DAYANANDA SAGAR UNIVERSITY

Shavige Malleshwara Hills, Kumaraswamy Layout,

Bengaluru - 560078, Karnataka.

SCHOOL OF HEALTH SCIENCES

COLLEGE OF PHARMACEUTICAL SCIENCES

SCHEME & SYLLABUS
FOR
DOCTOR OF PHARMACY (PHARM D) – 2015

(With Effect from 2015-16)

SCHOOL OF HEALTH SCIENCES
COLLEGE OF PHARMACEUTICAL SCIENCES
PROGRAMME: DOCTOR OF PHARMACY (PHARM D)- 2015-16

YEAR – 1

SL	COURSE CODE	COURSE TITLE	CR / AU	NO. OF HOURS OF TEACHING			SCHEME OF EVALUATION	
				L	P	C	IA MARKS	ANNUAL MARKS
1	15PD101	HUMAN ANATOMY AND PHYSIOLOGY	CR	3	--	3	30	70
2	15PD102	PHARMACEUTICS	CR	2	--	2	30	70
3	15PD103	MEDICINAL BIOCHEMISTRY	CR	3	--	3	30	70
4	15PD104	PHARMACEUTICAL ORGANIC CHEMISTRY	CR	3	--	3	30	70
5	15PD105	PHARMACEUTICAL INORGANIC CHEMISTRY	CR	3	--	3	30	70
6	15PD171	HUMAN ANATOMY AND PHYSIOLOGY	CR	--	1.5	1.5	30	70
7	15PD172	PHARMACEUTICS	CR	--	1.5	1.5	30	70
8	15PD173	MEDICINAL BIOCHEMISTRY	CR	--	1.5	1.5	30	70
9	15PD174	PHARMACEUTICAL ORGANIC CHEMISTRY	CR	--	1.5	1.5	30	70
10	15PD175	PHARMACEUTICAL INORGANIC CHEMISTRY	CR	--	1.5	1.5	30	70
GRAND TOTAL = 1000				**14**	**7.5**	**21.5**	**300**	**700**
11	15PD191	REMEDIAL MATHEMATICS	AU	2	--	2	25	50
12	15PD192	REMEDIAL BIOLOGY	AU				25	50
13	15PD193	ENGLISH	AU	1	--	1	25	50
14	15PD194	CONSTITUTION OF INDIA	AU	1	--	1	25	50

Note: (i) Remedial Mathematics for PCB students only

(ii) Remedial Biology for PCM students only

(iii) CR: Credit Subject, AU: Audit Subject, L: Lecture, P: Practical's, C: No. of Credits, IA: Internal Assessment

SCHOOL OF HEALTH SCIENCES
COLLEGE OF PHARMACEUTICAL SCIENCES
PROGRAMME: DOCTOR OF PHARMACY (PHARM D)- 2015-16

YEAR – 2

SL. NO	COURSE CODE	COURSE TITLE	CR / AU	NO. OF HOURS OF TEACHING			SCHEME OF EVALUATION	
				L	P	C	IA MARKS	ANNUAL MARKS
1	15PD201	PHARMACOLOGY – I	CR	3	--	3	30	70
2	15PD202	PHARMACEUTICAL MICROBIOLOGY	CR	3	--	3	30	70
3	15PD203	PHARMACOGNOSY AND PHYTOPHARMACEUTICALS	CR	3	--	3	30	70
4	15PD204	COMMUNITY PHARMACY	CR	2	--	2	30	70
5	15PD205	PATHOPHYSIOLOGY	CR	3	--	3	30	70
6	15PD206	PHARMACOTHERAPEUTICS – I	CR	3	--	3	30	70
7	15PD271	PHARMACOGNOSY AND PHYTOPHARMACEUTICALS	CR	--	3	1.5	30	70
8	15PD272	PHARMACEUTICAL MICROBIOLOGY	CR	--	3	1.5	30	70
9	15PD273	PHARMACOTHERAPEUTICS – I	CR	--	3	1.5	30	70
GRAND TOTAL = 900				**17**	**9**	**21.5**	**270**	**630**
10	15PD291	ENVIRONMENTAL SCIENCE	AU	2	--	--	25	50
11	15PD292	KANNADA	AU	2	--	--	25	50
12	15PD293	STATISTICS AND COMPUTER SCIENCE	AU	1	--	--	25	50

