones & Thyroid Drugs, Parathormone, Calcitonin & Vitamin D, Insulin, oral hypoglycemic agents & glucagon. [07]

**Unit-II:** ACTH & Corticosteroids, Androgens & anabolic steroids, Estrogens, Progesterone & Oral Contraceptives, Drugs acting on uterus. [08]

**Unit-III: Chemotherapy**

General Principles of Chemotherapy, Sulfonamides, Cotrimoxazole, Quinolones, Antibiotics – Penicillins, Cephalosporins, Chloramphenicol, Tetracyclines, Macrolides. [08]

**Unit-IV:** Chemotherapy of Parasitic infections, Tuberculosis, Leprosy, Malaria, Fungal infections, Viral diseases, Introduction to Immunomodulators and Chemotherapy of Cancer, Multi-drug resistance [10]

**Unit-V:**

A. **Principles of Toxicology** Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous & atropine poisoning, Heavy metal Antagonists.

B. **Bioassays-** Basic Principles, Bioassay of oxytocin and acetylcholine [07]

**PHR-704P**

**PHARMACOLOGY- III**

**PRACTICAL**

1. To calculate the pA<sub>2</sub> value of Atropine & chlorpheniramine.
2. Bioassay of Ach, histamine & oxytocin on suitable isolated preparations using matching assay, bracketing assay, three point assay & four point assay.
3. Bioassay of histamine and acetylcholine using matching and interpolation method on rat guinea pig . All experiments will be conducted using software wherever possible.

**BOOKS RECOMMENDED:**

1. Goodman & Gilman, The Pharmacological basis of Therapeutics, Pergamon Press. Editors:- J.G. Hardman, Le Limbird, PB Molinoss, RW Ruddon & AG Gil, Pergamon Press.
2. Katzung, B.G. Basic & Clinical Pharmacology, Prentice Hall, International.
3. Laurene, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.
4. Rang MP, Dale MM, Riter JM, Pharmacology Churchill Livingstone.
5. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
6. Barar F.S.K : Text Book of Pharmacology, Interprint, New Delhi.
7. Satoskar & Bhandarkar: Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.
8. Paul. L., Principles of Pharmacology, Chapman and Hall.
9. Ghosh M.N. Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
10. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
11. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.

**PHR-705**  
**PHARMACOGNOSY-IV**

**Unit-1: 1.** Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitute's adulterants, uses, diagnostic macroscopic & microscopic features & specific chemical tests of following alkaloid containing drugs included in Ayurvedic Pharmacopoeia

Tobacco, Areca & Lobelia.

**Belladonna**, Hyoscyamus, Datura, Coca & **Withania**

Cinchona, Ipecac & **Opium**

Ergot, **Rauwolfia**, Catharanthus & Nux-vomica. [08]

**Unit-II:**

Pilocarpus. Veratrum & Kurchi.

Ephedra & Colchicum.

Solanum. Coffee & Tea **Vasaka**

Biosynthesis, Utilization & production of phytoconstituents such as– Tropane, Quinoline Opium and Indole alkaloids. Techniques employed in elucidation of biosynthetic pathways [10]

**Unit-III**

**(A)** World wide trade in Medicinal plants & derived product. Tropane alkaloids containing drugs, Cinchona, Ipecac, Rauwolfia, Taxol, Diosgenin, Digitalis, Liquorice, Papain, Ginseng, Aloe, Valerian, & plant laxatives.

**(B)** Role of Medicinal & aromatic plants in National Economy. [08]

**Unit-IV**

**Biological sources, preparation, Identification tests and uses of following enzymes – [08]**

Diastase, papain, Penicillinase, Hyalluronidase, Streptokinase. Plant Bitters & Sweeteners.

**Unit-V:**

Historical development of plant tissue culture, type of culture, Nutritional requirement, growth & their maintenance. Application of plant tissue culture in pharmacognosy. [08]

**PHR-705P**  
**PHARMACOGNOSY -IV**  
**PRACTICAL**

1. Identification of crude drugs listed above.
2. Microscopic study of characters of any 8 selected drugs given in theory in entire and powder form.
3. Chemical evaluation of powdered drugs & Enzymes.
4. Isolation of some phytoconstituents
5. Chromatographic studies of some herbal constituents.
6. Some preliminary experiments in plant tissue culture.

