Study & Evaluation Scheme

of

Doctor of Pharmacy

(Pharm D./Pharm D Post baccalaureate)

Programme

[Applicable w.e.f. Academic Session 2013-14 till revised]

[Approved by AC/EC meeting date September 21, 2013]

TEERTHANKERMAHAVEERUNIVERSITY

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TEERTHANKER MAHAVEER UNIVERSITY
(Established under Govt. of U. P. Act No. 30, 2008)
Delhi Road, Bagarpur, Moradabad (U.P)

Study & Evaluation Scheme
of
Doctor of Pharmacy

SUMMARY

Programme	**:**	Pharm. D
Duration	**:**	Five year of academics and one year of internship
Medium	**:**	English
Minimum Required Attendance	**:**	80 percent
Maximum credits	**:**	122
Minimum credits required for getting degree	**:**	122

Assessment	**:**	**Internal**	**External**	**Total**
	:	**30**	**70**	**100**

Internal Evaluation (Theory papers)	**:**	**Class Test -I**	**Class Test -II**	**Class Test -III**	**Continuous evaluation**	**Total**
Average of best two		**20**	**20**	**20**	**10**	**30**

Internal Evaluation (Practical papers)	**:**	**Class Test -I**	**Class Test -II**	**Class Test -III**	**Continuous evaluation**	**Total**
Average of best two		**20**	**20**	**20**	**10**	**30**

Duration of examination	**:**	**Theory**		**Practical**	
		External	**Internal**	**External**	**Internal**
		3 hrs	**2 hrs**	**4 hrs**	**4 hrs**

1. **Eligibility for appearing at year END Examination**.— Only those students who have been enrolled in Pharm. D. or Pharm. D. (Post Baccalaureate) programme, as the case may be, and satisfactorily undergone the course of study by attending not less than 80% of the classes held both in theory and in practical separately in each course shall be eligible for appearing at the year-end examination.

2. **Mode of examinations**.—

(i) Theory examination shall be of three hours and practical examination shall be of four hours duration.

(ii) A Student who fails in theory or practical examination of a subject shall re-appear both in theory and practical of the same subject.

(iii) Practical examination shall also consist of a viva –voce (Oral) examination.

(iv) **Clerkship examination** – Oral examination shall be conducted after the completion of clerkship of students. An external and an internal examiner will evaluate the student. Students may be asked to present the allotted medical cases followed by discussion. Students' capabilities in delivering clinical pharmacy services, pharmaceutical care planning and knowledge of therapeutics shall be assessed.

3. Award of internal marks and maintenance of records.—

(i) A regular record of both theory and practical class work and examinations including training for Pharm. D. or as the case may be, Pharm. D. (Post Baccalaureate) course, shall be maintained for each student in the institution and 30 marks for each theory and 30 marks for each practical subject shall be allotted as internal assessment (marks).

(ii) There shall be three periodic internal examinations (Class Tests) during each academic year and the average of highest aggregates of any two performances shall form the basis of calculating internal assessment marks.

(iii) The internal marks in practical shall be allotted on the following basis:-

(a) Actual performance in the internal examination (20 marks);

(b) Day to day assessment in the practical class work, promptness, viva-voce record maintenance, etc. (10 marks).

4. **Minimum marks for passing examination**.— A student shall not be declared to have passed examination unless he or she secures at least 50% marks in each of the subjects separately in the theory examinations including internal marks and at least 50% marks in each of the practical examinations including internal marks.

The students securing 60% marks or above in aggregate in all subjects in the Pharm. D. or, Pharm. D. (Post Baccalaureate) course examination, shall be declared to have passed in first class.

Students securing 75% marks or above in any subject or subjects shall be declared to have passed with distinction in the subject or those subjects provided he or she passes in all the subjects in a single attempt.

5. **Eligibility for promotion to next year**.— All students, who have appeared for all the subjects and passed the first year annual examination, are eligible for promotion to the second year and, so on. However, failure in more than two courses shall debar him/her from promotion to the next year classes.

There will be one supplementary after each end-year examination within three months from the date of publication of the result. All the failure candidates will appear and clear their back papers. Those who pass all such papers/ carry not more than two papers, will be promoted to the next year while those failing in more than two papers will have to repeat the same year of the programme.

6. Internship programme:-

(i) Internship is a phase of training wherein a student is expected to conduct actual practice of pharmacy & health care and acquires skills under the supervision so that s/he may become capable of functioning independently.

(ii) Every student has to undergo one year internship as per Pharm. D. education regulation 2008.

7. **Certificate of passing examination**.— Every student who has passed the examinations for the Pharm.D. (Doctor of Pharmacy) or Pharm.D. (Post Baccalaureate) (Doctor of Pharmacy) as the case may be, shall be granted a certificate of completion by head of the institution.

The degree of passing Pharm. D. (Doctor of Pharmacy) or Pharm.D. (Post Baccalaureate) (Doctor of Pharmacy) as the case may be, will be given by the university.

Question Paper Structure for internal examinations:

Each class test (periodic internal examination) would comprise of six questions. Student shall have to answer any four questions out of which one question will be compulsory. Each question would be of five marks.

1. *The question paper shall consist of six questions. The first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question No. 1 shall contain 8 parts representing all units of the syllabus and students shall have to answer any five (weightage 1 marks each).*

2. *Out of the rest five questions, students shall be required to attempt any three. There will be minimum one and maximum two questions from each unit of the syllabus. The weightage of Question No. 2 to 6 shall be 05 marks each.*

3. *Each and every students will be evaluated individually for regularity, promptness, assignments and class room behavioural aspects (weightage 1 marks each).*

Question Paper Structure for external examinations:

1. *The question paper shall consist of eight questions. The first question shall be of short answer type (not exceeding 50 words) and treated as compulsory. Question No. 1 shall contain 8 parts representing all units of the syllabus and students shall have to answer any five (weightage 4 marks each).*

2. *Out of the rest seven questions, students shall be required to attempt any five. There will be minimum one and maximum two questions from each unit of the syllabus. The weightage of Question No. 2 to 6 shall be 10 marks each.*

Programme: Pharm. D

First Year

Applicable to those who opt **Remedial Mathematics**:

S.N.	*Course Code*	*Subject*	*Periods*			*Credits*	*Evaluation Scheme*		
			L	*T*	*P*		*Internal*	*External*	*Total*
1	PDR101	Human Anatomy and Physiology	3	1	-	3.5	30	70	100
2	PDR102	Pharmaceutics	2	1	-	2.5	30	70	100
3	PDR103	Medicinal Biochemistry	3	1	-	3.5	30	70	100
4	PDR104	Pharmaceutical Organic Chemistry	3	1	-	3.5	30	70	100
5	PDR105	Pharmaceutical Inorganic Chemistry	2	1	-	2.5	30	70	100
6	PDR106	Remedial Mathematics	3	4	-	5.0	30	70	100
7	PDR151	Human Anatomy and Physiology (P)	-	-	3	1.5	30	70	100
8	PDR152	Pharmaceutics (P)	-	-	3	1.5	30	70	100
9	PDR153	Medicinal Biochemistry (P)	-	-	3	1.5	30	70	100
10	PDR154	Pharmaceutical Organic Chemistry (P)	-	-	3	1.5	30	70	100
11	PDR155	Pharmaceutical Inorganic Chemistry (P)	-	-	3	1.5	30	70	100
		Total	**16**	**09**	**15**	**28**	**360**	**840**	**1200**

First Year

Applicable to those who opt **Remedial Biology**:

S.N.	*Course Code*	*Subject*	*Periods*			*Credits*	*Evaluation Scheme*		
			L	*T*	*P*		*Internal*	*External*	*Total*
1	PDR101	Human Anatomy and Physiology	3	1	-	3.5	30	70	100
2	PDR102	Pharmaceutics	2	1	-	2.5	30	70	100
3	PDR103	Medicinal Biochemistry	3	1	-	3.5	30	70	100
4	PDR104	Pharmaceutical Organic Chemistry	3	1	-	3.5	30	70	100
5	PDR105	Pharmaceutical Inorganic Chemistry	2	1	-	2.5	30	70	100
6	PDR107	Remedial Biology	3	1	-	3.5	30	70	100
7	PDR151	Human Anatomy and Physiology (P)	-	-	3	1.5	30	70	100
8	PDR152	Pharmaceutics (P)	-	-	3	1.5	30	70	100
9	PDR153	Medicinal Biochemistry (P)	-	-	3	1.5	30	70	100
10	PDR154	Pharmaceutical Organic Chemistry (P)	-	-	3	1.5	30	70	100
11	PDR155	Pharmaceutical Inorganic Chemistry (P)	-	-	3	1.5	30	70	100
12	PDR156	Remedial Biology (P)	-	-	3	1.5	30	70	100
		Total	**16**	**06**	**18**	**28**	**360**	**840**	**1200**

Second Year

S.N.	*Course Code*	*Subject*	*Periods*			*Credits*	*Evaluation Scheme*		
			L	*T*	*P*		*Internal*	*External*	*Total*
1	PDR201	Pathophysiology	3	1		3.5	30	70	100
2	PDR202	Pharmaceutical Microbiology	3	1		3.5	30	70	100
3	PDR203	Pharmacognosy & Phytopharmaceuticals	3	1		3.5	30	70	100
4	PDR204	Pharmacology-I	3	1		3.5	30	70	100
5	PDR205	Community Pharmacy	2	1		2.5	30	70	100
6	PDR206	Pharmacotherapeutics-I	3	1		3.5	30	70	100
7	PDR251	Pharmaceutical Microbiology (P)			3	1.5	30	70	100
8	PDR252	Pharmacognosy & Phytopharmaceuticals (P)			4	2.0	30	70	100
9	PDR253	Pharmacotherapeutics-I (P)			3	1.5	30	70	100
		Total	**17**	**06**	**10**	**25**	**270**	**630**	**900**

Third Year

S. N.	*Course Code*	*Subject*	*Periods*			*Credits*	*Evaluation Scheme*		
			L	*T*	*P*		*Internal*	*External*	*Total*
1	PDR301	Pharmacology –II	3	1	-	3.5	30	70	100
2	PDR302	Pharmaceutical Analysis	3	1	-	3.5	30	70	100
3	PDR303	Pharmacotherapeutics -II	3	1	-	3.5	30	70	100
4	PDR304	Pharmaceutical jurisprudence	2	-	-	2.0	30	70	100
5	PDR305	Medicinal chemistry	3	1	-	3.5	30	70	100
6	PDR306	Pharmaceutical formulations	2	1	-	2.5	30	70	100
7	PDR351	Pharmacology –II (P)	-	-	3	1.5	30	70	100
8	PDR352	Pharmaceutical Analysis (P)	-	-	3	1.5	30	70	100
9	PDR353	Pharmacotherapeutics -II (P)	-	-	3	1.5	30	70	100
10	PDR354	Medicinal chemistry (P)	-	-	3	1.5	30	70	100
11	PDR355	Pharmaceutical formulations (P)	-	-	3	1.5	30	70	100
		Total	**16**	**05**	**15**	**26**	**330**	**770**	**1100**

Fourth Year

S. N.	Course Code	Subject	Periods			Credits	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	PDR401	Pharmacotherapeutics -III	3	2		4.0	30	70	100
2	PDR402	Hospital Pharmacy	2	2		3.0	30	70	100
3	PDR403	Clinical pharmacy	3	2		4.0	30	70	100
4	PDR404	Biostatics & Research Methodology	2	2		3.0	30	70	100
5	PDR405	Biopharmaceutics & Pharmacokinetics	3	1		3.5	30	70	100
6	PDR406	Clinical Toxicology	2	1		2.5	30	70	100
7	PDR451	Pharmacotherapeutics -III (P)			4	2.0	30	70	100
8	PDR452	Hospital Pharmacy (P)			4	2.0	30	70	100
9	PDR453	Clinical pharmacy (P)			4	2.0	30	70	100
10	PDR454	Biopharmaceutics & Pharmacokinetics (P)			4	2.0	30	70	100
		Total	**15**	**10**	**16**	**28**	**300**	**700**	**1000**

Fifth Year

S. N.	Course Code	Subject	Periods			Credits	Evaluation Scheme		
			L	S	P		Internal	External	Total
1	PDR501	Clinical Research	3	2	-	4	30	70	100
2	PDR502	Pharmacoepidemiology and Pharmacoeconomics	3	2	-	4	30	70	100
3	PDR503	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	2	2	-	3	30	70	100
4	PDR551	Clerkship*	-	4	-	2	30	70	100
5	PDR552	Project Work	-		4***	2	30	70	100**
		Total	**8**	**10**	**4**	**15**	**150**	**350**	**500**

*****Attending ward round on daily basic. ** 30 Marks – 10 seminars & 70 Marks –Thesis work & viva Voce. *** Maximum 50 hours of hospital posting

Sixth year

Internship or residency training including postings in specialty units. Students will independently provide the clinical pharmacy services to the allotted wards.

(i) Six months in General Medicine department, and

(ii) Two months each in three other specialty departments

- Pediatrics
- Gynecology and Obstetrics
- Psychiatry
- Skin and VD
- Orthopedics

ASSESSMENT OF INTERNSHIP:

i) The intern shall maintain a record of work which is to be verified and certified by the preceptor (teacher practioner) under whom he works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and at

the end of the training. Based on the record of work and date of evaluation, the Dean or Principal shall issue certificate of satisfactory completion of training following which the university shall award the degree or declare him/her eligible for it.

ii) Satisfactory completion of internship shall be determined on the basis of the following:-

(1)	Proficiency of knowledge required for each case management	SCORE 0-5
(2)	The competency in skills expected for providing Clinical Pharmacy Services	SCORE 0-5
(3)	Responsibility, punctuality, work up of case, involvement in patient care	SCORE 0-5
(4)	Ability to work in a team (Behaviour with other healthcare professionals including medical doctors, nursing staff and colleagues).	SCORE 0-5
(5)	Initiative, participation in discussions, research aptitude.	SCORE 0-5

Poor	Fair	Below Average	Average	Above Average	Excellent
0	1	2	3	4	5

Pharm D.: First Year

HUMAN ANATOMY & PHYSIOLOGY (THEORY)

Course Code: **PDR101** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with fundamental knowledge on the structure and functions of the human body. It also helps in understanding both homeostatic mechanisms and homeostatic imbalances of various body systems. Since a medicament, which is produced by pharmacist, is used to correct the deviations in human body, it enhances the understanding of how the drugs act on various body systems in correcting the diseased state of the different.

Expected outcomes: Upon completion of the course students shall be able to:

(i) describe the structure (gross and histology) and functions of various organs of the human body;

(ii) describe various homeostatic mechanisms and their imbalances of various systems;

(iii) identify various tissues and organs of the different systems of the human body;

(iv) perform the hematological tests and also record blood pressure, heart rate, pulse and Respiratory volumes;

(v) appreciate coordinated working pattern of different organs of each system; and

(vi) appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body

Lecture wise program:

Unit I **10 hrs**

Scope of anatomy and physiology, basic terminologies used in this subject Structure of cell – its components and their functions, Elementary tissues of the human body: epithelial, connective, muscular and nervous tissues-their sub-types and characteristics,

1. Osseous system - structure, composition and functions of the Skeleton. (done in practica classes - 6hrs).
2. Classification of joints, Types of movements of joints and disorders of joints (Definitions only).

Unit II **06hrs**

1. **Haemopoetic System:** Composition and functions of blood, Haemopoesis and disorders of blood components (definition of disorders),Blood groups, Clotting factors and mechanism, Platelets and disorders of coagulation

2. **Lymph:** Lymph and lymphatic system, composition, formation and circulation, Spleen: structure and functions, Disorders of lymphatic system (definition only).

Unit III **10hrs**

Cardiovascular system: Anatomy and functions of heart ,Blood vessels and circulation (Pulmonary, coronary and systemic circulation),Electrocardiogram (ECG),Cardiac cycle and heart sounds, Blood pressure – its maintenance and regulation, Definition of the following disorders Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias.

Unit IV **10hrs**

1. **Respiratory system:** Anatomy of respiratory organs and functions, Mechanism / physiology of respiration and regulation of respiration, Transport of respiratory gases, Respiratory volumes and capacities, and Definition of: Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation.

2. **Digestive system:** Anatomy and physiology of GIT, Anatomy and functions of accessory glands of GIT, Digestion and absorption, Disorders of GIT (definitions only).

Unit V **14hrs**

Nervous system: Definition and classification of nervous system, Anatomy, physiology and functional areas of cerebrum, Anatomy and physiology of cerebellum, Anatomy and physiology of mid brain, Thalamus, hypothalamus and Basal Ganglia, Spinal cord: Structure & reflexes – mono-poly-planter, Cranial nerves – names and functions ANS – Anatomy & functions of sympathetic & parasympathetic N.S.

Unit VI **10hrs**

1. **Urinary system:** Anatomy and physiology of urinary system, Formation of urine, Renin Angiotensin system – Juxtaglomerular apparatus - acid base Balance, Clearance tests and micturition.

2. **Endocrine system:** Pituitary gland, Adrenal gland, Thyroid and Parathyroid glands, Pancreas and gonads.

Unit VII **10hrs**

1. **Reproductive system:** Male and female reproductive system, Their hormones – Physiology of menstruation, Spermatogenesis & Oogenesis, Sex determination (genetic basis),Pregnancy and maintenance and parturition, Contraceptive devices.

2. **Sense organs:** Eye, Ear, Skin, Tongue & Nose.

Unit VIII **10hrs**

1. **Skeletal muscles:** Histology, Physiology of Muscle contraction, Physiological properties of skeletal muscle and their disorders (definitions).

2. **Sports physiology:** Muscles in exercise, Effect of athletic training on muscles and muscle performance, Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise, Drugs and athletics.

Text books

1. Tortora Gerard J. and Nicholas, P., *Principles of anatomy and physiology,* Publisher Harpercollins College New York.
2. Wilson, K.J.W., Ross and Wilson's foundations of anatomy and physiology, Publisher: Churchill Livingstone, Edinburg.
3. Guyton AC., Hall JE., *Text book of Medical Physiology,* WB Saunders Company.
4. Chaurasia B.D., *Human Anatomy, Regional & Applied,* Part I, II & III, CBS Publishers & Distributors, New Delhi.
5. Ross & Wilson, *Anatomy & Physiology in Health & Illness*, Churchill Livingstone.
6. Tortora G.J., & Anagnodokos N.P., *Principles of Anatomy & Physiology*, Harper & Row Publishers, New Delhi.

Reference books

1. Guyton arthur C., *Physiology of human body*, Holt saunders Publisher.
2. Chatterjee C.C., *Human physiology*. Volume 1&11, Publisher: medical allied agency, Calcutta.
3. Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H., *Gray's anatomy,* Publisher: Churchill Livingstone, London.

*Latest editions of all the suggested books are recommended.

Pharm D.: First Year

PHARMACEUTICS (THEORY)

Course Code: **PDR102** **L-2, T-1, P-0, C-2.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with fundamental knowledge on the art and science of formulating different dosage forms. It prepares the students for most basics of the applied field of pharmacy.

Expected outcomes: Upon the completion of the course the students & would be able to:

(i) know the formulation aspects of different dosage forms;
(ii) do different pharmaceutical calculation involved in formulation;
(iii) formulate different types of dosage forms; and
(iv) appreciate the importance of good formulation for effectiveness.

Lecture wise programme:

Unit I **10hrs**

1. **Introduction to dosage forms** - classification and definitions
2. **Prescription:** definition, parts and handling
3. **Posology**: Definition, Factors affecting dose selection. Calculation of children and infant doses.

Historical background and development of profession of pharmacy and pharmaceutical industry in brief.

Unit II **10hrs**

Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.

Unit III **10hrs**

Powders and Granules: Classification advantages and disadvantages, Preparation of simple & compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth & effervescent powders and granules.

Unit IV **10hrs**

Monophasic Dosage forms: Theoretical aspects of formulation including adjuvants used like stabilizers, colorants, flavours with examples. Study of Monophasic liquids like gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.

Unit V **10hrs**

Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the different types of emulsion formulations, stability and evaluation.

Unit VI **10hrs**

Suppositories and pessaries: Definition, advantages and disadvantages, types of bases used, method of preparation, Displacement value and evaluation.

Galenicals: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.

Unit VII **10hrs**

Pharmaceutical calculations based on conversion of weights and measures, percentage solutions, allegation, proof spirit, isotonic solutions.

Surgical aids: Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.

Unit VIII **10hrs**

Incompatibilities: Introduction, classification and methods to overcome incompatibilities. Compounding of prescriptions based on incompatibility.

Text books:

1. Cooper and Gunns, *Dispensing for pharmacy students*., Media Algonquin, 1981
2. N. K.Jain and S. N. Sharma., *A text book of Professional Ph*armacy Pitampura : Vallabh Publication, 2001.
3. Badger W.L. & Banchero J.T., *Introduction to Chemical Engineering*, Mc Graw Hill International Book Co., London.
4. Perry R.H. & Chilton C.H., *Chemical Engineers Handbook*, Mc Graw Kogakusha Ltd.
5. McCabe W.L. & Smith J.C., *Unit Operation of Chemical Engineering*, Mc Graw Hill International Book Co., London.
6. Sambhamurthy, *Pharmaceutical Engineering*, New Age Publishers.
7. Gavhane, K.A., *Unit Operation-I*, Nirali Prakashan.

Reference books:

1. Howard C. Ansel, Loyd V. Allen, Jr.; Nicholas G. Popvich, *Pharmaceutical dosage forms and drug delivery systems*, 7th ed, Philadelphia : Lippincott Williams & Wilkins, 1999.
2. Arthur Osol, Remington's *Pharmaceutical Sciences*, Edition16th, Pennsylvania: Mack Publications, 1980.
3. Cooper and Gunn, *Register of General Pharmacy*, Geneva.
4. M L Schroff, *General Pharmacy*, Calcutta: Five star Enterprises, 1971.

Pharm D.: First Year

MEDICINAL BIOCHEMISTRY (THEORY)

Course Code: **PDR103** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with applied biochemistry which deals with complete understanding of the molecular level of the chemical process associated with living cells. Clinical chemistry describing the study of chemical aspects of human life in health and illness and the application of chemical laboratory methods to diagnosis, control of treatment and prevention of diseases.

Expected outcomes: the expected outcomes the present course would provide biochemical facts and the principles to the students of pharmacy. Upon completion of the subject student shall be able to –

i. understand the catalytic activity of enzymes and importance of isoenzymes in the diagnosis of diseases;
ii. know the metabolic process of biomolecules in health and illness (metabolic disorders);
iii. understand the genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism;
iv. know the biochemical principles of organ function tests of kidney, liver and endocrine gland; and
v. do the qualitative analysis and determination of biomolecules in the body fluids.

Lecture wise programme:

Unit I **10hrs**

1. **Introduction to biochemistry:** Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance.

2. **Enzymes**: Definition; Nomenclature; IUB classification; Factor affecting enzyme activity; Enzyme action; enzyme inhibition. Isoenzymes and their therapeutic & diagnostic applications; Coenzymes, their biochemical roles and deficiency diseases.

Unit II **10hrs**

Carbohydrate metabolism: Glycolysis, Citric acid cycle (TCA cycle), HMP shunt, Glycogenolysis, gluconeogenesis, glycogenesis. Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases); Glucose, Galactose tolerance test and their significance; hormonal regulation of carbohydrate metabolism.

Unit III **10hrs**

Lipid metabolism: Oxidation of saturated (□-oxidation); Ketogenesis and ketolysis; biosynthesis of fatty acids, lipids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atheroslerosis, fatty liver and hypercholesterolmiea).

Unit IV **10hrs**

Biological oxidation: Coenzyme systems involved in biological oxidation. Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC and Oxidative phosphorylation;

Unit V **10hrs**

1. **Protein and amino acid metabolism:** protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders; production of bile pigments; hyperbilirubinemia, porphoria, jaundice. Metabolic disorder of Amino acids.

2. **Nucleic acid metabolism:** Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; mutation and repair mechanism; DNA replication (semiconservative /onion peel models) and DNA repair mechanism.

Unit VI **10hrs**

1. **Introduction to clinical chemistry: Cell**; composition; malfunction; Role of the clinical chemistry laboratory.

2. **The kidney function tests:** Role of kidney; Laboratory tests for normal function: - Urine analysis (macroscopic and physical examination, quantitative and semiquantitative tests.) ,Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid), Urine concentration test and Urinary tract calculi. (stones)

Unit VII **10 Hrs**

1. **Liver function tests:** Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation. a) Test for hepatic dysfunction-Bile pigments metabolism. b) Test for hepatic function test- Serum bilirubin, urine bilirubin, and urine urobilinogen. c) Dye tests of excretory function. d) Tests based upon abnormalities of serum proteins. Selected enzyme tests.

2. **Lipid profile tests:** Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL, LDL and triglycerides.

Unit VIII **10Hrs**

1. **Immunochemical techniques** for determination of hormone levels and protein levels in serum for endocrine and infectious diseases. Radio immuno assay (RIA) and Enzyme Linked Immuno Sorbent Assay (ELISA)

2. **Electrolytes:** Body water, compartments, water balance and electrolyte distrubution. Determination of sodium, calcium potassium, chlorides, bicarbonates in the body fluids.

Recommended Text books

1. David W Martin, *Harpers Review of Biochemistry*, Ed.20th, Maruzen: lange Medical Pub.,1985.
2. U. Satyanarayana, *Biochemistry*, 2nd rev. ed, Calcutta, Books and Allied, 2001.
3. Stryer L., *Biochemistry*, WH, Freeman & Company, San Francisco.
4. Plummer. David J., *an Introduction to Practical Biochemistry*, Mc Graw Hill, New Delhi.
5. Singh S.P., *Practical Manual to Biochemistry*, CBS Publisher, New Delhi.
6. Harpers, *Review of Biochemistry*, Lange Medical Publication.
7. Conn E.E. & Stumph P.K., *Outline of Biochemistry*, John Willery & sons, New York.
8. Nelson D.L. & Cox M.M., *Lehninger Principles of Biochemistry*, Macmillan worth Publishers.

