

Bachelor of Pharmacy 2<sup>nd</sup> year (3<sup>rd</sup> Semester) WEF 2013 – 2014 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 301	Organic Chemistry – II	3	0	15	5	20	80	100	3
2	PHR – 302	Unit Operations-II	3	0	15	5	20	80	100	3
3	PHR – 303	Physical Pharmacy	3	0	15	5	20	80	100	3
4	PHR – 304	Pharmacognosy-I	3	0	15	5	20	80	100	3
5	PHR – 305	Anatomy, Physiology and Path Physiology- III	3	0	15	5	20	80	100	3
Practical Day to Day Evaluation										
6	PHR – 301P	Organic Chemistry – II	0	4	-	-	20	80	100	2
7	PHR – 302P	Unit Operations-II	0	4	-	-	20	80	100	2
8	PHR – 303P	Physical Pharmacy	0	4	-	-	20	80	100	2
9	PHR – 304P	Pharmacognosy-I	0	4	-	-	20	80	100	2
			15	16			180	720	900	

T.A. – Teacher Assessment, ESE – End Semester Examination, CT – Cumulative Test

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively 0.6 Credits – Sessional  
2.4 Credits – ESE

Bachelor of Pharmacy 2<sup>nd</sup> year (4<sup>th</sup> Semester) WEF 2013 – 2014 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 401	Pharmaceutical Analysis-II	3	0	15	5	20	80	100	3
2	PHR – 402	Anatomy, Physiology and Path physiology- IV	3	0	15	5	20	80	100	3
3	PHR – 403	Pharmacognosy -II	3	0	15	5	20	80	100	3
4	PHR – 404	Chemistry of Natural Products	3	0	15	5	20	80	100	3
5	PHR – 405	Pharmaceutical Jurisprudence & Ethics	3	0	15	5	20	80	100	3
Practical Day to Day Evaluation										
6	PHR – 401P	Pharmaceutical Analysis-II	0	4	-	-	20	80	100	2
7	PHR – 403P	Pharmacognosy –II	0	4	-	-	20	80	100	2
8	PHR – 404P	Chemistry of Natural Products	0	4	-	-	20	80	100	2
			18	12			160	640	800	

T.A. – Teacher Assessment, ESE – End Semester Examination, CT – Cumulative Test

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

0.6 Credits – Sessional

2.4 Credits – ESE

Bachelor of Pharmacy 3<sup>rd</sup> year (5<sup>th</sup> Semester) WEF 2013 – 2014 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 501	Pharmaceutical Chemistry	3	0	15	5	20	80	100	3
2	PHR – 502	Pharmaceutical Technology-I	3	0	15	5	20	80	100	3
3	PHR – 503	Medicinal Chemistry-I	3	0	15	5	20	80	100	3
4	PHR – 504	Pharmacology-I	3	0	15	5	20	80	100	3
5	PHR – 505	Pharmaceutical Microbiology	3	0	15	5	20	80	100	3
Practical Day to Day Evaluation										
6	PHR – 501P	Pharmaceutical Chemistry	0	4	-	-	20	80	100	2
7	PHR – 502P	Pharmaceutical Technology-I	0	4	-	-	20	80	100	2
8	PHR – 503P	Medicinal Chemistry-I	0	4	-	-	20	80	100	2
9	PHR – 504P	Pharmacology-I	0	4	-	-	20	80	100	2
10	PHR – 505P	Pharmaceutical Microbiology	0	4	-	-	20	80	100	2
			15	20			200	800	1000	

T.A. – Teacher Assessment, ESE – End Semester Examination, CT – Cumulative Test

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively 0.6 Credits – Sessional

2.4 Credits – ESE

Bachelor of Pharmacy 3<sup>rd</sup> year (6<sup>th</sup> Semester) WEF 2013 – 2014 Session onwards

S.N	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR – 601	Pharmaceutical Biotechnology	3	0	15	5	20	80	100	3
2	PHR – 602	Pharmaceutical Technology-II	3	0	15	5	20	80	100	3
3	PHR – 603	Medicinal Chemistry-II	3	0	15	5	20	80	100	3
4	PHR – 604	Pharmacology-II	3	0	15	5	20	80	100	3
5	PHR – 605	Pharmacognosy-II	3	0	15	5	20	80	100	3
Practical Day to Day Evaluation										
6	PHR – 602P	Pharmaceutical Technology-II	0	4	-	-	20	80	100	2
7	PHR – 603P	Medicinal Chemistry-II	0	4	-	-	20	80	100	2
8	PHR – 604P	Pharmacology-II	0	4	-	-	20	80	100	2
9	PHR – 605P	Pharmacognosy-II	0	4	-	-	20	80	100	2
			15	20			180	720	900	