**BOOKS RECOMMENDED:**

1. Trease, G.E. & Evans, W.C. "Pharmacognosy" Bailliere Tindall East Bourne, U.K.
2. Tyler V.E. etal Pharmacognosy, Lea & Febiger Phjadelphia.
3. Wallis T.E. Text book of Pharmacognosy" J&A Churchill Ltd. London.
4. Atal & Kapur, Cultivation & Utilization of Medicinal Plants, RRL, Jammu.
5. Stahl. E, Thin Layer Chromatography. A laboratory handbook, Springer Verlog, Berlin.
6. Henry TA. The Plant Alkaloids, McGraw Hill, New York.
7. Ganborg & Wetter, Plant Tissue Culture Methods, National Research Council of Canada, Saskatchewan.
8. Clarke ECG, Isolation & Identification of drugs. The Pharmaceutical Press, London.
9. Street H.E. Tissue Culture & Plant Science, Academic Press, London.
10. Kokate, C.K. Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan.
11. Indian Pharmacopoeia.
12. Kokate, C.K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.
13. Wallis T.E. Analytical Microscopy, J&A Churchill Ltd, London.

## **B.Pharm 4<sup>th</sup> year (VIII Semester)**

### **PHR- 801 ENVIRONMENT & ECOLOGY**

#### **Unit-I**

##### **Environment studies**

A- Definition, scope & importance

B- Natural Resources – renewable & non renewable

C- Use, utilization, exploitation and associated problems of forests, Water resources, Mineral resources, Food resources, Energy resources, Land resources.

D- Equitable use of resources for sustainable life style, role of an individual in conservation. [08]

#### **Unit-II**

##### **Ecosystems**

A. Introduction, types features & functions of difference ecosystems- Forest Grassland, Desert and Aquatic.

B. Biodiversity & its conservation with special reference to India. [08]

#### **Unit-III**

Environmental pollution- Air, Water, Soil, Marine, Noise, Thermal, Nuclear- Introduction causes and control measures. [08]

#### **Unit IV**

Law related to Environmental Protection

Air (Prevention and Control of pollution )Act 1987

Water prevention & Control of Pollution Act. 1974 [08]

#### **Unit-V**

##### **Environmental Protection Act -1986**

Noise Pollution

Hazardous Wastes

Hazardous Chemical

Hazardous Microorganism

Biomedical Waste

Solid waste disposal

Provisions as applicable to drugs and cosmetics. [08]

##### **BOOKS RECOMMENDED:**

1. Manoharachary C., Jyaranama Reddy P. Principles of Environmental Studies, Pharma Book Syndicate, Hyderabad.

2. Trivedy R.K., Handbook of Environmental Laws, Acts, Guidelines, Compliances & Standards Vol. I &II. Pharma Book Syndicate, Hyderabad

3. Relevant Acts & Rules published by Govt. of India with latest amendments.

4. Reddy, M.Anji , ' Text Book of Environmental Sciences & Technology".

5. National Formulary of India, Latest edition

**PHR- 802**  
**CLINICAL PHARMACY AND DRUG INTERACTIONS**

**Unit-I**

**INTRODUCTION TO CLINICAL PHARMACY**

Definition, development and scope

**PATIENT DATA ANALYSIS**

The patient's case history, its structure and use in evaluation of drug therapy, Communication skills including patient medication history interview, patient counseling. Hematological, Liver function, renal function, Tests associated with cardiac disorders. Adverse drug reaction- Epidemiology, Classification, Risk factors, Monitoring a detecting adverse drug reactions, Assessing causality, Reporting adverse drug reactions. [10]

**Unit-II**

**DAILY ACTIVITIES OF CLINICAL PHARMACISTS**

Drug therapy monitoring (Medication chart view, clinical review, **TDM** pharmacist interventions. Drug utilization evaluation (DUE) and review (DRU). Quality assurance of clinical Pharmacy services, Prescription auditing and medication errors and monitoring [08]