Recommended Reference books (Theory)

1. Albert Lehinger, *Principles of biochemistry*, Delhi: CBS Publishers, 1987.
2. Ramarao, *Text book of biochemistry*, New Delhi: Ubs, 2004.
3. David T.Plummer, *An Introduction to practical biochemistry*, Ed.3rd New Delhi: Tata McGraw Hill, 2003.
4. T N Pattabhiraman, *Concise textbook of biochemistry*, Ed. 3rd, Chennai: All India pub., 2002.

Pharm D.: First Year

PHARMACEUTICAL ORGANIC CHEMISTRY (THEORY)

Course Code: **PDR104** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with IUPAC/Common system of nomenclature of different classes of organic compounds; Physical properties, assay, important and medicinal uses of some important organic compounds.

Lecture wise programme:

Unit I **10 Hrs**

Structures and Physical properties:

1. Polarity of bonds, polarity of molecules, M.P, Inter molecular forces, B.P, Solubility, non ionic & ionic solutes, protic and aprotic Solvents, ion pairs, Acids and bases, Lowry bronsted and Lewis theories, Isomerism .

2. Nomenclature of organic compound belonging to the following classes Alkanes, Alkenes, Dienes, Alkynes, Alcohols, Aldehydes, Ketones, Amides, Amines, Phenols, Alkyl Halides, Carboxylic Acid, Esters, Acid Chlorides And Cycloalkanes.

Free radicals chain reactions of alkane: Mechanism, relative reactivity and stability.

Unit II **10hrs**

1. **Alicyclic compounds**: Preparations of cyclo alkanes, Bayer strain theory and orbital picture of angle strain.

2. **Nuclophilic aliphatic substitution mechanism**: Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN2 reactions. Stereochemistry and steric hindrance, role of solvents, phase transfer catalysis, mechanism and kinetics of SN1 reactions, stereochemistry, carbocation and their stability, rearrangement of carbocation, role of solvents in SN1 reaction, Ion dipole bonds, SN2 versus SN1 solvolyses, nucleophilic assistance by the solvents.

Unit III **10hrs**

1. **Dehydro halogenation of alkyl halides:** 1,2 elimination, kinetics, E2 and E1 mechanism, elimination via carbocation, evidence for E2 mechanism, absence of rearrangement, isotope effect, absence of hydrogen exchange, the element effect, orientation and reactivity, E2 versus E1, elimination versus substitution, dehydration of alcohol, ease of dehydration, acid catalysis, reversibility, orientation.

2. **Electrophillic and free radicals addition:** Reactions at carbon-carbon, double bond, electrophile, hydrogenation, heat of hydrogenation and stability of alkenes, markownikoff rule, addition of hydrogen halides, addition of hydrogen bromides, peroxide effect, electrophillic addition, mechanism, rearrangement, absence of hydrogen exchange, orientation and reactivity, addition of halogen, mechanism, halohydrin formation, mechanism of free radicals additon, mechanism of peroxide initiated addition of hydrogen bromide, orientation of free addition, additions of carbene to alkene, cyclo addition reactions.

Unit IV **10hrs**

1. **Carbon-carbon double bond as substituents:** Free radical halogenations of alkenes, comparision of free radical substitution with free radical addition, free radical substitution in alkenes, orientation and reactivity, allylic rearrangements

2. **Theory of resonance:** Allyl radical as a resonance hybrid, stability, orbital picture, resonance stabilisation of allyl radicals, hyper conjugation, allyl cation as a resonance hybrid, nucleophilic substitution in allylic substrate, SN1 reactivity, allylic rearrangement, SN2 nucleophilic substituion in vinylic substrate, vinylic cation, stability of conjugated dienes, resonance in alkenes, ease of formation of conjugated dienes, orientation of elimination, electrophilic addition to conjugated dienes, 1,4-addition, 1,2-versus 1,4-addition, rate versus equilibrium, orientation and reactivity of free radical addition to conjugated dienes

Unit V **10hrs**

Elecrophilic aromatic substitution: Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent group, mechanism of nitration, sulphonation, halogenation, friedel craft alkylation, friedel craft acylation, reactivity and orientation, activating and deactivating O,P,M directing groups, electron release via resonance, effect of halogen on electrophilic aromatic substitution in alkyl benzene, side chain halogenation of alkyl benzene, resonance stabilization of benzyl radical.

Unit VI **10hrs**

Nucleophilic addition reaction: Mechanism, ionisation of carboxylic acids, acidity constants, acidity of acids, structure of carboxylate ions, effect of substituent on acidity, nucleophilic acyl substitution reaction, conversion of acid to acid chloride, esters, amide and anhydride. Role of caboxyl group, comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.

Unit VII **10hrs**

1. **Mechanism & synthetic applications following organic reactions: A**ldol condensation, claisen condensation, cannizzaro reaction, crossed aldol condensation,

crossed cannizzaro reaction, benzoin condensation, perkin condensation. Knoevenagel & Reformatsky reactions, Wittig reaction and Michael addition.

2. **Hoffman rearrangement:** Migration to electron deficient nitrogen, Sandmeyer's reaction, basicity of amines, diazotisation and coupling, acidity of phenols, Williamson synthesis, Fries rearrangement, Kolbe reaction, Reimer tieman's reactions.

Unit VIII **10hrs**

Nucleophilic aromatic substitution: Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic type.

Oxidation reduction reaction.

Study of the following official compounds- preparation, test for purity, assay and medicinal uses of Chlorbutol, Dimercaprol, Glyceryl trinitrate, Urea, Ethylene diamine dihyrate, Vanillin, Paraldehyde, Ethylene chloride, Lactic acid, Tartaric acid, citric acid, salicylic acid, aspirin, methyl salicylate, ethyl benzoate, benzyl benzoate, dimethyl pthalate, sodium lauryl sulphate, saccharin sodium, mephensin.

Recommended Text books

1. Robert Thornton Morrison and Robert Neilson Boyd, *Organic chemistry*, 2nd Ed, New Delhi: Prentice-Hall, 1971.
2. L. M. Atherden, Bentley and river, *Text book of Pharmaceutical chemistry*, 8th edition, Delhi: Oxford university press, 1998.
3. I. L. Finer- *Organic chemistry*, Lonodn: English Language Book Society, 1959.

Recommended Reference books

1. D. J. Cram, Hammond, George S, *Organic chemistry*, New York: Mcgraw Hill, 1964.
2. William Henry Brown, *Introduction to organic chemistry*, 4th ed., Pacific Grove: Brooks/ Cale Publishing, 1988.
3. Jerry March, *Advanced organic chemistry*: reactions, mechanisms, and structure **,** Ed.4th, University of Michigan**,** Wiley Interscience. 1992.
4. Donald J Cram, Hammond, George S**,** *Organic Chemistry***,** Mcgraw Hill Book Co.**,** 1959.

Pharm D.: First Year

PHARMACEUTICAL INORGANIC CHEMISTRY (THEORY)

Course Code: **PDR105** **L-2, T-1, P-0, C-2.5**

Theory: 2 Hrs. /Week

Objective: The basic objective of this course is to get familiar with analytical chemistry and also the study of inorganic pharmaceuticals regarding their monographs. The course deals with basic knowledge of analysis of various pharmaceuticals.

Expected outcomes: Upon completion of the course students shall be able to:

(i) understand the principles and procedures of analysis of drugs and the application of inorganic pharmaceuticals;

(ii) know the analysis of the inorganic pharmaceuticals their applications; and

(iii) Appreciate the importance of inorganic pharmaceuticals in preventing and curing the disease.

Lecture wise programme:

Unit- I **10hrs**

1. **Errors:** Types of errors, significance of errors, minimisation of errors, absolute and relative errors, mean and relative mean deviations.

2. **Volumetric analysis:** Principle of equivalence and end point, fundamental requirements, primary and secondary standard, detection of end point, minimisation of the errors, types of reactions involved in volumetric analysis.

3. **Acid-base titrations:** Acid base concepts, role of solvent, relative strengths of acids and bases, ionization, law of mass action, common-ion effect, ionic product of water, pH, hydrolysis of salts, Henderson-Hasselbach equation, buffer solution and neutralization curves.

Unit- II **10hrs**

1. **Redox titrations:** Concepts of oxidation and reduction, redox reactions, strengths and equivalent weights of oxidizing and reducing agents, theory of redox titrations, redox indicators and oxidation reduction curves.

2. **Iodimetric and iodometric titrations:** involving ceric sulphate, potassium iodate, potassium bromate and potassium permanganate.

3. **Non aqueous titrations:** General, acidimetry in non aqueous solvents, alkalimetry in non aqueous solvents.

Unit- III **10hrs**

1. **Precipitation titrations:** Precipitation reactions, solubility products, effect of acids, temperature and solvent upon the solubility of precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, indicators, Gay-Lussac method, Mohr's method, Volhard's method and Fajan's method.

2. **Complexometric titrations:** Ligands, classification of ligands, stability of complex, complexing agents, titration curves, indicators, type of titration, masking and demasking agents.

Unit- IV **10hrs**

1. **Theory of indicators:** Definition, types of indicators, Ostwald's and quinonoid theories, choice of indicators, mixed and absolute indicators.

2. **Gravimetry:** Principle, factors, process of precipitation, digestion, washing, drying, ignition, organic precipitants and electrogravimetry.

3. **Limit tests:** Chloride, sulphate, iron, lead, heavy metals and arsenic.

Unit- V **10hrs**

1. **Medicinal gases:** Nitrogen, oxygen, carbon dioxide, nitrous oxide

2. **Acidifiers:** Dilute hydrochloric acid.

3. **Antacids: antacids:** Aluminium hydroxide, calcium carbonate, magnesium hydroxide, light & heavy magnesium oxide, light & heavy magnesium carbonate, sodium bicarbonate, combination of antacid preparation.

4. **Cathartics:** Sodium potassium tartrate, sorbitol, magnesium sulphate and magnesium citrate.

Unit-VI **10hrs**

1. **Electrolyte replenishers:** Physiological ions, Electrolytes used for replacement therapy, acid-base balance & combination therapy (calcium chloride, calcium gluconate, calcium lactate, sodium di-hydrogen phosphate, sodium acetate, sodium bi carbonate, sodium chloride, potassium chloride, magnesium chloride). Cationic and anionic components of inorganic drugs useful for systemic effects.

2. **Essential Trace elements:** Iodine, iron, zinc, selenium, copper, chromium, sulphur.

Unit-VII **10hrs**

1. **Antimicrobials:** Borax, iodine, silvernitrate, mild silver protein, yellow mercuric oxide, selenium sulphate, ammoniated mercury, potassium permagnate, hydrogen peroxide.

2. **Pharmaceutical aids:** water, purified water, Water for Injection, Sterile Water for Injection, pharmaceutical acceptable glass.

3. **Dental Products:** Dentifrices- anti-caries agents (Sodium fluoride), ammonical silver nitrate, zinc chloride, strontium chloride and sodium metaphosphate.

Unit- VIII **10hrs**

1. **Miscellaneous compounds:** Sodium meta bisulphite, sodium thiosulphate, titanium dioxide, sublimed sulphate, strontium chloride, ammonium carbonate, sodium nitrite.

2. **Radio Pharmaceuticals:** Nuclear radio pharmaceuticals, nomenclature, methods of obtaining, standards and units of activity, measurement of activity, clinical application, dosage hazards and precautions, $_{26}Fe^{59}$, $_{6}C^{13}$, $_{6}C^{14}$, $_{15}P^{32}$, $_{53}I^{131}$.

Recommended Text books

1. Pandeya Surendra N., *A textbook of Medicinal Chemistry*, 3rd ed., Varanasi: SG Publisher, 2004.
2. Beckett A H, Stenlake J B, *Practical Pharmaceutical Chemistry* Vol-I & Vol-II , CBS Publishers, 2007.
3. Gundu p. Rao, *Inorganic Pharmaceutical Chemistry*, Delhi: Vallabh, 2006.

Recommended Reference books

1. G R Chatwal , *Pharmaceutical Chemistry Inorganic*, New Delhi : Himalaya Publication house,2008.
2. Nagavi B G *Pharmaceutical Inorganic chemistry*, Newdelhi.: Arihant Publication, Mysore.
3. John H.Kennedy **,** *Analytical chemistry: principles* **,** New York : Sauders College**,** 1990.

Pharm D.: First Year

REMEDIAL MATHEMATICS (THEORY)

Course Code: **PDR 106** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with introduction to matrices, determinants, trigonometry, analytical geometry, differential calculus, integral calculus, differential equations, laplace transform.

Upon completion of the course the student shall be able to: –

1. Know Trignometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications;
2. solve the problems of different types by applying theory; and
3. Appreciate the important applications of mathematics in pharmacy.

Lecture wise programme:

Unit I **10hrs**

Algebra: Definition, order, equality, types of matrices, zero matrix, transpose of a matrix, symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices, simple properties of addition, multiplication of matrices, Adjoint and inverse of a square matrix. Determinant of a square matrix (up to 3 (X) 3 matrices), properties of determinants.

Unit-II **10hrs**

Trignometry: Introduction to Trigonometry, Trigonometric Ratios of an Acute Angle, Relation between sides and angles of a triangle, solution of triangles-(Solution of Right Angled Triangle, Solution of Oblique Triangles)

Unit-III **10hrs**

Differential Calculus I: Definition, Some general theorem on derivation-Derivative of the sum or difference of two function, Derivative of product of two functions, Derivative of quotient, Derivative of Trigonometry function, Derivative of inverse Trigonometry function, Logarithms differential.

Unit-IV **10hrs**

Differential Calculus II: Successive differential: High order derivative, calculation of the nth derivative. Determination of nth derivative of rational function. Leibnitz's theorem, Partial differentiation, Euler's theorem

Unit-V **10hrs**

Integral Calculus: Integration of 1/x, e^x , Integrals of the type f' (x), $[f(x)]^n$, $\frac{f'(x)}{f(x)}$, Integration of tanx, cotx, secx, cosecx, Integration by parts, Integration by means of substitution, Integration using partial fractions, Definite Integral, Properties of Definite Integral

Unit-VI **10hrs**

Laplace Transformation: Definition, properties of Laplace Transform, change of scale property, Heaviside's shifting properties, Unit step function, Periodic function.

Unit-VII **10hrs**

Differential Equations: Definition, order and degree, general and particular solutions of a differential equation. Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type $\frac{dy}{dx} + Py = Q$, where P and Q are functions of x or constant, Exact differential equations

Unit VIII **10hrs**

Straight lines: **S**hifting of origin. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, two-point form, intercepts form and normal form, Definition and properties of circle and parabola.

Recommended Text Books:

1. H. K. Das, *Introduction to Engineering Mathematics*, Volume I (S.Chand).
2. R.D. Sharma, *Applied Mathematics*, Vol. I & II (Dhanpat Rai Publications)
3. Dr. Mohd. Vaseem Ismail, Dr. Qazi Shoeb Ahmad & Shadab Ahmed Khan, *Remedial Mathematics*, (Birla Publications Pvt. Ltd.)
4. M. L. Khanna, J N Sharma., *Mathematics for I I T.* 134th ed. Meerut: Jai Prakash Nath Publication. 2002-3.
5. Shantinarayan, *Differential calculus*, 1st Ed. Delhi: S.CHAND Publication. 1996.
6. Rao, Sreenivasa BM and Nagaraj, S., *Text book of Mathematics for second year pre-university*, 3rd Ed. Excellent Educational Enterprises.

Recommended Reference books

1. Shanthinarayan, *Integral calculus*, 9th ed. New Delhi: S. Chand Publication.1980
2. B. S. Grewal, *Higher Engineering Mathematics*, Delhi: Khanna Publication. 2003
3. Loney S. L. *Plane Trignometry* Vol. I 6th ed. SURJEET Publication. 1998.

Pharm D.: First Year

REMEDIAL BIOLOGY (THEORY)

Course Code: **PDR 107** **L-3, T-1 P-0, C-3.5**

Objective: The basic objective of this course is to get familiar with natural sources such as plant and animal origin. This subject has been introduced in order to make the students aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of plants and animals.

Lecture wise programme:

Unit I **10 hrs**

Definition of Botany, scope of Botany, origin and continuity of life, importance of green plants, uses of plants, characteristics of living objects- Life-cycle, cellular structure, protoplasm, respiration, reproduction, metabolism, nutrition, growth, movements, (Brownian movement) and difference between the living and nonliving objects, history of plants.

Unit II **10 hrs**

1. **Study of plant cell**: structure, chemical composition of chlorophyll, Plant enzymes such as- Hemicellulose, lignin, cutin, suberin, mucilage and micro chemical tests.

2. **Non-living Cellular Inclusions:**- Carbohydrates, proteins, fats & oils and it's tests, other cell products-tannins, resins, essential oils, gums, mineral crystals (silica, $CaCo_3$, calcium oxalate), latex, organic acids, and alkaloids.

Unit III **10 hrs**

1. **Formations of new cells**- somatic cell division (mitosis) and meiosis (reproductive cell division) with diagram.

2. **Tissue system:** Epidermal, ground or fundamental tissue system, vascular & meristematic tissues and permanent tissues.

3. **Plant kingdom and it's classification:-**Cryptogonia & Phanerogonia/spermatophyta

4. **Morphology of plants:** Study of general morphology, types, different characteristics of root, stem & leaf. Pollination and fertilization.
   Modifications of roots, stem & leaf with diagram and suitable examples.

Unit IV **10 hrs**

1. **Inflorescence and pollination of flowers:** Different parts of flowers, definition, classification, types of inflorescence. Different modes of Pollination of flowers, pollination in compositae, maize, zoophily and hydrophily, advantages and disadvantages of self and cross pollination.

2. **Fruits and seeds:-** Types of fruits and their characteristics, Development of the seed, monocot and dicot seeds e.g. pea, gram & bean. Dispersal of seed and fruits.

Unit V **10 hrs**

1. **Plant physiology:-** General consideration of different plant phenomena: N_2 Assimilation, Photosynthesis, colloidal system, Brownian movement, flocculation, diffusion, imbibition, osmosis, difference between osmotic pressure and suction pressure, experiments of osmosis, turgidity & plasmolysis.

2. **Soils**:-Formation of soils, types, physical and chemical properties of soils (acidity and alkalinity), soil organisms like humus & fertilizers (sulphate of ammonia, urea etc). Chemical composition of plant, N_2 fixation by saprophytic- and symbiotic bacteria (nodule formation), N_2 cycle, translocation & transpiration.

Unit VI **10 hrs**

1. **Mechanism of photosynthesis:** role played by light and chlorophyll, hill reaction, factors affecting photosynthesis.

2. **Enzymes:** Study of classification, sources and function of different eenzymes i.e. Cellulase, Pectase, Diastase and Tannase.

3. **Respiration**:- mechanism of respiration, glycolytic pathway, kreb's cycle, Significance of electron transport system (ETS).

4. **Study of some important families:** Leguminosae, Umbelliferae, Solanaceae, Lilliaceae, Zinziberaceae and Rubiaceae.

Unit VII **10 hrs**

1. **Study of fungi, yeast, penicillin and bacteria:-** General classifications, morphological characters and staining techniques. Life cycle of Penicillium & Aspergillus.

2. **Structure of animal cell**: physical & chemical nature of protoplasm, Asexual reproduction by the fission & conjugation methods.

3. **Study of different tissues:** Epithelial, Connective, Muscular and Nervous tissues.

4. **General characters of Rana trigina (frog):** digestive, respiration, blood vascular systems, nervous, reproductive, excretory system and sense organs of frog.

Unit VIII **10 hrs**

1. **Study of Pisces, aves & reptiles:-** taxonomical study of pharmaceutically important fishes (shark), aves (pigeon) and Raptiles (lizard, snakes).

2. **General organization of mammals**:- various definitions (Sinoconodon, Morganucodonts & docodonts), distinguishing features, classification, Evolutionary history, Anatomy and morphology, Endothermy of mammals

3. **Study of poisonous animals:** study of poisonous animals like slow loris, Mexican beaded lizard, snakes, amphibians like salamandrid salamanders

Recommended Text books

1. Gokhale S.B. *Text book of Biology*. 11th ed. Bangalore: Nirali Prakashan. 1993.
2. Thulajappa Y and Seetharam. *A Textbook of pre-university biology*. V1. I PUC. Excellent Educational Enterprises. 1993.

Recommended Reference books

1. B.V.Sreenivasa Naidu, *A Text book of Biology*.
2. Krishna Murthy K, *A Text book of Biology*, Delhi: Ajanta Publications. 1990.
3. Dutta A.C., *Botany: for degree students*. New Delhi: Oxford university, 2002. Ekambaranathaayyer M Outlines of Zoology. 1996.
4. Gokhale S.B. & Kokate C.K. *Practical Pharmacognosy*. 8th Ed. Pune : Nirali Prakashan. 2005.

Pharm D.: First Year

HUMAN ANATOMY & PHYSIOLOGY (PRACTICAL)

Course Code: **PDR151** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs. /Week

Objective: The basic objective of this course is to get familiar with the practical aspects of different tissues, histology and functioning of body parts.

List of Experiments:

1. Study of tissues of human body: Epithelial tissue and Muscular tissue.
2. Study of tissues of human body: Connective tissue and Nervous tissue.
3. Study of appliances used in hematological experiments.
4. Determination of W.B.C. count of blood.
5. Determination of R.B.C. count of blood.
6. Determination of differential count of blood.
7. Determination of Erythrocyte Sedimentation Rate, Hemoglobin content of Blood and Bleeding time & Clotting time.
8. Determination of Blood Pressure and Blood groups.
9. Study of various systems with the help of charts, models & specimens
    (a) Skeleton system part I-axial skeleton.
    (b) Skeleton system part II- appendicular skeleton.
    (c) Cardiovascular system.
    (d) Respiratory system.
    (e) Digestive system.
    (f) Urinary system.
    (g) Nervous system.
    (h) Special senses.
    (i) Reproductive system.
10. Study of different family planning appliances.
11. To perform pregnancy diagnosis test.
12. Study of appliances used in experimental physiology.
13. To record simple muscle curve using gastroenemius sciatic nerve preparation.
14. To record simple summation curve using gastroenemius sciatic nerve preparation.
15. To record simple effect of temperature using gastroenemius sciatic nerve preparation.
16. To record simple effect of load & after load using gastroenemius sciatic nerve preparation.
17. To record simple fatigue curve using gastroenemius sciatic nerve preparation.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.

2. The external evaluation will be conducted for 70 marks.

3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal examination	End year (External)
Identifications	4	10
Synopsis	4	10
Major experiments	7	20
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

Recommended Text books

1. Goyal, R. K, Natvar M.P, and Shah S.A, *Practical anatomy, physiology and biochemistry*, latest edition, Publisher: B.S Shah Prakashan, Ahmedabad.

Recommended Reference books

1. Ranade VG, *Text book of practical physiology*, Latest edition, Publisher: PVG, Pune Anderson Experimental Physiology, Latest edition, Publisher: NA

* Latest editions of all the suggested books are recommended.

Pharm D.: First Year

PHARMACEUTICS (PRACTICAL)

Course Code: **PDR152** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs. /Week

Objective: The basic objective of this course is to get familiar with the practical aspects of pharmaceutical formulations presented in different dosage forms.

List of Experiments:

Preparation of Syrups: Simple Syrup I.P, Syrup of Ephedrine Hcl NF, Syrup Vasaka IP, Syrup of ferrous Phosphate IP and Orange Syrup.

Preparation of Elixir: Piperizine citrate elixir BP, Cascara elixir BPC and Paracetamol elixir BPC

Preparation of Linctus: Simple Linctus BPC and Pediatric simple Linctus BPC.

Preparation of Solutions: Solution of cresol with soap IP, Strong solution of ferric chloride BPC, Aqueous Iodine Solution IP, Strong solution of Iodine IP and Strong solution of ammonium acetate IP

Preparation of Liniments: Liniment of turpentine IP* and Liniment of camphor IP.

Suspensions*: Calamine lotion and Magnesium Hydroxide mixture BP.

Emulsions*: Cod liver oil emulsion and Liquid paraffin emulsion.

Powders: Eutectic, Explosive & Dusting powders and Insufflations

Suppositories: Boric acid suppositories and Chloral suppositories

Incompatibilities: Mixtures with Physical and Chemical & Therapeutic incompatibilities

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.

6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	5	15
Major experiments	10	25
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

Recommended Text Books

1. *Pharmacopoeia of India*, The Controller of Publications, Delhi.
2. *British Pharmacopoeia*, Her Majesty's Stationary Office, University Press, Cambridge.
3. Carter S.J., Cooper & Gunn's *Tutorial Pharmacy*, CBS Publishers, Delhi.

Reference Books

1. Rawlins E.A., Bentley's *Text Book of Pharmaceutics*, ELBS Bailliere Tyndall.
2. Lachman L.,Liberman H.A.& Kanig J.L., *Theory and Practice of Industrial Pharmacy*, Le & Febiger.
3. Cooper and Gunn's *Dispensing for Pharmaceutical Students*, CBS Publishers, New Delhi.

Pharm D.: First Year

MEDICINAL BIOCHEMISTRY (PRACTICAL)

Course Code: **PDR153** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs. /Week

Objective: The basic objective of this course is to get familiar with the practical aspects of qualitative and quantitative biochemical estimations.

List of the Experiment:

1. Qualitative analysis of normal constituents of urine * and abnormal constituents of urine.* Quantitative estimation of urine sugar by Benedict's reagent method.** urine chlorides by Volhard's method.** urine creatinine by Jaffe's method.** urine calcium by precipitation method.** serum cholesterol by Libermann Burchard's method and** Preparation of Folin Wu filtrate from blood.*
2. Quantitative estimation of blood creatinine ** and blood sugar Folin-Wu tube method.**
3. Estimation of SGOT in serum.** Estimation of SGPT in serum.** Estimation of Urea in Serum and** Estimation of Proteins in Serum. **
4. Determination of serum bilirubin** and Glucose by means of Glucoseoxidase.**
5. Enzymatic hydrolysis of Glycogen/Starch by Amylases**, Study of factors affecting Enzyme activity. (pH & Temp.)** and Preparation of standard buffer solutions and its pH measurements (any two)*
6. Experiment on lipid profile tests**
7. Determination of sodium, calcium and potassium in serum. **

**** Major Experiments & * Minor Experiments**

Assignments:

Format of the assignment:

1. Minimum & Maximum number of pages.
2. It shall be computer draft copy.
3. Reference(s) shall be included at the end.
4. Name and signature of the student.
5. Assignment can be a combined presentation at the end of the academic year.
6. Time allocated for presentation may be 8+2 Min.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	5	15
Major experiments	10	25
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

Recommended Books

1. Stryer L., *Biochemistry*, WH, Freeman & Company, San Francisco.
2. Plummer, David J., *An Introduction to Practical Biochemistry*, Tata Mc Graw Hill, New Delhi.
3. Singh S.P., *Practical Manual to Biochemistry*, CBS Publisher, New Delhi.