T.A. – Teacher Assessment, ESE – End Semester Examination, CT – Cumulative Test

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively 0.6 Credits – Sessional  
2.4 Credits – ESE

**PHR-301**  
**SEMESTER-III**  
**ORGANIC CHEMISTRY-II**  
**(PHARMACEUTICAL CHEMISTRY-III)**

**UNIT-I:**

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

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

**UNIT-II:**

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

**UNIT-III:**

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

**UNIT-IV:**

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

**UNIT-V:**

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

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

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

**BOOKS RECOMMENDED:-**

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

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

**UNIT-I:**

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

**UNIT-II:**

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

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

**UNIT-III:**

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

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

**UNIT-IV:**

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

**UNIT-V**

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

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

**(08)**

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

**BOOKS RECOMMENDED:-**

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

## PHR- 303

### UNIT-I:

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

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

### UNIT-II:

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

### UNIT-III:

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

### UNIT-IV:

#### DISPERSION SYSTEMS:

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

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

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

### UNIT-V:

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

## PHR- 303P

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

Practicals based on the above mentioned theory topics.

#### BOOKS RECOMMENDED:

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

## PHR-304

### Unit-I:

#### PHARMACOGNOSY-I

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

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

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

### Unit-II :

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

### Unit-III :

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

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

**B.-** Plant growth regulators. **(08)**

### Unit-IV :

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

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

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

### Unit-V :

**Systematic Pharmacognostic Study of the Following:**

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

## PHR-304P

### PHARMACOGNOSY-I LAB.

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

#### BOOKS RECOMMENDED:

1. Trease. GE & Evans WC, Pharmacognosy, Bailliere Tindall Eastbourne. UK. a. 6
2. Wallis. TE, Text book of Pharmacognosy, JA Churchill Ltd.
3. Wallis, Practical Pharmacognosy 4th Ed, PharmaMed Press
4. Sengar, Text Book of Pharmacognosy, PharmaMed Press
5. Kokate. CK, Practical Pharmacognosy, Vallabh Prakashan, Delhi.
6. Wallis. T.E, Analytical Microscopy, J & A Churchill Limited London.
7. Brain, KR and Turner, TD, The practical evaluation of phyto pharmaceutical, Wright, Scientifica- Bristol.
8. Kokate, CK, Pharmacognosy, Nirali Prakashan. Pune.
9. Schewar, PJ, Marine Natural Products, Academic press, London.

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

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

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

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

**Unit -I**

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

**Unit -II**

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

**(08)**

**Unit-III**

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

**Unit-IV**

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

**Unit-V**

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

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

**BOOKS RECOMMENDED**

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

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

### **PHR-401**

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

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

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

A. Non-aqueous titration

B. Diazotisation titrations **(08)**

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

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

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

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

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

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

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

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

### **PHR-401P**

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

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

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

3. Exercises involving diazotization, Karl-Fischer methods.

4. Determination of Sodium, Potassium and Calcium ion by Flame Photometry. **BOOKS RECOMMENDED:**

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

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

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

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

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

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

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

8. Analysis" Pearson Education Asia.9

**ANATOMY PHYSIOLOGY AND PATHOPHYSIOLOGY –IV**

**Unit-I –**

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

**Unit-II –**

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

**Unit-III –**

**Cell injury & Adaptation** – Courses of cell injury, pathogenesis & morphology of cell injury. **Cellular Adaptation** – Atrophy, hypertrophy, aplasia, metaplasia, & dysplasia, intracellular accumulation & pathophysiology of Neoplasm. **(08)**

**Unit IV –**

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

**Unit-V Pathophysiology**

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

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

**BOOKS RECOMMENDED**

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

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

**Unit-I –**

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

**a)** Fibres: Wool, Cotton wool, Jute, Silk, Nylon, Terylene and Polyesters. Pharmaceutical aid: Talc, Asbestos, Bentonite, Kaolin and Prepared Chalk.

**b)** Fixed oil, Fats and Waxes: Almond, Castor oil, Cotton seed oil, Sesame oil, Olive oil, Cord liver oil, Arachis oil, , Chaulmoogra oil, Neem oil, Fish liver oil, Lard, Lanolin, Bees wax, Lard, Cocoa butter, Kokum butter and wool fat. **(08)**

**Unit-II –**

PHYTOCHEMICAL SCREENING:

