

# GONDWAN UNIVERSITY, GADCHIROLI

## Four Year Degree Course in Pharmacy

### I Semester B.Pharm [Course and Examination Scheme with Credit Grade System]

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours per week			No. of Credits	Theory					Practical				
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks	
BP101	Pharmaceutics-I	4	-	-	4	3	80	20	100	45	-	-	-	-	
BP 102	Pharmaceutical inorganic chemistry -I	4	-	-	4	3	80	20	100	45	-	-	-	-	
BP 103	Pharmaceutical Biochemistry –I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 104	Anatomy and Physiology –I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 105	Pharmacognosy –I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 106	Pharmaceutics-I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 107	Pharmaceutical inorganic chemistry -I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 108	Pharmaceutical Biochemistry –I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 109	Anatomy and Physiology –I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 1010	Pharmacognosy –I	-	-	4	2	5	-	-	-	-	80	20	100	50	
<b>Total</b>		<b>17</b>	<b>0</b>	<b>20</b>	<b>27</b>				<b>500</b>				<b>500</b>		
<b>Semester total</b>						<b>1000</b>									

## II Semester B.Pharm [Course and Examination Scheme with Credit Grade System]

Subject Code	Subject	Teaching Scheme				Examination Scheme								
		Hours per week			No. of Credits	Theory					Practical			
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks
BP201	Pharmaceutics-II	4	-	-	4	3	80	20	100	45	-	-	-	-
BP 202	Pharmaceutical inorganic chemistry -II	4	-	-	4	3	80	20	100	45	-	-	-	-
BP 203	Pharmaceutical Biochemistry -II	2	-	-	2	3	80	20	100	45	-	-	-	-
BP 204	Anatomy and Physiology -II	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 205	Pharmacognosy -II	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 206	Statistics and computer application in pharmacy	2	-	-	2	3	80	20	100	45	-	-	-	-
BP 207	Pharmaceutics-II	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 208	Pharmaceutical inorganic chemistry -I	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 209	Pharmaceutical Biochemistry -I	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 2010	Anatomy and Physiology -I	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 2011	Pharmacognosy -I	-	-	4	2	5	-	-	-	-	80	20	100	50
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>28</b>				<b>600</b>				<b>500</b>	
<b>Semester total</b>						<b>1100</b>								

### III Semester B.Pharm [Course and Examination Scheme with Credit Grade System]

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours per week			No. of Credits	Theory					Practical				
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks	
BP301	Physical Pharmacy –I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 302	Pharmaceutical Organic Chemistry-I	4	-	-	4	3	80	20	100	45	-	-	-	-	
BP 303	Pharmaceutical Analysis-I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 304	Pharmaceutical Microbiology	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 305	Pharmacology-I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 306	Hospital and community Pharmacy	2	-	-	2	3	80	20	100	45	-	-	-	-	
BP 307	Physical Pharmacy –I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 308	Pharmaceutical Organic Chemistry-I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 309	Pharmaceutical Analysis-I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 3010	Pharmaceutical Microbiology	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 3011	Pharmacology-I	-	-	4	2	5	-	-	-	-	80	20	100	50	
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>28</b>				<b>600</b>				<b>500</b>		
	<b>Semester total</b>												<b>1100</b>		

**IV Semester B.Pharm [Course and Examination Scheme with Credit Grade System]**

subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours per week			No. of Credits	Theory					Practical				
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks	
BP401	Physical Pharmacy-II	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 402	Pharmaceutical Organic chemistry-II	4	-	-	4	3	80	20	100	45	-	-	-	-	
BP 403	Pharmaceutical Analysis-II	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 404	Pharmaceutical Biotechnology	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 405	Pharmacology-II	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 406	Pharmaceutical Management	2	-	-	2	3	80	20	100	45	-	-	-	-	
BP 407	Physical Pharmacy-II	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 408	Pharmaceutical Organic chemistry-II	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 409	Pharmaceutical Analysis-II	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 4010	Pharmaceutical Biotechnology	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 4011	Pharmacology-II	-	-	4	2	5	-	-	-	-	80	20	100	50	
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>28</b>				<b>600</b>				<b>500</b>		
<b>Semester total</b>						<b>1100</b>									

**V Semester B.Pharm [Course and Examination Scheme with Credit Grade System]**

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours per week			No. of Credits	Theory					Practical				
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks	
BP501	Pharmaceutics-III (D.F.T.)	4	-	-	4	3	80	20	100	45	-	-	-	-	
BP 502	Pharmaceutical Engineering-I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 503	Pharmaceutical organic chemistry-III	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 504	Pharmacology-III	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 505	Pharmacognosy –III	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 506	Biopharmaceutics	2	-	-	2	3	80	20	100	45	-	-	-	-	
BP 507	Pharmaceutics-III (D.F.T.)	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 508	Pharmaceutical Engineering-I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 509	Pharmaceutical organic chemistry-III	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 5010	Pharmacology-III	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 5011	Pharmacognosy –III	-	-	4	2	5	-	-	-	-	80	20	100	50	
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>28</b>				<b>600</b>				<b>500</b>		
	<b>Semester total</b>												<b>1100</b>		

**VI Semester B.Pharm [Course and Examination Scheme with Credit Grade System]**

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours per week			No. of Credits	Theory					Practical				
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks	
BP601	Pharmaceutics-IV (D.F.T.)	4	-	-	4	3	80	20	100	45	-	-	-	-	
BP 602	Pharmaceutical Engineering-II	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 603	Medicinal Chemistry-I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 604	Pharmacology-IV	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 605	Pharmacognosy –IV	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 606	Pharmaceutical Analysis-III	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 607	Pharmaceutics-IV (D.F.T.)	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 608	Pharmaceutical Engineering-II	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 609	Pharmaceutical Analysis-III	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 6010	Pharmacology-IV	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 6011	Pharmacognosy –IV	-	-	4	2	5	-	-	-	-	80	20	100	50	
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>29</b>				<b>600</b>				<b>500</b>		
<b>Semester total</b>						<b>1100</b>									

**VII Semester B.Pharm [Course and Examination Scheme with Credit Grade System]**

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours per week			No. of Credits	Theory					Practical				
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks	
BP701	Pharmaceutics-V	4	-	-	4	3	80	20	100	45	-	-	-	-	
BP 702	Medicinal chemistry -II	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 703	Pharmaceutical Analysis-IV	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 704	Pharmacology-V	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 705	Pharmacognosy –V	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 706	Pharmaceutical Jurisprudence	2	-	-	2	3	80	20	100	45	-	-	-	-	
BP 707	Pharmaceutics-V	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 708	Medicinal chemistry -II	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 709	Pharmaceutical Analysis-IV	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 7010	Pharmacology-V	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 7011	Pharmacognosy –V	-	-	4	2	5	-	-	-	-	80	20	100	50	
	<b>Total</b>	<b>18</b>	<b>0</b>		<b>28</b>				<b>600</b>				<b>500</b>		
<b>Semester total</b>						<b>1100</b>									

**VIII Semester B.Pharm [Course and Examination Scheme with Credit Grade System]**

subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours per week			No. of Credits	Theory					Practical				
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks	
BP801	DFT-II	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 802	Medicinal Chemistry-III	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 803	Pharmaceutical Analysis-V	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 804	Clinical pharmacotherapeutics-II	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 805	Industrial Pharmacognosy	3			3										
BP 806	Pharmaceutical Jurisprudance	3			3										
BP 807	DFT-II	-	-	4	2	-	-	-	-	-	80	20	100	50	
BP 808	Medicinal Chemistry-III	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 809	Pharmaceutical Analysis-V	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 8010	Industrial Pharmacognosy	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 8011	Seminar & Project work	-	-	6	3	5	-	-	-	-	80	20	100	50	
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>29</b>				<b>600</b>				<b>500</b>		
<b>Semester total</b>						<b>1100</b>									

### SEMESTER STATEMENT

Semester	No of passing heads			Teaching Scheme				Max Mark		
	Theory	Practical	Total	Lectures	Tutorial	Practical	Credit	Theory	Practical	Total
I	5	5	10	17	-	20	27	100	100	200
II	6	5	11	18		20	28	100	100	200
III	6	5	11	18		20	28	100	100	200
IV	6	5	11	18		20	28	100	100	200
V	6	5	11	18		20	28	100	100	200
VI	6	5	11	19		20	29	100	100	200
VII	6	5	11	18		20	28	100	100	200
VIII	4	4+Project	08+ Project	13		16+Project	29	100	100+ Project(200)	300
Total	45	40	85	141		157	225	900	800	1700

## SEMESTER STATEMENT

Semester	No of passing heads			Teaching Scheme				Max Mark		
	Theory	Practical	Total	Lectures	Tutorial	Practical	Credit	Theory	Practical	Total
I	5	5	10	17	-	20	27	500	500	1000
II	6	5	11	18	-	20	28	600	500	1100
III	6	5	11	18	-	20	28	600	500	1100
IV	6	5	11	18	-	20	28	600	500	1100
V	6	5	11	18	-	20	28	600	500	1100
VI	6	5	11	19	-	20	29	600	500	1100
VII	6	5	11	18	-	20	28	600	500	1100
VIII	4	4+Project	08+ Project	13	-	16+Project	29	400	400+ Project(200)	1000
Total	45	40	85	141	-	157	225	4500	4100	8600

(semester –I)

**Subject Code: BP101**

**Subject: Pharmaceutics-I**

**THEORY**

**45 Hour (3hrs/week)**

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**1. Pharmaceutical Literature and Ethics :**

Historical background. Introduction and Importance of various pharmacopoeias with special reference Indian pharmacopoeia, B.P, USP, and International pharmacopoeia .General introduction to pharmaceutical ethics.

**2. Introduction to dosage forms :**

Classification of solids, semisolids, liquid dosage forms, conventional and novel drug delivery.

**3. Pharmaceutical calculation and metrology:**

Calculation of dosage for infants, children, adults, and elderly patients, percentage calculation, % w/v, v/v, and w/w, alcohol dilution, use of allegation method, proof spirit, isotonic solution and displacement value of suppositories.Posology (factor influencing dose, calculation of dose on the basis of age sex and surface area.

**4. Pharmaceutical Additive:**

Diluents, vehicles, bases, solvents, organoleptic additives, surfactants, polymer and Their applications.

**5. Incompatibilities:**

Definitions study of types of compatibilities –physical, chemical and therapeutic, Inorganic compatibilities and organic compatibilities.

(semester –I)

**Subject Code:BP106**

**Subject: Pharmaceutics-I**

**PRACTICAL**

**45 Hour 3hrs/week)**

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1. Preparation of following classes of products involving the use of calculations in metrology (at least two products from each category wherever applicable): Aromatic waters, injections, solutions, spirits, glycerine, syrups, elixirs, lotions, mucilages and liniments, suppositories, tablets, powders and capsules.

2. Study of one monograph from the latest edition of Indian Pharmacopoeia.

**SEMESTER –II**

**Subject Code:BP 201**

**Subject: Pharmaceutics-II**

**THEORY**

**45 Hour (3hrs/week)**

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**1. Prescription:**

Various parts of prescription and their function , handling of prescription, sources of error, care required in dispensing procedures including labeling and packaging of

dispensed product. Prescription container and closures, pricing the prescription  
.Latin term related to prescription and translation in to English.

## 2. **Pharmaceutical Preparation:**

Principal and procedure adopted in dispensing of following classes of pharmaceuticals:

Aromatic water, syrups, elixirs, spirits, tinctures, emulsions, suspensions, powders, Lozenges, hard and soft gelatin capsules, gargles, dentifrices, lotions, liniments, creams, ointments, pastes, suppositories, pessaries, urethral, and nasal bougies, glycerites, jellies, inhalations and sprays, throat paints, eye and ear drops, douches, enemas, effervescent granules.

## 3. **Surgical Aids :**

Surgical dressings, sutures and their standards.

# (semester –II) SEMESTER –II

**Subject Code: BP207**

**Subject: Pharmaceutics-II**

**PRACTICAL**

**45 Hour (3hrs/week)**

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1. Preparation of following classes of product involving the use of calculation in metrology (atleast three product from each category whenever applicable).Liniments, suppositories, tablets, powder and capsule, mixture, solution, emulsion, cream, ointments, pastes, jellies, Lozenge, lotions, inhalations and paints etc.
2. Identification of various types of incompatibilities in prescription. correction and dispensing of such prescription.
3. Prescription Reading: Minimum of 20 prescriptions from the clinical practice.

### **Books Recommended:**

1. Pharmaceutical dosage and drug delivery system-Ansel-Popovich and Allen (Williams and Wilkins).
2. Lachman –Liberman and Kanig-Industrial Pharmacy (Isci Febiger)
3. Bentley's T.B.of Pharmaceutics-Rawlins (ELBS)
4. Dispensing of medication, by Hooper (Mach Publishing)
5. Altaon M.E, Pharmaceutics-The science of dosage form design, ELBS/Churchill Livingstone.
6. Remington's Pharmaceutical Sciences (Latest Edition).
7. The Extra Pharmacopoeia-Martindale (Latest Edition).
8. S.J Carter: Tutorial Pharmacy.
9. Cooper and Gunn's: Dispensing Pharmacy.
10. N.K.Jain and S.N.Sharma: The theory and practice of Professional Pharmacy
11. B.M. Mittal: Textbook of Pharmaceutical Formulation, 4th Edition, Vallabh Prakashan, Delhi.
12. Indian Pharmacopoeia- Edition2010.
13. British Pharmacopoeia (Latest Edition).
14. Hurry's Cosmetology
15. Thomssen S.G, Modern Cosmetics, Lea and Febiger, Philadelphia.

(Semester-I)

**Subject code: BP102**

**Subject: Pharmaceutical Inorganic Chemistry II**

**45 hrs. (3 hrs/ week)**

**THEORY**

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1. Sources of impurities in Pharmaceutical - Importance of limit test and general principles and procedure for limit test of Chloride, Sulphate Iron, Arsenic Lead and Heavy Metals.
2. Radiopharmaceuticals used in medicine- therapeutic and diagnostic application of Radiopharmaceutical's, Radio- Opaque Contrast Media including I, P, Cr, Au, Fe, Ra.
3. Pharmacopoeia and monograph-different pharmacopeia and content of official monograph
4. Water - hardness of water methods to remove hardness of water, different official water
5. Pharmaceutical Aids and Necessities – acids, bases, buffers, antioxidant, suspending agent, tableting aids and pharmaceutically acceptable glasses.
6. Inhalants – inorganic gasses used in pharmacy, oxygen, nitrogen, nitrous oxide, carbon dioxide, ammonia helium.

(Semester-I)

**Subject code:BP107**

**Subject: Pharmaceutical Inorganic Chemistry II**

**45 hrs. (3 hrs/ week)**

**PRACTICAL**

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1. Semi-micro inorganic qualitative analysis of mixture containing two acidic and two basic radicals (10 mixtures)
2. Limit test for chloride, sulfate, iron, lead, arsenic
3. Swelling power of bentonite

(Semester-II)

**Subject code:BP202**

**Subject: Pharmaceutical Inorganic Chemistry II**

**45 hrs. (3 hrs/ week)**

**THEORY**

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1. Major intra and extra cellular electrolyte- major physiological ions, electrolyte used in replacement therapy, physiological acid base balance, electrolyte, used in acid – base therapy electrolyte in combination therapy
2. Dental product- anticaries agent, dentifrices
3. Antidote - classification , sodium thiosulphate, sodium nitrite
4. Gastrointestinal agent- acidifying agent, antacid, protective and adsorbent saline cathartics.
5. Essential and trace ions- copper, zinc, iron, selenium, sulfur, iodine and their official compound as per I.P.
6. Expectorant and emetics – ammonium chloride, potassium iodide, antimony potassium tartarate, mode of action of the entire compound.
7. Topical agent – general introduction and mode of action of antimicrobials and astringent.

(Semester-II)

**Subject code: BP208**

**Subject: Pharmaceutical Inorganic Chemistry II**

**45 hrs. (3 hrs/ week)**

**PRACTICAL**

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1. Preparation of some inorganic pharmaceutical compound(minimum 6)
  - a. Boric acid
  - b. Ferrous sulphate
  - c. Calcium carbonate
  - d. Barium sulphate

- e. Magnesium sulphate
- f. Zinc oxide
2. Standardization of compound belonging to different categories as per I.P(minimum 6)
3. Prepare and test purified water of pharmacopoeia standard (I.P)
4. Acid neutralizing capacity of Aluminum Hydroxide gel
5. Presence of iodate in potassium iodide
6. Ammonium salts in Potash Alum
7. Adsorption property in heavy Kaolin

### Recommended Books For Semester I And II

1. Inorganic, Medicinal and Pharmaceutical Chemistry by J.H. Block, E. B. Roche, Indian Edition, Varghese Publication.
2. Modern Inorganic Pharmaceutical Chemistry by C. A. Dicher.
3. Concise Inorganic Chemistry – J.D. Lee.
4. Bentley and Driver's Text Book of Pharmaceutical Chemistry Revised by L. M. Atherden, 8<sup>th</sup> Edition, and Oxford Medical Publications.
5. Pharmaceutical Inorganic Chemistry by Dhake and Tipnis, 2<sup>nd</sup> Edition.
6. Indian Pharmacopoeia 2010
7. Remington the Science and Practice of Pharmacy by Remington, 20<sup>th</sup> Edition, Lipincott, William and Wilkins.
8. Advanced Inorganic Chemistry, 18<sup>th</sup> Edition, Cotton And Wilkinson (Wiley Eastern Ltd., Delhi)
9. Inorganic Pharmaceutical Chemistry (Practical), 2<sup>nd</sup> Edition, Dhake and Belsare.
10. Vogel's Text Book of Quantitative Analysis, 5<sup>th</sup> Edition ]
11. Vogel's Quantitative Inorganic Analysis.
12. Wilson and Gisvold's Principles of Organic and Medicinal Chemistry
13. Harkishan Singh and A. K. Kapoor- Principles of Inorganic Chemistry

### (Semester-I)

**Subject code:BP103**

**Subject: Pharmaceutical Biochemistry I (PB-I)**

**45 hrs. (3 hrs/ week)**

#### **THEORY**

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- 1) **Introduction to biochemistry:** scope of biochemistry in pharmaceutical science, biochemical reactions.
- 2) **Cell:** biochemical organization of cell, prokaryotic and eukaryotic cell metabolism, transport across the cell membrane.
- 3) **General introduction to biomolecules:** Carbohydrates, proteins, fats.
- 4) **Nutrition:** concept of balanced diet, principle nutrients, nutritional diseases, role of crude fibers, energy metabolism, BMR.
- 5) **Vitamins:** vitamins as co-enzymes and their biological significance, metals as co-enzymes, water soluble and fat soluble vitamin with biochemical role and pharmaceutical application.
- 6) **Enzymes:** nomenclature, classification, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes, application in clinical diagnosis.
- 7) **Electron transport chain:** biological oxidation and its biochemical importance, redox potential and energy rich compounds, respiratory chain and oxidative phosphorylation (schematic diagram).

(Semester-I)

**Subject code: BP108**

**Subject: Pharmaceutical Biochemistry I (PB-I)**

**45 hrs. (3 hrs/ week)**

**PRACTICAL**

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- 1) Quantitative estimation of glucose in urine by Benedict method.
- 2) Quantitative estimation of carbohydrates by Follin-wu method.
- 3) Determination of ascorbic acid using dye 2,6-dichlorophenol indophenol.
- 4) A study of activity of enzyme salivary amylase.
- 5) Separation of amino acid by paper chromatography.
- 6) Estimation of total proteins in given sample of serum/plasma.