Reference Books

1. Harpers, *Review of Biochemistry*, Lange Medical Publication.
2. Conn E.E. & Stumph P.K., *Outline of Biochemistry*, John Willery & Sons, New York.
3. Nelson D.L. & Cox M.M., *Lehninger Principles of Biochemistry*, Macmillan Worth Publishers.

* Latest editions of all the suggested books are recommended.

Pharm D.: First Year

PHARMACEUTICAL ORGANIC CHEMISTRY (PRACTICAL)

Course Code: **PDR154** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs. /Week

Objective: The basic objective of this course is to get familiar with synthesis of drugs and their derivatives and assure their compliance to pharmacopoeial standard

Introduction to the various laboratory techniques through demonstration involving synthesis of the following compounds (at least 8 compounds to be synthesised):

Acetanilde / aspirin (Acetylation), Benzanilide / Phenyl benzoate (Benzoylation), P-bromo acetanilide / 2,4,6 – tribromo aniline (Bromination), Dibenzylidene acetone (Condensation), 1-Phenylazo-2-napthol (Diazotisation and coupling), Benzoic acid / salicylic acid (Hydrolysis of ester), M-dinitro benzene (Nitration), 8, 9, 10 – Antharaquinone (Oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde, M-phenylene diamine (Reduction of M-dinitrobenzene) / Aniline from nitrobenzene, Benzophenone oxime, Nitration of salicylic acid, Preparation of picric acid, Preparation of O-chlorobenzoic acid from O-chlorotolune and Preparation of cyclohexanone from cyclohexanol

Identification of organic compounds belonging to the following classes by:

Systematic qualitative organic analysis including preparation of derivatives: Phenols, amides, carbohydrates, amines, carboxylic acids, aldehydes and ketones, Alcohols, esters, hydrocarbons, anilides, nitrocompounds.

Introduction to the use of stereo models: Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene and inversion of configuration.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Text Books

1. Mann P.G. & Saunders B.C., *Practical Organic Chemistry*, ELBS/Longman, London.
2. Singh Harkrishan & Kapoor V.K., *Organic Pharmaceutical Chemistry*, Vallabh Prakashan, Delhi.

Reference Books:

1. Finar I.L., *Organic Chemistry*, Vol I & II, ELBS/ Longman, London.
2. 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.

Pharm D.: First Year

PHARMACEUTICAL INORGANIC CHEMISTRY (PRACTICAL)

Course Code: **PDR155** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs./Week

Objective: The basic objective of this course is to get familiar with the physico-chemical analysis of inorganic compounds.

Limit test (6 exercises)

Limit tests for chlorides, Sulphates, iron, heavy metals, arsenic, Modified limit tests for chlorides and sulphates

Assays (10 exercises): estimation of the following

Ammonium chloride- (Acid-base titration), Ferrous sulphate (Cerimetry), Copper sulphate (Iodometry) & Calcilumugluconate (Complexometry), Hydrogen peroxide (Permanganometry), Sodium benzoate (Nonaqueous titration), Sodium chloride (Modified volhard's method)

Assay of KI (KIO3 titration), Gravimetric estimation of barium as barium sulphate, Sodium antimony gluconate or antimony potassium tartarate.

Estimation of mixtures (Any two exercises)

Sodium hydroxide & sodium carbonate, Boric acid & Borax and Oxalic acid & sodium oxalate

Test for identity (Any three exercises)

Sodium bicarbonate, Barium sulphate, Ferrous sulphate and Potassium chloride

Test for purity (Any two exercises)

Swelling power in Bentonite, Acid neutralising capacity in aluminium hydroxide gel, Ammonium salts in potash alum, Adsorption power of heavy Kaolin and Presence of Iodates in KI

Preparations (Any two exercises)

Boric acids, Potash alum, Calcium lactate and Magnesium suphate

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment1&2	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Books

1. Block, J.H. Roche, E, Soine, T and Wilson, C., *Inorganic, Medicinal & Pharmaceutical Chemistry*, Lea & Febiger.
2. Discher, C.A.,et.al*Modern Inorganic Pharmaceutical Chemistry*, Waveland Press.

Reference Books

1. Indian Pharmacopoeia.
2. Atherden L.M., Bentley & Drivers' *Text Book of Pharmaceutical Chemistry*, Oxford University Press, London.

Pharm D.: First Year

REMEDIAL BIOLOGY (PRACTICAL)

Course Code: **PDRB156 (B)** **L-0, T-0, P-3, C-1.5**
Practical: 4 Hrs./Week Title:

Objective: The basic objective of this course is to get familiar with the practical aspects of morphological characters of plants and animals.

List of Experiments

1. Introduction of biology experiments
2. Study of cell wall constituents and cell inclusions
3. Study of Stem modifications
4. Study of Root modifications
5. Study of Leaf modifications
6. Identification of Fruits and seeds
7. Preparation of Permanent slides
8. T.S. of Senna, Cassia, Ephedra, Podophyllum
9. Simple plant physiological experiments
10. Identification of animals
11. Detailed study of Frog
12. Computer based tutorials

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03 hrs**	**04hrs**

Recommended Text books

1. Gokhale S.B. *Text book of Practical Biology*. 11th ed. Bangalore : Nirali Prakashan. 1993.
2. Thulajappa Y and Seetharam. *A Textbook of pre-university Practical biology*. V1. I PUC. Excellent Educational Enterprises. 1993.

Recommended Reference books

1. B.V.Sreenivasa Naidu, *A Text book of Practical Biology*.
2. Krishna Murthy K, *A Text book of Practical Biology*, Delhi: Ajanta Publications. 1990.
3. Dutta A.C., *Practical Botany: for degree students*. New Delhi: Oxford university, 2002. Ekambaranathaayyer M Outlines of Zoology. 1996.
4. Gokhale S.B. & Kokate C.K. *Practical Pharmacognosy*. 8th Ed. Pune : Nirali Prakashan. 2005.

Pharm D.: Second Year

PATHOPHYSIOLOGY (THEORY)

Course Code: **PDR201** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with the relevant aspects of pathology of various conditions with reference to its pharmacological applications and understanding of basic Pathophysiological mechanisms. Hence, it will equip the students with baseline knowledge of its application in other subjects also.

Expected outcomes: Upon completion of the subject students shall be able to:

1. describe the etiology and pathogenesis of the selected diseased states;
2. name signs and symptoms of diseases; and
3. mention the complications of the diseases concerned.

Syllabus and lecture wise schedule:

Unit-I **10 hrs**

Basic principles of cell injury and Adaptation:

Causes, Pathogenesis and morphology of cell injury reversible & irreversible tissue injury, neurosis and apoptosis, Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen storage diseases

Unit-II **8 hrs**

Pathogenesis of acute inflammation, Chemical mediators in inflammation, Types of chronic inflammation & Repairs of wounds in the skin, factors influencing healing of wounds

Unit-III **12hrs**

1. **Diseases of immunity:** Introduction to Tand B cells, MHC proteins or transplantation antigens
2. **Immune tolerance:** Hypersensitivity its types (I, II, III & IV) and their Biological significance, Allergy due to food, chemicals and drugs, Autoimmunity, Criteria for autoimmunity, Classifications of autoimmune diseases in man, mechanism of autoimmunity, Transplantation and immunologic tolerance, allograft rejections, transplantation antigens, mechanism of rejection of allograft., Acquired immune deficiency syndrome (AIDS), Amylodosis

Unit –IV **10 hrs**

Cancer: differences between benign and malignant tumors, Histological diagnosis of malignancy, invasions and metastasis, patterns of spread, disturbances of growth of cells, classification of tumors, general bio logy of tumors, spread of malignant tumors, etiology and pathogenesis of cancer.

Unit –V **8 hrs**

Types of shock: mechanisms, stages and management & biological effects of radiation

Unit –VI **8 hrs**

Environmental and nutritional diseases:

Air pollution and smoking- SO2, NO, NO2, and CO & Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation.

Unit –VII **12 hrs**

1. **Pathophysiology of common diseases:** Parkinsonism, Schizophrenia, Depression and mania,

2. **Hypertension:** Stroke (ischaemic and hemorrhage), Angina, CCF, Atherosclerosis, Myocardial infarction. Diabetes Mellitus, Peptic ulcer and inflammatory bowel diseases, Cirrhosis and Alcoholic liver diseases, Acute and chronic renal failure, Asthma and chronic obstructive airway diseases.

Unit –VIII **12 hrs**

1. **Infectious diseases :** Sexually transmitted diseases (HIV,Syphilis,Gonorrhea), Urinary tract infections, Pneumonia, Typhoid, Tuberculosis, Leprosy, Malaria Dysentery (bacterial and amoebic), Hepatitis- infective hepatitis

2. **Topic of Assignments:** tutorial classes will comprise of allocation of assignments and presentation of compiled informations under the following headings:

   i. Chemical Mediators of inflammation
   ii. Drug Hypersensitivity
   iii. Cigarette smoking & its ill effects
   iv. Biological Effects of Radiation
   v. Etiology and hazards of obesity
   vi. Complications of diabetes
   vii. Diagnosis of cancer
   viii. Disorders of vitamins
   ix. Methods in Pathology-Laboratory values of clinical significance

x. Pathophysiology of Dengue & Hemorrhagic Fever (DHF)

Format of the assignments:

1. Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year
4. It shall be computer draft copy.
5. Name and signature of the student
6. Time allocated for presentation may be 8+2 Min.

Text books (Theory)

1. Ramzi S. Cotran, Vinay Kumar; Tucker Collins. *Robbins pathologic basis of disease*. 6th ed. Singapore: Hercourt Asia Publication. 2000.
2. Harsh Mohan. *Text book of pathology*. 4th ed. New Delhi : Jaypee Publications. 1998.
3. Bhende Y.M., *General pathology*, Bombay: Popular Prakashan. 1969.

Reference books (Theory)

1. Roger Walker, Cate Whittlesea. *Clinical Pharmacy and Therapeutics*. 5th ed. New York : Elsevier Publications. 2012.
2. Dipiro J.L., *Pharmacotherapy – A Pathophysiological Approach*, Elsevier.

Pharm D.: Second Year

PHARMACEUTICAL MICROBIOLOGY (THEORY)

Course Code: **PDR202** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with various aspects of microorganisms, its classification, morphology, laboratory cultivation identification and maintenance. It's also discusses with sterilization of pharmaceutical products, equipment, media etc. The course further discusses the immunological preparations, diseases its transmission, diagnosis, control and immunological tests.

Scope of the Subject: Microbiology has always been an essential component of pharmacy curriculum. This is because of the relevance of microbiology to pharmaceutical sciences and more specifically to pharmaceutical industry. Pharmaceutical biotechnology is the logical extension of pharmaceutical microbiology which is expected to change the complete drug product scenario in the future. This course deals with the

Expected outcomes: Upon completion of the subject student shall be able to –

1. know the anatomy, identification, growth factors and sterilization of microorganisms;
2. know the mode of transmission of disease causing microorganism, symptoms of disease, and treatment aspects.
3. do estimation of RNA and DNA and there by identifying the source;
4. do cultivation and identification of the microorganisms in the laboratory;
5. do identification of diseases by performing the diagnostic tests; and
6. appreciate the behavior of motility and behavioral characteristics of microorganisms.

Syllabus and lecture wise schedule:

Unit –I **10 hrs**

Introduction to the science of microbiology. Major divisions of microbial world and Relationship among them, Different methods of classification of microbes and study of Bacteria, Fungi, virus, Rickettsiae & Spirochetes.

Unit –II **10 hrs**

Nutritional requirements, growth and cultivation of bacteria and virus. Study of different media required for the growth of aerobic and anaerobic bacteria & fungi. Differential media, enriched and selective, maintenance of lab cultures (aerobic & anaerobic cultures).

Unit –III **10hrs**

Different methods used in isolation and identification of bacteria with emphasis to different staining techniques and biochemical reactions. Counting of bacteria -Total and Viable counting techniques.

Unit –IV **10 hrs**

Detailed study of different methods of sterilization including their merits and demerits. Sterilization methods for all pharmaceutical products. Detailed study of sterility testing of different pharmaceutical preparations . Brief information on Validation.

Unit –V **10 hrs**

Disinfectants: Study of disinfectants, antiseptics, fungicidal and virucidal agents factors affecting their activation and mechanism of action. Evaluation of bactericidal, bacteriostatic, & virucidal activities and evaluation of preservatives in pharmaceutical preparations.

Unit –VI **10 hrs**

Immunology: Immunity, Definition, Classification, General principles of natural immunity, Phagocytosis, acquired immunity (active and passive). Antigens, chemical nature of antigens, structure and formation of Antibodies, Antigen-Antibody reactions. Bacterial exotoxins and endotoxins. Significance of toxoids in active immunity, Immunization programme and importance of booster dose.

Unit –VII **10 hrs**

Diagnostic tests: Schick's Test, Elisa test, Western Blot test, Southern Blot PCR Widal, QBC, Mantaux Peripheral smear. Study of malarial parasite.

Microbial culture sensitivity Testing: Interpretation of results Principles and methods of different microbiological assays,

Unit –VIII **10Hrs**

1. Microbiological assay of Penicillin, Streptomycin, vitamin B2 and B12. Standardisation of vaccines and sera.

2. **Study of infectious diseases:** Typhoid, Tuberculosis, Malaria, Cholera, Hepatitis, Meningitis, Syphilis, Gonorrhea and HIV.

Recommended Text books (Theory)

1. Vanitha Kale and Kishor Bhusari, *Applied Microbiology*, Himalaya Publishing house Mumbai.
2. Mary Louis Turgeon, *Immunology and Serology in Laboratory Medicines*, 2nd edition, 1996 Mosby- Year book inc St. Louis Missouri 63146.

3. Harsh Mohan, *Text book of Pathology*, 3rd edition, 1998, B-3 Ansari road Darya ganj N. Delhi.

Reference books (Theory)

1. Prescot L.M., Jarley G.P Klein D.A, *Microbiology*, 2nd- edition Mc Graw Hill Company Inc
2. Rawlins E.A., Bentley's, *Text Book of Pharmaceutics*, B ailliere Tindals 24-28 London 1988
3. Forbisher , *Fundamentals of Microbiology*, Philidelphia W.B. Saunders.
4. Prescott L.M. Jarley G.P., Klein. D. A., *Microbiology*, 2nd edition WMC Brown Publishers, Oxford. 1993 e. War Roitt, Jonathan Brostoff, David male, ― Immunology‖ 3rd edition 1996, Mosby-year book Europe Ltd, London.
5. *Pharmacopoeia of India*, Govt of India, 1996.

Pharm D.: Second Year

PHARMACOGNOSY & PHYTOPHARMACEUTICALS (THEORY)

Course Code: **PDR203** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with medicinal uses of various naturally occurring drugs its history, sources, distribution, method of cultivation, active constituents, medicinal uses, identification tests, preservation methods, substitutes and adulterants.

Expected outcomes

1. to understand the basic principles of cultivation, collection and storage of crude drugs;
2. to know the source, active constituents and uses of crude drugs; and
3. to appreciate the applications of primary and secondary metabolites of plants.

Lecture wise programme:

Unit –I **10 hrs**

Introduction, history, Resources, & scope of Pharmcognosy, Biological, marine, mineral and plant tissue cultures as sources of crude drugs, Novel medicinal agents from marine sources.

Unit –II **10 hrs**

Classification of crude drugs: Alphabetical, Morphological, taxonomical, chemical & pharmacological classifications. Study of following families with special reference to medicinally importance plants: apocynaceae, solanaceae, rutaceae, umbellifereae, leguminoseae, rubiaceae, liliaceae, labiateae, acanthaceae, compositae & papaveraceae.

Unit –III **10 hrs**

Cultivation, collection, processing and storage of crude drugs: Factors influencing cultivation of medicinal plants, Type of Soils & fertilizers of common use, Pest Management & natural pest control agents, Plant hormones and their applications, Polyploidy, Mutation & hybridization with reference to medicinal plants and Poly Houses/ Green Houses for cultivation

Unit –IV **10Hrs**

Detailed method of cultivation of crude drugs: atropa belladonna, cinchona, ginseng, ipecac, lemongrass, opium, Rawolfia serpentina, ergot, seena and Tea.

Unit –V **10Hrs**

1. Study of cell wall constituents and cell inclusions in details including mitotic & meiotic cell division.
2. study of morphological & powder microscopical characteristics, surface preparation and chemical tests of: digitalis, senna & vinca leaves, linseed & nux vomica seeds, clove, cinnamon & cinchona barks and ipecacunha, liquorice & rauwfia root

Unit –VI **10Hrs**

1. **Study of natural pesticides**: pyrethrum, neem, derris, sabacdilla, tobacco & ryania.

2. **Carbohydrate & related products:** detailed studies of carbohydrate containing drugs (11 drugs): Honey, starches, commercial dextrins, xanthen gum, gum acacia, tryacanth, agar, ispaghula, bacl, pectin and inulin,

Unit –VII **10Hrs**

1. Definition sources, method of extraction, chemistry and method of analysis of lipids & fats: castor oil, arachnid oil, olive oils, theobroma, cottonseed oil and palm oil.
2. **Detailed study of volatile oils**: methods of extraction, chemistry and biosynthesis of monoterpencs.

   Sources, collection, morphology, microscopical characteristics, chemical constituents and uses of coriander, fennel, cara way, dill, peppermint, cinnamon bark, saffron and camphor.
3. Definition, classification, chemistry & methods of analysis of proteins with special reference to gelatin, diastase, papain and ficin.

Unit –VIII **10Hrs**

1. Study of plant fibres used in surgical dressing & related products with particular emphasis on preparation, chemical tests, physical & chemical characteristics and uses of absorbent cotton, wool, viscose and alginate fibres.
2. Different methods of adulteration of crude drugs with suitable examples

Recommended Text books

1. G. E. Trease and William Charles Evans, Trease and Evans', *pharmacognosy*, 14th , London : WB.
2. C.K. Kokate, A.P. Purohit, S.B. Gokhale , *Pharmacognosy*, 24th , Pune : Nirali prakashan, 2003.

Recommended Reference books

1. Claus, Edward P. : **Tyler** Varro **E**. & **Brady** Lynn R , *Pharmacognosy*, Philadelphia : Lea & Febiger, 1970.
2. T.E. Wallis, *Textbook of pharmacognosy*, Edi. 5th, Delhi: CBS Pub, 2005.
3. C.S.Shah & J.S.Qadry, *Textbook of pharmacognosy*, 11th, Ahmedabad: B. S. Shah Prakashan, 1996.
4. M A Iyengar, *A handbook of pharmacognosy, India*: Department of pharmacy, 1974.

Pharm D.: Second Year

PHARMACOLOGY – I (THEORY)

Course Code: **PDR204** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with pharmacodynamic and pharmacokinetic aspects of drugs, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs.

Scope of the Subject: This subject will provide an opportunity for the student to learn about the drug with regard to classification, In this subject, apart from general pharmacology, drugs acting on autonomic nervous system, cardiovascular system, central nervous system, blood and blood forming agents and renal system will be taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.

Expected outcomes: Upon completion of the subject student shall be able to-

1. understand the pharmacological aspects of drugs falling under the under mentioned chapters;
2. handle and carry out the animal experiments;
3. appreciate the importance of pharmacology subject as a basis of therapeutics; and
4. Correlate and apply the knowledge therapeutically.

Syllabus and lecture wise schedule:

Unit- I **10 hrs**

General Pharmacology: Introduction, definitions and scope of pharmacology, Routes of administration of drugs- local and systemic routes, Pharmacokinetics (absorption, distribution-plasma protein binding, metabolism and excretion)

Unit- II **10 hrs**

Pharmacodynamics, Factors modifying drug effects, Drug toxicity - Acute, sub- acute and chronic toxicity, Pre-clinical evaluations & Drug interactions.

Pharmacology with reference to the classification, mechanism of action, pharmacokinetics, pharmacodynamics, adverse effects, contraindications, Therapeutic uses, interactions, dose and route of administration of following classes of Drugs:

Unit- III **10 hrs**

Pharmacology of drugs acting on ANS:

1. **Adrenergic drugs:** Adrenaline, Noradrenaline, Dopamine
2. **Antiadrenergic drugs-** Phenoxybenzamine, Atenolol, Labetalol
3. **Cholinergic drugs-** Acetylcholine, Pilocarpine
4. **Anticholinergic drugs**- Atropine, Hyoscine
5. **Neuromuscular blockers-** d-Tubocurarine, Succinylcholine, Dantrolene sodium
6. **Mydriactics-** Homatropine
7. **Miotics-** Pilocarpine
8. **Drugs used in myasthenia gravis-** Neostigmine
9. **Drugs used in Parkinsonism-** Levodopa & Ropinirole.

Unit- IV **10 hrs**

Pharmacology of drugs acting on cardiovascular system:

1. **Antihypertensives-** Captopril, Losartan, Prazosin
2. **Anti-anginal drugs-** Glyceryl trinitrate**,** Propranolol, Nicorandil
3. **Anti-arrhythmic drugs-** Quinidine, Lidocaine, Verapamil
4. **Drugs used for the therapy of Congestive Heart Failure-** Digoxin & Spironolactone
5. **Drugs used for hyperlipidaemias-** Simvastatin & Ezetimibe

Unit- V **10 hrs**

1. **Pharmacology of drugs acting on Central Nervous System**
2. **General anesthetics-** Nirrous oxide & Thiopentone sodium
3. **Sedatives** and **hypnotics-** Penobarbitone, Diazepam and Zopiclone
4. **Anticonvulsants-** Phenytoin, Valproic acid & Vigabatrin
5. **Analgesics-** Morphine, Codine & Paracetamol

6. **Anti-inflammatory agents-** Meloxicam & Celecoxib
7. **Psychotropic drugs-** Chlorpromazine & Haloperidol
8. **Alcohol and methyl alcohol**
9. **CNS stimulants-** Strychnine & Modafinil
10. **Cognition enhancers-** Rivastigmine & Memantine
11. **Local anaesthetics-** Procaine, Bupivacaine & lidocaine**.**

Unit- VI **10 hrs**

Pharmacology of Drugs acting on Respiratory tract:

1. **Bronchodilators-** Salbutamol & Theophylline
2. **Mucolytics-** Bromhexine
3. **Expectorants-** Sodium and potassium Citrate **&** Carbocisteine
4. **Antitussives-** Codeine, Noscapine & Chlorpheniramine
5. **Nasal Decongestants-** Pseudoephedrine & Phenylpropanolamine.

Unit- VII **10 hrs**

Pharmacology of Hormones and Hormone antagonists:

1. **Thyroid & Antithyroid drugs-** Propylthiouracil, Carbimazole
2. **Insulin & Insulin analogues-** Insulin lispro, Insulin glargine
3. **Oral hypoglycemic agents-** Glibenclamide, Metformin
4. **Sex hormones-** Ethinylestradiol, Diethylstillbestrol, Methyltestosterone
5. **Oral contraceptives-** Progestin, Estrogen**,** Levonorgesterol, Mifepristone
6. **Oxytocin** and **other smooth stimulants-** Ergotamine, Misoprostrol
7. **Smooth muscle relaxants-** Ritodrine, Nifedipine

Unit- VIII **10 hrs**

Pharmacology of autocoids and their antagonists:

1. **Histamines & Antihistaminics-** Fexofenadine and Rupatadine

2. **5-Hydroxytryptamine & 5-Hydroxytryptamine antagonists-** Cyproheptadine & Ondansetron

3. **Lipid derived autocoids-** Prostaglandins & Leukotrienes

4. **Platelet activating factors.**

Recommended Text books:

1. Tripathi, K. D., *Essentials of medical pharmacology*. 4th Ed, 1999. Publisher: Jaypee, Delhi.

2. Satoskar, R.S. and Bhadarkar, S.D., *Pharmacology and pharmacotherapeutics*. 16th edition (single volume), 1999. Publisher: Popular, Dubai.

3. Rang, H.P. & Dale, M.M., *Pharmacology*. 4th edition, 1999. Publisher: Churchill Living stone.

Recommended Reference books:

1. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's, *The pharmacological Basis of therapeutics*. 9th Ed, 1996. Publisher Mc Graw Hill, Pergamon press.
2. Craig, C. R. & Stitzel, R.E., *Modern Pharmacology*, Latest edition. Publisher: Little Brown.Co
3. Katzung, B.G., *Basic and clinical pharmacology*. Latest edition. Publisher: Prentice Hall, Int.
4. Shargel and Leon, *Applied Biopharmaceutics and pharmacokinetics*, Latest edition. Publisher: Prentice Hall, London.

Pharm D.: Second Year

COMMUNITY PHARMACY (THEORY)

Course Code: **PDR205** **L-2, T-1, P-0, C-2.5**

Theory: 2 Hrs. /Week

Objective: The basic objective of this course is to get familiar with various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling and health screening services for improved patient care in the community set up.

Scope: In the changing scenario of pharmacy practice in India, Community Pharmacists are expected to offer various pharmaceutical care services. In order to meet this demand, students will be learning

Expected outcomes: Upon completion of the course, the student shall be able to –

1. know pharmaceutical care services;
2. know the business and professional practice management skills in community pharmacies;
3. do patient counselling & provide health screening services to public in community pharmacy;
4. respond to minor ailments and provide appropriate medication;
5. show empathy and sympathy to patients; and
6. appreciate the concept of Rational drug therapy.