**Unit-III**

**CLINICAL PHARMACOKINETICS**

Physiological determinants of drug clearance and volumes of distribution. Renal and non-renal clearance. Estimation and determinants of bioavailability. Calculation of loading and maintenance doses. Dose adjustment in renal failure, hepatic dysfunction, geriatric and paediatric patients. [08]

**Unit- IV**

**CONCEPT OF ESSENTIAL DRUGS AND RATIONAL USE OF DRUGS**

**Definition, symptoms, classifications of the disease, treatment and parameters to monitor the therapy of following systems/diseases**

- Cardiovascular systems- hypertension, congestive cardiac failure, ischemic heart disease
- Renal system- acute and chronic renal failure
- GI diseases [08]

**Unit-V**

**RESEARCH DESIGN AND CONDUCT OF CLINICAL TRIALS-** Research support

including planning and execution of clinical trials. Guidelines for good clinical research practice and ethical requirements. Various phases of clinical trials. Categories of Phase IV studies. [06]

**BOKS RECOMMENDED:**

1. Basic skills in interpreting laboratory data- Scott LT, American Society of Health System Pharmacists, Inc., USA.
2. Practice Standrds and Definitions- The Society of Hospital Pharmacists of Australia, 1997.
3. Clinical Pharmacokinetics-Rowland and Tozer, Williams and Wilkins Publication.
4. Biopharmaceutics and Applied Pharmacokinetics-Leon Shargel, Prentice Hall publication.
5. Relevant review articles from recent medical and pharmaceutical literature.
6. Parthasarathi G, Nyfort-Hansen K, Nahata M.C., A Text book of Clinical Pharmacy Practice –Essential Concepts and Skills, Orient Longman.
7. Davisson's Pranciples and Practice of Medicine, ELBS/Churchill Livingstone.
8. Herfindal E.T. and Hirashman J.L., Clinical Pharmacy and Therapeutics Williams and Wilkins
9. John g.Wagner," Pharmacokinetics for the Pharmaceutical Scientist".

**PHR-803**  
**PHARMACEUTICAL ANALYSIS -III**

**Unit-I:**

Colorimetric Method- Chemistry, Instrumentation and applications

Ultra violet and Visible- Electronic excitation, spectrophotometry, quantitative laws, deviation from Beer's law, instrumentation, single and double beam spectrophotometry.

Applications in pharmacopoeial analysis [08]

**Unit-II:**

Fluorimetric Analysis- Theory, Instrumentation and applications.

Infra- Red spectrophotometry-Theory, instrumentations, Interpretation of IR , spectra of simple compounds, FTIR, applications in pharmaceutical analysis. [08]

**Unit-III**

NMR Spectroscopy- Theory of <sup>1</sup>H.NMR, chemical shift, Shielding & Desheilding, spin-spin coupling, spin-spin splitting spectra of simple compounds.

Applications in pharmacopoeial analysis [10]

**Unit-IV**

Mass Spectroscopy –Theory, Instrumentation & Applications, mass spectra of some simple compounds. Applications in pharmacopoeial analysis [08]

**Unit-V**

Basic Principles, Instrumentation and Application of GLC & HPLC.

Applications in pharmacopoeial analysis [06]

**PHR-803P**  
**PHARMACEUTICAL ANALYSIS -III**  
**PRACTICAL**

1. Assay of official formulation containing more than one ingredients using instrumental techniques.

2. Interpretation of spectra.

**BOOKS RECOMMENDED:**

1. Willard H.H. and Merrit L. Jr and Dean J.A., Instrumental methods of analysis Van Nostrand Renhold, New York.

2. Skoog V, Principles of Instrumental Analysis, Holler-Neimen

3. Kemp William, organic spectroscopy, PALGRAVE NewYork

4. Silver stein RM & Webster FX, Spectrometric Identification of Organic Compounds, John Wiley & Sons.

5. Chatten L.G. A text book of Pharmaceutical Chemistry Vol. I & II Marcel, Dekker, New York.

6. Becket A.H. and Stenlake J.B. Practical Pharmaceutical Chemistry Vol. I and II, The Athlone Press of the University of London.