(Semester-II)

**Subject code: BP203**

**Subject: Pharmaceutical Biochemistry II (PB-II)**

**45 hrs. (3 hrs/ week)**

**THEORY**

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- 1) **Bioenergetics:** introduction, concept of free energy, role of high energy nucleotide phosphate, production of ATP and its biological significance.
- 2) **Carbohydrate metabolism:** introduction to metabolism, glycolysis, citric acid cycle, gluconeogenesis, glycogenolysis, glycogen formation, pentose phosphate pathway, uronic acid pathway- significance and abnormalities.
- 3) **Lipid metabolism:** oxidation of fatty acid (alpha, beta), ketone bodies and their significance, Biosynthesis of saturated and unsaturated fatty acid, sphingolipids and phospholipids, control of lipid metabolism, essential fatty acids, biosynthesis of eicosanoids (Prostaglandins, Prostacyclins, Thromboxanes, Leucotrienes), abnormalities of lipid metabolism.
- 4) **Protein metabolism (metabolism of ammonia and nitrogen containing monomers):** nitrogen and sulphur cycles, nitrogen balance, biosynthesis and catabolism of amino acids, transamination (SGOT and SGPT), assimilation of ammonia (deamination), urea cycle, metabolic disorders of urea cycles, metabolism of sulphur containing amino acids, porphyrin biosynthesis, formation of bile pigment, porphyrias, hyperbilirubenemia.
- 5) **Nucleic acid and protein biosynthesis:** DNA and RNA bases nucleotides, role of DNA and different type of RNA, salient features of protein biosynthesis (with diagram).
- 6) **Hormones:** classification, hypothalamic and pituitary hormones (anterior and posterior), thyroid hormone, hormones of adrenal cortex, adrenal medulla, gonads, gastro-intestinal (or gut) hormones.
- 7) **Organ function test:** liver function test, jaundice, kidney function test, gastric function test, other organ function test.

(Semester-II)

**Subject code: BP209**

**Subject: Pharmaceutical Biochemistry II (PB-II)**

**45 hrs. (3 hrs/ week)**

**PRACTICALS**

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- 1) Estimation of total albumins in given sample of serum/ plasma.
- 2) Estimation of total cholesterol in given sample of serum/ plasma.
- 3) Estimation of total triglyceridines in given sample of serum/ plasma.
- 4) Estimation of total LDL in given sample of serum/ plasma.
- 5) Estimation of total HDL in given sample of serum/ plasma.
- 6) Estimation of total bilirubin in given sample of serum/ plasma.

**RECOMMENDED BOOKS:**

1. Lehninger's Principles of Biochemistry by Albert Lehninger, 4/Ed., Palgrave Macmillon.
2. Biochemistry by Lubert Stryer, W.H., Freeman & Company, New York.
3. Harper's Illustrated Biochemistry by R.K. Murray & D.K. Granner, 27/Ed, McGraw Hill.
4. Molecular Biology by J.D. Watson, The Benjamin/Cummings Company Inc.
5. Clinical Biochemistry by Herold Varley, CBS Publishers, New Delhi.
6. Text Book of Biochemistry with Clinical Correlations by Thomas & Devlin, A Wiley Medical Publication.
7. Clinical Chemistry Interpretation and Techniques by Alex Kaplan Lavernel L. & Szebo Kent E. Opheim Published Lea and Febiger.
8. Text Book of Pathology by Harsh Mohan, 5/Ed., Jaypee Brothers Medical Publishers (P) Ltd.
9. Clinical Biochemistry by S. P. Dandekar 2/Ed
10. Pathophysiology of Disease by Mephee & Lingappa, 2/Ed., Appleton & Lane.
11. Pharmaceutical Biochemistry by Sharma P.K & Dandiya P.C, Vallabh Prakashan.
12. Text book of Biochemistry by A. C. Deb
13. Human Biochemistry by Jamam, Orten publisher.
14. Biochemistry by U.Satyanarayan.
15. Varley's Practical Clinical Biochemistry by Harold Varley, 6/Ed., CBS Publishers, New Delhi.
16. Clinical Chemistry Interpretation and Techniques by Alex Kaplan Lavernel L. & Szebo Kent E. Opheim Published Lea and Febiger.
17. Mukherjee K.L. Medical Laboratory Technology. Tata McGraw Hill. New Delhi (Vol. I, II, III)
18. Deb A.C. Viva & Practicals in biochemistry. Central book agency. Calcutta.
19. Plummer D.T. An Introduction to Practical Biochemistry. Tata Mc-Graw Hill, New Delhi.
20. Godkar P.B. Clinical Biochemistry- Principles and Practice. Bhalani Publishing House, Bombay.

(Semester-I)

**Subject code:BP104**

**Subject: Anatomy and physiology-I**

**45 hrs. (3 hrs/ week)**

**THEORY**

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1. Basic terminology used in Anatomy and Physiology
2. Structure of cell , its component and their structure and functions
3. Elementary tissue of human body – Epithelial , Muscular , Nervous tissue , their characteristic

4. Blood composition and function of blood – RBC, WBC, Platelets, Haemopoiesis, mechanism of clotting, Anemia.
5. Lymphatic system- Lymph (composition, function, circulation), Lymph Nodes (structure and functions, spleen and its function )
6. Cardiovascular system-blood vessels , anatomy of heart , conducting system, cardiac cycle, and heart sounds, blood vessels and circulation, (pulmonary , coronary , and systemic and portal), ECG, blood pressure (maintenance and regulation), disorder of cardio vascular system
7. Endocrine system and their abnormalities ,
  - a. Pituitary glands
  - b. Thyroid glands and parathyroid glands
  - c. Adrenal glands
  - d. Pancreas
  - e. Gonads
8. Sense organ – eye, ear, tongue, skin, nose

**(Semester-I)**

**Subject code: BP109**

**Subject: Anatomy and physiology-I**

**45 hrs. (3 hrs/ week)**

**PRACTICAL**

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1. Brief introduction to use of Microscope
2. Study of instrument use in experimental Pharmacology
3. Determination of Hemoglobin content of own blood
4. Determination of RBC count of own blood
5. Determination of differential WBC count of own blood
6. Determination of blood group count of own blood
7. Determination of Vital Capacity
8. Determination of Blood Pressure
9. Determination of Bleeding Time
10. Determination of Breathing rate
11. Determination of Erythrocyte Sedimentation Rate (ESR)
12. Determination of Respiratory Volume
13. Study of gross Anatomy and Physiology of Circulatory system by models, charts, specimen
14. Study of gross Anatomy and Physiology of Lymphatic system by models, charts, specimen
15. Study of gross Anatomy and Physiology of Ear by models, charts, specimen
16. Study of gross Anatomy and Physiology of Eye by models, charts, specimen

**(Semester-II)**

**Subject code: BP204**

**Subject: Anatomy and physiology-II**

**45 hrs. (3 hrs/ week)**

**THEORY**

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1. Respiratory system
  - a. Mechanism and regulation of respiration
  - b. Transport of respiratory gases
  - c. Respiratory volumes and vital capacity
  - d. Disorders of respiratory system (types, definition and cause in brief )
2. Digestive system

- a. Physiology of salivary glands, stomach , liver, pancreas and intestine,
- b. Digestion of fat, carbohydrates and proteins
- c. Disorder of GIT (types , definition and cause in brief )
3. Urinary system
  - a. Kidney and structure of Nephron
  - b. Formation of urine
  - c. Disorder of urinary system (types, definition and cause in brief)
4. Muscular system-Characteristic and function of Muscle Tissue, Neurotransmitters, process of Nervous System (Sympathetic and Parasympathetic and Parasympathetic), fundamentals of neurotransmitters, process of Neuroconduction and Neurotransmission.
5. Reproductive system- Anatomy and Physiology of various parts of male and female Reproductive Systems, Physiology of Menstruation, Spermatogenesis, and Oogenesis.
6. Nervous System
  - a. Classification of Nervous System
  - b. Functional areas and function of Cerebrum, Cerebellum, Pons and Medulla, Thalamus and Hypothalamus, Basal Ganglia,
  - c. Spinal cord- structure and reflexes
  - d. Cranial nerves: name and functions
  - e. ANS: Anatomy and Physiology of Sympathetic and Parasympathetic Nervous System
  - f. Disorders of Nervous System (types, definition and cause in brief)

**(Semester-II)**

**Subject code:BP2010**

**Subject: Anatomy and physiology-II**

**45 hrs. (3 hrs/ week)**

**PRACTICAL**

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1. Recording of body temperature
2. Recording of Clotting Time
3. Recording of Electro Cardiogram
4. Study of Anatomy and Physiology of Human Skeleton
5. Study of Axial Skeleton
6. Study of Joints
7. Study of first aid measures
8. Determination of WBC count of own blood
9. Determination of deferential Leukocyte count of own blood
10. Study of gross Anatomy and Physiology of Digestive system by models , charts and specimen
11. Study of gross Anatomy and Physiology of Respiratory system by models , charts and specimen
12. Study of gross Anatomy and Physiology of Cardiovascular system by models , charts and specimen
13. Study of gross Anatomy and Physiology of Nervous System by models , charts and specimen
14. Study of gross Anatomy and Physiology of Urinary System by models , charts and specimen
15. Study of different of different family planning devices
16. Study of various disorder of CVS
17. Study of various disorder of GIT

## Recommended Books:

1. Goyal Ramesh K Basic of Human Anatomy and Physiology (with Practical) B.S.Shah Prakashan, Ahmedabad.
2. Tortora G.J. and Derrickson B. Principal of Anatomy and Physiology. 11 Ed. Join Weley and Sons Inc, N.J.
3. Kimber, Gray and Stackpole Anatomy and Physiology 11 Th Ed Macmillan Pub.Co. New York.
4. Chakrabarti B.K., Ghosh H.N. and Sahana S.N. Human Physiology (New Book Stall, Calcutta)
5. Gyton, A.C., Text Book of Medical Physiology(W.B. Saunders Co., Philadelphia)
6. Chatterjee C.C.: Human Physiology (Medical Allied Agency, Calcutta).
7. Chaudhari, A.R., Textbook of Practical Physiology. Paras Publishers, New Delhi.
8. Chaudhari, A.R., Viva in Physiology. Paras Publishers, New Delhi.
9. Difiore-Mariano, S.N., Atlas of Human Histology. Lea and Febiger, Philadelphia.
10. Garg, K., Bahel, I: and Shah, S, A., Practical Anatomy, Physiology and Biochemistry. B.S. Shah Prakashan, Pune.
11. Ross and willson text book of anatomy and physiology

### (Semester-I)

**Subject code:BP105**

**Subject: Pharmacognosy-I**

**45 hrs. (3 hrs/ week)**

#### **THEORY**

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1. Introduction to Pharmacognosy  
Historical development, modern concept & scope of Pharmacognosy significance of Pharmacognosy in various system of medicine viz Ayurveda, unani, siddlha, Homeopathy, Chinese medicine & Aromatherapy
2. Classification of crude drugs  
Based on alphabetical morphological, chemical & taxonomical methods, official & unofficial drugs, organized & unorganized drugs.
3. Adulteration & types of adulteration
4. Plant cell & it structure, study of plant tissue: parenchyma, collenchymas, sclerenchyma, xylem & phloem
5. Study of morphological & histological characters of crude drugs viz - stem barks, wood, leaf, flower, fruit & seed.
6. Botanical source, names, chemical constituents & uses of Ayurvedic drugs :  
Amla, Gokhru, Ashwagandha, Ashoka, Bramhi, Neem, Arjuna, Shatavari, Tulsi, Shankapuspi, Guggul, Kalmegh.

### (Semester-I)

**Subject code: BP109**

**Subject: Pharmacognosy-I**

**45 hrs. (3 hrs/ week)**

#### **PRACTICAL**

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- 1) To study compound microscope.
- 2) To understand the techniques of section cutting, staining, mounting & microchemical reagent.

- 3) To study the scheme for Pharmacognostic studies of crude drugs.
- 4) To study tissue & tissue system.
- 5) To study morphological & microscopical characteristics of Arjuna bark.
- 6) To study morphological & microscopical characteristics of Ashwagandha root.
- 7) To study morphological & microscopical characteristics of Tulsi leaf.
- 8) To study morphological characteristics of vitamin (Amala)
- 9) To study morphological characteristics of diuretic (Gokhru), antiseptic (Turmeric, Neem), antihypertensive (rauwolfia).
- 10) To study morphological & microscopical characteristics of Ashoka bark.
- 11) Determination of swelling factor of Isapgula seeds.
- 12) Isolation of starch from potatoes.
- 13) To study morphological & microscopical characteristics of sandal wood.
- 14) To study morphological & microscopical characteristics of Isapgula seeds.
- 15) To study morphological & microscopical characteristics of datura leaf.
- 16) To study morphological characteristics of shankpushpi, shatavari and liquorice.

### (Semester-II)

**Subject code: BP205**

**Subject: Pharmacognosy-II**

**45 hrs. (3 hrs/ week)**

#### **THEORY**

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- 1) Detailed study of cultivation, collection processing & storage of crude drugs: detailed study of method of cultivation, merits & demerits of cultivation.
- 2) Exogenous & endogenous factors affecting cultivation, quality of crude drugs & collection & processing (Garbling Drying, preservation & storage & preparation of crude drugs for commercial market.
- 3) Brief outline of occurrence, distribution, outline of isolation, identification tests, therapeutic effects & pharmaceutical application of carbohydrates, lipids, proteins, alkaloids, terpenoids, glycosides, volatile oils, tannins & resins
- 4) Pharmacognostic study of following crude drugs :  
 Carbohydrates – Agar, Isapgual, guar gum, alginate honey, pectin & starch  
 Lipid – castor oil, olive oil, neem oil, chaulmoogra oil, linseed oil.  
 Tannins – Black catechu, myrobalan, Gambier  
 Protein – gelatin  
 Resins – balsam of told, turmeric, asafoetida, podophyllum
- 5) Fibers : introduction, classification, chemical tests & uses of following fibers – cotton, jute, hemp, silk & wool
- 6) Brief study of drugs from microbial origin
  - 1) Antibiotics derived from amino acid metabolites – penicillin
  - 2) Polypeptide antibiotics derived from acetate metabolism – Tetracycline
  - 3) Polyenes – Griseofulvin
  - 4) Antibiotics derived from carbohydrate metabolism streptomycin

**PRACTICAL**

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1. Identification of fibers –cotton, jute, hemp, silk, wool.
2. Identification of following crude drug by morphological study and chemical test
  - a. Tragacanth
  - b. Acacia
  - c. Agar
  - d. Sodium alginate
  - e. Honey
  - f. Pectin
  - g. Starch
  - h. Guar gum
  - i. Gelatin
  - j. Gum karaya
3. To study the morphological and microscopical characteristics of cinchona bark.
4. To study the morphological and microscopical characteristics of cinnamon bark.
5. To study the morphological and microscopical characteristics of clove buds.
6. To study the morphological and microscopical characteristics of fennel fruit.
7. To study the morphological and microscopical characteristics of coriander fruit.
8. To study the morphological and microscopical characteristics of senna leaf.
9. To study the morphological and microscopical characteristics of cassia bark.
10. To study the morphological and microscopical characteristics of ipecac.
11. To study the morphological and microscopical characteristics of picorrhiza.
12. To study the morphological and microscopical characteristics of nux-vomica.
13. To study the morphological and microscopical characteristics of rauwolfia.
14. To study the morphological characteristics of carminative (ajowan, balckpepper, cardamom, nutmeg) and laxative(isaphghula, rhubarb)
15. To study the morphological and microscopical characteristics of ginger rhizome.
16. To study morphological & microscopical characteristics of ephedra stem

**RECOMMENDED BOOKS:**

1. Trease, G. E. and Evans, W. C., Pharmacognosy, W. B. Saunders Co.Ltd. Harourt Publishers Ltd., UK.
2. T.E. Wallis: Textbook of Pharmacognosy, CBS Publishers and Distributors New Delhi.
3. E.P. Clause; B.E. Tyler; Lea and Febiger: Pharmaconosy, Philadelphia USA.
4. L.R. Brady; V.E. Tyler; and Robbers J.E.; Pharmaconosy, Lea and Febiger Philadelphia USA.
5. V.D. Rangari: Pharmacognosy and Phytochemisty- Part-I and Part-II: Carreer Publications, Nashik.
6. M.P. Vickery and B. Vickery: Secondary Plant Metaboslim, Basingstoke, Macmillan.
7. C.K. Kokate; S.B. Gokhale; A.P. Purohit: Pharmacognosy, Nirali Prakashan Pune.

8. Atal C.K. and Kapur B.M. Cultivation and Utilization of Medicinal Plants, RRL, Jammu.
9. Chopra R.N., Nayar S. L. and Chopra I. C., Glossary of Indian Medicinal Plants CSIR, New Delhi.
10. Iyengar M.A., Study Of Crude Drugs, Manipal Power Press, Manipal.
11. Medicinal Plants of India, Zafar R., C.B.S. Publisher, New Delhi.
12. Kokate C.K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.
13. Khandelwal K.R, Practical Pharmacognosy, Nirali Prakashan Pune.

**(Semester-II)**

**Subject code: BP206**

**Subject : STATISTICS & COMPUTER APPLICATION IN PHARMACY**  
**THEORY 45 Hours (3 hrs. /week)**

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1. Basic concepts in Statistics
  - Meaning ,definition &scope of statics
  - Statically date ,data graphic, type of variables
  - Coactions & classification of data
  - Measurement of central tendency –arithmetic mean, mode, median.
  - Measurement of data –ranges mean deviation & slandered deviation.
2. Analysis of variance
  - Meaning &techniques- one way classification ,two way classification
3. Correlation & refraction analysis
  - Concept &method; signification ;lines of refraction properties of coefficient of variance &lines of regration method to find regration line
4. Experimented design &consumer testing
5. Statistical interferences
6. Probability

**COMPUTER APPLICATION IN PHARMACY**

**1. Computer fundamental**

- Over view of computer system
  - Classification of computer hardware general components of computer ;viz memory ;various input –output unit ;C.P.U. secondary storage unit ;low & high level language classification of computer on the basics of size & capacity ,printer ,Flow Chart .
  - Introduction to Operating System ,types of language and Computer network
2. **computer application in pharmacy** such as drug information strong & retrieval pharmacokinetics ; drug design ; crude drug ;identification , hospitals & clinical pharmacy pharmaceuticals analysis ; diagnosis & data analysis

**References:**

1. Introduction to Biostatistics & Computer Science – Y.I.Shah, Dr.A.R.Paradkar, M.G.Dhayagure
2. Stanford Bolton –Pharmaceutical statics
3. N.T.J.Bailey –Stastical method in biology
4. Computer and Commonsense (4th Edition) – Roger Hunt, John Shelly
5. Computer Today (3rd Edition) – Donald Landers.
6. Computer Medicine – S.Rose
7. Computer Applications in Pharmacy – William and fassett
8. MS-CIT – Computing Essentials – Timothy J.O’Leary, Linda I O’Leary.