Lecture wise programme:

Unit-I **10 hrs**

Definition & scope of community pharmacy: Community pharmacy in India, Roles and responsibilities of Community pharmacist. Characteristics of Indian community pharmacy, Indian role in Pharmaceutical Industries, Drug therapy& community pharmacists, brief idea of clinical risk management.

Unit-II **10 hrs**

Community Pharmacy Management: Selection of site, Space layout, and design**,** Staff, Materials- coding, stocking, Legal requirements**,** Maintenance of various registers**,** Use of Computers: Business and health care softwares and Inventory control in community

pharmacy: Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock

Unit-III **10 hrs**

Prescriptions – parts of prescription, legality & identification of medication related problems like drug interactions. Sources of errors in prescriptions, Conventions and avoiding ambiguity in writing prescription, pharmaceutical incompatibilities, Aims and objectives of Patient's medical records,

Unit-IV **10 hrs**

Pharmaceutical care Definition and Principles of Pharmaceutical care.

Patient counseling: Definition, outcomes, various stages, barriers, Strategies to overcome barriers**,** Key communication skills & patient counseling for good communication, Patient information leaflets- content, design, & layouts, advisory labels**,** Patient medication adherence**:** Definition, Factors affecting medication adherence, role of pharmacist in improving the adherence.

Unit-V **10 hrs**

Health screening services Definition, importance, methods for screening Blood pressure/ blood sugar/ lung function and Cholesterol testing, **OTC Medication**- Definition, safety considerations of OTC medications, OTC medication list & Counselling.

Unit-VI **10 hrs**

Health Education: WHO Definition of health, and health promotion, care for children, pregnant & breast feeding women, and geriatric patients. Commonly occurring Communicable Diseases, causative agents, Clinical presentations and prevention of communicable diseases – Tuberculosis, Hepatitis, Typhoid, Amoebiasis, Malaria, Leprosy, Syphilis, Gonorrhea and AIDS**,** Balance diet, and treatment & prevention of deficiency disorders**,** Family planning – role of pharmacist

Unit-VII **10 hrs**

Responding to symptoms of minor ailments**,** Relevant pathophysiology, common drug therapy to Pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhoea, constipation), Pyrexia, Opthalmic symptoms, worm infestations.

Unit-VIII **10 hrs**

Essential Drugs concept and Rational Drug Therapy: Pharmaco-epidemiology, role of pharmacists in pharmacoepidemiology, pharmaco-economics, types of pharmacoeconomic evaluation-cost minimization analysis, cost benefit analysis, cost effective analysis, cost

utility analysis, Code of ethics- Purpose and scope, application, Code of ethics for community pharmacists in relation to his job, trade & medical profession.

Recommended Books:

1. N S Parmar , *Health education & community pharmacy*, Delhi : C B S Pub., 2008.
2. WHO consultative group report.
3. Mohammad Ali and Jyoti, Gupta**,** *Drug store and business management***,** New Delhi: CBS.

Recommended Reference books:

1. Robin J Harman, *Handbook of pharmacy – health care*. The Pharmaceutical press, 2002.
2. Leon Shargel, *Comprehensive Pharmacy Review*. Lippincott Williams & Wilkins, 2009.

Pharm D.: Second Year

PHARMACOTHERAPEUTICS - I (THEORY)

Course Code: **PDR206** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with pathophysiology and therapeutics of various diseases.

Scope of the Subject: This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. This will enable the student to understand the pathophysiology of common diseases and their management.

Expected outcomes: At completion of this subject, it is expected that students will be able to understand –

1. the pathophysiology of selected disease states and the rationale for drug therapy;
2. the therapeutic approach to management of these diseases;
3. the controversies in drug therapy;
4. the importance of preparation of individualised therapeutic plans based on diagnosis;
5. needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);
6. describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
7. summarise the therapeutic approach to management of these diseases including reference to the latest available evidence;
8. discuss the controversies in drug therapy;
9. discuss the preparation of individualised therapeutic plans based on diagnosis; and

Syllabus and lecture wise schedule:

Etiopathogenesis and pharmacotherapy of diseases associated with different diseased/clinical conditions

Unit-I **10 hrs**

1. **Hypertension:** Introduction to primary and secondary hypertension, cause of primary and secondary hypertension, drug therapy of hypertension, their side effects, indication, contraindications, marketed preparations, dose and uses.

2. **Congestive heart failure:** Introduction, types of heart failure- ischemic & rheumatic heart failure, drugs used in the treatment of congestive heart failure, their side effects, indication, contraindications, marketed preparations doses and uses.

3. **Angina Pectoris:** Introduction, types of angina pectoris, drug used in the treatment of angina pectoris their side effects, indication, contraindications, marketed preparations, dose and uses.

4. **Myocardial infarction:** Introduction to myocardial infarction, morphological changes in myocardial infarction, diagnosis, complications, drug used in the treatment of myocardial infarction their side effects, indication, contraindications, marketed preparations, dose and uses.

Unit-II **10 hrs**

1. **Hyperlipidaemias:** Introduction causes of hyperlipidaemias, HDL, LDL, VLDL, drug therapy of hyperlipidaemias, their side effects, indication, contraindications, marketed preparations, dose and uses.

2. **Electrophysiology of heart:** Introduction to electrophysiology of heart, impulse generation through non automatic and autonomic fibers, conduction of impulse, excitability of myocardium, autonomic influence on cardiac electrophysiology and contractility.

3. **Electrophysiology of Arrhythmias:** Mechanism, chemotherapy of arrhythmias, side effects, indication, contraindications, marketed preparations, dose and uses.

Unit-III **10 hrs**

Introduction to Pulmonary function test

1. **Asthma:** Introduction, types, causes, drug used in the treatment of asthma, Chemical approach towards its management

2. **Chronic obstructive airways disease:** Introduction, classification of COPD, sign & symptoms, etiology, pathophysiology, diagnostic measures, prevention & epidemiology of chronic bronchitis & emphysema.

Unit-IV **10 hrs**

Drug induced pulmonary diseases: Types of drug induced pulmonary diseases, sign & symptoms, diagnosis & treatment of eosinophilic pneumonia, alveolar hemorrhage, interstitial fibrosis, granulomatus lung disease, pulmonary edema & pleural effusion

Unit-V **10 hrs**

1. **Diabetes:** Types of diabetes mellitus, physiological role of insulin and glucagon, risk factors of diabetes mellitus, complications, diagnosis, drug used in the treatment of diabetes mellitus their side effects, indication, contraindications, marketed preparations, dose and uses.

2. **Thyroid diseases:** Introduction to thyroid gland, classification of thyroid diseases, sign & symptoms, etiology, diagnosis, drug used in the treatment of thyroid diseases their side effects, indication, contraindications, marketed preparations, dose and uses.

Unit-VI **10 hrs**

1. **Oral contraceptives:** Introduction to contraception, its mechanism, disease associated with the use of oral contraceptive, causes, drug used in the treatment of disease caused by oral contraceptive

2. **Hormone replacement therapy:** Introduction to hormone replacement therapy, classification of risk factors associated with hormone replacement therapy and their management.

Unit-VII **10 hrs**

1. **Osteoporosis:** Introduction to osteoporosis, types of osteoporosis, sign & symptoms, etiology, diagnosis, drug used for the treatment of osteoporosis, their side effects, indication, contraindications, marketed preparations, dose and uses.

2. General prescribing guidelines for:

(i) **Paediatric patients:** Introduction, need of prescription, unlicensed and off label medicine, drug handling, selection of dosage, and preparation, compliance of parent & children, need of medicines in schools and emergencies, list of drugs used and banned for pediatric patient use and some important case studies

(ii) **Geriatric patients:** An overview of concurrent medications, avoidance of unnecessary poly pharmacy, selection of new medications including anaphylactic, prophylactic and maintenance doses while taking new medications, monitoring adverse drug events, review of drugs(in the therapy) while discharging, aspect of prescribing guide lines for the elderly patients, case study of relevance

(iii)**Pregnant woman:** General consideration for assessing the feasibility to prescribe medication to the pregnant woman, barriers to interpret the safety of medication in the pregnancy, selection of alternative medication with better safety profile. Pharmacokinetic changes in pregnancy and need of adjustment in medication dosing frequency. Principle involved in prescribing during pregnancy, choice of drugs for common problem during pregnancy, flow chart for prescribing in pregnancy

(iv)**Breast feeding mothers:** Challenges of medication in lactating mothers, general guideline for prescribing, introduction to safety of drugs passing through breast milk. Acquaintance of prescribing drugs treating with following conditions associated with lactating mothers: analgesic, antibiotics, constipation treatment, emergency hormonal

contraception, postnatal depression and antidepressant, threadworm treatment and thyroid medication.

Unit-VIII **10 hrs**

1. **Glaucoma:** Introduction, types of glaucoma, sign & symptoms, causes, diagnosis, drug used for the treatment of glaucoma.

2. **Conjunctivitis- viral & bacterial:** Introduction to viral & bacterial conjunctivitis, classification, etiology, diagnosis, drug used for the treatment of conjunctivitis

3. **Introduction to rational drugs:** Introduction to rational drug use, factors underlying and reason for irrational use of drugs, measures promoting and obstacles in rational drug use, steps involved in rational drug prescribing, essential drug concept and rational drug formulations.

   Role of pharmacist in rational medication and monitoring.

Text Books

1. Roger and Walker, *Clinical Pharmacy and Therapeutics*, Churchill Livingstone publication.
2. Joseph T. Dipiro et al., *Pharmacotherapy: A Pathophysiologic approach* - Appleton & Lange.

Reference Books

1. Robins SL, *Pathologic basis of disease* -, W. B. Saunders publication.
2. Green and Harris, *Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice*, Chapman and Hall publication.
3. Eric T. Herfindal, *Clinical Pharmacy and Therapeutics*, Williams and Wilkins Publication.
4. Lloyd Young and Koda, *Applied Therapeutics: The clinical Use of Drugs*, Kimble MA
5. *Avery's Drug Treatment*, 4th Edn, 1997, Adis International Limited.
6. Relevant review articles from recent medical and pharmaceutical literature

Pharm D.: Second Year

PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)

Course Code: **PDR251** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs./Week

Objective: The basic objective of this course is to get familiar with practical aspects of microbes structure, staining procedures and microbiological analysis of antibiotics.

List of the Experiments:

1. Study of apparatus used in experimental microbiology*.
2. Sterilisation of glass ware's. Preparation of media and sterilisation.*
3. Staining techniques – Simple staining ; Gram's staining ; Negative staining**
4. Study of motility characters*.
5. Enumeration of micro-organisms (Total and Viable)*
6. Study of the methods of isolation of pure culture.*
7. Bio chemical testing for the identification of micro*-organisms
8. Cultural sensitivity testing for some micro-organisms.*
9. Sterility testing for powders and liquids.*
10. Determination of minimum inhibitory concentration.*
11. Microbiological assay of antibiotics by cup plate method.*
12. Microbiological assay of vitamins by Turbidometric method**
13. Determination of RWC.**
14. Diagnostic tests for some common diseases, Widal, malarial parasite.** *
15. Indicate minor experiment & **
16. indicate major experiment

Assignments:

1. Visit to some pathological laboratories & study the activities and equipment/instruments used and reporting the same.
2. Visit to milk dairies (Pasturization) and microbial laboratories (other sterilization methods) & study the activities and equipment/instruments used and reporting the same.
3. Library assignments
   ii. Report of recent microbial techniques developed in diagnosing some common diseases.
   iii. Latest advancement developed in identifying, cultivating & handling of microorganisms.

Format of the assignment:

1. Minimum & Maximum number of pages
2. It shall be computer draft copy.
3. Reference(s) shall be included at the end.
4. Name and signature of the student.
5. Assignment can be a combined presentation at the end of the academic year
6. Time allocated for presentation may be 8+2 Min.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal Examination	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Text Books

1. Pelczar & Reid, *Microbiology*, Tata McGraw Hill, Delhi.
2. Prescott L.M., Harley J.P. & Klien D.A., *Microbiology*, Tata McGraw Hill.
3. Stanier R.Y., Ingraham, J.L., Wheelis M.L. & Painter P.R., *General Microbiology*, Macmillan Press Limited.

Reference Books

1. Hugo & Russell, *Pharmaceutical Microbiology*, Black Well Scientific Publication, Oxford.
2. Ananthanarayan R. & Paniker C.K.J., *Textbook of Microbiology*, Orient Longman.
3. Sykes, *Disinfection & Sterilization*.
4. Virella G., *Microbiology& Infectious Diseases*.

*Latest editions of all the suggested books are recommended.

Pharm D.: Second Year

PHARMACOGNOSY & PHYTOPHARMACEUTICALS (PRACTICAL)

Course Code: **PDR252** **L-0, T-0, P-4, C-2**

Practical: 4 Hrs./Week

Objective: The basic objective of this course is to get familiar with practical aspects of macroscopic and microscopic study of plant drugs.

List of experiments:

1. Introduction of Pharmacognosy laboratory and experiments.
2. Study of cell wall constituents and cell inclusions.
3. Macro, powder and microscopic study of Datura.
4. Macro, powder and microscopic study of Senna.
5. Macro, powder and microscopic study of Cassia. Cinnamon.
6. Macro, powder and microscopic study of Cinchona.
7. Macro, powder and microscopic study of Ephedra.
8. Macro, powder and microscopic study of Quassia.
9. Macro, powder and microscopic study of Clove
10. Macro, powder and microscopic study of Fennel.
11. Macro, powder and microscopic study of Coriander.
12. Macro, powder and microscopic study of Isapgol.
13. Macro, powder and microscopic study of Nux vomica.
14. Macro, powder and microscopic study of Rauwolfia.
15. Macro, powder and microscopic study of Liquorice.
16. Macro, powder and microscopic study of Ginger.
17. Macro, powder and microscopic study of Podophyllum.
18. Determination of Iodine value.
19. Determination of Saponification value and unsaponifiable matter.
20. Determination of ester value. 21 Determination of Acid value.
21. Chemical tests for Acacia.
22. Chemical tests for Tragacanth.
23. Chemical tests for Agar.
24. Chemical tests for Starch.
25. Chemical tests for Lipids.(castor oil,sesame oil, shark liver oil,bees wax)
26. Chemical tests for Gelatin.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.

2. The external evaluation will be conducted for 70 marks.

3. The external examiner will be appointed from the approved panel of examiners.

4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.

5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.

6. Scheme of Practical Examination: Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Books Recommended

1. Pulok K. Mukherjee, *Quality Control of Herbal drugs. An Approach to Evaluation of*
2. *Botanicals*, Business Horizons.
3. V. Rajpal, *Standardization of Botanicals*, Vol. I & II, Eastern Publishers, New Delhi.
4. Mohammad Ali, *Pharmacognosy and Phytochemistry*, CBS Publishers & Distribution, New Delhi.
5. Kalia, A.N., *Text Book of Industrial Pharmacognosy*. Satish Kumar Jain for CBS.
6. Vyas, S.P., Dixit, V.K., *Pharmaceutical Biotechnology*. CBS Publishers.
7. Prof. S. H. Ansari, *Essentials of Pharmacogosy*, Birla Publishers, Rohtas Nagar, Delhi.

Reference Books

1. Tyler, Brady and Robbers, *Pharmacognosy*, Lea & Febiger, 1981.
2. *WHO Quality Control Methods of Medicinal Plant Materials*, WHO.
3. *Indian Herbal Pharmacopoeia*, Vol. 1 & 2.

Pharm D.: Second Year

PHARMACOTHERAPEUTICS - I (PRACTICAL)

Course Code: **PDR253** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs. /Week

Objective: The basic objective of this course is to get familiar with different drug therapies for various diseases.

Practicals: Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion; attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge. Students are required to maintain a record of cases presented and the same should be submitted at the end of the course for evaluation. A minimum of 20 cases should be presented and recorded covering most common diseases.

Assignments:

Students are required to submit written assignments on the topics given to them. Topics allotted should cover recent developments in drug therapy of various diseases. A minimum of THREE assignments [1500 – 2000 words] should be submitted for evaluation.

Format of the assignment:

1. Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year.
4. It shall be computer draft copy.
5. Name and signature of the student.
6. Time allocated for presentation may be 8+2 Min.

Guidelines:

1. Students will be required to maintain and submit the precisely compiled diary containing the assignments (Case studies of most common diseases).
2. These assignments will be of two categories i.e. major & minor.
3. The entire practical exams will be evaluated through record compilation & oral presentation.
4. The evaluation will be conducted both by external & internal examiners.
5. A committee of senior teachers including the teacher preceptor will evaluate for internal assessment (30 marks).
6. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
7. The external evaluation will be conducted for 70 marks.
8. The external examiner will be appointed from the approved panel of examiners.

9. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
10. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
11. **Scheme of Practical Examinations:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Text & Reference Books:

1. Satoskar & Bhandarkar, *Pharmacology & Pharmacotheropeutics*., Popular Prakashan Pvt. Ltd. Bombay.
2. Goodman & Gilman, *The Pharmacological basis of Therapeutics*, Editors: J.G. Hardman, L.E. Limbird, P.B. Molinos, R.W. Ruddon and A.G. Gil, Pergamon press.

Pharm D.: Third Year

PHARMACOLOGY – II (THEORY)

Course Code: **PDR301** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with different categories drugs with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, and route of administration, precautions, contraindications and interaction with other drugs.

Scope of the Subject: This subject will provide an opportunity for the student to learn about drugs acting on autacoids, respiratory system, GIT, immune system and hormones, and pharmacology of autocoids and hormones. In addition, pharmacology of chemotherapeutic agents, vitamins, essential minerals and principles of toxicology are also taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.

Expected outcomes:

1. to understand the pharmacological aspects of drugs falling under the above mentioned chapters,
2. to carry out the animal experiments confidently,
3. to appreciate the importance of pharmacology subject as a basis of therapeutics, and
4. to correlate and apply the knowledge therapeutically.

Syllabus and lecture wise schedule:

Unit I **10 hrs**

Pharmacology of Drugs belonging to following categories:

1. **Anticoagulants**: Mechanism of coagulation, study of anti-coagulants, Heparin, Heparan Sulfate, Low-Molecular-Weight Heparin Preparations (Enoxaparin, dalteparin, tinzaparin, ardeparin, nadroparin, and reviparin), Synthetic Heparin Derivatives (Fondaparinux), Lepirudin, Bivalirudin, Argatroban, Danaparoid, Drotrecogin Alfa, Warfarin, Phenprocoumon and Acenocoumarol, Indandione Derivatives (Anisindione), Rodenticides (Bromadiolone, brodifacoum, diphenadione, chlorophacinone and pindone) and Ximelagatran

2. **Thrombolytics**: Plasminogen, α_2-Antiplasmin, Streptokinase, tissue plasminogen activator.

3. **Antiplatelet agents:** Aspirin, Dipyridamole, Ticlopidine, Clopidogrel, Glycoprotein IIb/IIIa Inhibitors like Abciximab, Eptifibatide and Tirofiban

Unit II **10 hrs**

Pharmacology of Drugs belonging to following categories:

1. **Haemopoietics and plasma expanders**: Introduction to hematopoiesis,

2. **Hematopoietic growth factors**: Erythropoietins,

3. **Myeloid growth factors**: gm-csf, g-csf,

4. **Thrombopoietic growth factors:** interleukin-11, thrombopoietin,

5. **Drugs effective in iron deficiency and other hypochromic anemias:** iron and iron salts *i.e.* ferrous sulfate, iron dextran injection, vitamin B_{12} and folic acid.

6. **Plasma expanders**: Dextran & degraded gelatin polymer.

7. **Diuretics**: Acetazolamide, glycerin, isosorbide, mannitol, urea, furosemide, bumetanide, ethacrynic acid, torsemide, hydroxyl chlorthiadiazide, Chlorthalidone, Triamterene , amiloride, spironolactone , eplerenone,

8. **Antidiuretics**: vasopressin and desmopressin

Unit III **10 hrs**

1. **Introduction to Chemotherapy:** Classification of various therapeutic antimicrobial categories, Mechanisms of Resistance, drug interaction, contra-indication, adverse effects, their Pharmacological Properties and Pharmacokinetics .

2. **Sulfonamides and co-trimoxazole**: Sulfamethoxazole, Sulfamethopyrazine,Silver sulfadiazine, sulfacetamide sodium, Trimethoprim and Co-trimoxazole.

3. **Penicillins and Cephalosporins**: Classification of the penicillins/ cephalosporins eg: Amoxicillin, Amoxicillin/potassium clavulanate, Piperacillin, Ticarcillin, Cephalexin, Cefuroxime, Cefotaxime, Ceftriaxone, Cefepime, Meropenem, Vancomycin etc. Mechanism of action & bacterial resistance to penicillins and cephalosporins, factors influencing the activity of β-lactam antibiotics.

4. **Tetracyclins and Chloramphenicol**: MOA, Indications and contraindications of Tetracyclines: oxytetracyclines & Doxycycline.

Unit IV **10 hrs**

1. **Macrolides, Aminoglycosides antibiotics:** Erythromycin, Roxithromycin, Azithromycin, Clarithromycin, Streptomycin, amikacin and tobramycin.

2. **Quinolines and Fluroquinolines:** nalidixic acid, ciprofloxacin, ofloxacin, norfloxacin, levofloxacin and sparfloxacin.

3. **Antifungal antibiotics:** Amphotericin B, Nystatin, Griseofulvin, Miconazole and Ketoconazole.

4. **Pharmacology of Anthelmintic drugs**: albendazole, mebendazole, ivermectin, Pyrantel pamoate, Diethylcarbamazine and Praziquantel.

5. **Antiviral agents:** Nonretroviral (anti herpes/influenza,hepatitis) and Retroviral drugs like Acyclovir, Fomivirsen, Foscarnet, Idoxuridine, Amantadine, Oseltamivir, Zanamivir, Adefovir, Interferons, Zidovudine, Didanosine, Zalcitabine, Abacavir, Efavirenz, Saquinavir, Indinavir, Amprenavir and Fosamprenavir and Enfuvirtide.

Unit V **10 hrs**

1. **Chemotherapy of tuberculosis and leprosy:** INH, Rifampicin, Pyrazinamide, Streptomycin, Clarithromycin, Dapsone and Clofazimine.

2. **Chemotherapy of Malaria:** Chloroquine, Amodiaquine, Quinine, Primaquine, Sulfadoxine, Pyrimethamine, Atovaquone, Halofantrine, Lumefantrine and Artemisinins.

3. **Chemotherapy of protozoal infections (amoebiasis and Giardiasis):** Metronidazole, tinidazole, Diloxanide furoate, paromomycin, iodoquinol and ornidazole.

4. **Antineoplastic drugs:** Cytarabine, Cyclophosphamide, 5-Fluorouracil, Melphalan, 6-Mercaptopurine, Thiotepa, Methotrexate, 6-Thioguanine, Daunorubicin, Doxorubicin, Etoposide, Dactinomycin, Paclitaxel, Mitomycin, Vinblastine, Vincristine and Cisplatin.

Unit VI **10 hrs**

1. **Immunopharmacology** Pharmacology of immunosuppressants and stimulants, the immune response and its mechanism.

2. **General approach to organ transplantation therapy:** adrenocortical steroids, calcineurin inhibitors: cyclosporine, tacrolimus, antiproliferative and antimetabolic drugs: sirolimus, everolimus and azathioprine

3. **Principles of Animal toxicology** Acute, sub- acute and chronic toxicity: Study of various parameters evaluated and its importance in toxicologic evaluation.

4. **The dynamic cell: The structures and functions of the components of the cell**

5. **Cellular macromolecules:** Nucleic acids: RNA & DNA

6. **Large macromolecular assemblies:** viruses and non biologic nanoparticles, polynucleotides

7. **Chromosome structure**: Pro and eukaryotic chromosome structures, genome complexity, the flow of genetic information.

8. **DNA replication**: General, bacterial and eukaryotic DNA replication.

9. **The cell cycle**: Restriction point, cell cycle regulators and modifiers.

Unit VII **10 hrs**

1. **Cell signaling**: Communication between cells and their environment, ion-channels, signal transduction pathways (MAP kinase, P38 kinase, JNK, Ras and PI3-kinase pathways and Biosensors.

2. **Gene structure**: Organization and elucidation of genetic code.

3. **Gene expression**: Expression systems (pro and eukaryotic), genetic elements that control gene expression (nucleosomes, histones, acetylation, HDACS, DNA binding protein families.

Unit VIII **10 hrs**

1. **Transcription and Transcription factors**: Basic principles of transcription in pro and eukaryotes. Transcription factors that regulate transcription in pro and eukaryotes.

2. **RNA processing:** rRNA, tRNA and mRNA processing.

3. **Protein synthesis**: Mechanisms of protein synthesis, initiation in eukaryotes, translation control and post-translation events.

4. **Altered gene functions:** Mutations, deletions, amplifications, LOH, traslocations, trinucleotide repeats and other genetic abnormalities. Oncogenes and tumor suppressor genes. The gene sequencing, mapping and cloning of genes in human disease. Introduction to gene therapy and targeting. Recombinant DNA technology: principles. Processes (gene transfer technology) and applications

Recommended Text Books:

1. Alberts B., Bray, D., Lewis, J., Raff M., Roberts, K and Watson JD, *Molecular Biology of the Cell*, , 3rd edition.
2. Lodish, H., Baltimore, D., Berk, A et al., *Molecular Cell Biology* , 5th edition.
3. Turner, PC., McLennan, AG., Bates, AD and White MRH, *Molecular Biology*, 2nd edition.
4. Lewin, B., *Genes VIII*, (2004)
5. Crommelin, DJA and Sindelar RD, *Pharmaceutical Biotechnology*, (1997)
6. Watson, JD., Gilman, M., et al., *Recombinant DNA*, (1996)
7. Walsh, G., *Biopharmaceutical: Biochemistry and Biotechnology*, (1998)
8. Tripathi, K. D. *Essentials of medical pharmacology*, 4th edition, 1999. Publisher: Jaypee, Delhi.
9. Satoskar, R.S. and Bhadarkar, S.D., *Pharmacology and pharmacotherapeutics*, 16th edition (single volume), 1999. Publisher: Popular, Dubai.
10. Rang, H.P. and Dale, M.M., *Pharmacology*, 4th edition, 1999. Publisher: Churchill Living stone.