7. Pharmacopoeia of India, Ministry of Health, Govt of India.

**PHR-804**  
**PHARMACOPOEIAL STANDARDS**

**Unit I**

General notices, test methods- biological and chemical [8]

**Unit II**

Test methods- Physiochemical and Pharmaceuticals methods [8]

**Unit III**

Tests on herbal products, Vaccines & Blood related products, General tests [8]

**Unit IV**

Containers, general notices, general monographs on dosage forms [8]

**Unit V**

General monographs of veterinary products, general requirements for herbs and herbal products, vaccines and antisera, General monographs of biotechnology products, blood and blood related products

Illustrative studies of 2 monographs each for API (paracetamol, dexamethasone), excipients (lactose, starch) and dosage forms (amoxicillin dry syrup, betamethasone eye drop) [8]

**BOOKS RECOMMENDED:**

1. Indian Pharmacopoeia 2010

Any one of the following:

- (A) Standardization of herbal drugs and cosmetics
- (B) Drug design.
- (C) Pharmaceutical Marketing
- (D) Pharmaceutical Packaging
- (E) Novel Drug Delivery System
- (F) GMP, Quality Assurance & Validation
- (G) Hospital Pharmacy
- (H) Advanced Pharmacology
- (I)- Pharmaceutical Entrepreneurship

### (A) STANDARDISATION OF HERBAL DRUGS and COSMETICS

**Unit I** – Commerce and quality control of natural medicinal plants products, organoleptic, microscopical, physical & chemical evaluation of crude drugs. [08]

**Unit-II** - Standardization of plant material as per WHO guidelines. [08]

**Unit-III –Herbal Cosmetics:**

Brief study of Phytocosmetics, Industrial significance and current status. Herbs used for different cosmetic formulations like shampoos, conditioners, hair darkeners and skin care products. Study of following drugs used in different cosmetic formulations: Soapnut, Amla, Henna, Hibiscus, Tea, Aloe vera, Glycyrrhiza, turmeric, sandalwood etc. Basic evaluation parameters for skin care products and shampoos. [08]

**Unit-IV** -Analysis of official formulations derived from crude drugs including some ayurvedic preparations. [08]

**Unit-V** – Role of markers in the standardization of herbal products [08]

#### BOOK RECOMMENDED

1. Trease, G.E. Evans W.C., Pharmacognosy ELBS.
2. Tyler Varro. E., Brady Lynn. R. Robbers J.E. Pharmacognosy
3. Wallis T.E..Text book of Pharmacognosy
4. Harborne Phytochemical methods of chemical analysis.
5. Pharmacopial standards for Ayurvedic formulations CCRAS, Delhi.
6. Vapoorte, Swendson Chromatography of alkaloids.
7. Mottal.A.C. Clerk's isolation & identifications of drugs
8. Dhavan B.N. & Srimal R.C, The use of pharmacological techniques for evaluation of natural products. CDRI Lucknow.
9. Brain K.R. and Turner T.D, The practical evaluation of phytopharmaceuticals
10. Peach K. & Tracey MV, Modern methods of plant analysis
11. British herbal pharmacopocia.
12. Indian herbal pharmacopocia.
13. Chaudhary.R.R., Herbal drug industry

### (B) DRUG DESIGN

**Unit-I**

Introduction to Drug Design, Lead Discovery, Interactions (Forces) involved in drug receptor complex, Physiochemical properties in relation to biological action, Stereochemical aspects in drug design, Bioisosterism. [08]

**Unit-II**

Drug metabolism-Phase I & Phase II Metabolic Reactions, Prodrugs & Soft drug concepts [08]

**Unit-III**

- a. Analogous based drug design concept with suitable examples
- b. Structure Based drug design concept with examples [08]

**Unit-IV**

Combinatorial chemistry-Introduction, Parallel and Split & Mixed synthesis. [08]  
Computer Aided Drug Design-Introduction & Softwares used in CADD

**Unit-V QSAR**

Introduction, parameters, Quantitative models- Hansch method & Software's in QSAR. [08]