(a) Preparation of extract

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

**Unit-III –**

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

**Unit-IV –**

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

**Unit-V –**

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

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

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

**BOOKS RECOMMENDED:**

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

## PHR-404

### CHEMISTRY OF NATURAL PRODUCTS

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

#### UNIT-I:

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

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

#### UNIT-II:

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

#### UNIT-III

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

#### UNIT-IV

Terpenoids : Citral, menthol and camphor. **(08)**

#### UNIT-V

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

## PHR-404P

### CHEMISTRY OF NATURAL PRODUCTS

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

#### BOOKS RECOMMENDED:

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

**PHARMACEUTICAL JURISPRUDENCE & ETHICS**

**UNIT-I:**

**INTRODUCTION:**

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

**UNIT-II:**

**AN ELABORATE STUDY OF THE FOLLOWING:**

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

**UNIT-III :**

**AN ELABORATE STUDY OF THE FOLLOWING:**

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

**UNIT-IV:**

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

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

**UNIT-V:**

- a) Patents Act 1970, Trade mark and copyrights acts.- main provisions.
  - b) U.S Food and Federal D&C Act – CFR -21, CGMP; EuGMP,WHO,Orange book
- (08) Note :** The teaching of all the above Acts should cover the latest amendments.

**BOOKS RECOMMENDED:**

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

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

PHR-501

### PHARMACEUTICAL CHEMISTRY- V (BIOCHEMISTRY)

#### Unit-I:

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

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

#### Unit-II

**a. Carbohydrate metabolism:** Glycolysis, Gluconeogenesis and Glycogenolysis. Metabolism of galactose. [08]

#### Unit-III

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

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

#### Unit-IV

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

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

#### Unit-V

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

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

#### PHARM- 501P

### PHARMACEUTICAL CHEMISTRY- V (BIOCHEMISTRY) PRACTICAL

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

#### BOOKS RECOMMENDED:

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

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

**Unit-I: Preformulation studies:**

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

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

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

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

**Unit-V:**

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

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

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

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

**BOOKS RECOMMENDED**

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

PHR-503

PHARMACEUTICAL CHEMISTRY-VI  
(MEDICINAL CHEMISTRY –I)

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

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

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

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

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

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

**Unit-IV:** [08]

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

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

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

PHR -503P

PHARMACEUTICAL CHEMISTRY-VI  
(MEDICINAL CHEMISTRY-I)  
PRACTICAL

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

**BOOKS RECOMMENDED:**

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

## PHR-504

### PHARMACOLOGY – I

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

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

#### **Unit-III: Pharmacology of ANS**

Drug acting on autonomic nervous system

##### **I-Cholinergic system-**

Parasympathomimetic (Cholinergic) drugs.

Parasympatholytic (anti Cholinergic) drugs.

Drug acting on autonomic ganglia (Stimulants and blocking agents)

##### **II-Adrenergic system**

Sympathomimetic (Adrenergic) drugs

Sympatholytic (Anti-adrenergic) drugs [08]

#### **Unit-IV: Pharmacology of CNS**

General Anaesthetics, Alcohols & disulfiram, Sedative hypnotics,

Psychopharmacological agents-anti anxiety agents, antipsychotics, antidepressants.

Antiepileptic drugs, Antiparkinsonism drugs, Analgesics & antagonists. [12]

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

Local anesthetics [06]

Skeletal muscle Relaxants Peripherally and centrally acting muscle Relaxants

## PHR-504P

### PHARMACOLOGY- I

#### PRACTICAL

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

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

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

#### **BOOKS RECOMMENDED:**

1. Goodman & Gilman, The Pharmacological basis of Therapeutics, Editors:

J.G. Hardman, McGraw Hill Pub Co.,

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

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

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

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

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

Ltd. Bombay.

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

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

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

10. Turner, Screening Methods in pharmacology, Elsvier

## PHR-505

### PHARMACEUTICAL MICROBIOLOGY

#### Unit-I:

Introduction to the scope of microbiology and microscopy

Structure of bacterial cell.

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

#### Unit-II:

Identification of Microbes: Stains and types of staining techniques.

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

Different culture media and their classification-

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

Microbial growth [08]

#### Unit-III:

Control of microbes by physical and chemical methods.

Disinfection, factors influencing disinfectants, dynamics of disinfection,

Disinfectants and antiseptics and their evaluation.