Reference books

1. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's, *The pharmacological Basis of therapeutics*, 9th edition, 1996. Publisher: Mc Graw Hill, Pergamon press.
2. Craig, C.R. and Stitzel, R.E., *Modern Pharmacology*, Latest edition. Publisher: Little Brown and company.
3. Katzung, B.G. *Basic and clinical pharmacology*, Latest edition. Publisher: Prentice Hall, International.
4. Gupta, P.K. and Salunkhe, D.K., *Modern Toxicology*, Volume I, II and III. Latest edition. Publisher: B.V. Gupta, Metropolitan Book Co. (p) Ltd, New Delhi.

* Latest editions of all the suggested books are recommended.

Pharm D.: Third Year

PHARMACEUTICAL ANALYSIS (THEORY)

Course Code: **PDR302** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with different analytical tools for drug analysis.

Unit I **10 hrs**

Quality Assurance:
Introduction, sources of quality variation, control of quality variation, Concept of statistical quality control, Validation methods- quality of equipment, validation of equipment and analytical instruments & calibration, GLP, ISO 9000, Total quality management, quality review and documentation, ICH- international conference for harmonization-guidelines, Regulatory control.

Unit II **10 hrs**

1. **Chromatography:** Introduction, history, classification, separation techniques, choice of methods. The following techniques be discussed with relevant examples of pharmaceutical products involving principles and techniques of separation of drugs from excipients.

2. **Column Chromatography**: Adsorption column chromatography, Operational technique, frontal analysis and elution analysis. Factors affecting column efficiency, applications and partition chromatography
3. **TLC**: Introduction, principle, techniques, Rf value and applications.
4. **Paper Chromatography:** Introduction, principle, types of paper chromatography, preparation & development techniques and applications.

5. **Ion-exchange chromatography**: Introduction, principles, types of ion exchange, synthetic resins, physical properties, factors affecting ion exchange, methodology and applications.

Unit III **10 hrs**

1. **HPLC**: Introduction, theory, instrumentation solvent reservoir and mixing system, column and packing material, chromatography solvents, Pump, Injector, Detector and applications.

2. **HPTLC**: Introduction, theory, instrumentation, and applications.

3. **Gas Chromatography**: Introduction, theory, instrumentation-carrier gases, types of columns, stationary phases in GLC & GSC. Detectors-Flame ionization, electron capture and thermal conductivity detectors. Typical gas chromatogram, derivatisation techniques, programmed temperature gas chromatography and applications.

4. **Electrophoresis**: Principles of separation, equipment for paper and gel electrophoresis and applications.

5. **Gel filtration** and **affinity chromatography**: Introduction, techniques and applications.

Unit IV **10 hrs**

1. **Electrometric Methods:** Theoretical aspects, instrumentation, interpretation of data/spectra and analytical applications be discussed on the following topics.

2. **Potentiometry**: Electrical potential, electrochemical cell, reference & indicator electrodes, measurement of potential and pH, construction and working of electrodes, Potentiometric titrations, methods of detecting end point and Karl Fischer titration.

3. **Conductometry**: Introduction, conductivity cell, conductometric titrations and applications.

4. **Polarography**: Instrumentation, DME, residual current, diffusion current and limiting current, polarographic wave, Ilkovic's equation, Effect of oxygen on polarographic wave, Polarographic maxima and suppressors and applications.

Unit V **10 hrs**

1. **Amperometric Titrations:** Introduction, types of electrodes used, reference and indicator electrode, instrumentation, titration procedure, advantages and disadvantages of amperometry over potentiometry. Pharma applications.

2. **Absorption Spectroscopy:**

3. Theory of electronic, atomic and molecular spectra. Fundamental laws of photometry, Beer-Lambert's Law, application and its deviation, limitation of Beer's law and its application to single and multiple component analysis, measurement of equilibrium constant and rate constant by spectroscopy. Spectra of isolated chromophores, auxochromes, batho-chromic, hypsochromic, hyperchromic and hypochromic effect, effects of solvent on absorption spectra, molecular structure and infrared spectra.

4. **Instrumentation** – Photometer, U.V.-Visible spectrophotometer – sources of U.V.-Visible radiations, collimating systems, monochromators, samples cells and following

detectors-Photocell, Barrier layer cell, Phototube, Diode array, applications of U.V.-Visible spectroscopy in pharmacy and spectrophotometric titrations.

Unit VI **10 hrs**

1. **Infrared Spectroscopy**: Vibrational transitions, frequency, structure correlations, Infrared absorption bands, **Instrumentation**–IR spectro-meter – sources of IR, Collimating systems, monochromators, sample cells, sample handling in IR spectroscopy and detectors–Thermocouple, Golay Cells, Thermistor, Bolometer, Pyroelectric detector, Applications of IR in pharmacy.

2. **Fluorimetric Analysis:** Theory, luminescence, factors affecting fluorescence, quenching. Instrumentation, Applications, fluorescent indicators, study of pharmaceutically important compounds estimated by fluorimetry.

3. **Flame Photometry:** Theory, nebulisation, flame and flame temperature, interferences, flame spectrometric techniques and instrumentation and pharmaceutical applications.

Unit VII **10 hrs**

1. **Atomic Absorption Spectrometry:** Introduction, Theory, types of electrodes, instrumentation (radiation source, chopper, atomizers, nebulization of liquid sample monochromators detector amplifier and read out device) and applications.

2. **Atomic Emission Spectroscopy**: Spectroscopic sources, atomic emission spectrometers, photographic and photoelectric detection.

3. **NMR & ESR (introduction only):** Introduction, theoretical aspects and applications.

4. **Mass Spectroscopy**: (**Introduction only**) – Fragmentation, types of ions produced mass spectrum and applications.

Unit VIII **10 hrs**

1. **Polarimetry: (Introduction only**) – Introduction to optical rotatory dispersion and circular dichroism & polarimeters

2. **X-RAY Diffraction: (Introduction only**) – Theory, reciprocal lattice concept, diffraction patterns and applications.

3. **Thermal Analysis**: Introduction, instrumentation, applications, and DSC& DTA.

Recommended Text Books:

1. *Pharmacopoeia of India*, Ministry of Health, Govt of India.

2. Becket A.H. & Stenlake J.B., *Practical Pharmaceutical Chemistry* Vol. I and II, the Athlone Press of the University of London.
3. Chatten L.G., *A text book of Pharmaceutical Chemistry* Vol. I & II Marcel, Dekker, New York.
4. Willard H.H. & Merrit L. Jr, and Dean J.A., *Instrumental Methods of Analysis*, Van Nostrand Renhold, New York.
5. Silver stein R.M. & Webster F.X., *Spectrometric Identification of Organic Compounds*, John Wiley & Sons.
6. Skoog V., *Principles of Instrumental Analysis*, Holler-Neimen

Recommended Reference Books:

1. Willard, H.H., Merrit, L.L., Dean, J.A., Settle, P.A., *Instrumental Methods of Analysis*, Van Nostrand.
2. Skoog, D.A., Heller, F.J., Nieman, T.A., *Principles of Instrumental Analysis*, WB Saunders.
3. Haswell, S.J., ed. *Atomic Absorption Spectroscopy*, Elsevier.
4. Ardrey, R.E., *Pharmaceutical Mass Spectra*, Pharmaceutical Press, London.
5. Sethi, P.D., *Quantitative Analysis of Pharmaceutical Formulations*, CBS Publishers, New Delhi.
6. Kalsi, P.S., *Spectroscopy of Organic Compounds*, new age publishers, New Delhi.
7. Gross J.H., *Mass Spectrometry*, Springer Berlin, Heidelberg.
8. Haffmann D. H. Advances in *Chromatography*, Marcel Dekker.
9. Braun Robert D., *Introduction to Instrumental Analysis*, McGraw-Hill.
10. Wilfried, M.A. Niessen, *Liquid Chromatography-Mass Spectrometry*, Marcel Dekker.

* Latest editions of all the suggested books are recommended.

Pharm D.: Third Year

PHARMACOTHERAPEUTICS – II (THEORY)

Course Code: **PDR303** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with pathophysiology and therapeutics of various diseases.

Scope of the Subject: This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly This will enable the student to understand the pathophysiology of common diseases and their management.

Expected outcomes: upon completion of course, students will be able:

1. to know the pathophysiology of selected disease states and the rationale for drug therapy
2. to know the therapeutic approach to management of these diseases;
3. to know the controversies in drug therapy;
4. to know the importance of preparation of individualised therapeutic plans based on diagnosis; and
5. to appreciate the needs to identify the patient-specific parameters relevant in initiating drug therapy and monitoring therapy (including alternatives, time-course of clinical & laboratory indices of therapeutic response and adverse effects).

Syllabus and lecture wise schedule:

Etiopathogenesis and pharmacotherapy of diseases associated with following systems / diseases

Unit-I **10 hrs**

Guidelines for the rational use of antibiotics and surgical Prophylaxis against the following infections:

1. **Tuberculosis:** causative organism, risk factors, mode of transmission, types of tuberculosis, diagnosis, drugs used in treatment of tuberculosis- First line drugs, Second line drugs, Short course chemotherapy.
2. **Meningitis:** causative agents, types of meningitis, sign and symptoms, diagnosis, drugs used in the treatment of meningitis.

3. **Respiratory tract infections: Asthma-** risk factors, types of asthma, diagnosis, aerosol therapy of asthma, drugs used in the treatment of asthma.

4. **Chronic obstructive pulmonary disease**- cause, types of COPD, diagnosis, non-pharmacological therapy of COPD and pharmacological therapy of COPD.

Unit II **10 hrs**

1. **Gastroenteritis:** causative agents, sign and symptoms, transmission of disease, diagnosis, management of gastroenteritis.

2. **Endocarditis:** Types of endocarditis, causative agents, sign and symptoms, complications, diagnosis and doses regimen used in the treatment of endocarditis

3. **Septicemia:** cause, sign and symptoms, cascade of septicemia, diagnosis and treatment of septicemia.

Unit-III **10 hrs**

1. **Urinary tract infections:** causative agent, route of infection, sign and symptoms, diagnosis and management of UTI.

2. Malaria: causative organisms, sign and symptoms, complications, prognosis and drugs used in the treatment of malaria.

3. **HIV:** cause, routes of transmission, phases of syndrome, clinical manifestation, diagnosis and therapy of syndrome.

4. **Opportunistic infections-** causes, types of infection, treatment of infection

Unit-IV **10 hrs**

1. Fungal infections:

(i) **Mycoses**- cause, sign and symptoms, diagnosis and treatment of mycoses

(ii) **Histoplasmosis**- types, cause, sign and symptoms, diagnosis and treatment of histoplasmosis

(iii)**Blastomycosis**- cause, sign and symptoms, diagnosis and treatment of blastomycosis

- cause, sign and symptoms, diagnosis and treatment of coccididomycosis

(iv)**Cryptococcosis**- cause, sign and symptoms, diagnosis and treatment of cryptococcosis

Viral infections:

i. **Viral Haemorrhagic fever:** types, cause, sign and symptoms, diagnosis and treatment of viral Haemorrhagic fever
ii. **Rabies:** cause, sign and symptoms, transmission, diagnosis and treatment of rabies
iii. **Small pox:** types, cause, sign and symptoms, diagnosis and treatment of small pox
iv. **Chicken pox:** cause, sign and symptoms, diagnosis and treatment of chicken pox
v. **Measles:** cause, sign and symptoms, diagnosis and treatment of measles
vi. **Mumps:** cause, sign and symptoms, diagnosis and treatment of mumps
vii. **Bird flu:** cause, sign and symptoms, diagnosis and treatment of bird flu
viii. **Swine flu:** cause, sign and symptoms, transmission, diagnosis and treatment of swine flu
ix. **Gonarrhoea:** cause, sign and symptoms, diagnosis, prevention of gonorrhoea and drugs used in treatment of gonorrhoea.
x. **Syphillis:** causative organism, immunology, mode of tranission and stages of acquired syphilis,

Unit-V **10 hrs**

1. **Rheumatoid arthritis:** types of rheumatoid arthritis, sign and symptoms, complications, diagnosis, drugs used in treatment of rheumatoid arthritis.

2. **Osteoarthritis:** types of osteoarthritis, causes, sign and symptoms, diagnosis, non-pharmacological & pharmacological therapy of osteoarthritis including tropical therapy.

3. **Gout:** causes, sign and symptoms, diagnosis, non-pharmacological therapy of gout, pharmacological therapy of gout including prophylactic therapy of gout.

4. **Spondylitis:** sign and symptoms, diagnosis and drugs used in treatment of spondylitis.

5. **Systemic lupus erythematosus**: sign and symptoms, diagnosis, drugs used in treatment of systemic lupus erythematosus.

Unit-VI **10 hrs**

1. **Acute Renal Failure:** causes, sign and symptoms, diagnosis, clinical presentation and therapy of acute renal failure.

2. **Chronic Renal Failure:** causes, sign and symptoms, diagnosis, clinical features and therapy of chronic renal failure.

3. **Renal Dialysis:** introduction to renal dialysis, principle, types & significance of renal dialysis

4. **Drug induced renal disorders: Acute tubular necrosis**- risk factors, prevention, and management,

5. **Osmotic nephrosis**- risk factors, prevention, and management, **Obstructive nephropathy**- risk factors, prevention and management, **Chronic interstitial nephritis-** risk factors, prevention, and management.

Unit-VII **10 hrs**

1. **Basic principles of Cancer therapy:** molecular and cellular basis for cancer therapy

2. **General introduction to cancer chemotherapeutic agents:** Purpose of chemotherapy**,** Factors affecting response to chemotherapy, classification of chemotherapeutic agents.

3. **Chemotherapy of breast cancer:** causes, sign and symptoms, diagnosis and treatment of early, locally advanced & metastatic breast cancers.

4. **Leukemia:** types of leukemia**,** sign and symptoms, diagnosis and treatment of leukemia.

5. **Management of chemotherapy nausea and emesis:** types, risk factors, treatment

Unit-VIII **10 hrs**

1. **Psoriasis:** classification**,** sign and symptoms, diagnosis, non-pharmacological & pharmacological therapy of psoriasis, first line drugs and second line drugs, phototherapy.

2. **Scabies:** cause, sign and symptoms, diagnosis and drugs used in treatment of scabies.

3. **Eczema:** types of eczema, causative agents, diagnosis and drugs used in treatment of eczema.

4. **Impetigo:** types of impetigo, causative agents, diagnosis and drugs used in treatment of impetigo.

Recommended Text books:

1. Roger and Walker, *Clinical Pharmacy and Therapeutics*, Churchill Livingstone publication
2. Goodman & Gilman, *The Pharmacological basis of Therapeutics*, Pergamon Press.
3. Satoskar & Bhandarkar, *Pharmacology & Pharmacotherapeutics*, Popular Prakashan Pvt. Ltd., Bombay.
4. Kulkarni S.K., *Hand Book of Experimental Pharmacology*, Vallabh Prakashan, Delhi.

Recommended Reference books:

1. Joseph T. Dipiro et al., *Pharmacotherapy: A Pathophysiologic approach*, Appleton & Lange
2. Eric T. Herfindal, *Clinical Pharmacy and Therapeutics*, Williams and Wilkins Publication
3. Lloyd Young and Koda, *Applied Therapeutics: The clinical Use of Drugs*, Kimble MA

* Latest editions of all the suggested books are recommended.

Pharm D.: Third Year

PHARMACEUTICAL JURISPRUDENCE (THEORY)

Course Code: **PDR304** **L-2, T-0, P-0, C-2.0**

Theory: 2 Hrs. /Week

Objective: The basic objective of this course is to get familiar with the Pharmacy Act, dangerous drugs, medicinal & toilet preparation Act and such other acts & rules framed thereunder.

Scope of the Subject: This course exposes the student to several important legislations related to the profession of pharmacy in India. The Drugs and Cosmetics Act, along with its amendments are the core of this course. Other acts, which are covered, include etc. Besides this the new drug policy, professional ethics, DPCO, patent and design Act will be discussed.

Expected outcomes: Upon completion of the subjects, students shall be able to

1. practice the Professional ethics;
2. understand the various concepts of the pharmaceutical legislation in India;
3. know the various parameters in the Drug and Cosmetic Act and rules;
4. know the Drug policy, DPCO, Patent and design act;
5. understand the labeling requirements and packaging guidelines for drugs and cosmetics;
6. be able to understand the concepts of Dangerous Drugs Act, Pharmacy Act and Excise duties Act; and
7. other laws as prescribed by the Pharmacy Council of India from time to time including International Laws.

Syllabus and lecture wise schedule:

Unit – I **10 hrs**

1. **Pharmaceutical Legislations:** The role of pharmaceutical legislation and regulation, necessity of pharmaceutical laws and regulation, evolution of policy and law, globalization and harmonization, drafting and revising pharmaceutical legislation and regulation, basic elements of national pharmaceutical legislation, medicine registration, licensing and marketing authorization, classifying pharmaceuticals for dispensing, regulating traditional and herbal medicines.

2. **Principle and Significance of professional ethics:** Critical study of the code of pharmaceutical ethics drafted by PCI.

Unit – II **10 hrs**

Drugs and Cosmetics Act, 1940,and its rules 1945: Objectives, Legal definition, Study of Schedule's with reference to Schedule B, C&C1, D, E1, F&F1, F2, F3, FF, G, H, J, K, M, N, P, R, V, W, X, Y. Sales,(wholesale and retail sale of schedule C, C_1 and X) Import,(prohibition of import of certain drugs or cosmetics, import of drugs under license or permit, conditions of import license, import of fixed dose combination drugs, import of schedule C, C_1 and X, import of drugs for examination, test or analysis, import of drugs for personal use, import of drug by Govt. hospital, import of new drugs, procedure for import of drugs, offences relating to import of drugs.) labeling (general and special labeling requirements of schedule C, C_1, G, H and X) and packaging of drugs & cosmetics. Provisions Relating to Indigenous Systems.

Unit – III **10 hrs**

Constitution and Functions of Drugs Technical Advisory Board (DTAB), Drugs Consultative Committee (DCC) and Central Drugs laboratory (CDL). Qualification and duties: Govt. analyst and Drugs Inspector, (qualifications, powers & duties).

Unit – IV **10 hrs**

1. **Pharmacy Act –1948:** Objectives Legal Definitions, General Study, Constitution and Functions of State & Central Councils, Registration Procedure, Education Regulations-91 (ER-91).

2. **Medicinal and Toilet Preparation Act –1955**: Objectives, Legal Definitions, Licensing, Bonded and Non Bonded Laboratory, Ware Housing, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietory Preparations.

Unit – V **10 hrs**

Narcotic Drugs and Psychotropic substances Act-1985 and Rules. Objectives, Legal Definitions, General Study, offences and penalties, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and regulations, Schedules to the Act.
Study of Salient Features of Drugs and magic remedies Act and its rules, offences and penalties.

Unit – VI **10 hrs**

Study of essential Commodities Act 1955: Relevance to drugs price control Order,(power to control production, supply, distribution, of essential commodities, imposition of duties on

state govt., delegation of power, effect of orders inconsistent with other enactment, offences and penalties.

Drug Price control Order (retail price, material cost, conversion cost, packing material, packing charges, maximum allowable post manufacturing expenses, excise duty), & National Drug Policy, National pharmaceutical pricing authority(NPPA).

Unit – VII **10 hrs**

1. Hathi Committee, National pharmaceutical pricing policy (objective, principles for drug price control and determination, Non-price Controlled Drugs, Imported Drugs, Patented Drugs, essential issues for the implementation of the policy.

2. **Prevention Of Cruelty to animals Act-1960:** cruelty to animal, institutional animal ethics committee, breeding and stocking, performance of experiments, transfer and acquisition of animals for experiment, records, contract animal experiments, power to suspend or revoke registration, penalties.

Unit – VIII **10 hrs**

1. **Patents & design Act-1970:** objective, condition of patentability, drafting and filing a patent application, processing of patent application, exclusive rights of patent owner, exploitation of the patented invention, utility, patentable invention, procedure for obtaining patent, opposition to the grant of patent, grant and sealing of patent, joint inventor, limitations, register of patents summary.

2. Brief study of prescription (Drugs used for anorexia, weight loss and weight gain, Fertility drugs, Drugs used for cosmetic purposes and hair growth, Cough and cold medicines, Prescription vitamins and mineral products) and Non-prescription(OTC) Products.

Recommended Text Books

1. Jain N.K., *A Textbook of Forensic Pharmacy*, Vallabh Prakashan, N. Delhi.
2. Singh H., *History of Pharmacy in India*- Vol.-I, II & III, Vallabh Prakashan.
3. Mittal B.M.,*Textbook of Forensic Pharmacy*, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta

Reference Books

Relevant Acts & Rules, Published by the Govt. of India.

* Latest editions of all the suggested books are recommended.

Pharm D.: Third Year

MEDICINAL CHEMISTRY (THEORY)

Course Code: **PDR305** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with Quantitative Structure Activity Relationship (QSAR), prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules with classification, SAR, mechanism of action and synthesis of drugs.

Unit-I **10 hrs.**

Modern concept of rational drug design: A brief introduction to Quantitative Structure Activity Relationship (QSAR), prodrug, combinatorial chemistry, computer aided drug design (CADD) and concept of antisense molecules.

A study of the development of the following classes of drugs including classification, SAR, mechanism of action, synthesis of important compounds (**marked with asterisk only**), chemical nomenclature, brand names of important marketed products, side effects and their pharmaceutical uses.

Unit-II **10 hrs.**

1. **Local anti-infective agents**: Proflavine, Benzalkonium chloride*, Cetrimide, Chlorocresol*, Formaldehyde solution, Hexachlorophene and Nitrofurantoin
2. **Preservatives:** Methyl Paraben, Sodium Propionide and Sorbic acid
3. **Antifungal agents:** Undecylenic acid, Nystatin, Amphotericin and Miconazole
4. **Urinary tract anti-infectives:** Amikacin, Cefixime, Ampicillin and Cefadroxil

Unit-III **10 hrs.**

1. **Antitubercular agents**: Isoniazid*, PAS*, Streptomycin, Rifampicin, Ethambutol*, Cycloserine and Pyrazinamide*
2. **Antiviral agents and Anti AIDS agents:** Amantadine*, Acyclovir*, Zidovudine* and Saquinavir*
3. **Antiprotozoal agents:** Diloxanide, Iodoquinol and Tinidazole
4. **Anthelmentics:** Metronidazole*, Paramomycin, Piperazine*, Mebendazole and Diethylcarbamazine* (DEC)

5. **Antiscabies and Antipedicular agents:** Lindane, Permethrin and Benzyl Benzoate

Unit-IV **10 hrs.**

1. **Sulphonamides and sulphones:** Dapsone, Sulfadiazine, Sulfaguanidine*, Phthalysulfathiazole, Succinylsulfathiazole, Sulfadimethoxine, Sulfamethoxypridazine, Sulfamethoxazole, co -trimoxazole and Sulfacetamide*

2. **Antibiotics:** Benzyl Penicillin*, Phenoxy methyl Penicillin*, Benzathine Penicillin Ampicillin*, Cloxacillin, Carbenicillin, Gentamicin, Neomycin, Erythromycin, Tetracycline, Cephalexin, Cephaloridine , Cephalothin, Griseofulvin and Chloramphenicol

Unit-V **10 hrs.**

1. **Antimalarials**: Chloroquine*, Amodiaquine, Primaquine, Proguanil, Pyrimethamine*, Quinine and Trimethoprim.

2. **Antineoplastic agents:** Actinomycins, Azathioprine, Busulphan, Chlorambucil, Cisplatin, cyclophosphamide, Daunorubicin hydrochloride, Fluorouracil, Mercaptopurine, Methotrexate and Mytomycin.

Unit-VI **10 hrs.**

Cardiovascular agents:

1. **Antihypertensive agents**: Captopril*, Enalepril, Guanethidine, Prazosin and Sodium Nitroprusside

2. **Antianginal agents and vasodilators:** Nitroglycerin, Verapamil*, Nifedipine and Diltiazem

3. **Antiarrhythmic agents:** Quinidine, Procainamide*, Disopyramide and Lidocaine*

4. **Antihyperlipidemic agents:** Clofibrate, Cholestyramine, Lovastatin* and Simvastatin

5. **Coagulants and Anticoagulants:** Heparin, Thrombin, Menadione*, Bishydroxycoumarin, Warfarin Sodium and Dicumarol

Unit-VII **10 hrs.**

1. **Hypoglycemic agents:** Insulin, Chlorpropamide*, Tolbutamide, Glibenclamide, Phenformin* and Metformin.

2. **Thyroid and Antithyroid agents:** Carbimazole, Levothyroxine, Propylthiouracil and Methimazole

3. **Diureties:** Furosemide*, Chlorothiazide, Hydrochlorothaizide*, Benzthiazide, Urea, Mannitol* and Ethacrynic Acid.

Unit-VIII **10 hrs.**

1. **Diagnostic agents:** Iopanoic Acid, Propyliodone, Sulfobromophthalein. Sodium indigotindisulfonate, Indigo Carmine, Evans blue, Congo Red and Fluorescein Sodium

2. **Endocrine & Steroidal Hormones:** Androgens and Anabolic steroids-Testosterone*, Stanozolol. Estrogens and Progestational agents-Progesterone* and Estradiol.

3. **Adrenocorticoids:** Prednisolone*, Dexamethasone, Betamethasone and Cortisone,

Recommended Text Books

1. Mann P.G. & Saunders B.C., *Practical Organic Chemistry*, ELBS/Longman, London.
2. 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.
3. *Pharmacopoeia of India*, Minsitry of Health, Govt. of India.
4. Wolff, Burger's *Medicinal Chemistry*, John Wiley & Sons, New York.
5. Nogrady T., *Medicinal Chemistry – A Biochemical Approach*, Oxford University Press, New York
6. Foye W.C., *Principles of Medicinal Chemistry*, Lea & Febiger, Philadelphia.
7. Singh Harkrishan and Kapoor V.K., *Organic Pharmaceutical Chemistry*, Vallabh Prakashan, Delhi.
8. Finar I.L., *Organic Chemistry*, Vol I & II, ELBS/ Longman, London.
9. *A Text book of Organic Medicinal Chemistry*, Wilson & Griswold.
10. Abraham D.J., ed., Burger's *Medicinal Chemistry & Drug Discovery*, Vol.-I-VI, John Wiley & sons, New Jersey.
11. Laszlo Kurti, Barbara Czako, *Strategic Applications of Name Reaction in Organic Synthesis*, Elsevier, Academic Press, New York.