### **BOOKS RECOMMENDED:**

1. E.J, Ariens: Drug Design, Academic Press, New York (1975).
2. S.H. Salkovisky, A.A. Sinkula and S.C. Valvani, Physical Chemical Properties of Drugs, Marcel Dekker Inc. New York.
3. M.E. Wolff, Burger's Medical Chemistry, John Wiley and Sons, New York.
4. R.F, Doerge, Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co, Philadelphia.
5. Olson, Edward C "Computer Assisted Drug Design (American Chemical Society).
6. Burger A "A guide to chemical basis of Drug Design "John Wiley & Sons".
7. Thomas J.Perun "Computer aided Drug Design methods Applications".

### **(C) PHARMACEUTICAL MARKETING**

**Unit-I** Principles of marketing management, Introduction to pharmaceutical marketing, Identification of the marketing, Market behaviour, Prescribing habits of physician, Patient motivation, Market analysis. [08]

**Unit-II** MARKET RESEARCH: Measuring & Forecasting Market Demand - Major concept in demand measurement, Estimating current demand Geo-demo- graphic analysis. Estimating industry sales. Market share and future demand. Market segmentation & Market targeting. Drug development and the marketing research interface, Diversification and specialization, Marketing generic drugs. [08]

**Unit-III** Economic and competitive aspects of pharmaceutical industry- Advertising, Detailing, Retail competition, International marketing. [08]

**Unit-IV** Distribution channels in pharmaceutical marketing – Manufacturer, Wholesaler, Retailer, Hospital & Government agencies, Selection of stockists and distributors. [08]

**Unit-V** Controls- Internal control and external control. [08]

### **BOOKS RECOMMENDED**

1. Smith, Mickey C, "Principles of pharmaceutical marketing", CBS Publishers & Distributors.
2. Kotler, Philip "Marketing Management". Pearson Education Asia.

### **(D) PHARMACEUTICAL PACKAGING**

#### **Unit-I**

New concepts in pharmaceutical packaging.

Package systems, package design research, package design for international transit [08]

#### **Unit-II**

3. Packaging materials with special reference to polymers, metals, glass and plastics, control of packaging materials and their specifications

4. Blister and strip packaging materials, their testing and specifications including microbiology [08]

#### **Unit-III**

5. Testing of containers & closures, Pharmacopoeial tests and specifications, Defects in packages.

6. Stability of package and packaging material

7. Ancillary materials used in packaging, their design and specifications [08]

#### **Unit-IV**

8. Sterilization of packaging materials, post-sterilization testing

9. Packaging of Parenterals, Ophthalmics, aerosols and testing

Corrugated fiber board materials, Printing requirements, label and leaflets preparation, Legal requirement as per D & C rules and rules of importing countries, testing of packaging materials and their transit worthiness [08]

#### **Unit-V**

Mechanization of packaging operation, use of bar codes and controls on inline packing, testing of finished packs as per ICH guidelines , packaging materials and product mix-up, their investigations and corrective & punitive action(CAPA) [08]

### **BOOKS RECOMMENDED:**

1. Ross, Packaging of Pharmaceuticals.
2. Joseph D.O. Brien, Medical Device Packaging Handbook.
3. Griffin, Drug and cosmetic Packaging.
4. Barail, Packaging Engineering.

5. Harburn, Quality-Control of Packaging Materials in Pharmaceutical Industry.
6. Kac Chensney, Packaging of Cosmetics and Toiletries.
7. USP
8. BIS specifications

## **(E) NOVEL DRUG DELIVERY SYSTEM**

### **Unit-I**

1. Theory of controlled release drug delivery systems.
2. Release and diffusion of drugs from C.D.D.S., General methods of design and evaluation of C.D.D.S. [08]

### **Unit-II**

3. Carriers for drug delivery systems, Prodrugs, Physical, chemical and biomedical engineering approach to achieve controlled drug delivery.
4. Microencapsulation: Methods, kinetics of drug release from microcapsules technology and applications. [08]

### **Unit-III**

5. Transdermal drug delivery systems: Theory, formulation and evaluation, iontophoresis.
6. Implants and inserts: Types, design and evaluation methods, Osmotic pumps. [08]