**GONDWANA UNIVERSITY, GADCHIROLI**

**Four Year Degree Course in the Faculty of Medicine  
Board of Pharmaceutical Sciences**

**Course and Examination Scheme with Credit Grade System from the session 2012-13**

**III Semester B. Pharm. (Bachelor of Pharmacy)**

Course Code	Course Title	Teaching Scheme				Examination Scheme									
		Hrs. per week			No. of Credits	Theory					Laboratory				
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks CA	Total	Min Passing Marks	Max Marks	Max. Marks CA	Total	Min Passing Marks	
BP301	Physical Pharmacy –I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 302	Pharmaceutical Organic Chemistry-I	4	-	-	4	3	80	20	100	45	-	-	-	-	
BP 303	Pharmaceutical Analysis-I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 304	Pharmaceutical Microbiology& Immunology-I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 305	Pharmacology-I	3	-	-	3	3	80	20	100	45	-	-	-	-	
BP 306	Hospital and community Pharmacy	2	-	-	2	3	80	20	100	45	-	-	-	-	
<b>Laboratories</b>															
BP 307	Physical Pharmacy –I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 308	Pharmaceutical Organic Chemistry-I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 309	Pharmaceutical Analysis-I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 3010	Pharmaceutical Microbiology& Immunology-I	-	-	4	2	5	-	-	-	-	80	20	100	50	
BP 3011	Pharmacology-I	-	-	4	2	5	-	-	-	-	80	20	100	50	
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>--</b>				<b>600</b>				<b>500</b>		
<b>Semester Total</b>		<b>38</b>			<b>28</b>	<b>1100</b>									

**Four Year Degree Course in the Faculty of Medicine**  
**Board of Pharmaceutical Sciences**  
**Course and Examination Scheme with Credit Grade System from the session 2012-13**  
**IV Semester B. Pharm. (Bachelor of Pharmacy)**

Course Code	Course Title	Teaching Scheme				Examination Scheme								
		Hours per week			No. of Credits	Theory					Laboratory			
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks CA	Total	Min Passing Marks	Max Marks	Max. Marks CA	Total	Min Passing Marks
BP401	Physical Pharmacy-II	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 402	Pharmaceutical Organic Chemistry-II	4	-	-	4	3	80	20	100	45	-	-	-	-
BP 403	Pharmaceutical Analysis-II	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 404	Pharmaceutical Microbiology & Immunology-II	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 405	Pharmacology-II	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 406	Pharmaceutical Management	2	-	-	2	3	80	20	100	45	-	-	-	-
<b>Laboratories</b>														
BP 407	Physical Pharmacy-II	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 408	Pharmaceutical Organic Chemistry-II	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 409	Pharmaceutical Analysis-II	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 4010	Pharmaceutical Microbiology & Immunology-II	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 4011	Pharmacology-II	-	-	4	2	5	-	-	-	-	80	20	100	50
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>--</b>				<b>600</b>				<b>500</b>	
<b>Semester Total</b>		<b>38</b>			<b>28</b>	<b>1100</b>								

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 301</b>
<b>Title of the Course:</b>	<b>Physical Pharmacy - I (Pharmaceutics III)</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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- 1. Rheology:** Fundamentals of rheology, type of flow behavior, thixotropy, measurement of thixotropy, Measurement of various rheological properties, factors influencing rheology of dispersed system.
- 2. Complexation:** Classifications of complexes, methods of preparation and analysis, application.
- 3. Micromeritics:** Introduction and pharmaceutical importance, particle size and distribution, particle shape, particle volume, particle number, surface area, methods for determining particle size, particle volume measurement, specific surface, methods for determining surface area, Derived properties of powders-porosity, packing- arrangement-densities, bulkiness, flow properties of powders, angle of repose.
- 4. Surface active agent:** classification based on chemical nature and HLB scale, micelle formation and factor affecting micelle formation, micellar solubilization, factor affecting solubilization, application of solubilization.
- 5. Diffusion and dissolution:** Diffusion, steady state diffusion, diffusion controlled release-Higuchis equation, application of diffusion.
- 6. Suspension:** Theoretical consideration, flocculation and deflocculation, sedimentation parameter, role of wetting, evaluation of suspension.

#### References:

1. Remington's Pharmaceutical Sciences.
2. Theory & Practice of Industrial Pharmacy - Lachman, Libermann & Lea and Febiger
3. Alfred Martin, Physical Pharmacy and Pharmaceutical Sciences, Lippincott Williams and Wilkins
4. Bentley's Text Book of Pharmaceutics by Rewilins.
5. Physical Pharmaceutics by Milo Gibaldi.
6. Tutorial Pharmacy - Cooper & Gunn
7. Bean, beckett, carless, Advance in Pharmaceutical sciences, vol I And IV
8. Aulton, Pharmaceutics. The Science of dosage form design.
9. Text book of Physical pharmaceutics by C.V.S. Subrahmanyam

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 307</b>
<b>Title of the Course:</b>	<b>Physical Pharmacy - I (Pharmaceutics III)</b>
<b>Laboratory:</b>	<b>60 Hours (4 hrs. /week)</b>

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1. Determination of bulk density, true density, angle of repose and porosity of given sample.
2. Study effect of lubricant and glidant on flow property of powder or granules.
3. Study effect of particle size on angle of repose and flow property of powder.
4. Determination of molecular weight of polymer by using viscosity method.

- Determination of CMC of given surfactant.
- Determination of critical micelle concentration (CMC) of given surfactant through interfacial tension method.
- Determination of oil water partition coefficient and distribution of benzoic acid between two immiscible liquid phases.
- Determination of particle size of suspension by Andresen pipette method.
- Determination of partition coefficient of drug between two phases.
- Study sedimentation parameter of suspension and effect of various types of flocculating agents on sedimentation parameter.

**References:**

- Practical Physical Pharmacy by Dr.U.B.Hadkar, T.N.Vasudevan, K.S.Laddha,
- Practical Pharmaceutical Technology by – Engene
- Practicals in Physical Pharmacy by Dr. D. V. Derle.

**III Semester B. Pharm. (Bachelor of Pharmacy)**

<b>Course Code:</b>	<b>BP 302</b>
<b>Title of the Course:</b>	<b>Pharmaceutical organic chemistry- I</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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- Structure and properties-  
Concept of structure theory, atomic orbital, electronic configuration, hybridization, bonds, electronegativity, intermolecular and intramolecular forces.
- Detection and estimation of element (C,H,O,N,S and Halogen).
- Nomenclature ,physical properties , preparation, reaction, uses and detection of organic compound of the following classes (including mechanism of action wherever necessary) –
  - Alkane- conformation of n-butane, Grignard reagent, halogenations, combustion, pyrolysis.
  - Alkene- E1, E2, Markovnikov's rule, peroxide effect, ozonolysis.
  - Alkyne
  - Phenol- Kolbe's reaction, reamer-tiemann reaction,
  - Cycloalkane.

**Recommended Books:**

- Stereochemistry of Carbon Compounds by E.L.Eliel, 32 reprint 2005, Tata McGraw Hill Publishing Co.Ltd.New Delhi.
- Stereochemistry of organic Compound Principles and applications by Nasipuri, Revised Edition, New age international Publishers.
- Organic Chemistry: Morrison & Boyd.
- A Guidebook of reaction mechanism in organic chemistry: Peter Skyes.
- Fundamentals of Organic Chemistry : I.L.Finar ( vol.I &II)
- Principles of Organic Chemistry: T.A.Geissman.
- Basic principles of Organic Chemistry: John D.Roberts & Majorie C.Skyes.

8. Organic Chemistry: Stanley H. Pine.
9. Advanced Organic Chemistry: Reaction, Mechanism & Structure. By Jerry March
10. A Textbook of Organic Chemistry: Arun Bahl, B.S.Bahl.

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 308</b>
<b>Title of the Course:</b>	<b>Pharmaceutical organic chemistry- I</b>
<b>Laboratory:</b>	<b>60 Hours (4 hrs. /week)</b>

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1. To study the apparatus used in organic chemistry laboratory.
2. To determine the melting point of the organic compound.
3. To determine the boiling point of the organic compound.
4. To determine the solubility of the organic compound.
5. To detect the functional group present in organic compound.
6. To prepare Benzanilide from aniline.
7. To prepare 2,4,6-tri Bromophenol from phenol.

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 303</b>
<b>Title of the Course:</b>	<b>Pharmaceutical Analysis I</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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#### 1. Quantitative Analysis-

- Pharmaceutical analysis- definition and scope
- Different techniques of analysis
- Methods of expressing concentrations
- Primary and secondary standards
- Precision and accuracy.

#### 2. Acid-Base Titrations-

- Neutralization theory
- Neutralization curve
- Theory of indicators.

#### 3. Redox Titrations-

- Redox titration curves and detection of end point / Redox indicators
- Potassium permagnate
- Cerric ammonium sulphate
- Iodimetry and Iodometry.

#### 4. Gravimetric Analysis-

- Practical aspects of gravimetric analysis- precipitation, digestion, filtration, washing, drying / ignition of precipitate
- Co-precipitation and post-precipitation.

## 5. Complexometric Titration-

- Types of EDTA titrations
- Applications in pharmaceuticals
- Titration of mixtures
- Masking and De-masking agents
- Metal ion indicators.

### Recommended Books:

1. Vogel's Text Book of Quantitative Chemical Analysis, 6/Ed., Pearson Education.
2. Quantitative analysis by V.Alexyev, Student Edition, CBS Publisher & Distributor.
3. Fundamentals of Analytical Chemistry by Skoog, West, Holler, Hardesty, 8/ED., Thomson Brookscole.
4. Pharmaceutical Analysis by Higuchi, Reprint 2004, CBS Publisher & Distributors.
5. The Quantitative analysis of drugs by Garrat D C, 3/Ed., CBS Publisher & Distributors.
6. Quantitative analysis by Day RA & Underwood AL, 5/Ed., Prentice Hall of India Pvt. Ltd. New Delhi.
7. Analytical Chemistry by Christian GD, 6/ED., John Wiley & sons.
8. A Textbook of Pharmaceutical Analysis by Connors KA, 4/Ed., John Wiley & Sons.
9. Practical Pharmaceutical Chemistry Part-I by Beckett AH & Stanlake JB, 4/Ed., CBS Publisher & Distributors.
10. Handbook of Instrumental Techniques for Analytical Chemistry by Frank Settle, First Indian Reprint 2004, Pearson Education.
11. Pharmaceutical Analysis Vol.II & K.R.Mahadik, S.G.Wadodkar, H.N.More, Nirali Prakashan.

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 309</b>
<b>Title of the Course:</b>	<b>Pharmaceutical Analysis I</b>
<b>Laboratory:</b>	<b>60 Hours (4 hrs. /week)</b>

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#### 1. Preparations And Standardisations Of-

Potassium Permanganate Solution, Iodine Solution, EDTA Solution.

#### 2. Pharmaceutical Assay Of-

Aspirin IP, Boric Acid IP, Ammonium Chloride IP, Sodium Bicarbonate IP, Hydrogen Peroxide IP, Sodium Chloride IP, Potassium Chloride IP, Phenol IP.

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 304</b>
<b>Title of the Course:</b>	<b>Pharmaceutical Microbiology and Immunology – I</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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#### **1. Introduction to microbiology:**

Scope and applications to pharmaceuticals, Whittaker's five kingdom concept, classification of microbes into bacteria, rickettsia, actinomycetes, fungi, protozoa, algae and viruses. Historical developments – contributions of Alexander Fleming, Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch and Paul Ehrlich.

#### **2. Microscopy:**

Principles and applications of compounds, Dark-field, phase contrast and fluorescence microscope. Different parts of compound microscope, resolving power, magnification power, numerical aperture and working distance. Electron microscopy-SEM and TEM

#### **3. Microbiology of bacteria:**

Size, shape and arrangement, structural of bacterial cell, reproduction, growth, requirements, growth curve, culture media, measurement of bacterial growth, colony characteristic, methods for isolation, identification and preservation of microbial cultures.

Genetics – DNA, RNA, protein synthesis, transposons, plasmids, mutation – types of mutation, mutagenic agents.

Recombination in bacteria – conjugation, transformation, transduction, Replica plate technique.

#### **4. Microbiology of fungi:**

Introduction, classification, nutrition and reproduction.

#### **5. Microbiology of viruses:**

Introduction, general properties, structure, bacteriophage – lytic growth cycle and lysogeny, human viruses – cultivation and multiplication, quantitative determination.

#### **6. Microbial diseases (etiology, pathophysiology, transmission, prevention and treatment)**

Bacterial and viral diseases i.e Tuberculosis, AIDS, Leprosy, Syphilis, Influenza, Typhoid, Malaria, Cholera, Fungal Infections.

#### **Recommended Books:**

1. Pelczar and Reid, Microbiology.
2. Hugo And Russel, Pharmaceutical Microbiology
3. Kale and Bhusari, Applied Microbiology.
4. Prescott and Dunn, Industrial Microbiology.
5. Tortora, Microbiology.
6. Rawlins, Bentley's Textbook of Pharmaceutics.

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 310</b>
<b>Title of the Course:</b>	<b>Pharmaceutical Microbiology and Immunology – I</b>
<b>Laboratory:</b>	<b>60 Hours (4 hrs. /week)</b>

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1. Study of equipment and apparatus used in experimental microbiology.
2. Preparation and sterilization of culture media.
3. Aseptic transfer techniques.
4. Isolation of pure culture by streak plate method.
5. Isolation of pure culture by pour plate method.
6. Total count of microorganism by direct microscopy method.
7. Viable count of microorganism by plate count method.
8. Viable count of microorganism by spread plate method.
9. Smear preparation and fixation.
10. Study of bacterial morphology by simple staining.
11. Study of bacterial morphology by negative staining.
12. Study of bacterial morphology by gram staining.

#### References:

1. Pelczar and Reid, Microbiology.
2. Hugo and Russel, Pharmaceutical Microbiology
3. Kale and Bhusari, Applied Microbiology.
4. Prescott and Dunn, Industrial Microbiology.
5. Tortora, Microbiology.
6. Rawlins, Bentley's Textbook of Pharmaceutics.

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 305</b>
<b>Title of the Course:</b>	<b>Pharmacology - I</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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#### 1. General pharmacology

- A. Definition, introduction and scope of pharmacology
- B. Different routes of drug administration in humans and laboratory animals
- C. Pharmacokinetics
  1. Principles and applications of pharmacokinetics
  2. Absorbtion of drugs and factors affecting absorbtion
  3. Drug distribution: physiological barriers and factor affecting
  4. Biotransformation of drugs
  5. Excretion of drugs

- D. Pharmacodynamics: general, molecular and biochemical aspects of drug action receptors. Drug receptor interactions. Factors modifying drug effects.

Study of pharmacological action of following classes of drug with respect to classification of recently available drugs, mechanism of action, receptors, adverse effects, drug interaction, contraindication and therapeutic uses:

## 2. Pharmacology of drugs acting on ANS

- A. Introduction – neurohumoral transmission
- B. Adrenergic and cholinergic receptors
- C. Adrenergic drugs
- D. Adrenergic receptors blockers
- E. Cholinomimetics, anticholinesterases
- F. Anti-muscuranic agents
- G. Ganglionic blockers and stimulants
- H. Neuromuscular blocking agents

### Recommended Books:

1. Barar F.S.K. Essentials of pharmacotherapeutics 2<sup>nd</sup> Ed. S Chand & Co. Ltd. New Delhi.
2. Katzung B.G. Basic and Clinical Pharmacology 6<sup>th</sup> Ed. Prentice Hall International Inc. London.
3. Rosenteld, G.C., Loose Mitchell and Jones J.B. Lippincott Williams & Wilkins U.S.A. Board Review Series Pharmacology 3<sup>rd</sup> Ed.
4. Rang, H.R. Dale, M. Pharmacology 2<sup>nd</sup> Ed. E.L.B.S, London.
5. Brunton L. L. & Others Goodman And Gilman's The Pharmacological Basis Of Therapeutics. 11 Ed. Mc Graw Hill Medical Pub. Div. New York.
6. Girdwood R.H. Clinical Pharmacology 25<sup>th</sup> Ed Varghese Publishing House, Bombay
7. Gandhi T.P. , Goyal R. K. And Mehta A.A. Derasari And Gandhi Elements Of Pharmacology 11<sup>th</sup> Ed. B.S. Shah Prakashan, Ahmedabad.
8. Aviado, Doningo M Krantz And Cars Pharmacologic Principles Of Medical Practice 7<sup>th</sup> Ed. The Williams And Wilkins Co. , Baltimore, U.S.A

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 310</b>
<b>Title of the Course:</b>	<b>Pharmacology - I</b>
<b>Laboratory:</b>	<b>60 Hours (4 hrs. /week)</b>

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1. Introduction to experimental pharmacology.
  2. Study of laboratory animals used in experimental pharmacology.
  3. Study of laboratory appliances used in experimental pharmacology.
  4. Preparation of various physiological salts solution used in experimental pharmacology.
  5. Demonstration of rat dissection in general.

6. To isolate ileum, fundus, trachea, uterus and anococcygeous muscle and to record concentration response curve using these tissues of rats.
7. Demonstrate the effect of cholinergic agents on rabbit eye.
8. Demonstrate the effect of anticholinergic agents on rabbit eye.
9. Demonstrate the effect of local anesthetic on rabbit eye.

### III Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP 306</b>
<b>Title of the Course:</b>	<b>Hospital and Community Pharmacy</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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**1. Status of Health Delivery System in India.**

Defination and role of hospital in the health delivery system, Types of hospital.

**2. Hospital Pharmacy.**

Defination, function, objective, location, layout and flow chart of material and men, personnel, and facilities required including equipment.

**3. Drug distribution in hospital.**

Out-patient dispensing, inpatient dispensing, types of drug distribution system, floor stock system, satellite pharmacy, bed side pharmacy, dispensing of controlled drug.

**4. Central sterile supply unit and their management.**

Types of material for sterilization, packing of material prior to sterilization, sterilization equipment.

**5. Hospital drug policy.**

Pharmacy and therapeutic committee ( PTC), Hospital formulary.

**6. Drug information service.**

Source of information on drug, disease, treatment schedules and computerized services eg. ( MEDLINE).

**7. Community Pharmacy.**

Concept, development of community pharmacy in india , role of community pharmacist, patient counseling, interaction with doctor.

**References:**

1. Text Book of Drug Store and Business Management by R.M. Mehta
2. Hospital Pharmacy - by W.Hassan
3. Text Book of Hospital Pharmacy - by Merchant & Qadry
4. Text book of hospital and clinical pharmacy by Chunawala and Paradakar
5. Text book of hospital and clinical pharmacy by Nand and Khar

## IV Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP401</b>
<b>Title of the Course:</b>	<b>Physical Pharmacy - II (Pharmaceutics IV)</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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- 1. Solubility and distribution Phenomena:** Solubility definitions, expressions, solvent solute interactions, polar solvents-non polar solvents-semi polar solvents, solubility of liquids in liquids, ideal and real solutions, non ideal solution, solubility of solids in liquids, solubility of salts in water-solubility of slightly soluble, strong and weak electrolytes, factors affecting solubility, phase rule and phase equilibria, phase diagram-one and two component.
- 2. Interfacial Phenomenon :** Cohesion, adhesion , Surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at solid liquid-interfaces, adsorption isotherm, electrical properties of interface, origin of charge, electrical double layer, Nernst and zeta potential, effect of electrolyte, wetting phenomenon and detergency.
- 3. Colloidal Dispersion:** Definition, type, classification of colloids, properties of colloid-optical, kinetics, electrical, stabilization of colloids and protective colloids.
- 4. Kinetics and drug stability:** Rates and orders of reaction and molecularity of reaction, half life determination, influence of temperature, light, solvent and other factors on reaction rates. Accelerated stability analysis.
- 5. Emulsion:** Type, detection thermodynamic consideration theories of emulsification, stability of emulsion, assessment of emulsion shelf life.