Recommended Reference Book

1. Delgado J.N., Remers WA eds, Wilson & Giswolds *Text Book of Organic Medicinal & Pharmaceutical Chemistry*, Lippincott, New York.
2. Alex Gringauz- , *Introduction to Medicinal Chemistry*, Wiley-VCH, Inc. New York.
3. Abraham DJ,ed., *Burger's Medicinal Chemistry & Drug Discovery*, Vol-I-VI, John Wiley & Sons, New Jersey.
4. *Monographs and relevant review articles appearing in various periodicals and journals*.

*Latest editions of all the suggested books are recommended.

Pharm D.: Third Year

PHARMACEUTICAL FORMULATIONS (THEORY)

Course Code: **PDR306** **L-2, T-1, P-0, C-2.5**

Theory: 2 Hrs. /Week

Objective: The basic objective of this course is to get familiar with formulation and evaluation of various pharmaceutical dosage forms.

Scope of the Subject: Scope and objectives of the course: Subject deals with the design, formulation and pharmacopeial evaluation of various dosage forms.

Expected outcomes: Upon completion of the subject student shall be able to (Know, do, appreciate) –

1. to understand the principle involved in formulation of various pharmaceutical dosage forms;
2. to prepare various pharmaceutical formulation;
3. to perform evaluation of pharmaceutical dosage forms; and
4. to understand and appreciate the concept of bioavailability and bioequivalence, their role in clinical situations.

Syllabus and lecture wise schedule:

Unit I. **10 hrs**

Pharmaceutical dosage form:- concept of drug release & their types, therapeutic window, single unit, multiple unit dosage forms and their classification; Solid, liquid and semisolid dosage forms.

Unit II. **10 hrs**

Tablets:- Formulation of different types of tablets viz. compressed, soluble, dispersible, chewable, bilayered tablets, lozenges; tablet excipients viz. Bulking & granulating agent, preservatives, disintegrants, lubricants, glidants, coating agents, colours, flavours; granulation techniques viz. Wet & dry granulation and direct compression; quality control & evaluation of tablets. Tablet coating: Type of coating viz. Aqueous, non-aqueous, sugar, enteric, compressed & quality control tests for coated tablets.

Unit III. **10 hrs**

Capsules: Production and filling of hard gelatin capsules, Raw material for shell, capsule excipients viz. Bulking & granulating agents, preservatives, lubricants, glidants, coating agents, colours; finishing & polishing of capsules and quality control tests for capsules.

Production, filling and packaging of soft gelatin capsules, quality control tests for soft gelatin capsules.

Unit IV. **10 hrs**

Liquid orals: Advantages, classification of liquid orals viz. Mono-Phasic and biphasic dosage forms; Formulation of suspensions, emulsions and solutions, study of excipients viz. Suspending agents, emulsifiers, viscosity enhancer, co-solvents, preservatives, sweeteners, colours, stabilizers and flavours used . Evaluation and Stability of these preparations.

Unit V. **10 hrs**

Parenterals: Introduction, Types of water, Formulation of large and small volume, single or multiple dose Parenterals, Excipients used viz. Co-solvents, preservatives, stabilizers. Types of containers used for Parenterals (including official tests), Sterilization and their types, Terminal and inline sterilization.

Unit VI. **10 hrs**

1. **Ophthalmic preparations:** Introduction and classification, Factors affecting absorption, anatomy of skin, Packaging, storage and labeling.

2. **Ointments:** Types of Ointment Base, Preparation of ointment and evaluation.

3. **Jellies:** Types of jellies, Formulation of jellies and evaluation.

Unit VII. **10 hrs**

1. **Suppositories:** Introduction, Advantages, Types of suppository bases, Method of preparation, Types of Packaging and evaluation.

2. **Pessaries:** Introduction, Advantages, Types of Pessaries bases, Method of preparation, Types of Packaging and evaluation.

Unit VIII. **10 hrs**

Definition and concept of Controlled and novel Drug delivery systems: Types of NDDS viz. Rate controlled & Activation based drug delivery systems and biodegradable drug delivery systems with available examples, viz. Parenteral, transdermal, buccal, rectal, nasal, implants and ocular.

Recommended Text books

1. Lieberman Herbert A, Lachman Leon, Schwartz Joseph B ,*Pharmaceutical dosage forms*, Vol, I,II and III, infforma Healthcare, 2007

2. E.A. Rawlins , Bentley's *Text book of Pharmaceutics***,** Delhi : AITBS Publishers and Distributors,2005

3. Carter S J **,***Tutorial Pharmacy* Cooper and Gunns, New Delhi : CBS Publishers, 2004

Recommended Reference books

1. Remington**,** *Pharmaceutical Sciences*, Pennsylvania, 1970

2. U S Pharmacopeia and national formulary *USP* 24 - NF 19 supplement Vol-2, Pharamacopeiapub,2000.

3. H.M.S.O., *British pharmacopoea*, London : HMSO 1988-I.

4. Government of India ministry of Health & Family welfare **,***Indian Pharmacopoea* 1996.Vol-I,Vol-II,Vol-III,2007

*Latest editions of all the suggested books are recommended.

Pharm D.: Third Year

PHARMACOLOGY – II (PRACTICAL)

Course Code: **PDR351** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs./Week

Objective: The basic objective of this course is to get familiar with the practical aspects of animal handling and bioassays.

List of Experiments:

1. Study of laboratory animals and their handling (Frogs, Mice, Rats, Guinea pigs, Rabbits).
2. Study of physiological salt solutions used in experimental pharmacology.
3. Study of laboratory appliances used in experimental pharmacology.
4. Study of use of anesthetics in laboratory animals.
5. To record the dose response curve of Ach using isolated ileum/rectus abdominis muscle preparation.
6. To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by interpolation method.
7. To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by three point method
8. To record the dose response curve of Histamine using isolated guinea-pig ileum preparation.
9. Study of agonistic and antagonistic effects of drugs using isolated guinea-pig ileum preparation.
10. To carry out bioassay of Histamine using isolated guinea-pig ileum preparation by interpolation method.
11. To carry out bioassay of Histamine using guinea-pig ileum preparation by three point method.
12. To study the routes of administration of drugs in animals (Rats, Mice & Rabbits).
13. Study of theory, principle, procedure involved and interpretation of given results for the following experiments:
    (i) Analgesic property of drug using analgesiometer.
    (ii) Antiinflammatory effect of drugs using rat-paw edema method.
    (iii) Anticonvulsant activity of drugs using maximal electroshock and pentylene tetrazole methods.
    (iv) Antidepressant Activity of drugs using pole climbing apparatus and pentobarbitone induced sleeping time methods.
    (v) Locomotor activity evaluation of drugs using actophotometer and rotorod.
    (vi) Cardiotonic activity of drugs using isolated frog heart and mammalian heart preparations.

Guidelines:

a. The evaluation will be conducted both by external & internal examiners.
b. The external evaluation will be conducted for 70 marks.
c. The external examiner will be appointed from the approved panel of examiners.

d. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
e. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
f. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

Items	Internal	End year (External)
Identification	02	10
Synopsis	04	10
Major Experiment (Bioassay)	08	30
Minor Experiment (Interpretation of given graph or simulated experiment)	04	10
Viva	02	10
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Text books:

1. Kulkarni, S. K. and Dandia, P. C. *Hand book of experimental pharmacology*. Latest edition, Publisher: Vallab, Delhi.

Reference books:

1. Macleod, L.J., *Pharmacological experiments on intact preparations*, Latest edition, Publisher: Churchill livingstone.
2. Macleod, L.J., *Pharmacological experiments on isolated preparations*, Latest edition, Publisher: Churchill livingstone.
3. Ghosh, M.N., *Fundamentals of experimental pharmacology*, Latest edition, Publisher: Scientific book agency, Kolkata.
4. Ian Kitchen, *Textbook of in vitro practical pharmacology*, Latest edition, Publisher: Black well Scientific.

*Latest editions of all the suggested books are recommended.

Pharm D.: Third Year
PHARMACEUTICAL ANALYSIS (PRACTICAL)

Course Code: **PDR352** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs./Week

Objective: The basic objective of this course is to get familiar with different separation and analytical techniques.

List of Experiments:

1. Separation and identification of Amino Acids by Paper Chromatography.
2. Separation and identification of Sulpha drugs by TLC technique.
3. Effect of pH and solvent on the UV spectrum of given compound.
4. Comparison of the UV spectrum of a compound with that of its derivatives.
5. Determination of dissociation constant of indicators using UV-Visible spectroscopy.
6. Conductometric titration of mixture of acids with a strong base.
7. Potentiometric titration of a acid with a strong base.
8. Estimation of drugs by Fluorimetric technique.
9. Study of quenching effect in fluorimetry.
10. Colourimetric estimation of Supha drugs using BMR reagent.
11. Simultaneous estimation of two drugs present in given formulation.
12. Assay of Salicylic Acid by colourimetry.
13. Determination of Chlorides and Sulphates in Calcium gluconate by Nepheloturbidimetric Method.
14. Determination of Na/K by Flame Photometry.
15. Determination of pKa using pH meter.
16. Determination of specific rotation.
17. Comparison of the IR spectrum of a compound with that of its derivatives.
18. Demonstration of HPLC.
19. Demonstration of HPTLC.
20. Demonstration of GC-MS.
21. Demonstration of DSC.
22. Interpretation of NMR spectra of any one compound.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Text Books:

1. Higuchi. T and Hasen. E. B., *Text Book of Pharm. Analysis*, New York Inter Science Publishers.
2. Jenkins, *Quantitative Pharma. Analysis*, The Blakiston division, New York.
3. Garrot. D, *Quantitative Drug Analysis*, Chapman & Hall Ltd., London.
4. James. E., *Undergraduate Instrumental Analysis*, CBS Publishers.
5. Willard and Merritt, EWP, *Instrumental Analysis*, East West Press Ltd., Delhi/Madras.
6. Skoog and West, *Pharm Analysis* , Sounders Manipal College Publishing.
7. A.I.Vogel, *Text Book of Chemical Analysis*, ELBS with Macmillan press, Hampshire.
8. K.A.Connors, *Textbook of Pharm. Analysis* , John Wiley & Sons, New York, Brisbane, Singapore.
9. Beckett & Stenlake, *Textbook of Pharm. Analysis (Practical),* CBS Publishers, Delhi.
10. P.D. Sethi., *Textbook of Drug Analysis*, CBS Publishers, Delhi.

Recommended Reference books:

1. Silverstein, *Spectroscopy*, John & Wiley & Sons. Inc., Canada & Singapore.
2. P.P. Sharma, *How to practise GMP-A Plan for total quality control* , Vandana Publications, Agra.
3. Remington Vol-I & II, *The Science & Practice of Pharmacy* , Mack Publishing Co. Pennsylvania.
4. *TLC* by Stahl, Spring Verlay.
5. Chatten, *Text Book of Pharm. Chemistry*, CBS Publications.
6. William Kemp, *Spectroscopy*, ELBS with Macmillan Press, Hampshire.
7. *I.P.-1996*, The Controller of Publications, New Delhi.
8. *BPC- Dept. of Health*, U.K. for HMSO.
9. *USP* - Mack Publishing Co., Easton, PA.
10. *The Extra Pharmacopoeia* – The Pharm. Press, London.

*Latest editions of all the suggested books are recommended.

Pharm D.: Third Year

PHARMACOTHERAPEUTICS – II (PRACTICAL)

Course Code: **PDR353** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs./Week

Objective: The basic objective of this course is to get familiar with clinical discussions and drug therapy for various diseases.

Practicals: Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion; attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge. Students are required to maintain a record of cases presented and the same should be submitted at the end of the course for evaluation. The student shall be trained to understand the principle and practice involved in selection of drug therapy including clinical discussion. A minimum of 20 cases should be presented and recorded covering most common diseases.

Assignments: Students are required to submit written assignments on the topics given to them. Topics allotted should cover recent developments in drug therapy of various diseases. A minimum of THREE assignments [1500 – 2000 words] should be submitted for evaluation.

Format of the assignment:

1. Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year.
4. It shall be computer draft copy.
5. Name and signature of the student.
6. Time allocated for presentation may be 8+2 Min.

Guidelines:

1. Students will be required to maintain and submit the precisely compiled diary containing the assignments (Case studies of most common diseases).
2. These assignments will be of two categories i.e. major & minor.
3. The entire practical exams will be evaluated through record compilation & oral presentation.
4. The evaluation will be conducted both by external & internal examiners.
5. A committee of senior teachers including the teacher preceptor will evaluate for internal assessment (30 marks).
6. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
7. The external evaluation will be conducted for 70 marks.
8. The external examiner will be appointed from the approved panel of examiners.

9. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
10. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
11. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Books

1. Satoskar & Bhandarkar, *Pharmacology & Pharmacotherapeutics*, Popular Prakashan Pvt. Ltd., Bombay.
2. Goodman & Gilman, *The Pharmacological basis of Therapeutics*, Editors:-J.G. Hardman, L.E. Limbird, P.B. Molinoss, R.W. Ruddon & A.G. Gil, Pergamon Press.

Reference Books

Katzung, B.G., *Basic & Clinical Pharmacology*, Prentice Hall, International.

* Latest editions of all the suggested books are recommended.

Pharm D.: Third Year

MEDICINAL CHEMISTRY (PRACTICAL)

Course Code: **PDR354** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs. /Week

Objective: The basic objective of this course is to get familiar with the synthesis of drugs.

1. Assays of important drugs from the course content.
2. Preparation of medicinally important compounds or intermediates required for synthesis of drugs.
3. Monograph analysis of important drugs.
4. Determination of partition coefficients, dissociation constants and molar refractivity of compounds for QSAR analysis.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Text Books:

1. Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry, Lippincott-Raven Publishers-New York, Philadelphia.
2. William.O.Foye, Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd., New Delhi.
3. Burgers, Medicinal Chemistry, M.E.,Welly Med.Chemistry M.E. Walffed Johnwilley and Sons, Wiley-interscience Publication, New York, Toranto.
4. A Text Book of Medicinal Chemistry Vol. I and II by Surendra N. Pandeya, S.G. Publisher, 6, Dildayal Nagar, Varanasi -10.
5. Indian Pharmacopoeia 1985 and 1996. The Controller of Publications, Civil Lines, Delhi - 54.

Reference Books:

1. Current Index of Medical Specialities (CIMS) and MIMS India, MIMS, A.E. Morgan Publications (I) Pvt. Ltd, New Delhi-19.
2. Organic Drug Synthesis-Ledniser Mitzsher Vol. I and II.
3. Pharmaceutical Chemistry drug Synthesis Vol. I and II by H. J. Roth and A. Kleemann.
4. The Science and Practice of Pharmacy Vol. 1 and 2, Remington, MACK Publishing Company, Easton, Pennsylvania.

*Latest editions of all the suggested books are recommended.

Pharm D.: Third Year

PHARMACEUTICAL FORMULATIONS (PRACTICAL)

Course Code: **PDR355** **L-0, T-0, P-3, C-1.5**

Practical: 4 Hrs. /Week

Objective: The basic objective of this course is to get familiar with manufacturing of different dosage forms.

List of Experiments:

1. **Manufacture of Tablets:** Ordinary compressed tablet-wet granulation, tablets prepared by direct compression, soluble tablet and Chewable tablet.
2. **Formulation and filling of hard gelatin capsules**
3. **Manufacture of parenterals:** Ascorbic acid injection, calcium gluconate injection, sodium chloride infusion and dextrose and Sodium chloride injection/ infusion.
4. **Evaluation of Pharmaceutical formulations (QC tests):** Tablets, capsules and injections
5. **Formulation of two liquid oral preparations and evaluation by assay:** Solution: Paracetamol Syrup and Antacid suspensions- Aluminum hydroxide gel.
6. **Formulation of semisolids and evaluation by assay:** Salicyclic acid and benzoic acid ointment and Gel formulation Diclofenac gel.
7. **Cosmetic preparations:** lipsticks, cold cream and vanishing cream, clear liquid shampoo and tooth paste and tooth powders.
8. **Tablet coating (demonstration)**

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15

Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Books Recommended

1. Skoog, D.A., Heller, F.J., Nieman, T.A., *Principles of Instrumental Analysis*, WB Saunders.
2. Haswell, S.J., ed. *Atomic Absorption Spectroscopy*, Elsevier.
3. Ardrey, R.E., *Pharmaceutical Mass Spectra*, Pharmaceutical Press, London.
4. Sethi, P.D., *Quantitative Analysis of Pharmaceutical Formulations*, CBS Publishers, New Delhi.
5. Kalsi, P.S., *Spectroscopy of Organic Compounds*, New Age Publishers, New Delhi.

Reference Book:

1. Gross J.H., *Mass Spectrometry*, Springer Berlin, Heidelberg.
2. Haffmann D. H. Advances in *Chromatography*, Marcel Dekker.
3. Robert D. Braun, *Introduction to Instrumental Analysis*, McGraw-Hill.
4. Wilfried, M.A. *Niessen- Liquid Chromatography-Mass Spectrometry*, Marcel Dekker.

*Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

PHARMACOTHERAPEUTICS – III (THEORY)

Course Code: **PDR401** **L-3, T-2, P-0, C-4**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with the pathophysiology of selected diseased states and the rationale & controversies in drug therapy and therapeutic approach to management of diseases.

Scope: This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines mostly used in therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

Expected outcomes: At completion of this subject, it is expected that students will be able to understand –

i. the therapeutic approach to management of these diseases;
ii. the importance of preparation of individualised therapeutic plans based on diagnosis;
iii. needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);
iv. describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
v. to summarize the including reference to the latest available evidence;
vi. to discuss the controversies in drug therapy;
vii. to discuss the preparation of individualised therapeutic plans based on diagnosis; and
viii. identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Etiopathogenesis and pharmacotherapy of following diseases:

Unit-I **10 hrs**

1. **Peptic ulcer:** Classification, Cause, symptoms and Diagnostic tests. Epidemiology, treatment and possible complications of NSAID's related ulcers, stress related ulcers, nonulcer dyspepsia and Zollinger-Ellison syndrome.

2. **Gastro Esophageal Reflux Disease**: Cause, symptoms, Diagnosis, treatment, maintenance therapy, drug regimen and possible complications.

3. **Inflammatory bowel disease:** Crohn's disease, Ulcerative colitis, Cause, symptoms, Diagnosis, treatment and possible complications.

Unit-II **10 hrs**

1. **Alcoholic liver disease:** Causes, Risk factors, Diagnosis, Prognostic Factors, Therapies of ALD- Nutrition Therapy, Steroidal therapy, Anticytokine Therapy, Combination Therapy and Management of ALD.

2. **Viral hepatitis**: Types of hepatitis, Acute and chronic hepatitis. Etiology, symptoms, diagnosis and treatment of A, B, C, D &E type hepatitis. Jaundice- causes and treatment of prehepatic, hepatocellular, post hepatic and Neonatal jaundice.

3. **Drug induced liver disorders:** Necrosis, cirrhosis, fatty liver disease and Cholestasis.

Unit-III **10 hrs**

1. **Anaemias-** Causes, symptoms, diagnosis, treatment and associated risk factors of Iron deficiency anaemia, Thalassaemia, Aplastic anaemia, Haemolytic anaemia, Sickle cell anaemia, and Pernicious anaemia

2. **Venous thromboembolism:** Causes, symptoms. diagnosis, Prevalence, Risk Factors and treatment of deep Venous Thrombosis and Pulmonary Embolism, Management of Venous Thromboembolism during pregnancy.

3. **Drug induced blood disorders-** Aplastic anaemia, Agranulocytosis, Thrombocytopenia and Haemolytic anaemia

Unit-IV **10 hrs**

1. **Epilepsy:** Etiology, classification, symptoms, diagnosis, possible complications and management of epilepsy.

2. **Parkinsonism:** Etiology, symptoms, diagnosis, possible complications and treatment. Secondary Parkinsonism.

3. **Alzheimer's disease:** Characteristics, causes, diagnosis and management. Possible risk factors and complications.

Unit-V **10 hrs**

Schizophrenia: Types- **paranoid schizophrenia, disorganized & catatonic schizophrenia. Symptoms, Causes, diagnosis, effects and management, risk factors and complications of schizophrenia.**

1. **Anxiety disorders:** Classification, Causes, symptoms, risk factors, complications and management of Obsessive-compulsive disorder (OCD)**,** Post-traumatic stress disorder (PTSD), Specific phobias and panic disorders.

Unit-VI **10 hrs**

1. **Sleep disorders:** Classification, symptoms, causes, diagnosis and treatment. Risk factors and complications associated with Dyssomnias, Sleep disordered breathing and Parasomnias.

2. **Stroke:** Causes, signs, diagnosis, complications, risk factors and management of Ischemic and haemorrhagic stroke.

3. **Affective disorders:** Causes, symptoms and management of migraine, mania and depression

Unit-VII **10 hrs**

1. **Neuralgias:** Mechanisms of Peripheral and Central neuronal injury. Shingles and Trigeminal neuralgia- causes, symptoms, diagnosis and treatment. Possible complications and risks associated with neuralgia.

2. **Headaches:** Classification, Primary, secondary and chronic headaches: Causes, symptoms, diagnosis and treatment. Drug induced and symptomatic headache. Complications and risks due to chronic headache.

Unit-VIII **10 hrs**

Evidence Based Medicine (EBM): Definition, steps of EBM, statistical measures and limitations and patient care case studies.

Recommended Text Books

1. Roger and Walker, *Clinical Pharmacy and Therapeutics*, Churchill Livingstone publication
2. Joseph T. Dipiro et al., *Pharmacotherapy: A Pathophysiologic approach* - Appleton & Lange

Reference Books

1. Robins SL, *Pathologic basis of disease*, W.B.Saunders publication
2. Green and Harris, *Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice* - Chapman and Hall publication
3. Eric T. Herfindal, *Clinical Pharmacy and Therapeutics*, Williams and Wilkins Publication
4. Lloyd Young and Koda, *Applied Therapeutics: The clinical Use of Drugs*, Kimble MA
5. *Avery's Drug Treatment*, 4th Edn, 1997, Adis International Limited.
6. *Relevant review articles from recent medical and pharmaceutical literature*.

*Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

HOSPITAL PHARMACY (THEORY)

Course Code: **PDR402** **L-2, T-2, P-0, C-3**

Theory: 2 Hrs. /Week

Objective: The basic objective of this course is to get familiar with various drug distribution methods, professional practice management skills in hospital pharmacies, manufacturing practices of various formulations in hospital setup, store management and inventory control.

Scope: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug dispensing, manufacturing of parenteral preparations, drug information, patient counselling, and therapeutic drug monitoring for improved patient care.

Expected outcomes: After completion of the course, students will be able to:

g. know various drug distribution methods;
h. know the professional practice management skills in hospital pharmacies;
i. provide unbiased drug information to the doctors;
j. know the manufacturing practices of various formulations in hospital set up;
k. appreciate the practice based research methods; and
l. appreciate the stores management and inventory control.

Lecture wise programme

Unit –I **10hrs**

1. **Hospital –** Definition, its Organisation, classification, function and management. Health delivery system in India, Professional Relations and practices of hospital pharmacist.

2. **Hospital pharmacy-**Organisation and management**,** Organizational structure-Staff, Infrastructure & work load statistics**,** Management of materials and finance**,** Roles & responsibilities of hospital pharmacist

Unit –II **10hrs**

1. **The Budget –** classification, Preparation and implementation, Budgetary control-objective, limitations and advantages.

2. **Hospital drug policy:**

i. **Pharmacy and Therapeutic committee (PTC):** Oragnization, functions and role in drug safety

ii. **Hospital formulary-** content, preparation and revision of hospital formulary

iii. **Hospital committees:** Infection control & Research and ethical committee

Developing therapeutic guidelines, Hospital pharmacy communication - Newsletters

Unit –III **10hrs**

1. **Procurement & warehousing of drugs and Pharmaceuticals:** Organization of drugs, Types of materials stocked, storage conditions.

2. **Purchase control:** Principles, purchase procedures, purchase order, procurement and stocking.

3. **Inventory control:** Definition, Importance, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock

Unit –IV **10hrs**

1. **Drug distribution in the hospital:** Out-patient dispensing, Types of drug distribution systems charging Policy, labeling, Dispensing of drugs to ambulatory patients, Definition of ambulatory-care, primary care, tertiary care and emergency care.

2. **Dispensing of drugs to in-patients**: Individual prescription method, Floor stock method and Unit dose drug distribution methods.

Unit –V **10hrs**

1. **Distribution of Narcotic and other controlled substances.**

2. **Central sterile supply services –** Role of pharmacist, type of material for sterilization, packing of materials prior to sterilization, sterilization equipments and supply of sterile materials.

3. **Manufacture of Pharmaceutical preparations:** Policy making of manufacturable items, demand and costing, manufacturing practice, Master formula card, Production control and manufacturing records.

Unit –VI **10hrs**

Statutory and industrial aspects for productions, production control and other standardized parameters with regards to the following:

Sterile formulations – large and small volume parenterals, manufacture of Ointments, Liquids, and creams, manufacturing of Tablets, granules, capsules, and powders and total parenteral nutrition.

Unit –VII **10hrs**

Continuing professional development programs:

Education and training: sources of information on drugs, treatment schedules, procurement of information, computerized services (e.g. MEDLINE), Retrieval of information, Medication error, cases on drug interaction & adverse reactions, idiosyncratic cases etc.