### **Unit-IV**

7. Targeted Drug delivery systems: Concept of drug targeting, importance in therapeutics, methods in drug targeting, drug immobilization techniques, nanoparticles, liposomes, niosomes, pharmacosomes and resealed-erythrocytes. [08]

### **Unit-V**

8. Advances in drug delivery systems. An Introduction to buccal, nose to brain, ocular, pulmonary colonic delivery, transmucosal and stemceuticals [08]

### **BOOKS RECOMMENDED**

1. Julian, Drug Delivery Systems.
2. Robinson and Vincent, Controlled Drug Delivery.
3. Robinson, Sustained and Controlled Drug Delivery Systems.
4. Noxon, Microencapsulation.
5. Chien, Novel Drug Delivery Systems.
6. Deasy, Microencapsulation and Related Processes.
7. Gutcho, Microencapsulation and Related Processes.
8. Lisbeth, Illum & Davis, Polymers in Controlled Drug Delivery.
9. Ghosh, Premamoy " Polymer Science & Technology".

## **(F) GMP, QUALITY ASSURANCE & VALIDATION**

### **Unit-I**

No GMP- GMP-cGMP-CGMP with reference to Indian scenario  
Drugs & cosmetics rules with reference to G,H,M,P,P1, T,U,X

1. Requirements of GMP, CGMP, GLP, USFDA, WHO guidelines and ISO 9000 series. & ICH [08]

### **Unit-II**

2. Documentation- Protocols, Forms and maintenance of records in Pharmaceutical industry.
3. Preparation of documents for new drug approval and export registration (schedule L1 & Y) [08]

### **Unit-III**

4. Basic concept of quality assurance, Quality assurance systems, Sources and control of quality variation- raw materials, containers, closures, personnel, environment etc [08]

### **Unit-IV**

Facility design- Concepts in validation, validation master plan, validation of product, process, equipment, machinery, systems. Cleaning, Building management systems [08]

### **Unit-V**

6. In process quality control tests, IPQC problems in pharmaceutical industries.
7. Pharmacopoeial standards for dosage form and acceptance criteria, Sampling plan, Sampling and operating characteristics curves -raw materials, IPC, finished products and packaging materials

Internal audits, investigations of market complaints, out of specifications (OOS) [08]

**BOOKS RECOMMENDED:**

1. Willing, Tuckerman and Hitchings, Good Manufacturing Practices for Pharmaceuticals.
2. OPPI, Quality Assurance.
3. Loftus and Nash, Pharmaceutical Process Validation.
4. Florey, Analytical Profile of Drugs (All volumes).
5. Indian Pharmacopoeia.
6. United States Pharmacopoeia.
7. British Pharmacopoeia.
8. Garfield, Quality Assurance Principles for Analytical Laboratories.
9. Manohar A. Potdar, C.GMP for Pharmaceuticals.
10. Sharma P.P. How to practice GMP's , Vandana Publication, New Delhi
11. Sharma P.P. Validation in pharmaceutical industry , Vandana Publication, New Delhi
12. TRS guidelines
13. Orange guide
14. D&C Act
15. 21CFR part 211
16. ICH guidelines

**(G) HOSPITAL PHARMACY**

**Unit-I: Organization and Structure:** Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist. Pharmacy and therapeutic committee, Budget preparation and implementation.

**Hospital Formulary:** Contents, preparation and revision of hospital formulary. [08]

**Unit-II: Drug Store Management and Inventory Control:** Organization of drug., Types of materials stocked, storage conditions.

**Purchase and Inventory control:** Principles, various methods of inventory control, purchase procedures, purchase order, procurement and stocking. [08]

**Unit-III: Central Sterile Supply Unit and their Management:** Aseptic techniques and clean area classification, Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.

**Manufacture of Sterile and Non-sterile Products:** Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, Master formula record , Production control, Manufacturing records. [08]

**Unit-IV: Drug information service:** Sources of information on drugs, treatment schedules, procurement of information, computerized services (e.g. MEDLINE), Retrieval of information, Medication error.