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SCHOOL OF HEALTH SCIENCES
COLLEGE OF PHARMACEUTICAL SCIENCES
PROGRAMME: DOCTOR OF PHARMACY (PHARM D)- 2015-16

YEAR – 3

SL.	COURSE CODE	COURSE TITLE	CR/ AU	NO. OF HOURS OF TEACHING			SCHEME OF EVALUATION	
				L	P	C	IA MARKS	ANNUAL MARKS
1	15PD301	PHARMACOLOGY II	CR	3	--	3	30	70
2	15PD302	PHARMACEUTICAL ANALYSIS	CR	3	--	3	30	70
3	15PD303	PHARMACOTHERAPEUTICS II	CR	3	--	3	30	70
4	15PD304	PHARMACEUTICAL JURISPRUDENCE	CR	2	--	2	30	70
5	15PD305	MEDICINAL CHEMISTRY	CR	3	--	3	30	70
6	15PD306	PHARMACEUTICAL FORMULATIONS	CR	2	--	2	30	70
7	15PD371	PHARMACOLOGY II	CR	-	1.5	1.5	30	70
8	15PD372	PHARMACEUTICAL ANALYSIS	CR	--	1.5	1.5	30	70
9	15PD373	PHARMACOTHERAPEUTICS II	CR	--	1.5	1.5	30	70
10	15PD374	MEDICINAL CHEMISTRY	CR	--	1.5	1.5	30	70
11	15PD375	PHARMACEUTICAL FORMULATIONS	CR	--	1.5	1.5	30	70
GRAND TOTAL : 1100				**16**	**7.5**	**23.5**	**330**	**770**
12	15PD391	INTELLECTUAL PROPERTY RIGHTS	AU	2	--	--	25	50

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IA – Internal Assessment

SCHOOL OF HEALTH SCIENCES
COLLEGE OF PHARMACEUTICAL SCIENCES
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YEAR – 4

SL.	COURSE CODE	COURSE TITLE	CR/ AU	NO. OF HOURS OF TEACHING			SCHEME OF EVALUATION	
				L	P	C	IA MARKS	ANNUAL MARKS
1	15PD401	PHARMACOTHERAPEUTICS III	CR	3	--	3	30	70
2	15PD402	HOSPITAL PHARMACY	CR	2	--	2	30	70
3	15PD403	CLINICAL PHAMACY	CR	3	--	3	30	70
4	15PD404	BIOSTATISTICS & RESEARCH METHODOLOGY	CR	2	--	2	30	70
5	15PD405	BIOPHARMACEUTICS & PHARMACOKENITICS	CR	3	--	3	30	70
6	15PD406	CLINICAL TOXICOLOGY	CR	2	--	2	30	70
7	15PD471	PHARMACOTHERAPEUTICS III	CR	--	3	1.5	30	70
8	15PD472	HOSPITAL PHARMACY	CR	--	3	1.5	30	70
9	15PD473	CLINICAL PHARMACY	CR	--	3	1.5	30	70
10	15PD474	BIOPHARMACEUTICS & PHARMACOKINETICS	CR	--	3	1.5	30	70
Grand Total 1000				**15**	**12**	**21**	**300**	**700**

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SCHOOL OF HEALTH SCIENCES
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YEAR – 5

SL.	COURSE CODE	COURSE TITLE	CR/ AU	NO. OF HOURS OF TEACHING			SCHEME OF EVALUATION	
				L	P	C	IA MARKS	ANNUAL MARKS
1	15PD501	CLINICAL RESEARCH	CR	3	--	3	30	70
2	15PD502	PHARMACOEPIDEMIOLOGY & PHARMACOECONOMICS	CR	3	--	3	30	70
3	15PD503	CLINICAL PHARMACOKINETICS & PHARMACOTHERAPEUTICS DRUG MONITORING	CR	2	--	2	30	70
4	15PD504	CLERKSHIP	CR	1	--	1	30	70
5	15PD505	PROJECT WORK	CR	--	20	20	--	100
Grand Total 1000				**09**	**20**	**29**	**120**	**380**

Note: CR – Credit Subject, AU – Audit Subject, L – Lecture, P – Practical's, C – No. of Credits,
IA – Internal Assessment

YEAR – 6

SL.	COURSE CODE	COURSE TITLE	CR/ AU	NO. OF HOURS OF TEACHING			SCHEME OF EVALUATION	
				L	P	C	IA MARKS	ANNUAL MARKS
1	15PD681	DISSERTATION	CR	--	--	--		

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD101
TITLE OF THE COURSE : HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)
L:T:P : 3:1:3

Course Objectives
- To study the fundamental knowledge on structure and functions of various systems in the human body.