### References:

10. Remington's Pharmaceutical Sciences.
11. Theory & Practice of Industrial Pharmacy - Lachman, Libermann & Lea and Febiger
12. Alfred Martin, Physical Pharmacy and Pharmaceutical Sciences, Lippincott Williams and Wilkins
13. Bentley's Text Book of Pharmaceutics by Rewilins.
14. Physical Pharmaceutics by Milo Gibaldi.
15. Tutorial Pharmacy - Cooper & Gunn
16. Bean, beckett, carless, Advance in Pharmaceutical sciences, vol I And IV
17. Aulton, Pharmaceutics. The Science of dosage form design.
18. Text book of Physical pharmaceutics by C.V.S. Subrahmanyam

## IV Semester B. Pharm. (Bachelor of Pharmacy)

<b>Course Code:</b>	<b>BP407</b>
<b>Title of the Course:</b>	<b>Physical Pharmacy - II (Pharmaceutics IV)</b>
<b>Laboratory:</b>	<b>60 Hours (4 hrs. /week)</b>

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1. Determination of heat of solution of benzoic acid
2. Determination of heat of solution of boric acid.
3. Determination of relationship between dielectric constant of solvent and solubility of drugs.
4. Determination of Kraft point and cloud point of given surfactant

5. To plot ternary phase diagram
6. To plot temperature composition diagram of phenol water system
7. To plot adsorption isotherm.
8. Determination of surface tension, interfacial tension and spreading coefficient of given liquid using drop number method(paraffin and benzene)
9. Determination of surface tension, interfacial tension between two immiscible liquids and to calculate spreading coefficient of given sample (oil & chloroform)
10. Study effect of electrolyte and non solvent on cloud point of given surfactant.
11. Determination of mean globule diameter of emulsion
12. Study the effect of phase volume ratio on stability of emulsion.

**Recommended Books:**

1. Practical Physical Pharmacy by Dr.U.B.Hadkar, T.N.Vasudevan, K.S.Laddha,
2. Practical Pharmaceutical Technology by – Engene
3. Practicals in Physical Pharmacy by Dr. D. V. Derle.

**IV Semester B. Pharm. (Bachelor of Pharmacy)**

<b>Course Code:</b>	<b>BP402</b>
<b>Title of the Course:</b>	<b>Pharmaceutical Organic Chemistry- II</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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1. Nomenclature ,physical properties , preparation, reaction, uses and detection of organic compound of the following classes (including mechanism of action wherever necessary):
  - Aldehyde and Ketone- Cannizzaro reaction.
  - Amine- Halfmann rearrangement, diazonium salt, analysis of amine.
  - Alkyl halide- SN1, SN2.
  - Alcohol and ether,
  - Carboxylic acid- HVZ Reaction.
2. Introduction to Chemical reaction, Functional group, types of Organic reaction, Substrate and Reagent, Factors affecting organic reactions.
3. Aromatic hydrocarbon, Huckel rule, structure of benzene, resonance, electrophilic aromatic substitution reaction.
4. Stereochemistry- Stereoisomerism, Enantiomers, Diastereomers, Racemic modification and resolution, Geometric isomerism, Bayer strain theory.

**Recommended Books:**

11. Stereochemistry of Carbon Compounds by E.L.Eliel, 32 reprint 2005, Tata McGraw Hill Publishing Co.Ltd.New Delhi.
12. Stereochemistry of organic Compound Principles and applications by Nasipuri, Revised Edition, New age international Publishers.
13. Organic Chemistry: Morrison & Boyd.

14. A Guidebook of reaction mechanism in organic chemistry: Peter Skyes.
15. Fundamentals of Organic Chemistry : I.L.Finar ( vol.I &II)
16. Principles of Organic Chemistry: T.A.Geissman.
17. Basic principles of Organic Chemistry: John D.Roberts & Majorie C.Skyes.
18. Organic Chemistry: Stanley H. Pine.
19. Advanced Organic Chemistry: Reaction, Mechanism & Structure. By Jerry March
20. A Textbook of Organic Chemistry: Arun Bahl, B.S.Bahl.

#### **IV Semester B. Pharm. (Bachelor of Pharmacy)**

**Course Code:** BP408  
**Title of the Course:** Pharmaceutical Organic Chemistry- II  
**Laboratory:** 60 Hours (4 hrs. /week)

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1. To determine the melting point of the organic compound.
2. To detect the functional group present in organic compound.
3. To identify the organic compound and prepare its derivative.
4. To synthesize Benzamide from Ammonia and Benzoyl chloride.
5. To prepare m-Dinitrobenzene from Nitrobenzene.
6. To prepare Benzoic acid from Benzanilide.
7. To prepare Anthranilic acid from Phthalamide.
8. To synthesize p-iodonitrobenzene from p-nitroaniline.

#### **Recommended books:**

1. Stereochemistry of Carbon Compounds by E.L.Eliel, 32 reprint 2005, Tata McGraw Hill Publishing Co.Ltd.New Delhi.
2. Stereochemistry of organic Compound Principles and applications by Nasipuri, Revised Edition, New Age International Publishers.
3. Organic Chemistry: Morrison & Boyd.
4. A Guidebook of reaction mechanism in organic chemistry: Peter Skyes.
5. Fundamentals of Organic Chemistry : I.L.Finar ( vol.I &II)
6. Principles of Organic Chemistry: T.A.Geissman.
7. Basic principles of Organic Chemistry: John D.Roberts & Majorie C.Skyes.
8. Organic Chemistry: Stanley H. Pine.
9. Advanced Organic Chemistry: Reaction, Mechanism & Structure. By Jerry March
10. A Textbook of Organic Chemistry: Arun Bahl, B.S.Bahl.

#### **IV Semester B. Pharm. (Bachelor of Pharmacy)**

**Course Code:** BP403  
**Title of the Course:** Pharmaceutical Analysis II  
**Theory:** 45 Hours (3 hrs. /week)

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## 1. Refractometry-

- Introduction
- Factors affecting refractive index
- Specific and molar refraction,
- Instrumentation
- Applications.

## 2. Polarimetry-

- Introduction
- Factors affecting angle of rotation
- Instrumentation
- Applications.

## 3. Potentiometry-

- Electrochemical cell
- Standard electrode potential
- Mechanism of electrode potential
- Types of electrode- a) Reference electrodes- hydrogen, calomel, silver/silver chloride electrode. b) Indicator electrodes- Glass, Redox, Ion selective electrode
- Method of end-point detection
- Advantages and application.

## 4. Conductometry-

- Introduction
- Important terms like- conductance, specific conductance, specific resistance, equivalent and molecular conductance
- Factors affecting conductance
- Measurement of conductance
- Instrumentation
- Advantages, dis-advantages and applications.

## 5. Thermal Analysis-

### a) Thermaogravimetry (Tg)-

- Introduction
- TG curves
- Factors affecting TG curves
- Instrumentation and applications.

### b) Differential Thermal Analysis (DTA)-

- Introduction
- Theories of DTA
- Factors affecting DTA curves
- Instrumentation and applications.

## Recommended Books:

1. Vogel's Text Book of Quantitative Chemical Analysis, 6/Ed., Pearson Education.

2. Quantitative analysis by V.Alexyev, Student Edition, CBS Publisher & Distributor.
3. Fundamentals of Analytical Chemistry by Skoog, West, Holler, Hardesty, 8/ED., Thomson Brooks/Cole.
4. Pharmaceutical Analysis by Higuchi, Reprint 2004, CBS Publisher & Distributors.
5. The Quantitative analysis of drugs by Garrat D C, 3/Ed., CBS Publisher & Distributors.
6. Quantitative analysis by Day RA & Underwood AL, 5/Ed., Prentice Hall of India Pvt. Ltd. New Delhi.
7. Analytical Chemistry by Christian GD, 6/ED., John Wiley & sons.
8. A Textbook of Pharmaceutical Analysis by Connors KA, 4/Ed., John Wiley & Sons.
9. Practical Pharmaceutical Chemistry Part-I by Beckett AH & Stanlake JB, 4/Ed., CBS Publisher & Distributors.
10. Handbook of Instrumental Techniques for Analytical Chemistry by Frank Settle, First Indian Reprint 2004, Pearson Education.
11. Pharmaceutical Analysis Vol.II & K.R.Mahadik, S.G.Wadodkar, H.N.More, Nirali Prakashan.

#### **IV Semester B. Pharm. (Bachelor of Pharmacy)**

<b>Course Code:</b>	<b>BP409</b>
<b>Title of the Course:</b>	<b>Pharmaceutical Analysis I</b>
<b>Laboratory:</b>	<b>60 Hours (4 hrs. /week)</b>

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##### **1. Conductometric Titrations Of-**

- Strong acid Vs Strong base
- Strong acid Vs Weak base
- Weak acid Vs Strong base
- Weak acid Vs Weak base
- Very weak acid Vs Strong base
- Mixture of Weak and Strong acid Vs Strong base.

##### **2. Potentiometric Titrations Of-**

- Strong acid Vs Strong base
- Weak acid Vs Strong base.

**3.** Determination of concentration and PKa of weak acid using pH meter.

**4.** Potentiometric assay as specified in IP (min. two)

#### **Recommended Books:**

1. Vogel's Text Book of Quantitative Chemical Analysis, 6/Ed., Pearson Education.
2. Quantitative analysis by V.Alexyev, Student Edition, CBS Publisher & Distributor.
3. Fundamentals of Analytical Chemistry by Skoog, West, Holler, Hardesty, 8/ED., Thomson Brooks/Cole.
4. Pharmaceutical Analysis by Higuchi, Reprint 2004, CBS Publisher & Distributors.
5. The Quantitative analysis of drugs by Garrat D C, 3/Ed., CBS Publisher & Distributors.

6. Quantitative analysis by Day RA & Underwood AL, 5/Ed., Prentice Hall of India Pvt. Ltd. New Delhi.
7. Analytical Chemistry by Christian GD, 6/ED., John Wiley & sons.
8. A Textbook of Pharmaceutical Analysis by Connors KA, 4/Ed., John Wiley & Sons.
9. Practical Pharmaceutical Chemistry Part-I by Beckett AH & Stanlake JB, 4/Ed., CBS Publisher & Distributors.
10. Handbook of Instrumental Techniques for Analytical Chemistry by Frank Settle, First Indian Reprint 2004, Pearson Education.
11. Pharmaceutical Analysis Vol.II & K.R.Mahadik, S.G.Wadodkar, H.N.More, Nirali Prakashan.

#### **IV Semester B. Pharm. (Bachelor of Pharmacy)**

<b>Course Code:</b>	<b>BP404</b>
<b>Title of the Course:</b>	<b>Pharmaceutical Microbiology and Immunology – II</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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1. Sterilization:  
Different methods: dry heat, moist heat, gaseous, radiation and filtration, sterilization indicators, D-value, Z-value, sterility testing of pharmaceutical product as per I.P.
2. Disinfections:  
Chemical classification of different disinfectants, dynamics of disinfectants and factors affecting on disinfectant action, evaluation of disinfectant, phenol coefficient test.
3. Aseptic techniques:  
Design of aseptic area, sources of contamination in aseptic area and method of prevention, laminar air flow.
4. Immunology:
  - a. Fundamentals of immunology:  
Microbial flora of human body, portal entry of micro-organism, microbial pathogenicity, virulence, exotoxins, endotoxins. Defence mechanism of host specific and non specific. Types of immunity, antigens, antibody, complement proteins.
  - b. Antigen-antibody reactions:  
Introduction, Precipitation, Agglutination, Complement Fixation, Immunoelectrophoresis, Immunofluorescence, ELISA, Radioimmunoassay.
  - c. Hypersensitivity reactions:  
Introduction, immediate and delayed hyper sensitivity, type-I,II,III,IV hypersensitivity.
  - d. Preparation of vaccines and sera:  
Introduction, manufacturing and quality control. Preparation of vaccines (BCG, TAB, DPT, Polio, MMR, Rabies), Toxoids (Tetanus and Diphtheria) and Sera (Anti-Bacterial, Anti-Viral, Anti-Toxin and Anti- Venum). Diagnostic Agents – Tuberculin, Schick Tests.

### **Recommended Books:**

7. Pelczar and Reid, Microbiology.
8. Hugo And Russel, Pharmaceutical Microbiology
9. Kale and Bhusari, Applied Microbiology.
10. Prescott and Dunn, Industrial Microbiology.
11. Tortora, Microbiology.
12. Rawlins, Bentley's Textbook of Pharmaceutics.

### **IV Semester B. Pharm. (Bachelor of Pharmacy)**

<b>Course Code:</b>	<b>BP410</b>
<b>Title of the Course:</b>	<b>Pharmaceutical Microbiology and Immunology – II</b>
<b>Laboratory:</b>	<b>60 Hours (4 hrs. /week)</b>

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1. Biochemical tests (IMViC tests).
2. Antimicrobial sensitivity testing
3. Determination of MIC.
4. Microbiological assays of anti-biotics by cup plate method (minimum two antibiotics).
5. Sterility testing by direct transfer.
6. Sterility testing by membrane filtration methods.
7. Sterility testing for powdered drug sample.
8. Bacteriological examination of air.
9. Bacteriological examination of water and milk.

### **IV Semester B. Pharm. (Bachelor of Pharmacy)**

<b>Course Code:</b>	<b>BP405</b>
<b>Title of the Course:</b>	<b>Pharmacology-II</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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Study of pharmacological action of following classes of drug with respect to classification of recently available drugs, mechanism of action, receptors, adverse effects, drug interaction, contraindication and therapeutic uses:

- 1. Pharmacology of drugs acting on CVS**
  - A. Antihypertensive drugs
  - B. Antianginal drugs
  - C. Antiarrhythmic drugs
  - D. Drugs used for CHF
  - E. Drugs used in hyperlipidemia
  - F. Drug therapy of shock
- 2. Pharmacology of drugs acting on renal system**
  - A. Diuretics
  - B. Anti-diuretics

### **3. Autocoids and their blockers**

- A. Histamine and anti-histaminics
- B. 5-hydroxytryptamine and its antagonist
- C. Prostaglandins and non-steroidal anti-inflammatory drugs, antipyretic, analges

### **4. Pharmacology of drugs acting on haemopoetic system**

- A. Haematinic
- B. Coagulants and anti-coagulants
- C. Fibrinolytic and anti-platelets agents

#### **Recommended Books:**

1. Barar F.S.K. Essentials of pharmacotherapeutics 2<sup>nd</sup> Ed.S Chand & Co. Ltd. New Delhi.
2. Katzuny B.G. Basic and Clinical Pharmacology 6<sup>th</sup> Ed. Prentice Hall International Inc. London.
3. Rosenteld, G.C., Loose Mitchell and Jones J.B. Lippincott Williams & Wilkins U.S.A. Board Review Series Pharmacology 3<sup>rd</sup> Ed.
4. Rang, H.R. Dale, M. Pharmacology 2<sup>nd</sup> Ed. E.L.B.S, London.
5. Brunton L. L. & Others Goodman And Gilman's The Pharmacological Basis Of Therapeutics. 11 Ed. Mc Graw Hill Medical Pub. Div. New York.
6. Girdwood R.H. Clinical Pharmacology 25<sup>th</sup> Ed Varghese Publishing House, Bombay
7. Gandhi T.P. , Goyal R. K. And Mehta A.A. Derasari And Gandhi Elements Of Pharmacology 11<sup>th</sup> Ed. B.S. Shah Prakashan, Ahmedabad.
8. Aviado, Doningo M Krantz And Cars Pharmacologic Principles Of Medical Practice 7<sup>th</sup> Ed. The Williams And Wilkins Co. , Baltimore, U.S.A

#### **IV Semester B. Pharm. (Bachelor of Pharmacy)**

<b>Course Code:</b>	<b>BP411</b>
<b>Title of the Course:</b>	<b>Pharmacology-II</b>
<b>Laboratory:</b>	<b>60 Hours (4 hrs. /week)</b>

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1. To demonstrate per oral (gavage) route of drug administration in rats and mice.
2. To demonstrate parenteral route of drug administration.
3. To demonstrate blood withdrawal by puncture of retro orbital plexus from rats.
4. To demonstrate blood withdrawal from tail vein of rats.
5. To record cumulative dose response curve (CDRC) using rat ileum.
6. To record CDRC using rat fundus preparation.
7. To demonstrate anti-histaminic activity using histamine aerosol model.
8. To find unknown concentration of Ach by matching bioassay using rat ileum.

#### **Recommended books:**

1. Barar F.S.K. Essentials of pharmacotherapeutics 2<sup>nd</sup> Ed.S Chand & Co. Ltd. New Delhi.
2. Katzuny B.G. Basic and Clinical Pharmacology 6<sup>th</sup> Ed. Prentice Hall International Inc. London.

3. Rosenteld, G.C., Loose Mitchell and Jones J.B. Lippincott Williams & Wilkins U.S.A. Board Review Series Pharmacology 3<sup>rd</sup> Ed.
4. Rang, H.R. Dale, M. Pharmacology 2<sup>nd</sup> Ed. E.L.B.S, London.
5. Brunton L. L. & Others Goodman And Gilman's The Pharmacological Basis Of Therapeutics. 11 Ed. Mc Graw Hill Medical Pub. Div. New York.
6. Girdwood R.H. Clinical Pharmacology 25<sup>th</sup> Ed Varghese Publishing House, Bombay
7. Gandhi T.P. , Goyal R. K. And Mehta A.A. Derasari And Gandhi Elements Of Pharmacology 11<sup>th</sup> Ed. B.S. Shah Prakashan, Ahmedabad.
8. Aviado, Doningo M Krantz And Cars Pharmacologic Principles Of Medical Practice 7<sup>th</sup> Ed. The Williams And Wilkins Co. , Baltimore, U.S.A

#### **IV Semester B. Pharm. (Bachelor of Pharmacy)**

<b>Course Code:</b>	<b>BP406</b>
<b>Title of the Course:</b>	<b>Pharmaceutical Management</b>
<b>Theory:</b>	<b>45 Hours (3 hrs. /week)</b>

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**1. Drug house management.**

Selection of site for a drug store, layout of a drug store, legal aspect of drug store , documents required to open drug store.

**2. Management.**

Concept of management, principle of management, function of management, level of management.

**3. Material management.**

Inventory control , objective, function, techniques to control inventory.

**4. Pharmaceutical marketing.**

Function, buying, selling, transportation, storage, channel of distribution, wholesale, retail, departmental store, multiple shop, and mail order business.

**5. Salesmanship.**

Objective and technique of sale promotion, salesmanship, advertising, market research.

**6. Accountancy.**

Accounting concept, book-keeping, types of account, book of original entry, journal, ledger, cash book.

**7. Human resource management.**

Recruitment training evaluation of pharmacist and compensation to pharmacist.

**References:**

1. M. C. Smith, Principles of Pharmaceutical Marketing, CBS publisher, New Delhi.
2. H. Weihrich & H. Koontz, Management: A global perspectives, Tata McGraw Hill Publishing Co.Ltd. Delhi.
3. Eric T. Herfindel, Dick. R. Gourley. Textbook of therapeutics, Drug & disease management, Lippincott Williams & Wilkins, New York.
4. Text Book of Drug Store and Business Management by R.M. Mehta.

5. Kumar, Abbas, Fausto, Mitchell, Robbins Basic Pathology. Elsevier Health Scientific Marketing, New Delhi.
6. Statistics for management by Richard I. Levin.
7. Personnel management by Arun Monappa.