**Records and Reports:** Prescription filling drug profile, Patient medication profile, case on drug interaction & adverse reactions, idiosyncratic cases etc. [08]

**Unit-V: Drug distribution systems in Hospitals:** Out-patient dispensing, methods adopted, Dispensing of drugs to in-patients. Types of drug distribution systems Charging Policy, labeling, Dispensing of drugs to ambulatory patients, Dispensing of controlled drugs.

**Nuclear Pharmacy:** Introduction to Radiopharmaceutics- radio-active half life, Units of radioactivity. Production of radio pharmaceuticals, methods of isotonic tagging, preparation of radioisotopes in laboratory using radiation dosimetry, radio-isotope generators, permissible radiation dose level, Radiation hazards and their prevention, specifications for radio-active laboratory. [08]

**BOOKS RECOMMENDED:**

1. Hasan, Hospital Pharmacy, Lea & Febiger, Philadelphia.
2. Merchant H.S. and Qadry J.S. Text Book of Hospital Pharmacy, B.S. Shah Prakashan, Ahmedabad.

## **(G) ADVANCED PHARMACOLOGY AND PHARMACOTHERAPEUTICS**

### **UNIT 1 Molecular Pharmacology**

Receptor occupancy and cellular signaling systems including G-proteins, cyclic nucleotides, calcium and calcium binding proteins, phospholipases.

**Pharmacology of receptors** : *Classification, cellular signaling systems, and pharmacology of agonists of the following receptor types:*

Excitatory Amino Acid receptors, Purinoreceptors, GABA & Benzodiazepine

Receptors, Neurosteroid receptors, Cannabinoid receptors, Melatonin receptors

**Ion Channels and Their Modulators:** Classification and biology of potassium ionic channels, and pharmacology of their modulators

**UNIT 2. Novel Target Sites:** Physiological functions, pharmacological implications, and therapeutic potential of the following target sites:: Rho kinase (ROCK)

Phosphoinositide 3-kinase (PI3K), Akt (Protein kinase B), Caspases, Poly (ADPribose)

polymerase (PARP), Peroxisome proliferator activator receptors (PPAR)- $\alpha$

and AMP activated protein kinases, Protein kinases, Phosphodiesterases

### **UNIT 3 Pharmacological Techniques to Evaluate the following Class of Drugs**

Antiepileptics

Antianxiety agents and drugs used in mood and sleep disorders

Antipsychotics

Drugs affecting memory

Skeletal muscle relaxants and neuromuscular blockers

Antidiabetic agents

Analgesics and drugs used in arthritis and neuropathic pain.

Anti-inflammatory agents

Antiulcer agents

Hepatoprotective agents

### **UNIT 4 Pharmacotherapeutics**

Etiopathogenesis and pharmacotherapy of diseases associated with following systems/diseases:

Cardiovascular System: Hypertension, Congestive cardiac failure, Angina pectoris, Myocardial infarction, hyperlipidemia, Arrhythmias.

Endocrine System: Diabetes, Thyroid diseases, Oral contraception, HRT osteoporosis.

Infection Diseases: Tuberculosis, HIV and related opportunistic infections, malaria, amoebiasis, helminthiasis, leprosy.

Psychiatric Disorder: Anxiety, Alzheimer's diseases, mood & sleep disorder, schizophrenia.

Neurological disorder: Epilepsy, Parkinson, myasthenia gravis, migraine.

### **UNIT 5 Stem cell therapeutics**

Biology of stem cells.

Potentials of stem cell in various disorders.

Ethical Issues.

### **BOOKS RECOMMENDED**

1. M.N.Ghosh, Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta, India.

2. Edinburg University Pharmacology Staff (ed.) Pharmacological Experiments on Isolated Preparations, Livingstone, UK

3. H.G.Vogel (ed), Drug Discovery and Evaluation-Pharmacological Assays, Springer Verlag, Berlin, Germany.

4. D.R.Laurence and A.L.Bacharach (eds), Evaluation of Drug Activities: Pharmacometrics, Vol. 1 and 2, Academic Press, London, U.K.