Unit –VIII **10hrs**

Radio Pharmaceuticals –Introduction of radio pharmaceuticals, radio-active half life, units of radioactivity, production of radio pharmaceuticals, radio- isotope generators, radiation hazards and their prevention, permissible radiation dose level, specifications for radio-active laboratory, Handling and packaging of radiopharmaceuticals**.**

Recommended Text books: (latest editions)

1. Hospital pharmacy by William .E. Hassan
2. A text book of Hospital Pharmacy by S.H.Merchant & Dr. J.S. Qadry. Revised by R.K.Goyal & R.K. Parikh
3. Hasan, *Hospital Pharmacy*, Lea & Febiger, Philadelphia.
4. Merchant H.S. & Qadry J.S.,*Text Book of Hospital Pharmacy*, B.S. Shah Prakashan, Ahmadabad.

Recommended References:

1. WHO consultative group report.
2. R.P.S. Vol.2. Part –B; Pharmacy Practice section.
3. Handbook of pharmacy – health care. Edt. Robin J Harman. The Pharmaceutical press.

* Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

CLINICAL PHARMACY (THEORY)

Course Code: **PDR403** **L-3, T-2, P-0, C-4**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with monitoring of drug therapy of patient through medication and clinical reviews, detect, assess and monitor adverse drug reactions.

Expected outcomes: Upon completion of the subject student shall be able to:

a. obtain medication history interview and counsel the patients;

b. identify and resolve drug related problems;

c. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific diseased states; and retrieve, analyse, interpret and formulate drug or medicinal information.

Syllabus and lecture wise schedule:

Unit I **10 hrs**

1. **Definitions, Development and scope of clinical pharmacy**: Drug Information, Drug Utilization, Drug Evaluation and Selection, Medication Therapy Management, Formal Education and Training Programs, Disease State Management, Application of Electronic Data Processing.

2. **Introduction to daily activities of a clinical pharmacist:** Drug therapy monitoring (medication chart review, clinical review, pharmacist interventions), Ward round participation, Adverse drug reaction management, Drug and poisons information, Medication history, Patient counseling

Unit II **10 hrs**

1. **Drug utilization evaluation (DUE) and review (DUR):** Quality assurance of clinical pharmacy services.

2. **Patient data analysis:** Patient's case history, its structure and use in evaluation of drug therapy & Understanding common medical abbreviations and terminologies used in clinical practices.

3. **Clinical laboratory tests used in the evaluation of diseased states and interpretation of test results:** Detailed Haematological, Liver function, Renal function and thyroid function tests.

Unit III **10 hrs**

1. **Clinical laboratory tests used in the evaluation of diseased states and interpretation of test results**: associated with cardiac disorders, Fluid and electrolyte balance, Microbiological culture sensitivity tests and Pulmonary Function Tests.

Unit IV **10 hrs**

Drug & Poison information: Introduction to drug information resources, Systematic approach in answering Drug Information queries, Critical evaluation of drug information and literature, Preparation of written and verbal reports, Poisons information- organization & information resources.

Unit V **10 hrs**

Establishing a Drug Information Centre: Scope, definition and aims of pharmacovigilance, Adverse drug reactions - Classification, mechanism, predisposing factors and causality assessment [different scales used]. Reporting, evaluation, monitoring, preventing & management of Adverse drug reactions.

Unit VI **10 hrs**

Role of pharmacist in management of Adverse drug reactions: Communication skills including patient counselling techniques, medication history interview, presentation of cases and critical evaluation of biomedical literature to solve therapeutic dilemma

Unit VII **10 hrs**

1. **Pharmaceutical care concepts:** Therapeutic Outcome Monitoring, Elderly Medication Analysis, Pharmaceutical Safety Belt, Pharmacy days, Specific diseases and pharmaceutical care (Hypertension, Coronary heart disease, Diabetes, Asthma).

2. **Pharmaceutical care programmes**: Documentation, monitoring, evaluations and Communication

Unit VIII **10 hrs**

Medication errors: Different types and causes of medication errors, Recommendations for Preventing Medication Errors, Monitoring and Managing Medication Errors.

Recommended Text books

1. *Practice Standards and Definitions* - The Society of Hospital Pharmacists of Australia.
2. *Basic skills in interpreting laboratory data* - Scott LT, American Society of Health System Pharmacists Inc.
3. *Biopharmaceutics and Applied Pharmacokinetics* - Leon Shargel, Prentice Hall publication.
4. *A text book of Clinical Pharmacy Practice*; Essential concepts and skills, Dr. G. Parthasarathi etal, Orient Orient Langram Pvt.Ltd. ISSBN8125026

Recommended Reference books

1. *Australian drug information -Procedure manual*. The Society of Hospital Pharmacists of Australia.
2. Rowland and Tozer, *Clinical Pharmacokinetics* - Williams and Wilkins Publication.
3. Practical and clinical applications. *Pharmaceutical statistics*. Sanford Bolton, Marcel Dekker, Inc.

* Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

BIOSTATISTICS AND RESEARCH METHODOLOGY (THEORY)

Course Code: **PDR404** **L-2, T-2, P-0, C-3**

Theory: 2 Hrs. /Week

Objective: The basic objective of this course is to get familiar with statistical tools to optimize and correlate different types of data.

Syllabus and lecture wise schedule

Unit –I **10 hrs**

1. **Designing Research Methodology**: formulating the research problem, choice of research design, determining sources of data, Sample size determination and Power of a study Determination of sample size for simple comparative experiments, determination of sample size to obtain a confidence interval of specified width, power of a study, Report writing and presentation of data , error in the research process.

2. **Types of clinical study designs**: Case studies, observational studies and interventional studies

Unit –II **10 hrs**

Biostatistics: Introduction**,** Types of data distribution, Measures describing the central tendency distributions- average, median, mode, Measurement of the spread of data-range, variation of mean, standard deviation, variance, coefficient of variation, standard error of mean.

Unit –III **10 hrs**

1. **Data graphics:** Construction and labelling of graphs, histogram, pie charts, scatter plots, semi -logarithmic plots.

2. **Basics of testing hypothesis:** Null hypothesis, level of significance, power of test, P value, statistical estimation of confidence intervals.

Unit –IV **10 hrs**

1. **Level of significance (Parametric data) -** students t test (paired and unpaired), chi Square test, Analysis of Variance (one-way and two-way).

2. **Level of significance (Non-parametric data)**- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal-Wallis test (one way ANOVA)

Unit –V **10 hrs**

Linear regression and correlation- Introduction, Pearsonn's and Spearmann's correlation and correlation co-efficient, Linear regression- analysis of standard curves, application of linear regression, assumptions in test of hypothesis in linear regression, estimate of the variance: variance of sample estimate of the parameter.

Unit –VI **10 hrs**

1. **Introduction to statistical software**: SPSS, Epi Info, SAS.

2. **Statistical methods in epidemiology:** Incidence and prevalence, relative risk, attributable risk

Unit –VII **10 hrs**

Computer System in Hospital Pharmacy: Patterns of Computer use in Hospital Pharmacy – Patient record database management, Medication order entry – Drug labels and list – Intravenous solution and admixture, patient medication profiles, Inventory control, Management report & Statistics.

Unit –VIII **10 hrs**

1. **Computer in Community Pharmacy:** Computerizing the Prescription, Dispensing process Use of Computers for Pharmaceutical Care in community pharmacy, Accounting and General ledger system.

2. **Drug Information Retrieval & Storage**: Introduction– Advantages and use of Computerized Literature Retrieval.

Recommended Text books:

1. Bolton, *Pharmaceuticals Statistics- Practical & Clinical Applications*, Marcel & Dekker, New York.
2. Fisher, R.A., *Statistical Methods for Research Works*, Oliver & Boyd, Edinburgh.
3. Chow, *Statistical Design and Analysis of Stability Studies*, Marcel Dekker, New York.
4. Buncher, *Statistics in the Pharmaceutical Industry*, Marcel Dekker, New York.
5. Finney, D.J., *Statistical Methods in Biological Assays*, Hafner, New York.
6. Montgomery, D.C., *Introduction to Statistical Quality Control*, Willy.
7. Lipschutz, *Introduction to Probability and Statistics*, McGraw-Hill.
8. Li wan Po, *Statistics for Pharmacist*, Wiley-Blackwell.

Recommended Reference books:

1. **Pharmaceutical statistics** - practical and clinical applications, Sanford Bolton 3rd edition, publisher Marcel Dekker Inc. NewYork.
2. **Drug Information**- A Guide for Pharmacists, Patrick M Malone, Karen L Kier, John E Stanovich , 3rd edition, McGraw Hill Publications 2006

* Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

BIOPHARMACEUTICS AND PHARMACOKINETICS (THEORY)

Course Code: **PDR405** **L-3, T-1, P-0, C-3.5**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with biopharmaceutics and pharmacokinetics of drugs.

Unit I: **10 hrs**

1. **Biopharmaceutics:** Introduction to Biopharmaceutics, Fate of drug in the body, Experimental studies-Models (Insilco, In-vitro, In situ, Ex-vivo, In vivo models).

2. **Absorption of drugs from GIT**- Mechanism of drug absorption, Factors affecting drug absorption, Pharmaceutical factors, Patient related factors, Drug absorption from routes other than the oral one and Experimental models of drug absorption.

3. **Drug Distribution**- Steps in drug distribution, barriers in drug distribution, Factors affecting distribution of drugs. Tissue permeability of drugs, organ tissue size & perfusion rate, binding of drugs to tissue components, miscellaneous factors, volume of distribution and apparent volume of distribution.

4. **Drug Metabolism-** Introduction, Phase I reactions, Phase II reactions, Factors affecting metabolism of drugs, In-vitro models of Metabolism. Biopharmaceutics drug disposition classification system.

5. **Excretion of drugs**- Renal excretion of drugs, mechanism of renal excretion of drugs, concept of clearance, factors affecting renal clearance or excretion. Renal function & renal failure, Non renal routes of drug excretion, Hepatic, organ & biliary clearance.

Unit II **10 hrs**

1. **Pharmacokinetics:** Introduction to Pharmacokinetics, Pharmacokinetics & Pharmacodynamics parameters.

2. **Mathematical models**: rate constants and order of reactions, zero order, absorption kinetics, first order absorption kinetics and wegnor nelson method.

3. **Drug levels in blood**: Drug concentration time profile and Laplace transformation.

4. **Pharmacokinetic Models:** Compartment models, Physiological models and Distribution parameters models.

5. **Compartment models**: Mammillary models, Catenary model and applications of compartment models.

6. **Pharmacokinetic study**: Pharmacokinetic analysis of mathematical data

Unit III **10 hrs**

One Compartment Open model: Intravenous bolus administration, Intravenous infusion, Extravascular administration, Urinary excretion data, determination of various parameters of urinary execration, Plasma elimination half life, Multi exponential decay-drug disposition.

Unit IV **10 hrs**

Multiple Compartment models: Two compartment open model: Central compartment, Peripheral or tissue compartment, Intravenous bolus administration**,** Intravenous infusion**,** Extravascular administration, Loo reigalman method**,** Three Compartment open model

Unit V **10 hrs**

Multiple Dosage regimen:

1. **Introduction:** accumulation during repetitive dosing, Rapid intravenous injection, Prediction of multiple dose blood levels from a single dose, Average steady state levels forany route & model, Repetitive dosing for minimum effective concentration, Calculation of loading and maintenance dose.
2. **Adjustment of dosage regimen in renal & hepatic failure:** Minimum & maximum desired blood levels, Pharmacokinetic basis for renal effects on dosage requirements, Individualization of dosage regimen
3. **Multiple dosing of constant rate intravenous infusion.**

Unit VI **10 hrs**

Non Linear Pharmacokinetics: Introduction, Factors causing non-linearity, Michaelis menton method of estimating various parameters, chronopharmacokinetics, clearance & enzyme induction.

Unit VII **10 hrs**

1. **Non Compartmental Pharmacokinetics:** Statistical moment theory: categorization of moments- zero moment, MRT (First & Second moments).

2. **Non-compartmental models**-Pharmacokinetic parameters. MRT-half-life, apparent volume of distribution at steady state, drug clearance, mean absorption time, steady state plasma drug concentration, time to reach steady state and excretion of metabolized drug.

Unit VIII **10 hrs**

Bioavailability and Bioequivalence:

1. **Introduction of Bioavailability**: considerations in in-vivo bioavailability study design, measurement of bioavailability, in-vitro drug dissolution testing models, Dissolution acceptance criteria, In-vitro-in-vivo correlation, and Biopharmaceutics Classification system.

2. **Bioequivalence studies**: types of bioequivalence studies, Bioequivalence experimental study design, Bioequivalence study protocol, Statistical interpretation of bioequivalence data, methods of enhancement of bioavailability, bioavailability enhancement by enhancing drug permeability.

Recommended Text books:

1. D. M. Brahmankar and Sunil B.Jaiswal, *Bio pharmaceutics and Pharmacokinetics-A Treatise*, Vallabh Prakashan Pitampura, Delhi
2. Rebort F Notari Marcel Dekker Inn, *Biopharmaceutics and Clinical Pharmacokinetics-An introduction*, 4th edition Revised and expanded by, New York and Basel, 1987.
3. *Remington's Pharmaceutical Sciences*, Mack Publishing Company, Pennsylvnia.
4. Malcolm Rowland and Thomas, N. Tozen, *Cilincal Pharmacokinetics, Concepts and Applications:* Lea and Febrger, Philadelphia, 1995.
5. *Biopharmaceutics and Clinical Pharmacokinetics* by, Milo Gibaldi
6. Notari, R.E., *Biopharmaceutics and Pharmacokinetics – An introduction*, Marcel Dekker Inc. N.Y.
7. Rowland M., and Tozer T.N., *Clinical Pharmacokinetics*, Lea and Febriger, N.Y.
8. Wagner J.G., *Fundamentals of Clinical Pharmacokinetics*, Drugs Intelligence Publishers, Hamilton.
9. 4. Wagner J.G., *Pharmacokinetics for the Pharmaceutical Scientist*, Technomic Publishing A.G. Basel, Switzerland.

Recommended Reference books:

1. Milo Glbaldi Donald, *Pharmacokinetics:* R. Mercel Dekker Inc.
2. Milo Gibaldi and Laurie Prescott, *Hand Book of Clinical Pharmacokinetics*, by ADIS Health Science Press.
3. Abdou H.M, Mack, *Dissolution, Bioavailability and Bioequivalence*, Publishing Company, Pennsylvania 1989.
4. James Swarbrick, James, C. Roylan, *Encyclopedia of Pharmaceutical Technology*, Vol 13, Marcel Dekker Inc, New York 1996.

* Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

CLINICAL TOXICOLOGY (THEORY)

Course Code: **PDR406** **L-2, T-1, P-0, C-2.5**

Theory: 2 Hrs. /Week

Objective: The basic objective of this course is to get familiar with poisoning, and its management; supportive care of clinical toxicology and toxicokinetics.

Unit –I **8 hrs**

1. **General Principles of toxicology:** Basic Definitions and Terminology, Importance of Dose and the Dose–Response Relationship, Factors Influencing Dose–Response Curve, rationalization of Dose–Response Curve and General methods involved in the management of poisoning.
2. **Antidotes;** classification and their clinical applications, Supportive care in clinical toxicology, importance and benefits

Unit –II **8 hrs**

1. **Gut Decontamination:** mechanism of emesis, induction, gastric lavaging & its importance, absorption, function of activated charcoal and bowel irrigation.
2. **Elimination enhancement**: multiple-dose activated charcoal, urinary alkalinisation and extracorporeal elimination, Toxicokinetics; parameters of toxicokinetics, absorption, systemic availability, volume of distribution and clearance.
3. **Pesticide poisoning:** introduction of pesticide**s**, types of pesticide**s** and their toxic effects.

Unit –III **8 hrs**

1. **Organophosphorous poisoning:** introduction, use, causes, mechanism of action, absorption and metabolism, reproductive effects, neurotoxic effects, phatophysiology and treatment.
2. **Carbamates poisoning:** signs & symptoms, diagnosis and treatment.
3. **Organochlorines**: introduction, use, mechanisms of action, pharmacokinetics, acute\ chronic effects, biological monitoring and treatment.

Unit –IV **8 hrs**

1. **Pyrethroids**: introduction to various compounds, mechanism of action, sign & symptoms and treatment of pyrethroid poisoning.
2. **Opiates overdose**: introduction, mechanism of action, sign & symptoms and treatment of poisoning induced by morphine and its congeners.
3. **Antidepressants:** Introduction to tricyclic antidepressants, mechanism of action, sign & symptoms of poisoning cases and their treatments.
4. **Barbiturates and benzodiazepines**: introduction to barbiturates and benzodiazepines, mechanism of action, sign & symptoms of acute barbiturate poisoning and their treatment.

5. **Alcohol**: ethanol, methanol, sign & symptoms and treatment of acute and chronic alcoholism.

Unit –V **8 hrs**

1. **Non-steroidal anti-inflammatory drugs**: Introduction, classification mechanism of action, sign, & symptoms and treatment of poisoning cases of paracetamol and salicylates.
2. **Clinical symptoms, sources and management of chronic poisoning with the following agents** – Heavy metals, Arsenic, lead, mercury, iron, copper, petroleum products and PEG, inorganic acids & alkali and radiation poisoning.

Unit –VI **8 hrs**

1. **Venomous snake bites**: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries.
2. **Plants poisoning**: Mushrooms, causes of Mushrooms poisoning, toxins and their symptoms, poisonous Mushrooms and treatment, General introduction of mycotoxins, sign & symptoms and treatment.
3. **Food poisonings**: causes, common food poisoning illnesses and its treatment.
4. **Envenomations**: Arthropod bites and stings; Sign & Symptoms and treatments.

Unit –VII **8 hrs**

Substance abuse: adverse drug effects, hypersensitive reactions, teratogenecity etc & symptoms and treatment of dependence with respect to CNS Stimulants: amphetamine, Opioids, CNS depressants, Hallucinogens: LSD, Cannabis group & Tobacco.

Recommended books:

1. Turner R.I., *Screening Methods in Pharmacology*, Academic Press, 1965.
2. Laurance & Bacharch, *Pharmacometrics*, VOL. I & II, Academic Press.
3. Seth U.K., Dadkar Kamathy, *Eperimental Topics in Pharmacology*, Academic Press Inc.
4. Floyd R. Domer, *Animal Experimental in Pharmacological Analysis*. Thomas.
5. Ian Kitchen, *In vitro Experiments in Pharmacology*, Blackwell Scientific Publications, 1984.
6. Ghosh M.N., *Fundamental of Experimental Pharmacology*, Scientific Book Agency, 1984.

Reference books:

1. Matthew J Ellenhorn. *Ellenhorns Medical Toxicology – Diagnosis And Treatment Of Poisoning*. Second edition. Publisher- Williams and Willkins publication, London
2. V V Pillay, *Handbook of forensic medicine and toxicology*, Thirteenth edition 2003, Publisher -Paras Publication, Hyderabad.
3. Frank A. Barile, *Clinical Toxicology: Principles and Mechanisms*, Publisher - CRC Press India
4. Thomas A. Gossel, J. Douglas Bricker *Principles of clinical toxicology*, Publisher- Lippincott Williams & Wilkins , India
5. Marsha D. Ford, *Clinical toxicology* , Publisher -W.B. Saunders, United States

* Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

PHARMACOTHERAPEUTICS – III (PRACTICAL)

Course Code: **PDR451** **L-0, T-0, P-4, C-2**

Practical: 4 Hrs. /Week

Objective: The basic objective of this course is to get familiar with principles and practice involved in ward round participation and clinical discussion on selection of drug therapy.

Practicals: Hospital postings for a period of at least 50 hours is required to understand the principles and practice involved in ward round participation and clinical discussion on selection of drug therapy. Students are required to maintain a record of 15 cases observed in the ward and the same should be submitted at the end of the course for evaluation. Each student should present at least two medical cases they have observed and followed in the wards.

Guidelines:

1. Students will be required to maintain and submit the precisely compiled diary containing the assignments (Case studies of most common diseases).
2. These assignments will be of two categories i.e. major & minor.
3. The entire practical exams will be evaluated through record compilation & oral presentation.
4. A committee of senior teachers including the teacher preceptor will evaluate for internal assessment (30 marks).
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. The evaluation will be conducted both by external & internal examiners.
7. The external evaluation will be conducted for 70 marks.
8. The external examiner will be appointed from the approved panel of examiners.
9. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
10. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.

11. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Text Books

1. Katzung, B.G., *Basic & Clinical Pharmacology*, Prentice Hall, International.
2. Barar F.S.K., *Text Book of Pharmacology*, Interprint, New Delhi.
3. Goodman & Gilman, *The Pharmacological basis of Therapeutics*, Editors:-J.G. Hardman, L.E. Limbird, P.B. Molinoss, R.W. Ruddon & A.G. Gil, Pergamon Press.
4. Satoskar & Bhandarkar, *Pharmacology & Pharmacotherapeutics*, Popular Prakashan Pvt. Ltd.,
5. Bombay.
6. Tripathi K.D., *Essentials of Medical Pharmacology*, Jay Pee Publishers, New Delhi.

Reference Books

1. Laurence D.R. & Bannet P.N., *Clinical Pharmacology*, Churchill Livingstone.
2. Rang M.P., Date M.M., Riter J.M., *Pharmacology*, Churchill Livingstone.
3. Craig, C.R. & Stitzel R.R., *Modern Pharmacology*, Little Brown and Co., 1994.

* Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

HOSPITAL PHARMACY (PRACTICAL)

Course Code: **PDR452** **L-0, T-0, P-4, C-2**

Practical: 4 Hrs./Week

Objective: The basic objective of this course is to get familiar with design, management, drug stocks, dispensing and inventory in hospital pharmacy.

1. Assessment of drug interactions in the given prescriptions
2. Manufacture of parenteral formulations, powders.
3. Drug information queries.
4. Inventory control

List of Assignments:

1. Design and Management of Hospital pharmacy department for a 300 bedded hospital.
2. Pharmacy and Therapeutics committee – Organization, functions, and limitations.
3. Development of a hospital formulary for 300 bedded teaching hospital
4. Preparation of ABC analysis of drugs sold in one month from the pharmacy.
5. Different phases of clinical trials with elements to be evaluated.
6. Various sources of drug information and systematic approach to provide unbiased drug information.
7. Evaluation of prescriptions generated in hospital for drug interactions and find out the suitable management.

Guidelines:

1. Students will be required to prepare a record of all the assignments presentable in soft copy and hard copy to be submitted at the end year external exams duly signed by the teacher preceptor.
2. The evaluation will be conducted both by external & internal examiners.
3. The external evaluation will be conducted for 70 marks.
4. The external examiner will be appointed from the approved panel of examiners.
5. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
6. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.

7. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Text & Reference Books:

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

* Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

CLINICAL PHARMACY (PRACTICAL)

Course Code: **PDR453** **L-0, T-0, P-4, C-2**

Practical: 4 Hrs./Week

Objective: The basic objective of this course is to get familiar with patient medication counseling and different patient case studies.

Students are expected to perform 15 practicals in the following areas covering the topics dealt in theory classes:

1. Answering drug information questions (4 Nos)
2. Patient medication counselling (4 Nos)
3. Case studies related to laboratory investigations (4 Nos)
4. Patient medication history interview (3 Nos)

Assignment:

Students are expected to submit THREE written assignments (1500 – 2000 words) on the topics given to them covering the following areas dealt in theory class.

Drug information, Patient medication history interview, Patient medication counselling, Critical appraisal of recently published articles in the biomedical literature which deals with a drug or therapeutic issue.

Format of the assignment:

1. Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year.
4. It shall be computer draft copy.
5. Name and signature of the student.
6. Time allocated for presentation may be 8+2 Min.

Guidelines:

1. Students will be required to maintain and submit the precisely compiled diary containing the assignments.
2. These assignments will be of two categories i.e. major & minor.
3. The entire practical exams will be evaluated through record compilation & oral presentation.

4. The evaluation will be conducted both by external & internal examiners.
5. A committee of senior teachers including the teacher preceptor will evaluate for internal assessment (30 marks).
6. There will be three internal (sessional) practical examinations and average of best two will be sent to the University for the Computation of final result.
7. The external evaluation will be conducted for 70 marks.
8. The external examiner will be appointed from the approved panel of examiners.
9. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
10. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
11. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended Text books:-

1. Grover J.K., *Experiments in Pharmacy & Pharmacology*, CBS Publishers, New Delhi.
2. Rang M.P., Dale M.M., Riter J.M., *Pharmacology*, Churchill Livingstone.

Recommended Reference books

1. Satoskar & Bhandarkar, *Pharmacology & Pharmacotheropeutics*., Popular Prakashan Pvt. Ltd. Bombay.
2. Barar F.S.K, *Text Book of Pharmacology*, Interpoint, New Delhi.
3. Goodman & Gilman, *The Pharmacological basis of Therapeutics*, Editors: J.G. Hardman, L.E. Limbird, P.B. Molinos, R.W. Ruddon and A.G. Gil, Pergamon press.
4. Katzung B.G., *Basic & Clinic Pharmacology*, Prentice Hall, International.
5. Laurence D.R., & Bennet P.N., *Clinical Pharmacology*, Churchill Livingstone.

* Latest editions of all the suggested books are recommended.

Pharm D.: Fourth Year

BIOPHARMACEUTICS AND PHARMACOKINETICS (PRACTICAL)

Course Code: **PDR454** **L-0, T-0, P-4, C-2**

Practical: 4 Hrs. /Week

Objective: The basic objective of this course is to get familiar with different biopharmaceutics and pharmacokinetics parameters and their calculations.

List of Experiments:

1. Improvement of dissolution characteristics of slightly soluble drugs by some methods.
2. Comparison of dissolution studies of two different marketed products of same drug.
3. Influence of polymorphism on solubility and dissolution.
4. Protein binding studies of a highly and poorly protein bound drugs.
5. Extent of plasma-protein binding studies on the same drug (i.e. highly and poorly protein bound drug) at different concentrations in respect of constant time.
6. Bioavailability studies of some commonly used drugs on animal/human model.
7. Calculation of Ka, Ke, t1/2, Cmax, AUC, AUMC, MRT etc. from blood profile data.
8. Calculation of bioavailability from urinary excretion data for two drugs.
9. Calculation of AUC and bioequivalence from the given data for two drugs.
10. In vitro absorption studies.
11. Bioequivalency studies on the different drugs marketed.(eg) Tetracycline, Sulphamethoxzole, Trimethoprim, Aspirin etc., on animals and human volunteers.
12. Absorption studies in animal inverted intestine using various drugs.
13. Effect on contact time on the plasma protein binding of drugs.
14. Studying metabolic pathways for different drugs based on elimination kinetics data.
15. Calculation of elimination half-life for different drugs by using urinary elimination data and blood level data.
16. Determination of renal clearance.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the subject teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.