**Note:** *Syllabus for V to VIII Semester shall be prescribed in due course of time.*

**V Semester B.Pharm [Course and Examination Scheme with Credit Grade System]**

Subject Code	Subject	Teaching Scheme				Examination Scheme								
		Hours per week			No. of Credits	Theory					Practical			
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks
BP501	Pharmaceutical Engineering-I	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 502	Pharmaceutical organic chemistry-III	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 503	Pharmacology-III	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 504	Pharmacognosy –III	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 505	Biotechnology	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 506	Biopharmaceutics	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 507	Pharmaceutical Engineering-I	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 508	Pharmaceutical organic chemistry-III	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 509	Pharmacology-III	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 5010	Pharmacognosy –III	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 5011	Biotechnology	-	-	4	2	5	-	-	-	-	80	20	100	50
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>28</b>				<b>600</b>				<b>500</b>	
	<b>Semester total</b>								<b>1100</b>					

**B.Pharm-III (Semester- V)**  
**PHARMACETICAL ENGINEERING-I (BP-501)**

SN	Topics	Hrs
01	<b>Size Reduction</b> Theories & objective of size reduction, advantage & disadvantage, mechanism, modes of stress applied in size reduction, classification of size reduction equipment, factor affecting size reduction.	7
02	<b>Size Separation</b> Definition, standard for powder, types of screen, modes of motion in size separation, equipment for size separation- shaking screen, air separator, cyclone separator, rotex screen, bag filter.	8
03	<b>Mixing</b> Types of mixture, factor influencing mixing, equipment used in mixing of powder, liquid & semisolid.	6
04	<b>Conveying ( transportation of solid)</b> Classification of conveyor, Conveyor- principle, construction, working, application, advantage & disadvantage, storage of solid.	6
05	<b>Flow of fluid</b> Valves, transportation of fluid- reciprocating rotary pump, rotary & centrifugal pump, miscellaneous pump, fluid static, dynamics, flow rate measuring devices- orifice meter, venture meter, pitot tube rotameter.	9
06	<b>Centrifugation</b> Principle, classification of centrifuges, equipment's.	3
07	<b>Filtration</b> Mechanism & types of filtration, theories of filtration, factor influencing filtration, filter aid's ,study of filter press, meta filter, rotary drum filter & disc filter.	6

## B.Pharm-III (Semester- V)

### PHARMACETICAL ENGINEERING-I PRACTICALS (BP-507)

#### PRACTICALS:

1. To determine thickness area using batch settling method.
2. To study effect of centrifuge time on cake volume of the given suspension sample.
3. To study effect of centrifuge speed on cake volume of the given suspension sample.
4. To determine drag coefficient for particle settling method.
5. To determine hardness of water sample.
6. To study sedimentation behavior using suspending agent.
7. To study effect of ball mill on particle size.
8. To study particle sedimentation using stokes law.
9. To study filter aid on rate of filtration.
10. To study the particle size distribution.
11. To study of efficiency of pump.
12. To study factors affecting filtration process.

#### REFERENCE BOOKS:

1. W. McCabe, J.C. Smith, P. Harriot, "Unit operation of chemical Engineering". McGraw Hill, (1993).
2. E. Gonderton, "Pharmaceutical unit operation", Academic press.
3. Perry's, "Handbook of chemical engineering", McGraw Hill,(1984)
4. A.R. Paradkar, "Introduction to Pharmaceutical Engineering", Nirali prakashan, 10<sup>th</sup> Ed.2007
5. K. Sambamurthy-"Pharmaceutical Engineering", New Age international Pvt Ltd.
6. G.G Brown- "Unit operation", CBS publishers & Distributers, New Delhi.
7. W.I. Badger and J.T. Banchero, "Introduction to Chemical engineering"; McGraw Hill, Tata-McGraw Hill Publishing Company Ltd, New Delhi.(1988)
8. N.G.Padya., C.S.Shaha-"Elements of Heat Engines", Charotar Book Stall, Tulsi Sadan, Anand (W. Rly), India.
9. Donald P. Eckman –"Industrial Instrumentation", Seventh Wiley Eastern, Reprint, 1983, Wiley Eastern Ltd, 4835/24, Ansari Road, Daryaganj, New Delhi.
10. C.V.S Subramanyam- "Pharmaceutical Engineering principle & practices", Vallabh prakashan New Delhi.
11. Warren McCabe, Julian Smith and Peter Harriott, "Unit operations of chemical engineering", McGraw Hill Inc., Singapore.

**B.Pharm-III (Semester- V)**  
**PHARMACEUTICAL ORGANIC CHEMISTRY-III (BP-502)**

SN	Topics	Hrs
01	<p><b>Heterocyclic compounds:</b>            Structure, nomenclature, synthesis and properties including reaction mechanism, stereochemical considerations and pharmaceutical uses of the following heterocyclic compounds:            Pyrrole, Furan, Thiophene, Imidazole, Oxazole, Pyridine, Pyrimidine, Quinoline, Isoquinoline, Indole, Purine and Phenothiazine.</p>	10
02	<p><b>Polynuclear aromatic compounds:</b>            Structure, nomenclature, synthesis, properties and stereochemistry of Naphthalene, Anthracene and Phenanthrene.</p>	05
03	<p><b>Carbohydrate:</b>            Classification, structure and reactions of Glucose, configuration of aldoses, cyclic structure of D-glucose, mutarotation and conformations, structure of Maltose, Sucrose, Starch.</p>	10
04	<p><b>Amino acids and Proteins:</b> classification, isolation, and synthesis, of amino acids. Structure of natural amino acids, isoelectric point, peptide and polypeptides. Protein synthesis, methods of C-terminal and N- terminal amino acids determination in protein. Structures of proteins.</p>	10
05	<p><b>Lipids:</b>            Classification and general chemistry of lipids and fats, their properties and characterization, fatty acids and their Reactions. Glycoprotein, lipoprotein, Phospholipids, Spingolipids, fixed oils and waxes.</p>	10

## B.Pharm-III (Semester- V)

### PHARMACEUTICAL ORGANIC CHEMISTRY-III PRACTICALS (BP-508)

1. Synthesis of following heterocyclic compounds:

Benzimidazole from o-phenylenediamine and formic acid.

Quinoline from Aniline by Skraup method.

2-phenyl indole from acetophenone and phenyl hydrazine.

2,3- diphenyl Quinoxaline from Benzil and o-phenylenediamine

Eosin from phthalic anhydride and resorcinol

2. Analysis of fixed oils and fats (I.P. method)

Acid value

Saponification value

Iodine value

3. Quantitative determination of organic compounds via functional groups

Carboxyl group by alkalimetry.

Phenolic group by bromination method

Ester group by alkalimetry

Amino group by bromination method

#### REFERENCES:

1. Bahal and B.S. Bahl, A Text Book of Organic Chemistry, S. Chand & Company Ltd., New Delhi
2. A.I. Vogel, Elementary Practical Organic Chemistry, Part III, Quantitative Organic Analysis, Second Edition, CBS Publishers and Distributors, Delhi.
3. G. Chatwal, Chemistry of Natural Product, Vol. I & II, Himalaya Publication, Bombay.
4. O.P. Agrawal, Chemistry of Natural Product, Vol. I & II, Krishna Publication, Meerut.
5. R.K. Bansal, Heterocyclic Chemistry, New Age International Publishers, New Delhi.
6. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice-Hall of India Pvt. Ltd, New Delhi,
7. L. Finar, Organic Chemistry, Vol. I & II, ELBS, London.
8. Indian Pharmacopoeia 2010

**B.Pharm-III (Semester- V)  
Pharmacology-III (BP-503)**

SN	Topics	Hrs
	<b>Study of Pharmacology of following classes of drug with respect to classification including recently available drugs, mechanism of action, receptors, adverse effects, Drug interaction, contraindication and therapeutic uses.</b>	
01	<b>1 Pharmacology of drug acting on CNS</b> A. Introduction: cell signaling, neurotransmission, central neurotransmitters B. Alcohol and Alcoholism C. General anesthetics D. Sedatives and Hypnotics E. Anticonvulsants F. Antipsychotics, Antidepressants and Anxiolytics G. Drug dependence and drug abuse H. CNS stimulants I. Drugs for Neurodegenerative disorders J. Opioid Analgesic.	24
02	<b>Pharmacology of Local Anaesthetics</b>	2
03	<b>Pharmacology of drugs acting on Respiratory System</b> A. Drug therapy of asthma. B. Anti tussives, expectorant and mucolytic agent.	6
04	<b>Pharmacology of drugs acting on GIT</b> A. Drugs used in ulcers B. Drugs for treatment of diarrhea and constipation. C. Emetic and anti-emetics.	6
05	<b>Clinical Research:</b> A. Clinical Trials: History, Terminologies, Various phases of clinical research, Role of clinical trial in new drug development. B. Documents in clinical study: Investigator Brochure (IB), Protocol and its amendment, case report form (CRF), Informed consent form (ICF). C. Ethical issues in clinical trial.	7

## **B.Pharm-III (Semester- V)**

### **Pharmacology-III PRACTICALS (BP 509)**

1. General introduction to CNS experimental pharmacology.
2. To study the analgesic activity using tail flick method in rats or mice.
3. To study the analgesic activity using hot plate analgesiometer in rats or mice.
4. To study the anti-inflammatory activity using plethysmometer in rats or mice.
5. To study the anticonvulsant activity using electroconvulsimeter in mice
6. To study hypnotic activity using pentobarbital induced loss of righting reflex in mice.
7. To study the antipyretic activity using telethermometer in rats.
8. To study the antidepressant activity using forced swim test in rats or mice.
9. To study the anxiolytic activity using in rats or mice.
10. To study the CNS Stimulant activity using actophotometer in rats or mice.
11. To study the CNS Depressant activity using actophotometer in rats or mice.

#### **References:**

1. Aviado, Doningo M Krantz and Carrs Pharmacologic Principles of Medical Practice. The Williams and Wilkins Co., Baltimore, U.S.A.
2. Braunwald E., Harrison's Principles of Internal Medicine. McGraw-Hill Medical.
3. Brunton L. L. and Others Goodman and Gilman's The Pharmacological Basis of Therapeutics. Mc Graw Hill Medical Pub. Div. New York.
4. Christopher H., Davidson's Principles and Practice of Medicine. Churchill Livingstone.
5. Girdwood R.H. Clinical Pharmacology. Varghese Publishing House, Bombay
6. James Crossland, Lewis Pharmacology. Churchill Livingstone.
7. Maickel, Pradhan, Pharmacology in Medicines – Principles and Practice. SP Press International INC.
8. Rang, H.R. Dale, M. Pharmacology E.L.B.S., London
9. Rosenteld, G.C., Loose Mitchell and Jones J. B. Lippincott Williams and Wilkins U.S.A. Board Review Pharmacology.
10. Lawrence, D.R. and Bacharach, A.L.: Evaluation of Drugs Activities : Pharmacometrics. Academic press, London
11. Parthasarathi G, Hansen Kavin Nytor & Nahata Milap C. A Textbook of Clinical Practice: Essential Concepts & skills, Orient Longman
12. Perry, W. L. M. Pharmacological Experiments on isolated preparations. E and S Livingstone, London. Publications.
13. Remington's Pharmaceutical Science and practice pharmacy. Lippincott Williams and Wilkins, New Delhi
14. Wilma M and Hayek R.N. Essential Drug Dosage Calculations. Prentice Hall.
15. Parthasarathi G, Hansen Kavin Nytor & Nahata Milap C. A Textbook of Clinical Practice: Essential Concepts & skills, Orient Longman.

**B.Pharm-III (Semester- V)  
Pharmacognosy III (BP-504)**

<b>SN</b>	<b>Topics</b>	<b>Hrs</b>
01	<b>Extraction, isolation and purification methods for phytopharmaceuticals.</b> a. Extraction: Theory of mass transfer, maceration, percolation, Soxhlet extraction and super critical fluid extraction. b. Chromatography isolation and purification: General principles and applications of adsorption, ion exchange, size-exclusion, affinity. Detailed study of thin layer chromatography, paper chromatography, column chromatography, high performance thin layer chromatography, high pressure liquid chromatography and gas liquid chromatography.	<b>10</b>
02	<b>General introduction of lipids, enzymes and proteins</b> Definition, classification , method of extraction, chemistry, biosynthetic pathways and method of analysis of above classes Biological source, collection, method of preparation, chemical constituent, chemical test for identification and uses of following: Almond oil, castor oil, cod liver oil, Sesame oil, cotton seed oil, peanut oil, bees wax, cocoa butter, olive oil, jojoba oil, shark liver oil, and wool fat. Bromelain, diastase, papain, pepsin, trypsin, pancreatin, Gelatin	<b>12</b>
03	<b>Terpenoids and volatile Oils</b> a. Introduction, occurrence, general properties, classification, chemistry, uses, methods of extraction and evaluation, general biosynthetic pathway of terpenoid. b. Pharmacognostic study of following drugs Hydrocarbon: Black Pepper Alcohol: Peppermint, Cardamom, Coriander, sandalwood Aldehyde: Cinnamon, Lemon Grass, Citronella Ketone: Caraway, Camphor, Dill Phenol: Clove, Tulsi Phenolic ether: Fennel, Nutmeg Oxide: Eucalyptus	<b>10</b>
04	<b>Biogenesis of Natural products</b> A brief introduction to biosynthesis A brief account of primary and secondary metabolite's production from carbon metabolism in plants. Production of Amino acid by shikimic acid pathway.	<b>6</b>
05	<b>A brief introduction to natural colours and dyes:</b> Heena, Saffron, Carotenoids.	<b>3</b>
06	<b>A brief account to Plant bitters and Sweeteners</b>	<b>4</b>

### **Pharmacognosy III (BP-5010)**

#### **PRACTICAL:**

1. Isolation of volatile oil by hydro-distillation method using Clavenger's apparatus
2. Paper chromatography and TLC of natural products.
3. Thin layer chromatography of volatile oils.
4. Estimation of citral content from lemon grass oil
5. Study of morphological and microscopic characters of-  
Coriander, Cinnamon, Caraway, Dill, Clove, Fennel, Eucalyptus
6. Analysis of fixed oil: Determination of acid value, Iodine value and Saponification value.
7. Chemical tests for following drugs  
Sesame oil, cotton seed oil, gelatine, shark liver oil and wool fat.

#### **Reference Books**

1. Ashutosh Kar. Pharmacognosy and Pharmacobiotechnology, New Age International Publishers, New Delhi.
2. C.K. Atal & B.M. Kapoor: Cultivation & Utilization of Medicinal & Aromatic Plants, RRL, Jammu.
3. Pharmacognosy and Phytochemistry- Part I & Part II – V. D. Rangari, Career Publication, Nashik.
4. C.K. Kokate. 1994. Practical Pharmacognosy, 4 th Ed., Vallabh Prakashan, Delhi.
5. C.S. Shah, J.S. Quadri. Textbook of Pharmacognosy, 7th edition, B.S. Shah Prakashan, Ahmedabad.
7. G.E. Trease, W.C. Evans, 2008. Pharmacognosy, 15 th Ed., WB Saunders, London.
8. H.S. Puri. Rasayana - Traditional Herbal Medicines for modern times, Vol. I- II, Taylor & Francis,
9. Indian Herbal Pharmacopoeia, 2002. Vol. I-II, Indian Drug Manufacturers' Association, RRL Jammu Tawi, IDMA, Mumbai.
10. Indian Pharmacopoeia. Government of India, Ministry of Health & Family Welfare, New Delhi.
11. M.Z. Abdin, Y.P. Abrol. Traditional Systems of Medicine. Narosa Publishing House, New Delhi.
12. P.K. Mukharjee, 2002. Quality Control of Herbal Drugs- an approach to evaluation of botanicals, Business Horizons.
13. P.K. Mukharjee, 2003. GMP for Botanicals- Regulatory and quality issues on phytomedicines. Business Horizonscations Pharmaceutical Press.
14. PDR for Herbal Medicines, 2007, 4th Ed., Medicinal Economic Company, New Jersey.
15. Quality Standards of Indian Medicinal Plants, Vol. I-X, Indian Council of Medical Research, New Delhi.
16. Quality Control Methods for Medicinal Plant Material, WHO, Geneva, 1998.
17. S.S. Agarwal, M. Paridhavi, 2007. Herbal Drug Technology, Universities Press.
18. S. Natori, N. Ikekawa, M. Suzuki, 1981. Advances in Natural Product Chemistry, extraction and isolation of biologically active compounds. Wiley, New York.
19. T. Swain, J.B. Pridham, 1965. Biosynthetic pathway in higher plants, Academic Press, New York.
20. T.E. Wallis, 1960. Text Book of Pharmacognosy, CBS Publishers, New Delhi.
21. The Aurvedic Pharmacopoeia of India, 1999. Government of India, Ministry of Health and Family Welfare, Department of Indian Systems of Medicine and Homeopathy, New Delhi.

22. V. Rajpal and D. P. S. Kohli. 2009. Herbal Drug Industry, 2nd Edition, Business Horizons Publication, New Delhi.  
 23. V.E. Tyler, L.R. Brady, J.E. Robbers, 1988. Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia.

<b>B.Pharm-III (Semester- V)</b> <b>Biotechnology (BP-505)</b>		
<b>SN</b>	<b>Topics</b>	<b>Hrs</b>
01	Definition and scope - potential and achievements	02
02	Fermentation technology and industrial microbiology Fermentation as a biochemical process, fermenter construction and working, downstream processing, fermentation monitoring, in-situ recovery of fermentation products, waste discharge and effluent treatment, definition of BOD and COD, safety and proof of efficacy of biotech products, general applications of fermentation in the manufacturing of antibiotics (Penicillin, streptomycin, tetracycline) dextran, vitamins (Vit.B2 and Vit.B12), microbial enzymes, microbial limit tests and assays (antibiotics, vitamins, amino acids etc.), standards of water used in fermentation, pharmaceutical and cosmetic industry.	14
03	Animal cell culture and genetic engineering Introduction to mammalian genome, genetic recombination of animal cells, purified DNA, vectors probing and cloning, strain and restrictional enzymes, gene machine, DNA hybridization, molecular engineering, polymerase chain reaction, genetic diseases, human gene therapy, tissue engineering.	08
04	Preparation and characterization of immunologicals Preparation and standardization of vaccines, sera, allergenic extracts, diagnostics, biologicals, Introduction to veterinary vaccines, immunomodulating substances, lymphokines, preparation of monoclonal antibodies, applications of monoclonal antibodies.	<b>07</b>
05	Biotechnology derived products (therapeutic proteins) Examples of biotechnology derived therapeutics products, production of human Insulin, interferon, somatostatin, somatotropin.	<b>04</b>
06	Plant Tissue Culture Development of plant tissue cultures, Cellular totipotency, Organ cultures, callus and suspension cultures, Organogenesis, somatic embryo genesis, Protoplast fusion. Germplasm storage including cryopreservation.	<b>10</b>

### **Pharmaceutical Biotechnology Practical (BP5011)**

1. Standardization of water used in fermentation and pharmaceutical industry by MPN and IMViC
2. Microbial limit tests
3. Microbial assays
4. Preparation of plant cell culture media
5. Measurement of plant cell growth
6. Development of callus culture
7. Development of embryo culture
8. Production of secondary metabolites using any available plant cell
9. Fermentative production of antibiotics (penicillin) / Vitamins (Vit B12)
10. Estimation of Protein with standard curve by Ninhydrine method.
11. Estimation of Protein with standard curve by Biuret method.
12. Fermentative production of citric acid.

#### **Reference Books:**

1. Bainse William, Biotechnology from A to Z, 2nd Edition, 2002, Oxford University Press.
2. Berger S. L., et. al., Methods in Enzymology, Academic Press Inc., CA 1992.
3. British Pharmacopoeia, 1993, London, HMSO.
4. Carter S. J., Cooper and Gunn's Tutorial Pharmacy, 6th Edition, 1996, CBS Publishers and Distributors, Delhi.
5. Casida L. E., Industrial Microbiology, 2000, New Age International, Delhi.
7. De Kalyan Kumar, Plant Tissue Culture, 1st Edition, 1997, New Central Book Agency (P) Ltd.
8. Freifelder David, Molecular Biology, 2nd Edition, 1998, Narosa Publishing House.
9. J. I. Disouza, Killedar S. G., Biotechnology and Fermentation Process, Nirali Prakashan
10. Gennaro A. R., Remington-the Science and Practice of Pharmacy, 20th Edition, 2002, Lippincott Williams and Wilkins, New York.