Preservative efficacy [08]

#### Unit-IV:

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

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

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

(ERH) in microbiological testing. [08]

#### Unit-V:

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

## PHR-505P

### PHARMACEUTICAL MICROBIOLOGY

#### PRACTICAL

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

#### BOOKS RECOMMENDED:

1. Stanier R.Y., Ingraham, J.L., Wheelis M.L. & Painter P.R. General Microbiology, Macmillan Press Limited.

2. Malathi, Manual of Practical Microbiology, PharMAmED Press, Hyderabad

3. Tortora, Microbiology An Introduction, 9<sup>TH</sup>. Ed, Pearson education

4. Glazer, "Microbial Biotechnology' Cambridge Univ. Press

5. Pelczar & Reid, Microbiology, Tata Mc Graw Hill, Delhi.

6 Ananthanarayan R & Paniker CKJ, Textbook of Microbiology, Orient Longman.

7 Aneja K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom Cultivation, Vishwa Prakashan.

8 Gunasekaran P, Lab Manual of Microbiology, New Age Publishers.

9. Latest edition of USP

10. Latest edition of IP

11. Latest edition of B.P.

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

**PHR –601**

## **PHARMACEUTICAL BIOTECHNOLOGY**

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

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

[08]

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

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

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

### **Unit-III:**

#### **Microbial Transformation:**

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

### **Unit-IV:**

#### **Enzyme immobilization:**

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

### **Unit-V:**

#### **Antibiotics:**

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

### **BOOKS RECOMMENDED:**

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

**PHR-602**

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

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

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

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

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

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

**Unit-IV: Parenteral Products:**

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

**Unit-V:**

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

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

**PHR-602P**

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

**PRACTICAL**

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

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

**BOOKS RECOMMENDED**

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

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

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

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

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

6. Augsburger Larry L."Pharmaceutical Doasage Forms: tablets

" 3<sup>rd</sup> edition Informa healthcare

7. IP (Latest edition)

8. BP (Latest edition)

9. USP (Latest edition)

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

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

**PHARMACEUTICAL CHEMISTRY-VII  
(MEDICINAL CHEMISTRY - II)**

**Unit-I-Drug Design**

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

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

Cardiac glycosides & drug used for CHF- Digitoxin

Antiarrhythmic drugs- Propranolol, Procainamide

Antianginal drugs- Isosorbide mononitrate

Antihypertensive drugs-Captopril, methyldopa, Nifedipine.

[08] Anticoagulants- Heparin, warfarin

Antihyperlipidemics- Lovastatin, Clofibrate

**Unit-III**

Antispasmodic and Antiulcer drugs- Dicyclomine, Ranitidine, Omeprazole.

Antitussives- Dextromethorphen.

[08]

**Unit-IV: Analgesics and Antipyretics** – Aspirin, Mefanamic Acid, Ibuprofen,

Diclofenac, Paracetamol [08]

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

**PHR-603P**

**PHARMACEUTICAL CHEMISTRY -  
VII (MEDICINAL CHEMISTRY-II)  
PRACTICAL**

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

**BOOKS RECOMMENDED:**

1. Thomas J..Perun," Computer –aided Drug Design methods applications'.PharmaMed Press, Hyderabad

2 Delagado J N and Remers W A R, Eds., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.

3 Foye W C, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.

4 Shri ram,/ Yogeeswari, medicinal chemistry, 2<sup>nd</sup>. Ed, Pearson education

5 Singh Harkishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.

6. Korolkovas, Essentials of medicinal chemistry, Wiley India

7. 8. Wermuth C G. The practice of Medicinal Chemistry-III, Academic press an imprint of Elsevier

9 Pharmacopoeia of India 2010, Ministry of Health, Govt. of India.

10.Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.

11. Furniss B S, Hannaford A J, Smith P W G and Tathell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.

12. Latest edition of B.P.

13. Latest edition of U.S.P.

**PHR-604**  
**PHARMACOLOGY-II**

**Unit-I:**

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

**Unit-II:**

**Drugs Acting on Haemopoietic System**

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

**Drugs Acting on Respiratory System**

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

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

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

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

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

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

1. Relevant experiments based on theory syllabus

**BOOKS RECOMMENDED:**

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

## PHR--605

### PHARMACOGNOSY – III

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

**Glycosides:**

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

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

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

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

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

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

## PHR-605 P

### PHARMACOGNOSY - III

#### PRACTICAL 11

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

**BOOKS RECOMMENDED:**

1. Trease, G.E., & Evans, W.C., Evans, W.C., "Pharmacognosy" Bailliere Tindall east Baorne, U.K.
2. Tyler V.E. et al : "Pharmacognosy" Lea & Febiger, Philadelphia.
3. Wallis. T.E, Practical pharmacognosy, 4rt. Ed, PharmaMed Press, Hyderabad.
4. Senger, A Texbook of pharmacognosy, PharmaMed Press
5. Nadkarni A.K. Indian Materia Medica 1-2, Popular Prakashan (P) Ltd. Bombay.
6. Atal C.K. & Kapur BM. "Cultivation & utilization of Medicinal plants, RRL, Jammu.
7. Harborne A J, Phytochemical methods,a guide to modern technics og plant analysis,PharmaMed Press, Hyderabad
8. The wealth of India, Raw Materials (All volumes) Council of Scientific & Industrial Research, New Delhi.
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