5. David R. Gross, Animal Models in Cardiovascular Research, Kluwer Academic Publishers, London, U.K.

6. J.T. Dipiro, R.L. Talbert, G.C.Yee, G.R.Matzke, B.G.Wells, L.Michael Posey (eds.), Pharmacotherapy: A Pathophysiologic Approach, The McGraw Hill Companies, Inc.

7. E.T.Herfindal and D.R.Gourley, Text Book of Therapeutics: Drug and Disease Management, Lippincott Williams & Wilkins, USA.

10. T.M Speight and NHG Holford (ed.), Avery's Drug Treatment: Principles and Practice of Clinical Pharmacology and Therapeutics, ADIS Press, Sydney, Australia.

11. Dennis L. Kasper, Eugene Braunwald, Anthony S. Fauci, Stephen L. Hauser, Dan L. Longo,

## **(I)- Pharmaceutical Entrepreneurship**

### **Unit-I**

Entrepreneurship- history & concept, importance

Entrepreneur- Leadership Attributes, Innovations, Influences, Personality Traits And Characteristics. Types of Entrepreneurs. Business etiquettes, Business language and Communication. (8)

### **Unit-II**

Entrepreneurship in the pharmaceutical industry- needs, problems and issues

Importance of communication, decision making and problem solving skills.

Business strategies, competition, marketing opportunities, supply chain management keeping in mind return on investments. Case studies -3 to 5 (8)

### **Unit-III**

Identification of market for product and services, SWOT analysis

Formulation of strategies, market leaders and success stories of their leading brands.

Regulatory aspects- Drugs and Cosmetics Act and rules relevant to licensing requirements for retail, wholesale, (schedules H,G,L1,M,Miii,P,P1,U,V,X,Y); DPCO - price control and price fixation, Factory Act, Central and State Excise Act Including Vat, Environmental Protection Act covering air, water, solid waste disposal record keeping, income tax and sales tax , ( include only relevant to working), quality system and its relevance. (8)

### **Unit-IV**

Technology Transfer considerations

Funding of projects- Financial, Bootstrapping, External Financing

Project Management, Financial Management – understanding of balance sheet and profit and loss accounts, imports and exports. (need based for understanding for practical application). Case studies - 3 (8)

### **Unit-V**

Importance of hr recourses- team building and management

Concept of social entrepreneurship & sustainable entrepreneurship

(Growth oriented). Case studies-3 (8)

### **Suggested Books:**

1. Welsh, J.A. & Jerry, F.W., 'Entrepreneur's Master Planning Guide, How to launch a successful business', Prentice Hall, Englewood cliff.
2. Srivastava U.K., 'Project Planning, Financing, Implementation and Evaluation, IIM, Ahmedabad.
3. Rao, T.V. & Pareek U, 'Developing Entrepreneurships: A Handbook'. Learning Systems, New Delhi.
4. Handbook of Entrepreneurship Research: An Interdisciplinary Survey and Introduction
5. Duening, Thomas N., Hisrich, Robert D., Lechter, Michael A., Technology Entrepreneurship, Academic Press, 2009.
6. Lundström, Anders und Stevenson, Lois (2005), Entrepreneurship Policy: Theory and Practice, Springer.
7. Deakins, D.; Freel, M. (2009). Entrepreneurship and Small Firms, 5th Edition. McGraw Hill.
8. Pharmaceutical Industry: Innovation & Developments (Business Issues, Competition and Entrepreneurship) by David A. Mancuso, Isobel M. Grenada Publisher: Nova Science Publishers Inc (3 Aug 2011)
9. The Business of Healthcare Innovation [Hardcover]  
Lawton Robert Burns, Publisher: Cambridge University Press; 2 edition
10. Bootstrapping Your Business: Start And Grow a Successful Company With Almost

No Money by Greg Gianforte, Marcus Gibson, Publisher Adams Media 2005

11. Drugs and Cosmetics Act and Rules, and DPCO, Govt. of India.

12 Factory Act.

13 Shop and Establishment Act.

14 Environmental Protection Act.

15. Central Excise Tariff Act and Import Policy.

**PHR-805 P**

**Project on Elective**