11. Gupta P. K., Elements of Biotechnology, 1st Edition, 2001, Rastogi Pub., Meerut.
12. Higgins, Best D.J. and Jones J., Biotechnology: Principles and Applications, Blackwell Scientific Publications, Boston, MA 1985.
13. Hugo W. B., Russell A. D., Pharmaceutical Microbiology, 6th Edition, 1998,
14. Jay James M., Modern Food Microbiology, 4th Edition, 1996, CBS Publishers and Distributors, Delhi.
15. Kumar H. D., Textbook of Biotechnology, 2nd Edition, 1991, Affiliated East West Press Pvt. Ltd., New Delhi.
16. Patel A. H., Industrial Microbiology, 1984, Macmillan Ltd., Delhi.
17. Pharmacopoeia of India, 1985, Govt. of India, Ministry of Health and Family Welfare.
18. Prasad B., Veterinary Pharmaceuticals, 4th Edition, 2001, CBS Publishers and Distributors, Delhi.
19. Razdan M. K., An Introduction to Plant Tissue Culture, 1993, Oxford IBH Pub., New Delhi.
20. Reed Gerald, Prescott Dunn's Industrial Microbiology, 4th Edition, 1987, CBS Publishers and Distributors, Delhi.
21. Singh B. D., Biotechnology, 2001, Kalyani Publisher.
22. Stanbury P. F., Whitekar A. and Hall S. J., Principles of Fermentation Technology, 2nd Edition, 1997, Aditya Books (P) Ltd., New Delhi.
23. Trevan Keshav, Biotechnology, 4th Edition, 1990, New Age International Ltd. Pub., New Delhi.
24. Vyas, S. P., Dixit V. K., Pharmaceutical Biotechnology, 1st Edition, 1999, CBS Publishers and

**B.Pharm-III (Semester- V)**  
**BIOPHARMACEUTICS (BP-506)**

SN	Topics	Hrs
01	<b>Concept, definition and introduction</b> to Biopharmaceutics, Pharmacokinetics, Pharmacodynamics and Plasma drug concentration time profile.	03
02	<b>Absorption of Drug:</b> Cell membrane, Mechanism of drug absorption, Factors affecting drug absorption (Pharmaceutical, Patient related), Non oral route of drug absorption (buccal, sublingual, nasal, transdermal, vaginal, rectal and parenteral).	10
03	<b>Drug Distribution:</b> Introduction, Factors affecting distribution of drugs, Concept of apparent volume of distribution, Protein binding of drugs, Kinetics of protein binding, Significance of drug protein binding, Factors affecting protein binding of drugs.	08
04	<b>Excretion &amp; metabolism( Biotransformation)</b> Renal excretion, Concept of clearance, Factors affecting renal excretion, Non renal route of excretion, Factors affecting metabolism, Pathways of metabolism.	<b>08</b>
05	<b>Prodrug</b>	<b>03</b>
06	<b>Bioavailability and Bioequivalence:</b> Concept and definition of absolute and relative bioavailability, Purpose of bioavailability study, Measures of bioavailability ( $C_{max}$ , $t_{max}$ , AUC etc), Bioequivalence study, Biopharmaceutics classification system, In vitro drug dissolution testing model, In vitro in vivo correlation.	<b>08</b>
07	<b>Pharmacokinetics:</b> Rate, Rate constants and order of reactions, Zero order, First order, Pharmacokinetics model.	<b>05</b>

**REFERENCE BOOKS:**

1. Gibaldi : “Biopharmaceutics & Clinical Pharmacokinetics,” 3rd ed., Lea Febiger,1984.
2. Niazi : “Biopharmaceutics & Clinical Pharmacokinetics,” Appleton- Century Crofts, 1979.
3. Shargel & Yu: “Applied Biopharmaceutics & Pharmacokinetics,” 4th ed., Appleton & Lange, 1999
4. Rowland & Tozer: “Clinical Pharmacokinetics (Concepts & Applications),” 3<sup>rd</sup> ed., Lea & Febiger – Waverly,1995.
5. Brahmkar & Jaiswal : Biopharmaceutics & Pharmacokinetics (A Treatise), Vallabh Prakashan, 1995.
6. Gibaldi & Perrier : “Pharmacokinetics,” 2nd ed. (Revised & Expanded), Marcel Dekker (series in Text-Books & Monographs: Swarbrick, Ed., vol.15), 1982.
7. Ritschel : Hand Book of Basic Pharmacokinetics, Drug Intelligence Publication.
8. Banakar, Umesh, “Pharmaceutical Dissolution Testing”, Volume 49, Marcel Dekker Inc., New York, 1992.
9. Remington: The Science and Practice of Pharmacy, 21st Edition. Philadelphia, PA: Lippincott Williams & Wilkins, 2005  
Swarbrick, Ed., “Current Concepts in Pharmaceutical Sciences (Biopharmaceutics),”Lea & Febiger,

**VI Semester B.Pharm [Course and Examination Scheme with Credit Grade System]**

Subject Code	Subject	Teaching Scheme				Examination Scheme								
		Hours per week			No. of Credits	Theory					Practical			
		L	T	P		Duration of Paper (Hrs.)	Max. Mark	Max. Marks Sessional	Total	Min Passing Marks	Max Marks	Max. Marks Sessional	Total	Min Passing Marks
BP601	Pharmaceutical Engineering-II	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 602	Medicinal Chemistry-I	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 603	Pharmaceutical Analysis III	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 604	Pharmacology-IV	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 605	Pharmacognosy –IV	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 606	Quality Assurance	3	-	-	3	3	80	20	100	45	-	-	-	-
BP 607	Pharmaceutical Engineering-II	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 608	Medicinal Chemistry-I	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 609	Pharmaceutical Analysis-III	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 6010	Pharmacology-IV	-	-	4	2	5	-	-	-	-	80	20	100	50
BP 6011	Pharmacognosy –IV	-	-	4	2	5	-	-	-	-	80	20	100	50
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>20</b>	<b>28</b>				<b>600</b>				<b>500</b>	
<b>Semester total</b>						<b>1100</b>								

**B.Pharm-III (Semester- VI)**  
**PHARMACETICAL ENGINEERING-II (BP-601)**

SN	Topics	Hrs
01	<b>Heat Transfer</b> Mechanism- Conduction, Convection, Radiation, Fourier Law, Heat Exchanger- Heat Transfer In Parallel Flow & Counter Flow, Tubular Heat Exchanger, Application.	<b>10</b>
02	<b>Crystallization</b> Crystal form, theories of crystallization, Equipment-Swenson walker, vacuum, agitated batch, Krystal crystallizer, caking of crystal.	08
03	<b>Drying</b> Mechanism, theory, factor affecting, Dryer- tray dryer, fluidized bed dryer, spray dryer, freeze dryer, vacuum dryer, drum dryer.	06
04	<b>Corrosion</b> Mechanism, factor influencing corrosion process, prevention & control of corrosion.	<b>06</b>
05	<b>Evaporation</b> Theory, factor influencing evaporation, evaporator- pan, tubular (horizontal, vertical); climbing film, falling film, forced circulating, multiple effect evaporator- economy, and evaporator capacity.	<b>10</b>
06	<b>Environmental control</b> Air conditioning, refrigeration, Humidification and dehumidification, application to Pharmaceutical field.	<b>05</b>

## PHARMACETICAL ENGINEERING-II (BP-607)

### Semester VI

#### PRACTICALS:

1. To study of rate of drying of solid sample (amorphous & crystal)
2. To study of drying behavior of solid sample( amorphous & crystal)
3. To study crystallization of sodium chloride with seeding
4. To study crystallization of sodium chloride without seeding
5. To study effect of viscosity on rate of evaporation.
6. Determine critical solution temperature of phenol water solution.
7. Plotting boiling point diagram for given mixture.
8. To study effect of pressure on rate of evaporation.
9. To study crystallization of boric acid with seeding.
10. To study crystallization of boric acid without seeding.
11. To study of effect of cooling on crystal growth.
12. To determine rate of heat loss through different material.
13. To determine free moisture content & bound moisture content.
14. Engineering drawing sheet's Alphabets and numbering, and Geometric Constructions.

#### REFERENCE BOOKS:

1. W. McCabe, J.C. Smith, P. Harriot, "Unit operation of chemical Engineering". McGraw Hill, (1993).
2. E. Gonderton, "Pharmaceutical unit operation", Academic press.
3. Perry's , "Handbook of chemical engineering", McGraw Hill,(1984)
4. A.R. Paradkar, "Introduction to Pharmaceutical Engineering", Nirali prakashan, 10<sup>th</sup> Ed.2007
5. K. Sambamurthy-"Pharmaceutical Engineering", New Age international Pvt Ltd.
6. G.G Brown- "Unit operation", CBS publishers & Distributers, New Delhi.
7. W.I. Badger and J.T. Banchero, "Introduction to Chemical engineering"; McGraw Hill, Tata-McGraw Hill Publishing Company Ltd, New Delhi.(1988)
8. N.G.Padya., C.S.Shaha-"Elements of Heat Engines", Charotar Book Stall, Tulsi Sadan, Anand (W. Rly), India.
9. Donald P. Eckman -"Industrial Instrumentation", Seventh Wiley Eastern, Reprint, 1983, Wiley Eastern Ltd, 4835/24, Ansari Road, Daryaganj, New Delhi.
10. C.V.S Subramanyam- "Pharmaceutical Engineering principle & practices", Vallabh prakashan New Delhi.
11. Warren McCabe, Julian Smith and Peter Harriott, "Unit operations of chemical engineering", McGraw Hill Inc., Singapore.

**B.Pharm-III (Semester- VI)**  
**PHARMACEUTICAL MEDICINAL CHEMISTRY-I (BP-602)**

SN	Topics	Hrs
01	<b>Basic principles of medicinal chemistry:</b> Structure of biological membrane, physicochemical parameters affecting drug action, drug absorption, distribution and elimination. Stereochemical aspects of drug action, drug receptor interaction including transduction mechanism, blood brain barrier.	<b>10</b>
02	<b>Drug metabolism:</b> Phase I and phase II reactions, biological factors affecting drug metabolism, inducers and inhibitors of drug metabolism, significance of drug metabolism studies in drug development.	05
03	<b>Prodrug concept:</b> Principles of prodrug design and applications.	03
04	Following topics shall be treated covering nomenclature, synthetic procedure of official drugs, uses and SAR including physicochemical and steric aspects and mode of action. <b>Drugs Acting on CNS:</b> General and Local Anaesthetics, Sedative and hypnotics, Anticonvulsants, CNS Stimulants, Antidepressants. Drugs Used In Parkinsonism and Alzheimers Disease, Antipsychotics, Antianxiety, <b>Drugs Acting on GIT:</b> Antacids, Emetics, Antiemetics, Purgatives, Antidiarrhoeals.	<b>24</b>
05	Introduction and applications of Green Chemistry.	<b>03</b>

**Subject: Pharmaceutical Medicinal Chemistry-I (BP-608)**

**PRACTICAL:**

- To perform pharmacopoeial assay of following drugs containing dosage form  
Metoclopramide, Methadone, Chlorpromazine, Fluphenazine, Phenylbutazone, Thibendazon.
- Synthesis of following compound by green chemistry  
Acetanilide from aniline, Benzoic acid from benzil, Benzpinacol from Benzophenone, Benzpinacolone from Benzpinacol, 1,1-bis-2-naphthol from 2-naphthol, Dihydropyrimidinone from benzaldehyde, Methyl ester from vegetable Oils.

**REFERENCES:**

1. Wilson and Gisvold's Text Book of Medicinal Chemistry, Lippincott Williams and Wilkins.
2. Indian Pharmacopoeia, Government of India, Ministry of Health and Family Welfare, Published by the Controller of Publications and Information Directorate ( CSIR), New Delhi
3. Ashutosh Kar, Advanced Practical Medicinal Chemistry, New Age International Publication.
4. J. N. Delagado and W. A. R. Remers, Eds, Wilson and Gisvold's Textbook of Organic, Medicinal and Pharmaceutical Chemistry, J. Lipponcott Co. Philadephia.
5. W. C. Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
6. H. E. Wolff, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York Oxford University Press, Oxford.
7. Daniel Lednicer, Strategies for Organic Drug Synthesis & Design, John Wiley & sons, USA.
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9. I. L. Finar, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
10. Vogel's Text book of Practical Organic Chemistry, ELBS/ Longman, London
11. Mann & Saunder, Practical Organic Chemistry, Orient Longman, London.
12. Shriner, Hermann, Morrill, Curtin & Fuson, The Syntematic Identification of Organic Compounds, John Wiley & Sons. USA.
13. R. M. Silverstein, G. Claytron Bassel's, T. C. Movvill, Spectormetric identification of Organic compounds, John Wiley & Sons, USA
14. Kadam, Mahadik and Bothra "Advanced Practical Medicinal Chemistry"

**B.Pharm-III (Semester- VI)**  
**PHARMACEUTICAL ANALYSIS III (BP-603)**

<b>SN</b>	<b>Topics</b>	<b>Hrs</b>
01	<b>UV-Visible Spectroscopy:</b> Brief review of Electromagnetic Spectrum & its properties. Absorption Law & Limitations. Theory of Electronic Spectroscopy. The Chromophore concept, Choice of Solvent and Solvent Effects. Modern Instrumentation (Single Beam, Double Beam) Design, Working & Principle, with significant emphasis on Source, Filters, Monochromators including Gratings, Sample Holder (Cuvette) and Detectors. Application of UV-Visible Spectroscopy (Qualitative & Quantitative analysis) including Difference & Derivative Spectroscopy.	<b>10</b>
02	<b>IR Spectroscopy:</b> IR regions, Requirements for IR absorption. Basic Principle. Vibrational Frequency & Factors influencing vibrational frequency. Fundamental Modes of Vibrations in diatomic molecule Instrumentation with significant emphasis on Sampling Techniques and Heat Detectors. Applications in identification of functional groups.	10
03	<b>Nephelometry and turbidimetry:</b> Theory, Instrumentation and Application.	05
04	<b>Polarography:</b> Theory, Mass Transport Process, Current Processes, Current Potential Relationship, Polarization, Choice of Electrodes, Effect of Oxygen, Calculation of Concentration, Applications, Normal and Differential Polarography.	<b>04</b>
05	<b>Amperometric titrations</b> and its applications	<b>04</b>
06	<b>Coulometry:</b> Introduction, coulometry at controlled potential, coulometry at constant current, instrumentation and application.	<b>04</b>
07	<b>Fluorescence spectroscopy:</b> Fluorescence And Phosphorescence, Excitation and Emission Spectra, Factors Affecting Fluorescence Intensity, Instrumentation, Application, Determination of Quinine Sulphate, Thiamine Hydrochloric Acid.	<b>05</b>
08	<b>Flame photometry:</b> Theory, Instrumentation and Applications.	<b>03</b>

**Subject: Pharmaceutical Analysis III (BP-609)**

**PRACTICAL:**

1. Calibration of UV-Visible Spectrophotometer.
2. Determination of Wavelength of maximum absorbance using UV spectrophotometer & validity of Lambert Beer's law.
3. To study the effect of solvent & pH on UV spectrophotometer of a given compound.

4. Assay of Paracetamol Tablets using UV Spectrophotometer.
5. Assay of Metformin Tablets using UV Spectrophotometer.
6. Assay of Metoprolol Tablets using UV Spectrophotometer.
7. Assay of Propranolol Tablets using UV Spectrophotometer.
8. Assay of Furosemide Tablets using UV Spectrophotometer.
9. Assay of Hydrochlorothiazide Tablets using UV Spectrophotometer.
10. Demonstration of IR spectrophotometer.
11. To study IR spectra of given compound(s)
12. Identification of functional group by IR.
13. Determination of sodium concentration by flame photometry
14. Determination of potassium concentration by flame photometry
15. Nitrogen estimation by Kjeldahl's method.

#### **REFERENCES:**

1. William Kemp. Organic Spectroscopy, Palgrave, New York.
2. United States Pharmacopoeia & National Formulary, The United States Pharmacopoeial Convention, Washington DC.
3. Skoogh, Principles of Instrumental Analysis, Saunders College Publishing, USA.
4. K.A. Connors, Text Book of Pharmaceutical Analysis- Wiley Intersciences, New York.
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6. H.H., Willard, L.L. Merrit & John A. Dean, Instrumental Method of Analysis, CBS Publishers & Distributors, New Delhi.
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8. D.A., Skoog, F.J. Holler, S.R. Crouch, Principles of Instrumental Analysis. Baba Barkha Nath Printers, Haryana. Ed. Fenniri Hicham, Combinatorial Chemistry, Oxford University.
9. British Pharmacopoeia, MHRA, London
10. Bentley and Driver, Textbook of Pharmaceutical Chemistry, Oxford University Press, Walton Street, Oxford
11. A.H. Beckett, J.B. Stenlake, Practical Pharmaceutical Chemistry, Part I and Part II, CBS Publishers and Distributors, New Delhi.
12. B.K. Sharma. Instrumental Methods of Chemical Analysis, Goel Publishing House, Meerut.
13. G. R. Chatwal And Shyam K. Anand "instrumental methods of chemical analysis"
14. A. V. Kasture, K. R. Mahadik, S. G. Wadodkar, H. N. More, A Textbook of Pharmaceutical Analysis, Vol. I, 6th edition, 2002, Nirali Prakashan, New Delhi.

**B.Pharm-III (Semester- VI)  
Pharmacology-IV (BP-604)**

<b>SN</b>	<b>Topics</b>	<b>Hrs</b>
01	Study of Pharmacological action of following classes of drug with respect to classification including recently available drugs, mechanism of action, receptors, adverse effects, Drug interaction, contraindication and therapeutic uses:	<b>10</b>
02	<b>Pharmacology of drug acting on endocrine systems</b> A. Pituitary hormone and regulation of secretion B. Thyroid hormone, Anti-Thyroid agents C. Parathyroid hormone, calcitonin, vitamin D. D. Insulin, Oral Hypoglycemic agents. E. Adreno-corticoids, Anabolic Steroids and Fertility Agents	10
03	<b>Chemotherapy of microbial infection</b> A. Introduction B. Penicillin and cephalosporin's C. Macrolides and Amino Glycosides and Polypeptides D. Quinolones and Fluoroquinolones E. Chemotherapy of Fungal Infections F. Chemotherapy of Viral Infections G. Chemotherapy of Malaria H. Chemotherapy of Tuberculosis and Leprosy I. Pharmacology of Anthelmintics J. Anti-Neoplastic agents	<b>24</b>
04	<b>Drugs acting on Immune system:</b> A. Immunostimulants B. Immunosuppressant	<b>03</b>
05	<b>Clinical trial:</b> A. Designs used in clinical trials with their advantages and disadvantages, hypothesis, risks and benefits, subject selection, inclusion and exclusion criteria, randomization, blinding and controls. B. Management of Clinical trials: Role and responsibilities of Stakeholders of clinical trials such as FDA, CRO, Sponsor, Physicians, Nurses, Health professionals, Hospitals, Patient. C. Guidelines for clinical research: ICH-GCP.	<b>08</b>

## **Pharmacology-IV (BP-6010)**

### **PRACTICAL:**

1. To determine  $pA_2$  value of antagonist using different tissues isolated from rats.
2. To study antipsychotic activity by using conditioned avoidance response.
3. To study antiparkinson activity using catalepsy test.
4. Demonstration of  $ED_{50}$  determination of some drugs in rats or mice.
5. To study learning memory enhancing activity using radial arm maze.
6. To study learning memory enhancing activity using water maze.
7. To study learning memory enhancing activity using elevated plus maze.
8. To study addiction and abuse liability of some drugs.
9. To study analgesic activity using acetic acid induced writhing.
10. To demonstrate BP of rats by non invasive method
11. To demonstrate ECG and EEG of rats by non invasive method.

### **References:**

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2. Braunwald E., Harrisons Principles of Internal Medicine. McGraw-Hill Medical.
3. Brunton L. L. and Others Goodman and Gilman"s The Pharmacological Basis of Therapeutics. Mc Graw Hill Medical Pub. Div. New York.
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16. Turner R.A. Screening methods in Pharmacology. Academic Press, London.