6. Scheme of Practical Examination:

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Recommended text books

1. Milo Gibaldi, *Biopharmaceutics and Clinical Pharmacokinetics*,
2. *Mack Publishing Company, Pennsylvnia*, Remington's Pharmaceutical Sciences,.
3. *Milo Glbaldi Donald, R. Mercel Dekker Inc*, Pharmacokinetics..
4. Robert F Notari, *Biopharmaceutics and Pharmacokinetics*,
5. Swarbrick *Biopharmaceutics*,
6. D. M. Brahmankar and Sunil B.Jaiswal, *Bio pharmaceutics and Pharmacokinetics-A Treatise*, Vallabh Prakashan Pitampura, Delhi
7. Abdou H.M, Mack, *Dissolution, Bioavailability and Bioequivalence*, Publishing Company, Pennsylvania 1989.
8. Rebort F Notari Marcel Dekker Inn, *Biopharmaceutics and Clinical Pharmacokinetics-An introduction* 4th edition Revised and expanded by New York and Basel, 1987.
9. James Swarbrick, James, C. Roylan, Marcel Dekker Inc *Encyclopedia of Pharmaceutical Technology*, Vol 13, , New York 1996.

Reference Books

1. Notari, R.E., *Biopharmaceutics and Pharmacokinetics – An introduction*, Marcel Dekker Inc. N.Y.
2. Rowland M., & Tozer T.N., *Clinical Pharmacokinetics*, Lea and Febriger, N.Y.
3. Wagner J.G., *Fundamentals of Clinical Pharmacokinetics*, Drugs Intelligence Publishers, Hamilton.
4. Wagner J.G., *Pharmacokinetics for the Pharmaceutical Scientist*, Technomic Publishing A.G. Basel, Switzerland.
5. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
6. Cilincal Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.

* Latest editions of all the suggested books are recommended.

Pharm D.: Fifth Year

CLINICAL RESEARCH (THEORY)

Course Code: **PDR501** **L-3, T-2, P-0, C-4**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with clinical research, GCP, steps from drug discovery to formulation design, various approvals and forms for IND, NDA & ANDA filings.

Unit I **10hrs**

Drug development process: Introduction, Various Approaches to drug discovery**,** Pharmacological &Toxicological aspects, IND Application, Drug characterization and Dosage forms.

Unit II **10 hrs**

Clinical development of drug: Introduction to Clinical trials, different Phases (I, II, III & Phase IV trials), Non-interventional Trials, Financing Clinical Trials, Clinical Trial Public Access Registries, EMEA Community Databases.

Unit III **10 hrs**

Post Marketing Surveillance (PMS): Purpose, Definition, Duties of general marketing compliance officer, Organizations and personnels involved in safety assurance, Standard operating procedures for PMS, Duties of the safety management supervisor, Collection of safety management information, Drafting of safety assurance measures based on examination of safety management information and the results thereof, Implementation of safety assurance measures, Practical Aspects of PMS, Method of PMS, Good Post-marketing Study Practice.

Unit IV **10 hrs**

Abbreviated New Drug Application submission: Introduction, ANDA requirement, Guidance Documents for ANDAs, Generics (Draft - Distributed for comment purposes only), Procedural Draft, Drug Master Files, Required Specifications for FDA's IND, NDA, and ANDA drug master file binders, guidance for industry: Changes to an Approved NDA or ANDA, refusal to receive, Inactive Ingredient Database**,** Laws, Regulations, Policies and Procedures, Code of Federal Regulations (CFR) 21CFR Part 314, 21CFR Part 320, 21CFR Part 310**,** MaPPs, ANDA Forms.

Unit V **10 hrs**

Good Clinical Practice: ICH, GCP, Central drug standard control organisation (CDSCO) guidelines, Challenges in the implementation of guidelines, Ethical guidelines in Clinical Research, Composition, responsibilities, procedures of IRB / IEC, Overview of regulatory environment in USA, Europe and India, Role and responsibilities of clinical trial personnel as per ICH GCP i.e. Sponsor, Investigators, Clinical research associate, Auditors, Contract research coordinators &Regulatory authority.

Unit VI **10 hrs**

Designing of clinical study documents: Investigator's Brochure, Clinical Study Protocol, Subject Information and Informed Consent Forms, Clinical Study Reports & Case Report Form (CRF).

Unit VII **10 hrs**

1. **Informed consent**: Introduction, Need of IC, Volunteer Rights, Informed consent Process, Guidelines, Elements of IC documents and Revision procedure.

2. **Data management and its components:** Introduction, Tools for CDM, Regulations, Guidelines and Standards in CDM, CDM Process, Review and finalization of study documents, Database designing, Data collection, CRF tracking, Data entry, Data Validation, Discrepancy management, Medical coding, Database locking, Roles and Responsibilities in CDM

Unit VIII **10 hrs**

Safety monitoring in clinical trials: Purpose, NINDS Requirements for Monitoring; Responsibilities of Data and Safety Monitoring Boards, Study Monitoring Committee, Independent Medical Monitor, Medical Safety Monitor, Data and Safety Monitoring Board; Scope, Responsibilities, Membership, Initial Meeting, Meeting Format, Interim Data Reports, Communication of DSMB Recommendations, Communications from Study Investigators.

Recommended Text books:

1. Central Drugs Standard Control Organization, *Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India*. New Delhi: Ministry of Health; 2001.
2. *International Conference on Harmonisation of Technical requirements for registration of Pharmaceuticals for human use*. ICH Harmonised Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
3. *Ethical Guidelines for Biomedical Research on Human Subjects* 2000. Indian Council of Medical Research, New Delhi.
4. David Machin, *Textbook of Clinical Trials edited*, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.

Recommended Reference books:

1. Giovanna di Ignazio, *Principles of Clinical Research edited* , Di Giovanna and Haynes.
2. R K Rondels, S A Varley, *Clinical Data Management edited* , C F Webbs. Second Edition, Jan 2000, Wiley Publications.
3. JG Hardman, *Goodman & Gilman*:, LE Limbard, 10th Edn. McGraw Hill Publications, 2001.

* Latest editions of all the suggested books are recommended.

Pharm D.: Fifth Year

PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS (THEORY)

Course Code: **PDR502** **L-3, T-2, P-0, C-4**

Theory: 3 Hrs. /Week

Objective: The basic objective of this course is to get familiar with pharmacoepidemiology and pharmacoeconomics**.**

Unit-I **10 hrs**

1. **Pharmacoepidemiology:** Definition, scope and origin of pharmacoepidemiology.
2. **Evaluation of pharmacoepidemiology**: Factors influencing the evaluation studies of pharmacoepidemiology, purpose, study design, analysis, main findings and conclusion.
3. **Need for pharmacoepidemiology**: In clinical trials, in adverse event reporting systems and in postmarketing surveillance**.**

Unit-II **10 hrs**

1. **Aims of pharmacoepidemiology:** signal generation, risk quantification and hypothesis testing.
2. **Applications:** Estimation/quantitation of risk, patient counseling, formulation of public health/policy decisions and formulation of therapeutic guidelines and discovery of new indications, studies of drug utilization, pharmacoepidemiological study of devices, studies of drug induced birth defects, medication error and hospital pharmacoepidemiological aspects.

Unit-III **10 hrs**

1. **Pharmacoeconomic decision making:** Measurement of outcomes in pharmacoepidemiology and drug use measures, Prevalence, incidence and incidence rate. Monetary units, number of prescriptions, units of drugs dispensed, defined and prescribed daily doses, medication adherence determinations.
2. **Concept of risk in pharmacoepidemiology:** Measurement of risk, attributable and relative risk, time-risk relationship and odds ratio.

Unit-IV **10 hrs**

1. **Pharmacoepidemiological methods:** Including theoretical aspects and practical studies of various methods with the help of case studies. drug utilization review, case reports, case series, surveys of drug use, cross – sectional studies, cohort studies, case control

studies, case –cohort studies, meta – analysis, spontaneous reporting, prescription event monitoring and record linkage system.

Unit-V **10 hrs**

Sources of data for pharmacoepidemiological studies:

1. **Adhoc data sources**: Case control surveillance, prescription event monitoring and registries.

2. **Automated data systems**: Health maintenance organisations, commercial insurance databases, medical record database, in hospital database and pharmacy based medical record linkage system.

Unit-VI **10 hrs**

Selected special applications of Pharmacoepidemiology:

1. **Studies of vaccine safety:** Introduction, clinical problems to be addressed using pharmacoepidemiological research.

2. **Hospital pharmacoepidemiology:** Introduction**,** characterstics of hospital patients and hospital drug use, hospital based adverse drug reaction monitoring and drug use evaluation programme.

3. **Pharmacoepidemiology and risk management:** Introduction, types of risk, risk factors to be addressed using pharmacoepidemiological research and their management.

4. **Drug induced birth defects. :** Introduction, the nature of birth defects and their relation to drugs, clinical problems to be addressed using pharmacoepidemiological research.

Unit-VII **10 hrs**

1. **Phrmacoeconomics:** Definition, history, needs of pharmacoeconomic evaluations, Role in formulary management decision-making in hospital, managed care Pharmacy and Therapeutics (P&T) committees, Use of pharmacoeconomic information by hospital Pharmacy and Therapeutics (P&T) committees.

2. **Pharmacoeconomic evaluation:** Outcome assessment and types of evaluation Including theoretical and practical aspects of various methods, Cost – minimization, cost- benefit, cost – effectiveness and cost utility for individual methods.

Unit-VIII **10 hrs**

1. **Applications of Pharmacoeconomic:** Drug therapy evaluation, clinical pharmacy service evaluation, cost minimization, cost benefit, cost effectiveness and cost utility analyses, applications of software: **Treeage** and **SSPS.**

2. **Case studies**: Drug selection using pharmacoeconomic, Cost-of-illness analysis, calculation of the cost of migraine therapy within a managed Care, Formulary decision making incorporating humanistic outcomes, Using pharmacoeconomic methodologies to develop health policy, Cost-minimization analysis of treprostinil vs. epoprostenol as an alternate to oral therapy non-responders to the treatment of pulmonary arterial hypertension.

Recommended Text books:

1. G Parthasarathi et al, *A Textbook of clinical pharmacy practice – Essential concepts and skills*., 1st Edn. Orient longman publications, 2004.
2. Remington's – *The Science and Practice of Pharmacy*, Vol I & II, AR Gennaro et al, Mack Publishing company, 20th Edn, 2004.

Reference Books:

1. Joseph T Dipiro, *Pharmacotherapy – A Pathophysiologic Approach*, 5th Edn. Published by McGraw – Hill medical publication, 2002.
2. Leon Shargel, *Comprehensive Pharmacy Review*: 5th Edn. Published by Lippincot Williams & Wilkins 2004.
3. Scott L Traub, *Basic skills in interpreting lab data*: 2nd Edn. Published by American Society of Health System Pharmacist 1996.

* Latest editions of all the suggested books are recommended.

Pharm D.: Fifth Year

CLINICAL PHARMACOKINETICS AND PHARMACOTHERAPEUTIC

DRUG MONITORING (THEORY)

Course Code: **PDR503** **L-2, T-2, P-0, C-3**

Theory: 2 Hrs. /Week

Objective: The basic objective of this course is to get familiar with clinical pharmacokinetics, dosage regimen, drug interaction & monitoring, dosage adjustment and population pharmacokinetics.

Unit I: **10 hrs**

Introduction to Clinical Pharmacokinetics- Introduction, Absorption, Distribution, Disposition, Clearance, Elimination rate constant, Elimination half life, Non linear pharmacokinetics.

Unit II: **10 hrs**

Design of Dosage Regimens- Multiple dosage regimen, Design of dosage regimen from plasma concentration, Individualization, Measurement of Serum Drug Concentration, Empirical methods, Dosage regimen based on Partial Pharmacokinetic parameters and Population Averages, Conversion from intravenous to oral dosing, Determination of dose and dosing intervals, Design of exposure-response studies, Dose concentration- Response relationship and effects over time, Determination of frequency of drug administration

Unit III: **10 hrs**

1. **Pharmacokinetics of Drug Interactions**: Drug Absorption Interactions, Effect of change in gastrointestinal pH, Adsorption, chelation and other complexing mechanisms, Changes in gastrointestinal motility, Induction or inhibition of drug transport proteins, Malabsorption caused by drugs.
2. **Drug Distribution Interactions:** Protein –binding interactions & Induction or inhibition of drug transport proteins.
3. **Drug Metabolism (Biotransformation) interactions:** Change in First-pass metabolism, Enzyme induction, Enzyme inhibition, Genetic factors in drug metabolism & Cytochrome P450 isoenzyme and predicting drug interactions.
4. **Drug Excretion interactions:** Changes in urinary pH**,** active renal tubular excretion**,** renal blood flow and biliary excretion including entero hepatic shunt.

Unit IV: **10 hrs**

1. **Therapeutic Drug Monitoring:** Introduction- TDM testing indications: criteria for TDM-Test availability, narrow safety margin, compliance, high Pharmacokinetic variability, Therapeutic effect difficult to monitor. Considerations for TDM- sample type, timing of sample and Interpretation.

2. **Individualization of Drug dosage regimen**- Variability-Genetic, age & weight, disease, interacting drugs, environmental & other factors-compliance, Pregnancy, alcohol intake, seasonal variations.
3. **Indications for TDM and TDM process**-Toxicity suspected, lack of response, assessment of compliance with medication regimen, change in clinical state of patient, potential drug interactions, manifestations of toxicity and disease state. **TDM process-** decision to request a drug level, biological sample, drug assay request, laboratory measurement, communication of results by the laboratory, Clinical interpretation, Therapeutic management.
4. **Pharmacokinetic/ Pharmacodynamic correlation in drug therapy**- In vitro-in vivo correlations, graphical approach, correlation coefficients, PK/PD modelling.

Unit-V: 10 hrs

1. **Dosage Adjustment in Renal & Hepatic disease:** Renal impairment, types of renal failure, symptoms, causes, diagnostic approach, Pharmacokinetic considerations.
2. **General approaches for dose adjustment in renal disease**: based on drug clearances, elimination rate constant, Measurement of Glomerular filtration rate, Serum creatinine concentration and creatinine clearance. Calculation of creatinine clearance from serum creatinine concentration, Dose adjustments for uremic patients, basis for dose adjustment in uremia, nomograms, and comparison of the various methods for adjustment in uremic patients. General clearance and Wagner methods.
3. **Extracorporeal removal of drugs:** Peritoneal dialysis, Hemodialysis, factors affecting dialysis, Physicochemical & pharmacokinetic properties of drugs, characteristics of dialysis machine, Haemoperfusion, Hemofiltration, Continuous Renal Replacement therapy, Dug removal during continuous renal replacement therapy.
4. **Effect of Hepatic diseases on Pharmacokinetics**: Dosage considerations in hepatic diseases, fractions of drug metabolized, active drug & metabolites, Hepatic blood flow &intrinsic clearance, Pathophysiologic assessment, hormonal influence, liver function test & hepatic metabolic markers.

Unit VI: 10 hrs

1. **Population Pharmacokinetics:** Introduction, background, Two stage & Nonlinear mixed effects modeling approach, to population pharmacokinetics, study design and execution.
2. **Sampling design**: Single trough, Multiple troughs and Full population PK designs, Importance of Sampling individuals on more than one occasion, Simulation, Study Protocol and Study execution.
3. **Introduction to Bayesian theory**: Adaptive method or dosing with feedback, the Bayes estimator, comparison of Bayes least squares, steady state and Chiou methods.
4. **Analysis of Population pharmacokinetic data-**
   a) exploratory data analysis,
   b) Population pharmacokinetic model development,
   c) validation and Selection criteria.

5. **Regional Pharmacokinetics-**Introduction, Experimental methods- Post martem tissue biopsies, Regional blood sampling in-vivo, Artificially perfused regions, Surgical Transplantation, Selective drug administration, Autoradiography, Histochemical methods.

Unit VII: 10 hrs

1. **Pharmacogenetics**: Introduction, Polymorphism, Pharmacogenomics, clinical impact of pharmacogenetics, genomic organization- Chromosomes, DNA, Genes. Benefits of Pharmacogenetics.
2. **CYP Pharmacogenetics:** Cytochrome P450, CYP2D6, CYP2C19, CYP1A2, CYP2C9, Pheno-or-genotyping for drug metabolizing enzymes.
3. **Genetic polymorphism in Drug transport:** P-glycoprotein and multi drug resistance, genetic polymorphism in drug targets, Pharmacokinetics/Pharmacodynamics considerations and pharmacogenetics/ pharmacogenomics.

Unit VIII 10 hrs

1. **Therapeutic Drug monitoring of drugs used in the following diseased conditions**: cardiovascular disease, seizure disorders, Psychiatric conditions and organ transplantations.
2. **Regional Pharmacokinetic models-**Model Independent methods, Black box methods, Tracer kinetic principles, Linear system analysis, Convolution and de-convolution, Clearance concepts, Mass balance principles,
3. **Compartment models-** Flow limited & membrane limited regional compartment model and such other regional pharmacokinetic models.

Recommended books:

1. Eds Leon Shargel et al, *Applied Biopharmaceutics & Pharmacokinetics*,Prentice Hall International, Inc. 1999
2. Malcom Rowland & Thomas Tozer. *Clinical Pharmacokinetics – Concepts and Applications.* 3rd Edn.
3. Trevor M Speight, Nicholas HG et al, *Avery's Drug Treatment:*4th Edn. Adis International Ltd. 1997.

References Book:

1. Joseph T Dipiro, *Pharmacotherapy, A Pathophysiologic Approach*, 5th Edn. Appleton & Lange 2002.
2. Bertram G Katzung, *Basic and Clinical Pharmacology.* 9th Edn. Lange Publications, 2004.
3. Eric T Herfindal, *Textbook of therapeutics, drug and disease management:*7th Edn. Williams & Wilkins Publications, 2000
4. Wolfgang A. Ritschel, Gregory L. Kearns. *Hand Book of Basic Pharmacokinetics.* 5th Edn.

* Latest editions of all the suggested books are recommended.

Pharm D.: Fifth Year

CLERKSHIP

Course Code: **PDR551** **L-0, T-0, S-4, C-2.0**

Objective: The basic objective of this course is to get familiar with consultation on various clinical expects by interaction with patients involving principles of pharmacotheapeutics, clinical pharmacokinetics, toxicological and hospital pharmacy.

Guidelines:

The duration of clerkship will be six months.
Every student will be trained in drug information, adverse drug reaction monitoring (ADR) and management identifying various types of interaction cases and such other drug related problems.

1. Students will have to spend half a day in the first hour attending ward rounds on daily basis as a part of clerkship.
2. After finishing the round they shall go through case sheets (indoor & outdoor patients) and try to find out concurrent drug related problems.
3. Evaluation scheme:

(i) The performance in clerkship phase shall be evaluated by internal and external examiners.
(ii) Students shall be evaluated individually.

Internal Evaluation

1. A committee of four senior teachers i.e. the teacher preceptors will evaluate the performance of individual student.
2. Four seminars presented by students shall be evaluated for 30 marks each and the average of best two shall be forwarded to the university with marks of other subjects.
3. **Internal evaluation shall be done on the following items:** **Marks**
   a) Write up of the seminar (7.5)
   b) Presentation of work (7.5)
   c) Communication skills (7.5)
   d) Question and answer skills (7.5)
   Total (30 marks)

External Evaluation

1. The end year examination of clerkship programme will comprise of evaluation of students by the external (appointed) examiner.
2. External evaluation of clerkship at the end year examination shall be done on the following items: **Marks**

i) Write up of the seminar (17.5)
ii) Presentation of work (17.5)
iii) Communication skills (17.5)
iv) Question and answer skills (17.5)

Total (70 marks)

Pharm D.: Fifth Year

Project Work

(THESIS COMPILATION & VIVA-VOCE)

Course Code: **PDR552** **L-0, T-0, S-4, C-2**

Objective: The basic objective of this course is to present the findings of project and to develop data collection, analysis & reporting and interpretation skills.

Guidelines

1. The duration of Project work shall be of six months.

2. To allow the student to develop data collection and reporting skills in the area of community, hospital and clinical pharmacy, a project work shall be carried out under the supervision of a teacher. The project topic must be approved by the Head of the Department or Head of the Institution. The same shall be announced to students within one month of commencement of the fifth year classes. Project work shall be presented in a written report and as a seminar at the end of the year. External and the internal examiners shall do the assessment of the project work.

3. Project work shall comprise of objectives of the work, methodology, results, discussions and conclusions.

Methodology: To complete the project work following methodology shall be adopted, namely:

(i) Students shall work in groups of not less than *two* and not more than *four* under an authorised teacher;

(ii) Project topic shall be approved by the Head of the Department or Head of the Institution;

(iii) Project work chosen shall be related to the pharmacy practice in community, hospital and clinical setup. It shall be patient and treatment (Medicine) oriented, like drug utilisation reviews, pharmacoepidemiology, pharmacovigilance or pharmacoeconomics;

(iv) Project work shall be approved by the institutional ethics committee;

(v) student shall present at least three seminars, one in the beginning, one at the middle and one at the end of the project work; and

(vi) Two-page write-up of the project indicating title, objectives, methodology anticipated benefits and references shall be submitted to the Head of the Department or Head of the Institution.

Evaluation of the project work: The following methodology shall be adopted for evaluating the project work—

(i) Project work shall be evaluated by internal and external examiners.
(ii) Students may be evaluated in groups for four students.

Internal Evaluation:

1. A group of four senior teachers including preceptors and Head of the departments, will evaluate the performance of each student.
2. The average of marks given by teacher preceptors will be computed as internal assessment.
3. Three seminars presented by students shall be evaluated for thirty marks each and the average of best two shall be forwarded to the university with marks of other subjects.
4. Internal evaluation shall be done on the following items:

		Marks
(i)	Write up of the seminar	(7.5)
(ii)	Presentation of work	(7.5)
(iii)	Communication skills	(7.5)
(iv)	Question and answer skills	(7.5)
Total		(30 marks)

External Evaluation:

1. The End year evaluation of project work will be done by the duly appointed external examiner.
2. It will be accomplished for total marks of seventy (70).
3. The project work at the end year, shall be evaluated on the following items:

	Marks
(i) Write up of the seminar	(17.5)
(ii) Presentation of work	(17.5)
(iii) Communication skills	(17.5)
(iv) Question and answer skills	(17.5)
Total	(70 marks)

Pharm D.: Sixth Year

Hospital Internship Programme

Course Code: **PDR601** **L-0, T-0, P-0, C-0**

Objective: The basic objective of this course is to provide patient care in cooperation with patients, prescribers and other members of an inter-professional health care team based upon sound therapeutic principles and evidence-based data, taking into account relevant legal, ethical, social, cultural, economic, and professional issues, emerging technologies and evolving biomedical, pharmaceutical, social/behavioral/ administrative and clinical sciences that may impact therapeutic outcomes.

Expected Outcomes: After the completion of internship programmes, students will be able to:

1. to manage and use resources of the health care system, in cooperation with patients, prescribers, other health care providers, and administrative and supportive personnel, to promote health; to provide, assess, and coordinate safe, accurate, and time-sensitive medication distribution; and to improve therapeutic outcomes of medication use.
2. to promote health improvement, wellness, and disease prevention in co-operation with patients, communities, at-risk population, and other members of an inter professional team of health care providers.
3. to demonstrate skills in monitoring of the National Health Programmes and schemes, oriented to provide preventive and promotive health care services to the community.
4. to develop leadership qualities to function effectively as a member of the health care team organised to deliver the health and family welfare services in existing socio-economic, political and cultural environment.
5. to communicate effectively with patients and the community.

Areas of Hospital Internship Programme:

Internship or residency training including postings. Student would independently provide the clinical pharmacy services to the allotted wards.

(i) Six months in General Medicine department, and

(ii) Two months each in three other speciality departments

- Pediatrics
- Gynecology and Obstetrics
- Psychiatry
- Skin and VD
- Orthopedics

Legitimate Requirements of Hospital Internship Programme:

i) All parts of the internship shall be done, as far as possible, in institutions in India. In case of any difficulties, the matter may be referred to the Pharmacy Council of India to be considered on merits.

ii) Where an intern is posted to district hospital for training, there shall be a committee consisting of representatives of the college or university and the district hospital administration, who shall regulate the training of such trainee. For such trainee a certificate of satisfactory completion of training shall be obtained from the relevant administrative authorities which shall be countersigned by the Principal or Dean of College.

ASSESSMENT OF INTERNSHIP:

1. The intern shall maintain a record of work which is to be verified and certified by the preceptor (teacher practioner) under whom s/he works.
2. The scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and at the end of the training.
3. Every candidate shall be required, after passing the final Pharm.D. or Pharm.D. (Post Baccalaureate) examination as the case may be to undergo compulsory rotational internship to the satisfaction of the College authorities and University concerned for a period of twelve months so as to be eligible for the award of the degree of Pharm.D. or Pharm.D. (Post Baccalaureate) as the case may be.
4. Satisfactory completion of internship shall be determined on the basis of the following:-

(1)	Proficiency of knowledge required for each case management	SCORE 0-5
(2)	The competency in skills expected for providing Clinical Pharmacy Services	SCORE 0-5
(3)	Responsibility, punctuality, work up of case, involvement in patient care	SCORE 0-5
(4)	Ability to work in a team (Behavior with other healthcare professionals including medical doctors, nursing staff and colleagues).	SCORE 0-5
(5)	Initiative, participation in discussions, research aptitude.	SCORE 0-5

Poor	Fair	Below Average	Average	Above Average	Excellent
0	1	2	3	4	

5. Based on the record of work and date of evaluation, the Dean or Principal shall issue certificate of satisfactory completion of training, following which the university shall award the degree or declare him eligible for it.