Course Outcomes
- Students will be able to understand both homeostasis mechanisms and imbalances of various systems in the human body.

Unit -1

1. **Scope of anatomy, physiology and basic terminology.** **1 hr**

2. **i) Structure of the Cell**: **4 hrs**
   Structure & function of plasma membrane, cell cycle and transport of substances across cell membrane
   ii) Cell physiology:
   Different type of cells
   Development of action potential
   Cell stimulation and neuronal functions.

3. **Tissues:** **2 hrs**
   Epithelial, connective, muscular and nervous tissues, their types and characteristics.

4. **Skeletal Muscles** **2 hrs**
   Electrophysiology of muscle contraction
   Properties of skeletal muscles
   Muscles in exercise
   Disorders: Muscular dystrophy, Myasthenia gravis

5. **Blood:** **6 hrs**
   Composition and functions of blood
   Blood grouping and its significance
   Mechanism of coagulation
   Disorders: Anaemias, Polycythaemia, Leukopenia, Leukocytosis, Leukaemia, Thrombocytopenia, Thrombosis & Haemophilia

Unit -2

6. **Bones and Joints:** **4 hrs**
   Structure and function of skeleton & types of joints.
   Disorders: Osteoporosis, Arthritis, Rickets & Gout

7. **Lymph & Lymphatic system:** **3 hrs**
   Formation of lymph and its composition Structure & functions of lymph node, spleen and thymus gland Disorders: Lymphoedema & Splenomegaly

8. **Cardiovascular system:** **8 hrs**
   Structure of blood vessels

Anatomy and physiology of heart:
Blood circulation - systemic, hepatic, pulmonary, fetal and circle of Willis
Conduction system of the heart, heart rate, Electrophysiology of cardiac muscle, cardiac cycle.
Blood pressure and its regulation, ECG and heart sounds.
Disorders: Congestive Heart Failure, Cardiac Arrhythmias, Angina Pectoris, Myocardial Infarction, Atherosclerosis, Rheumatic Heart Disease, Cardiac Hypertrophy, Left Ventricular Hypertrophy, Hypertension & Hypotension

Unit -3

9. **Digestive system: 6 hrs**
   Gross anatomy of the gastro-intestinal tract and its physiology with special reference Salivary gland, Liver, Gall bladder and Pancreas.
   Digestion & absorption of nutrients in GIT
   Movements of intestine
   Disorders: Peptic Ulcer, GERD, Constipation, Diarrhea, Liver Cirrhosis, Hepatitis &Anorexia.

10. **Respiratory system: 5 hrs**
    Anatomy & functions of respiratory tract, Mechanism of respiration,
    Lung volumes & capacities, Hypoxia and Resuscitation, Transport of oxygen and carbon dioxide.
    Disorders: Asthma, COPD, Tuberculosis, Pneumonia, Cyanosis and Caisson's disease.
11. **Endocrine system: 5 hrs**
    Basic structure, secretions & functions of:
    Hypothalamus & Pituitary gland, Thyroid & Parathyroid gland, Adrenal gland & Pancreatic Islets
    Disorders: Gigantism, Acromegaly, Diabetes insipidus, Dwarfism Hypothyroidism, Hyperthyroidism, Cushing's syndrome, Addison's disease, Diabetes Mellitus & Pheochromocytoma

Unit -4

12. **Urinary system: 5 hrs**
    Structure and functions of kidney & urinary tract. Physiology of urine formation & acid-base balance. Micturition reflex, Renal function Test
    Disorders: Renal Calculi, Cystitis, Glomerulonephritis & Renal Fibrosis
13. **Reproductive system: 7 hrs**
    Structure and functions of male and female reproductive systems, Sex hormones
    Physiology of menstruation, Spermatogenesis and oogenesis, Pregnancy and parturition, Oral contraceptives
    Disorders: Infertility, Polycystic Ovarian Disease, Erectile Dysfunction & AIDS