**B.Pharm-III (Semester- VI)  
Pharmacognosy IV (BP-605)**

<b>SN</b>	<b>Topics</b>	<b>Hrs</b>
01	<p><b>Glycosides</b></p> <p>a. Introduction, definition, occurrence, properties, classification, uses, general biosynthetic pathways. General extraction and isolation method.</p> <p>b. Pharmacognostic study of following drugs</p> <p>Anthraquinones: Senna, Aloe, Rhubarb</p> <p>Cardioactive: Digitalis, Squill, Strophanthus</p> <p>Saponins: Liquorice, Dioscorea, Shatavari</p> <p>Bitter: Quassia, Kalmegh</p> <p>Cynogenetic: Bitter almond</p> <p>Isothiocyanate: Black mustard</p> <p>Flavonoid: Orange peels</p>	12
02	<p><b>Resins:</b></p> <p>A) Introduction, Classification, Physical &amp; Chemical properties, occurrence/distribution, General extraction methodology and analysis of resins.</p> <p>Biological source, collection, preparation, chemical constituents, Identification tests, uses, adulterants and substituents of following:</p> <p>Asafoetida, Guggul, Podophyllum, Capsicum, Turmeric, Cannabis and Ginger.</p> <p>B) Biological source &amp; Uses of following Balsam of Tolu, Balsam of Peru, Benzoin ,Myrrh, Storax, Colophonys &amp; Jalap.</p>	10
03	<p><b>Tannins</b></p> <p>a. Introduction, definition, classification, properties, uses, chemical tests and general method of extraction.</p> <p>b. Pharmacognostic study of following drugs</p> <p>Pale catechu, Black catechu, Ashoka, Arjuna, Bahera, Amala, Myrobalon, Galls</p>	08
04	<p><b>A study of structural elucidation of following phytoconstituents –</b></p> <p>Camphor, eugenol,</p>	06
05	<p><b>Isolation, purification &amp; chromatographic profiles of following –</b>Eugenol, cineole, camphor, menthol, citral</p>	06
06	<p><b>Marine Drugs-</b></p> <p>Introduction, classification and studies of categories of marine drugs</p> <p>Anticancer, Cardiovascular agents and marine toxins.</p>	03

## Pharmacognosy IV (BP-6011)

### PRACTICAL:

1. Demonstration of percolation and continuous extraction technology (Soxhlet extractor)
2. Determination of total content of tannins from Black catechu.
3. Extraction of total sennosides from Senna leaves.
4. Study of morphological and microscopical characters of –  
a) Senna b) Digitalis c) Liquorice d) Shatavari e) Quassia f) Kalmegh
5. Chemical test of resinous crude drugs. ex: Asafoetida, Guggul, Turmeric, Tolu and Peru balsam, Myrrh.
6. Determination of balsamic acids in Tolu or Peru balsam
7. Extraction of ginger OR capsicum oleo resin
8. To determine vein-islet number, vein-termination number, stomatal index of given sample.

### Reference Books

1. Ashutosh Kar. Pharmacognosy and Pharmacobiotechnology, New Age International Publishers, New Delhi.
2. C.K. Atal and B.M. Kapoor: Cultivation and Utilization of Medicinal & Aromatic Plants, RRL, Jammu.
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22. V. Rajpal and D. P. S. Kohli. 2009. Herbal Drug Industry, 2nd Edition, Business Horizons Publication, New Delhi.
23. V.E. Tyler, L.R. Brady, J.E. Robbers, 1988. Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia.

<b>B.Pharm-III (Semester- VI)</b> <b>Quality Assurance (BP-606)</b>		
<b>SN</b>	<b>Topics</b>	<b>Hrs</b>
01	Basic concept of Quality Control & Quality Assurance, Total Quality Management, Philosophy of GMP, GLP, ISO and introduction to ICH guidelines.	<b>05</b>
02	Quality Control Laboratory: Responsibilities, routine controls, instruments, protocols, standard test procedure sampling plans etc. Quality control documentation and audits of QC facilities.	<b>05</b>
03	Quality Control in Pharmaceutical Industries - Introduction to validation – Equipment, Method, Personnel and Process validations, Validation of water and air handling systems.	<b>05</b>
04	In process quality control on various dosage forms. Standard Operating Procedures for operations like cleaning, filling, drying, compression, coating, sterilization etc.	<b>05</b>
05	Concept and historical development of pharmaceutical product registration. Effect of GATT and WTO with regard to pharmaceuticals.	<b>05</b>
06	Regulations, requirements, procedures and application of new drug approval process: Preclinical studies, Brochure preparation for IND and ANDA. Clinical research protocols.	<b>05</b>
07	Regulatory requirements – European community, United State, Japan, India and other territories. New Developments in regulatory affairs across the world with regard to WHO and ICH guidelines.	<b>07</b>
08	Introduction to Intellectual Property Right. Introduction Understanding Intellectual property rights (IPR) and review of IPR regime: - Copyrights, Trademarks, Geographical indications,	<b>08</b>

	Appellations of origin, Industrial designs, and Intellectual property laws in India. Patent procedure, filing, search and licensing.	
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1. Quality Control by Dale H. Bester field, Prentice Hall International Inc., New Jersey, 5th edn., (1998).
2. Good Laboratory Practice by Sandy Weinberg, Merce Dekker, New York, 2nd edn. Vol. 69 (1995).
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**B.Pharm-IV (Semester- VII)**  
**DOSAGES FORM & TECHNOLOGY (DFT-I) (BP-701)**

SN	Topics	Hrs
01	<p><b>Preformulation Considerations</b> Concept, Study of physical properties: description, microscopic examination, particle size, partition coefficient, dissolution, solubility, membrane permeability, drug stability, crystal structure and polymorphism.</p>	<b>07</b>
02	<p><b>Suppository</b> Introduction, Types of suppository, suppository bases, Preparation, new trends of suppository, Factors affecting drug absorption from various suppositories, Displacement value, Evaluation, packaging &amp; storage.</p>	<b>06</b>
03	<p><b>Ointment</b> Ointment bases, Preparation and preservation of ointment base, Drug absorption, ophthalmic ointment, Evaluation.</p>	<b>05</b>
04	<p><b>Capsule</b> Introduction, advantage &amp; disadvantages, Additives used in capsule, Types of capsule: Hard gelatin capsule- advantages &amp; disadvantages, Material for production &amp; manufacturing of capsule shell Methods of filling hard gelatin capsule, Capsule size Soft gelatin capsule (soft gel) - formulation &amp; manufacture, Evaluation of capsule.</p>	<b>08</b>
05	<p><b>Tablet</b> Rational, Types of tablet, Tablet excipients, Methods of tablet manufacture (wet, dry &amp; direct compression) and granulation, Problems &amp; defects during tablet manufacturing, Tablet standardization. Tablet coating: Types of coating, film forming material, Coating formulation, Coating process &amp; equipment, Coating defects.</p>	<b>14</b>
06	<p><b>Cosmetics</b> Fundamental concept, Classification, Formulation &amp; Preparation of Cold cream, Vanishing cream, Moisturizing, Cleansing cream, Face powder, dentifrices, Tooth paste, Tooth powder, Shampoo, Lipstick.</p>	<b>05</b>

## DOSAGES FORM & TECHNOLOGY (DFT-I) (BP-707)

### PRACTICALS:

- 1) Introduction of instruments/machines used in Instrument/Machine room.
- 2) Introduction of different additives used in formulation.
- 3) To evaluate marketed uncoated and coated tablet formulations.
- 4) To prepare capsule formulations of any one drug.
- 5) Preparation and evaluation of following dosage forms.
- 6) Tablets
- 7) Capsules
- 8) Ointments
- 9) Suppositories
- 10) Ophthalmic ointment
- 11) Cold cream, vanishing cream, toothpaste, face powder, toothpowder, Cleansing cream, Shampoo, Lipstick etc.

### REFERENCE BOOKS:

1. Lachman Leon, Lieberman Herbert A. Kanig Joseph L., "The Theory and Practice of Industrial Pharmacy", 3<sup>rd</sup> Edition, 1987, Varghese Publishing House, Mumbai.
2. E. A. Rawlins, Ed., Bentley's, "Textbook of Pharmaceutics", 8<sup>th</sup> Edn., Ballierwe Tindall, 1995.
3. Carter S. J. Ed., "Tutorial Pharmacy", Cooper & Gunn, 6<sup>th</sup> Edn., CBS Publishers & distribution, India, 1986.
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**B.Pharm-IV (Semester- VII)**  
**MEDICINAL CHEMISTRY-II (BP-702)**

SN	Topics	Hrs
01	Drug Design: general introduction common approaches used in drug design, physicochemical properties affecting in drug design. Computer aided drug design. QSAR: Methods of QSAR and molecular modeling. Introduction of Combinatorial chemistry and high thorough-put screening:	<b>10</b>
02	Nomenclature, classification, mode of action, SAR, Uses and synthesis of some official drugs from following categories: <b>Cardiovascular drugs:</b> Antihypertensive, Antiarrhythmic, Anti-anginal, cardiotonics. Skeletal Muscle Relaxants, Diuretics, Anti-coagulant, Antithrombotic, Coronary vasodilator, Hypolipoproteinemic drugs. Hypoglycemic agents. <b>Chemotherapeutic Agents:</b> Antiviral, Antineoplastics, Antiprotozoal (Antimalarials, Antiamoebics, Anthelmintics), Antibiotics. Antibacterial (Sulfonamides and Quinolones), Antimycobacterial Drugs (Antituberculars and Antileprotics), Antifungal agents.	<b>35</b>

## Medicinal Chemistry II(BP-708)

### PRACTICAL:

#### Introduction to Computer aided drug design.

#### Synthesis and physico-chemical characterization of following compounds

- Orange II from sulfanilic acid and  $\beta$ -naphthol
- Phenothiazine from diphenyl amine
- Benzocain from p- aminobenzoic acid
- 7 hydroxy 4-methyl coumarin from resorcinol
- Benzhydrol from benzophenone
- 1-phenylazo 2-naphthol from aniline and 2-naphthol

#### Pharmacopoeial assay of following solid dosage form

Mebendazole, Glipizide, Nifedipine, Cimetidine, Diclofenac, Atenolol

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**B.Pharm-IV (Semester- VII)**  
**PHARMACEUTICAL ANALYSIS-IV (BP-703)**

SN	Topics	Hrs
01	<b>X-ray diffraction:</b> Theory, Instrumentation, methods, Applications.	<b>03</b>
02	<b>Mass Spectrometry:</b> Introduction, Basic Principle, Instrumentation, Single focusing, Double focusing, Quadrupole Mass Filter, Applications.	<b>08</b>
03	<b>Nuclear Magnetic Resonance Spectroscopy:</b> Introduction, Theory, Chemical Shift and its measurement, Factor influencing Chemical Shift, Solvent used in NMR, Instrumentation, Applications.	<b>08</b>
04	<b>Radio-immunoassay:</b> Principle and applications.	<b>05</b>
05	<b>Separation Techniques:</b> Partition Coefficient, Liquid-Liquid extraction, solid-liquid extraction, Applications.	<b>06</b>
06	<b>Photocolorimetry:</b> Theory, Instrumentation, Applications.	<b>02</b>
07	<b>Electrophoresis:</b> Theory, Instrumentation, Applications.	<b>02</b>
08	<b>Miscellaneous methods of analysis:</b> Nitrite Titrations, Kjeldahls Method of Nitrogen Estimation, Oxygen Combustion Flask, Karl Fischer Titration, Determination of Alcohol In Galenicals.	<b>05</b>
09	<b>Introduction to concept of quality assurance:-</b> Validation of analytical instruments and methods, GLP, ICH guidelines in pharmacopoeial and biochemical analysis, ISO guidelines, Documentation and record keeping..	<b>06</b>

## PHARMACEUTICAL ANALYSIS-IV (BP-709)

### PRACTICAL:

1. Determine accuracy and precision of standardization method of NaOH.
2. Estimation of Paracetamol in given sample by single point analysis by UV.
3. Estimation of diazepam in a given sample by using standard absorptivity by UV.
4. Assay of Sulfamethoxazole and trimethoprim as per IP.
5. Estimation of atenolol by using hydrotropic solubilizing agent.
6. Estimation of tinidazole by hydrotropic solubilization technique.
7. Estimation of nimesulide by multipoint calibration method.
8. Simultaneous spectrophotometric estimation of paracetamol and nimesulide by simultaneous equation method.
9. Identification of functional group by IR. (Minimum 4 sample).

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10. Bentley and Driver, Textbook of Pharmaceutical Chemistry, Oxford University Press, Walton Street, Oxford
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**B.Pharm-IV (Semester- VII)**  
**Clinical Pharmacotherapeutics-I (BP-704)**

SN	Topics	Hrs
01	Introduction to rational drug use: Definition, role of pharmacist, essential drug concept and rational drug formulations.	<b>04</b>
02	<p><b>Etiopathogenesis and Pharmacotherapy of diseases/disorders associated with following systems.</b></p> <p><b>Cardiovascular and Hemopoietic system:</b> Hypertension, Angina Pectoris, Atherosclerosis, Congestive Heart Failure, Arrhythmias, Myocardial infarction, Hyperlipidaemias, Thromboembolic disorders and Anaemia.</p> <p><b>Respiratory system:</b> Bronchial asthma, Chronic Obstructive Pulmonary Disease, Allergic rhinitis, Common cold &amp; Cough, Cystic fibrosis.</p> <p><b>Gastro-intestinal system:</b> Peptic ulcer, Inflammatory Bowel Disease, Liver diseases.</p> <p><b>Central Nervous system:</b> Parkinsons disease, Alzheimer"s disease, Behavioral disorders.</p> <p><b>Urogenital system:</b> Renal failure, Benign Prostatic Hypertrophy, Infertility, Dysmenorrhea, Menopause.</p> <p><b>Musculoskeletal system:</b> Rheumatoid arthritis, Osteoarthritis, Gout, Spondylitis, Systemic Lupus Erythematosis.</p>	<p><b>12</b></p> <p><b>6</b></p> <p><b>6</b></p> <p><b>6</b></p> <p><b>6</b></p> <p><b>5</b></p>

## Clinical Pharmacotherapeutics-I(BP-7010)

### PRACTICAL:

1. Bioassay (Bracketing & Interpolation) on isolated tissue of rat.
2. Demonstration of Anesthesia (general and local).
3. Study of drugs on some models related to central nervous system. (Sedative & Hypnotics, Locomotor, Stereotypy, Muscle Relaxant, Analgesic & Anti-inflammatory).
4. Prescription related patient oriented problems on
  - Some common problems of gastro-intestinal tract (Dyspepsia, nausea, vomiting, colic, dehydration and constipation).
  - Some common problems of respiratory system (Cough, bronchial asthma).
  - Anaemia
  - Management of some painful conditions.
  - Use of some drugs in emergency (Myocardial infarction, hypertensive emergency, acute cardiac failure, anaphylaxis, cardiovascular collapse, pulmonary embolism).
  - Diabetes mellitus
  - Some bacterial infections (Respiratory infections, urinary tract infections, infective diarrhea etc.)
  - Malaria and Amoebiasis
5. Medication errors in prescribing, drawing up and administration of medication for diseases prescribed in theory.
6. Dose calculation of commonly used drugs including drugs for I.V. infusions.
7. Presentations of analysis related to Pharmacoeconomics. Data related to prescriptions from patients with similar disease to be collected & analyse in terms of cost & effectiveness.
8. Study of drugs on some models related to central nervous system (anticonvulsant, anxiolytic, antianxiety, catatonia & amnesia).

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33. James Crossland, Lewis Pharmacology. Churchil Livingston.
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**B.Pharm-IV (Semester- VII)  
Pharmacognosy-V(BP-705)**

SN	Topics	Hrs
01	<p><b>Alkaloids</b> Introduction, definition, occurrence, properties, classification, chemistry. General Biosynthetic pathways for Indole, Tropane, Quinoline and Isoquinoline alkaloids. Systematic pharmacognostic study of following crude drugs containing Alkaloids.</p> <p>a. Indole-Ergot, Rauwolfia, Nux-vomica, Vinca. b. Tropane - Datura, Coca, Belladonna. c. Purines -Tea, Theobroma. d. Quinoline - Cinchona. e. Isoquinoline - Opium, Ipecac. f. Pyridine/ piperidine - Lobelia. g. Imidazole - Pilocarpus. h. Quinazoline – Vasaka i. Amino alkaloids - Colchicum, Ephedra. j. Steroidal - Ahwagandha, Kurchi</p>	15
02	<p><b>Extraction, Isolation and Estimation of following Phytoconstituents</b> Quinine, Ephedrin and Atropine</p>	03
03	<p><b>Flavonoids</b> Introduction, properties, classification, chemistry and general method of extraction</p> <p>1. Flavones: Roman chamomile, <i>Passiflora incarnate</i>, Grape fruit. 2. Flavonol: Buck Wheat, Green Tea 3. Flavonones: Liquorice, Citrus Peels 4. Bioflavones- Ginkgo</p>	05
04	<p><b>Study of traditional drugs:</b> Common/Vernacular names, B.S., morphology, chemical nature, pharmacology, traditional uses, marketed formulations of the following: Kantkari, Tylophora, Kalijiri, Rasna, Punarnava, Chitrak, Aparnarg, Gokhru, Sankhapushpi, Tulsi, Methi, Palash, Gymnema, Shilajit, Nagarmotha, Tinospora, Neem, and Bhringraj. Lehsun, Guggul, Artemisia, Asoka, Saffron.</p>	10
05	<p><b>Herbal Drug Interactions</b> General introduction to interaction and classification. Study of fallowing drugs and their possible side effects and interactions. Hypercium, kava-kava, Ginkobiloba, Ginseng, garlic, Ginger &amp; Ephedra.</p>	06
06	<p><b>Standardization of Herbal Drugs</b> Importance of standardization and problems involved in the stanardisation. Standardization of single Drug and compound Formulations, W.H.O. guidelines for quality standards of Herbal formulations, Validation of Herbal products. Estimation of parameters, limit Used for standardization and herbal extracts</p>	06

## Pharmacognosy-V (BP-7011)

### PRACTICAL:

1. Extraction, Isolation and Identification of curcumin by TLC.
2. Extraction, Isolation and Identification of caffeine by TLC.
3. Study of morphological, microscopical characters & chemical / microchemical tests for following drugs:
  - a. Leaf: Datura, Vinca, Vasaka
  - b. Root: Rauwolfia
  - c. Barks: Cinchona, Kurchi,
  - d. Stem: Ephedra
  - e. Seed: Nux-Vomica
4. Determination of Ash value & Extractive values of crude drugs
5. Estimation of the crude fibre contents in given sample
6. Extraction, Isolation of following phytopharmaceuticals.
  - Eugenol from clove oil
  - Hesperidine from orange peel
  - Quinine from cinchona bark

### Reference Books

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**B.Pharm-IV (Semester- VII)**  
**INDUSTRIAL PHARMACY (BP-706)**

SN	Topics	Hrs
01	<b>Pilot Plant Scale up Techniques:</b> Significance of pilot plant study, requirements, raw materials, preparation of master procedures, Product considerations: solid dosage forms, injections, semisolids and ophthalmic products.	<b>09</b>
02	<b>Pelletization Techniques:</b> A general overview of pellets, preparation of pellets by extrusion/spheronization centrifugal method, fluid bed processes. Properties of pellets: size and size distribution, shape, density/porosity, mechanical properties. Formulation aspect of pellets.	<b>10</b>
03	<b>Aerosols:</b> Principle, component of aerosol package- propellants (types), container, valves and actuators, aerosol formulation and different types of systems, manufacture, stability testing and quality of aerosols.	<b>04</b>
04	<b>Optimization Techniques in Pharmaceutical Formulation and processing:</b> Concept of optimization, optimization parameters, optimization methods.	<b>05</b>
05	<b>Packaging of Pharmaceuticals:</b> Desirable characteristics, Detail study of different types of container and closure (glass, plastic and rubbers) including their merits and demerits, Temper-resistant packaging, blister and strip packaging, Selection and evaluation of pharmaceutical packaging materials.	<b>08</b>
06	<b>cGMP:</b> Introduction, Regulatory objectives of cGMP, Organization and Personnel, Buildings and Facilities, Production and Process control, packaging and Labeling control, Record and Reports.	<b>06</b>
07	<b>Safety management:</b> Industrial hazards due to fire, accident, mechanical and electrical equipment, chemicals and pharmaceutical safety measures.	<b>03</b>

**REFERENCE BOOKS:**

1. JD Nally. Good manufacturing Practices for Pharmaceuticals. Informa healthcare, New York.
2. Hiranath SR, Textbook of Industrial Pharmacy, Orient blackswam,2008
3. Chaudhari S. The WTO and Indias Pharmaceutical Industry: Patent Protection, TRIPs and Developing Countries. Oxford University Press.
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10. Remington , "The Science and Practice of Pharmacy", Vol. I and II, 21<sup>st</sup> ed. Lippincotts Williams and Wilkin, Indian Edn. Distributed by B. I. Publications Pvt. Ltd., 2005.

**B.Pharm-IV (Semester- VIII)**  
**DOSAGE FORM TECHNOLOGY II (BP-801)**

SN	Topics	Hrs
01	<p><b>Oral Controlled Drug Delivery Systems</b> Introduction, Design and fabrication of novel drug delivery system for oral controlled release: - osmotic pressure controlled gastrointestinal delivery systems, hydrodynamic pressure-controlled gastrointestinal delivery systems, membrane permeation-controlled gastrointestinal delivery systems, gel diffusion-controlled gastrointestinal delivery systems, pH-controlled gastrointestinal delivery systems, and ion-exchange-controlled gastrointestinal delivery systems. Modulation of gastrointestinal transit time:- gastrointestinal anatomy and dynamics, prolongation of GI retention (hydrodynamically balanced intragastric delivery system, intragastric floating gastrointestinal drug delivery system, inflatable gastrointestinal drug delivery system, intragastric osmotically controlled drug delivery system, intrarumen controlled-release drug delivery device, bio/mucoadhesive gastrointestinal drug delivery systems, co administration with GI motility-reducing drugs). Overcoming of hepatic first pass elimination and its approaches.</p>	<b>13</b>
02	<p><b>Sterile Dosage Form:</b> Type of injections, parenteral routes of administrations, water for injection, pyrogenicity, its sources and elimination, large &amp; small volume parenteral. Formulation and development of sterile dosage forms, active ingredients, solvent and vehicles, surfactant and solubilizers, antimicrobials, antioxidants, buffers, chelating agents, tonicity adjusters. Containers and closures for sterile dosage forms. Quality control tests like sterility, pyrogen, clarity, safety and leakage testing.</p>	<b>10</b>
03	<p><b>Microencapsulation:</b> Introduction, importance of microencapsulation in pharmacy, concept of core &amp; coating materials, Techniques of microencapsulation:., coacervation phase separation, multi orifice centrifugal process, spray drying &amp; spray congealing, air suspension and coating pan, solvent evaporation, evaluation of microcapsules.</p>	<b>07</b>
04	<p><b>Fundamental Concepts in Controlled Release</b> Introduction, Rationale, Classification and Factors influencing design and performance of sustained/controlled drug delivery system, Physicochemical properties of a drug influencing drug product design and performance, Biological factors influencing design and performance of sustained/controlled release system, Polymer properties influencing drug permeation.</p>	<b>07</b>
05	<p><b>Parenteral Controlled Drug Delivery Systems</b> Introduction, Sustained/controlled release dosage forms: - aqueous solution (high viscosity products, complex formation), oil solution, oil suspensions, biocompatible carriers (erythrocytes, biological and synthetic macromolecules), liposomes, implants, infusion devices, prodrugs. Drug targeting :- Active and passive drug targeting, carriers for targeted drug delivery system (Monoclonal antibodies,immunoliposomes, lipoproteins, polymeric micelles and nanoparticles)</p>	<b>08</b>

## DOSAGE FORM TECHNOLOGY II (BP-807)

### PRACTICALS:

Preparation and evaluation of following dosage forms:

1. Small volume parenterals: solution, emulsion, suspension, powder ready to use.
2. Large volume parenterals
3. Ophthalmic solutions
4. Otic solution.
5. Microspheres.
6. Matrix tablet.
7. Microencapsule

### REFERENCE BOOKS:

1. Kydoneius A. Treatise on controlled drug delivery: Fundamentals, Optimization, Applications, Marcel Dekker, New York.
2. Ansel HC, Allen LV, Popovich NG . Pharmaceutical Dosage Form and Drug Delivery Systems, Lippincott, Williams & Wilkins, Philadelphia.
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4. Hickey AJ. Pharmaceutical Inhalation Aerosol Technology, 1<sup>st</sup> ed, Marcel Decker, 2004.
5. Benita. Microencapsulation- methods & Industrial Applications, 2<sup>nd</sup> ed, vol-158, Taylor & Francis Publication, 2006.
6. Bean HS, Beckett AH, Carless JE. Advances in Pharmaceutical sciences, Academic Press
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8. Indian Pharmacopoeia. Published by the IP commission, Ghaziabad, Delhi.
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16. Warbrick JS. Novel drug delivery systems, Vol. 14

**B.Pharm-IV (Semester- VIII)**  
**MEDICINAL CHEMISTRY III (BP-802)**

SN	Topics	Hrs
01	Drug acting on respiratory system: Antiasthmatics, Bronchodialators, Phosphodiesterase Inhibitors, Expectorants, Decongestants and Antitussives.	08
02	Sympathetic and parasympathetics drugs: Adrenergic Neurotransmitters Anti Adrenergic, Cholinergic and Anticholinergics, Antispasmodics, Ganglionic Stimulants and Blockers, Neuromuscular Blockers.	13
03	Thyroids and antithyroids.	03
04	Histamine and Antihistaminic agents	06
05	Narcotic Analgesics and NSAIDS	04
06	Prostaglandins and Eicosanoids.	03
07	Steroids.	06
08	Oxytocics	02

**Medicinal Chemistry III(BP-808)**

**PRACTICAL:**

**Assay of following drugs**

Ibuprofen, Sulfanilamide, Isoniazid, Aspirin, Ascorbic acid, Sulfamethoxazole  
Paracetamol

**Synthesis and physico-chemical characterization of following compounds**

Benzotriazole from o-phenylene diamine  
Phenytoin from benzoin  
Chlorobutanol from chloroform  
Quinoline from aniline by skrup method  
Benzlidine acetone from benzaldehyde

**Microwave assisted synthesis of following.**

2-cyano-3-(4'-methoxyphenyl)-propenoate from P-anisaldehyde  
2, 3 diphenyl quinaxaline from o-phenylene diamine

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1. Wilson and Gisvold's Text Book of Medicinal Chemistry, Lippincott Williams and Wilkins.
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**B.Pharm-IV (Semester- VIII)**  
**PHARMACEUTICAL ANALYSIS V (BP-803)**

SN	Topics	Hrs
01	<b>Chromatography:</b> Introduction and classification of chromatography.	<b>02</b>
02	<b>Column Chromatography:</b> Adsorption column chromatography, Development Techniques (Frontal, displacement and elution analysis), Preparation of column, Factors affecting column efficiency, Partition chromatography.	<b>05</b>
03	<b>Ion exchange Chromatography:</b> Principle, Ion exchange resins/material, Properties of ion exchangers, Mechanism of ion exchange process, Factors affecting ion exchange.	<b>05</b>
04	<b>Paper chromatography:</b> Principle, Choice of filter papers, Solvents, Chromatographic chambers, Development techniques (Descending, Ascending, Radial multiple chromatography, two dimensional chromatography), Factors affecting retention factor.	<b>05</b>
05	<b>Thin layer chromatography (TLC):</b> Principle, Different methods / techniques, Development of chromatograph, Rf value (Retention factor) and factors affecting Rf value.	<b>07</b>
06	<b>Gas chromatography</b> Theory, Instrumentation (Carrier gas, Columns, stationary phases for gas-liquid and gas-solid chromatography, Detectors- flame ionization, electron capture and thermal conductivity detector), Quantitative analysis.	<b>07</b>
07	<b>High Performance Thin layer chromatography (HPTLC)</b> Principle, Instrumentation, Preparation of plate, Development techniques.	<b>04</b>
08	<b>High Performance Liquid chromatography (HPLC)</b> Principle, Instrumentation, Solvent treatment systems, Pumps, column packing material, Detectors.	<b>07</b>
09	<b>Gel chromatography:</b> Theory, instrumentation and applications.	<b>03</b>

**Pharmaceutical analysis-V (BP-809)**

**PRACTICAL:**

1. Separation of mixture of amino acids / sugars / dicarboxylic acids by paper Chromatography. (Minimum four)
2. Experiment based on column chromatography.(Minimum two)
3. Experiment based on TLC.(Minimum three)
4. Experiment based on ion-exchange chromatography.
5. Demonstration HPLC
6. Biochemical analysis of glucose, cholesterol, creatinine, creatine in biological samples.

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15. B.K. Sharma. Instrumental Methods of Chemical Analysis, Goel Publishing House, Meerut.
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17. A. V. Kasture, K. R. Mahadik, S. G. Wadodkar, H. N. More, A Textbook of Pharmaceutical Analysis, Vol. I, 6th edition, 2002, Nirali Prakashan, New Delhi.

<b>B.Pharm-IV (Semester- VIII)</b> <b>Clinical Pharmacotherapeutics-II (BP-804)</b>		
SN	Topics	Hrs
01	General - Prescribing Guidelines for – Pediatric patients, Geriatric patients, Pregnant and Breast Feeding womens.	<b>05</b>
02	<b>Etiopathogenesis and pharmacotherapy of diseases / disorders associated</b> <b>Endocrine system:</b> Diabetes mellitus, Disorders of Thyroid gland, Adrenocortical dysfunction, Oral Contraceptives.	<b>05</b>
03	<b>Etiopathogenesis and pharmacotherapy of Infectious diseases:</b> Tuberculosis, Leprosy, Meningitis, Respiratory Tract Infections, Gastroenteritis, Endocarditis, Septicemia, Urinary Tract Infections, Malaria, AIDS and Opportunistic Infections, Fungal Infections, Viral Infections, Gonorrhea and Syphilis.	<b>18</b>
04	<b>Etiopathogenesis and pharmacotherapy of Oncology:</b> Basic principles of Cancer therapy, Chemotherapy of Breast cancer, Leukemia, Cancer of G.I. Tract, Lungs, Prostate, Skin, Gynecological. Management of adverse effects of anticancer drugs.	<b>09</b>
05	<b>Pharmacology of special topics:</b> Gene therapy-Approach and Application of gene therapy, Stem Cell therapy	<b>02</b>
06	<b>Pharmacovigilance (drug safety):</b> Introduction to Pharmacovigilance, Development of Pharmacovigilance system in India, Various legislations enacted, Safety regulations, WHO, CIOMS and Pharmacovigilance, ICH guidelines.	<b>06</b>

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2. Bennett P.N, Brown M.J. Clinical Pharmacology. Churchill Living Stone
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5. Craig C.R, Stitzel R.E. Modern Pharmacology with Clinical application. Lippincott Williams & Wilkins, New York
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11. Karen Rascati. Essentials of Pharmacoeconomics. Lippincott Williams & Wilkins.
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17. Parrthsarathi G, Hansen Kavin Nytor & Nahata Milap C. A Textbook of Clinical Practice: Essential Concepts & skills, Orient Longman
18. P G Yeole, Dhanlakshmi Iyer, Highlights on Pharmacovigilance, Studium Press (India) Pvt. Ltd.
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20. Raymond J.M. Niesink, John de vries. Hollinger M.A. Toxicology- Principle and applications, CRC, Florida

21. Remington's Pharmaceutical Science and practice pharmacy. Lippincott Williams and Wilkins, New Delhi
22. Roger Walkar, Clinical Pharmacy and Therapeutics. Churchill Livingstone Publication.
23. Satoskar R. S. and Bhandarkar S. Pharmacology and Pharmacotherapeutics. Popular Prakashan Pri. Ltd., Mumbai
24. Turner R.A. Screening methods in Pharmacology. Academic Press, London.
25. Vogel H.G. Drug Discovery and Evaluation, Pharmacological Basis. Springer-Verlag Berlin, Heidelberg.
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29. Braunwald E., Harrison's Principles of Internal Medicine. McGraw-Hill Medical.
30. Brunton L. L. and Others Goodman and Gilman's The Pharmacological Basis of Therapeutics. McGraw Hill Medical Pub. Div. New York.
31. Christopher H., Davidson's Principles and Practice of Medicine. Churchill Livingstone.
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35. Rang, H.R. Dale, M. Pharmacology E.L.B.S., London
36. Rosenteld, G.C., Loose Mitchell and Jones J. B. Lippincott Williams and Wilkins U.S.A. Board Review Pharmacology.

**B.Pharm-IV (Semester- VIII)**  
**Industrial Pharmacognosy (BP-805)**

SN	Topics	Hrs
01	Importance and status of herbal medicine	<b>02</b>
02	<b>Phytopharmaceuticals</b> Industrial methods of isolation and utilization of the following Phytopharmaceuticals: Quinine, Cardiac glycosides, Sennosides, Diosgenin, Glycyrrhizin, Andrographolides, Rutin, Guggul lipids.	<b>10</b>
03	<b>Herbal Formulations</b> A comparative study of Ayurvedic and modern dosage forms, Different stages of Herbal formulations , study of methods of preparations of various ayurvedic dosages forms. like Aristas, Asava, Ghutika, Tailia, Churna, Avaleha, Ghritaand Bhasms, Unani formulations like Majooms, Safoofs and their evaluation. Determination of heavy metals in herbal preparation and alcohol contents in Aristas and Asvas.	<b>10</b>
04	<b>Chemotaxonomy –</b> Introduction, merits& demerits and application with examples.	<b>04</b>
05	<b>Herbal Cosmetics:</b> Brief study of Phytocosmetics of industrial significance and current status. Herbs used for different cosmetic preparations like Shampoos, Conditioners, Hair Darkeners and Skin Care. Study of following herbs used in different cosmetics formulations-- Soapnut, Amla, Henna, Hibiscus, Tea, Aloe vera, Glycyrrhiza, Turmeric, Sandalwood and others involved in the suitable formulation. Basic evaluation parameter for skin care and shampoos.	<b>08</b>
06	<b>Quality control in the production chain of herbal product</b> Introduction, product chain, Benefits of integral quality control and basic requirements of quality control of herbal production.	<b>04</b>
07	<b>Neutraceuticals</b> Introduction, classification, Neutraceuticals and diseases cardiovascular, obesity, Diabetes, cancer and inflammatory diseases.	<b>05</b>
08	<b>Brief account of plant based industries involved in medicinal and aromatic plants in India.</b>	<b>02</b>

## **INDUSTRIAL PHARMACOGNOSY (BP 8010)**

### **PRACTICAL**

1. Isolation of aloin from *Aloe vera*.
2. Formulation and evaluation of following category of Ayurvedic preparations (Minimum one of each category)
  - i. Asava and Arista
  - ii. Churna
  - iii. Lepas
  - iv. Ghrita and Taila
  - v. Natural sunscreen oil
  - vi. Natural blooming bath oil
3. Extraction /Isolation of tannic acid from myrobalan.
4. Extraction and estimation of cardiac glycoside.
5. Preparation and evaluation of herbal cosmetics-
  - Hairs cosmetics
  - Skin cosmetics
6. Evaluation of Marketed Herbal Formulations.

### **Reference Books**

1. Ashutosh Kar. Pharmacognosy and Pharmacobiotechnology, New Age International Publishers, New Delhi.
2. C.K. Atal and B.M. Kapoor: Cultivation and Utilization of Medicinal & Aromatic Plants, RRL, Jammu.
3. Pharmacognosy and Phytochemistry- Part I and Part II – V. D. Rangari, Career Publication, Nashik.
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14. PDR for Herbal Medicines, 2007, 4th Ed., Medicinal Economic Company, New Jersey.
15. Quality Standards of Indian Medicinal Plants, Vol. I-X, ICMR, New Delhi.
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<b>B.Pharm-IV (Semester- VIII)</b> <b>PHARMACEUTICAL JURISPRUDENCE (BP-806)</b>		
<b>SN</b>	<b>Topics</b>	<b>Hrs</b>
01	<b>Drug legislation in India.</b> Origin and nature of pharmaceutical legislation in India, scope and objective, New drug policy.	<b>03</b>
02	<b>Code of Ethics for Pharmacists.</b> Pharmaceutical code of ethics, Study of code of pharmaceutical ethics drafted by PCI regarding to pharmacist in relation to his job, to his trade, and to medical profession.	<b>02</b>
03	<b>Pharmacy Act 1948.</b> Objective, Definitions, Pharmacy council of India and State Pharmacy Councils, Composition and Function, Preparation of Registers and qualifications for entry into registers, Educational Regulation and Approval of Courses and Institutions, Offences & Penalties.	<b>06</b>
04	<b>Medicinal and Toilet Preparations (Excise Duties) Act 1955, Rules 1976.</b> Definitions, Restricted and unrestricted preparations, Manufacturing in bond and outside bond, Offences and Penalties.	<b>04</b>
05	<b>Drugs Price Control Order, 1995</b> Definition, price of bulk drugs, Retail price of formulation, DPEA, Maintenance of records.	<b>02</b>
06	<b>Drugs and Magic Remedies (Objectionable Advertisements) Act 1954</b> Definitions, Prohibited Advertisement, Savings.	<b>02</b>
07	<b>Drugs and Cosmetics Act 1940, Rules 1945.</b> Definitions, Administrative bodies -DTAB and DCC, Composition and function, Central Drug Laboratories and Government Analysts, Drug inspectors, Licensing Authorities, Controlling Authorities and Customs Collectors Provisions, Manufacture and Sale of Drugs, Labeling and Packaging of Drugs, Provisions applicable to manufacture and Sale of Ayurvedic Drugs, Provisions Governing Import, Various offences and corresponding Penalties, Schedules of the Drugs and Cosmetic Act and Rules.	<b>15</b>
08	<b>Narcotic Drugs and Psychotropic Substances Act, 1985 and Rules, 1985</b> Introduction & objective, Definitions, Prohibited and controlled operation, Authorities and officers, Offences and corresponding penalties.	<b>07</b>
09	<b>Indian patent act</b>	<b>04</b>

#### **REFERENCE BOOKS:**

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2. Mittal B.M., "A Text Book of Forensic Pharmacy," X ed., National Book Depot.
3. Jain N. K. "A Text Book of Forensic Pharmacy," Vallabh Prakashan,
4. Mallick "Drug and Cosmetics Act & Rules together with Drug (Prices Control) Order," XI ed., Eastern Book Company, 1998.
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**B.Pharm-IV (Semester- VIII)**  
**SEMINAR AND PROJECT WORK (BP-8011)**

<b>SN</b>	<b>Topics</b>	<b>Hrs</b>
01	<p><b>Project Work:-</b> The topic for the project shall be based on the practical work/theoretical/review oriented/any topic from current Pharmaceutical development and shall be assigned to him/her by the respective guide from faculty member (Maximum eight students per teacher) immediate from the date of the commencement of the eighth semester. Internal assessment will be based on average marks obtained after delivering three seminars on given topic during this semester.</p>	