14. **Sense organs: 3 hrs**
    Anatomy & Physiology of

i) Eye
ii) Taste & Smell
Disorders: Glaucoma, Cataract, Conjunctivitis

Unit - 5

15. Sense organs: 3 hrs

Anatomy & Physiology of

i) Ear
ii) Skin
Disorders: Otitis, Psoriasis & Tinnitus

16. Nervous system: 8 hrs

Classification of nervous system

i) Central nervous system:

Structure & functions of brain, Functional areas of brain: Cerebrum, Cerebellum, Pons & Medulla, Thalamus & Hypothalamus and Basal ganglia, Cerebrospinal fluid and its functions, meninges, Cranial nerves & their functions, Structure of spinal cord, Reflex arc

ii) Autonomic nervous system: 2 hrs

Anatomy, physiology and divisions of ANS Motor and sensory pathways

iii) Somatic Nervous System 1hr

iv) Disorders: Epilepsy, Parkinson's Disease, Depression, Insomnia, Anxiety, Schizophrenia, Migraine & Alzheimer's Disease

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD171
TITLE OF THE COURSE : HUMAN ANATOMY AND PHYSIOLOGY-I (Practical)
L:T:P :3:1:3

List of Experiments:

1. Study of tissues of human body (a) Epithelial tissue (b) Muscular tissue
2. Study of tissues of human body (a) Connective tissue (b) 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
   (a) Erythrocyte Sedimentation Rate.
   (b) Hemoglobin content of Blood.
   (c) Bleeding time & Clotting time.
8. Determination of (a) Blood Pressure (b) Blood group
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.

Text Books:

1. R.K. Goyal and N.M. Patel, Practical Anatomy Physiology and Biochemistry, B.S. Shah Prakashan, 11th Ed 2008.

Reference Books:

1. Inderbir Singh, Text Book of Human Histology with Colour Atlas, Jaypee Brothers Medical Publishers, 6th Ed, 2011.
2. Thakaore Bhai, P. Gandhi and Harit R. Derasari, Elements of Human Anatomy Physiology and Heath Education, B.S. Shah Publishers, 12th Ed, 2004.
3. Douglas E. Kelly, Richard L. Wood and Allen C. Enders, Bailey's Text Book of Microscopic Anatomy, Williams & Wilkins Publishers, 18th Ed, 1984.

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD102
TITLE OF THE COURSE : PHARMACEUTICS (Theory)
L:T: P :2:1:3

Course objectives

- To import a fundamental knowledge on the art and science of formulating dosage forms.
- To introduce basic principle of preparing various dosage forms.

Course Outcomes

- Students will know and identify the formulation aspects of different dosage forms and also do different pharmaceutical calculations.
- Able to formulate different dosage forms.

Unit- 1 **9 hrs**

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

Unit-2 **8 hrs**

2 Historical back ground and development of profession of pharmacy and pharmaceutical industry in brief.
3 Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.
4 Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.

Unit -3 **9 hrs**

5 Powders and Granules: Classification advantages and disadvantages, Preparation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules.
6 Monophasic Dosage forms: Theoretical aspects of formulation including adjuvant 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 – 4 **14 hrs**

7 Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.
8 Suppositories and pessaries: Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.
9 Galenicals: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.

Unit -5 **10 hrs**

10 Pharmaceutical calculations.

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

12 Incompatibilities:Introduction, classification and methods to overcome the incompatibilities.

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD172
TITLE OF THE COURSE : PHARMACEUTICS (Practical)
L:T:P : 2 :1:3

List of Experiments:

1. **Syrups**
   a. Simple Syrup I.P
   b. Syrup of Ephedrine Hcl NF
   c. Syrup Vasaka IP
   d. Syrup of ferrous Phosphate IP
   e. Orange Syrup
2. **Elixir**
   a. Piperizine citrate elixir BP
   b. Cascara elixir BPC
   c. Paracetamol elixir BPC
3. **Linctus**
   a. Simple Linctus BPC
   b. Pediatric simple Linctus BPC
4. **Solutions**
   a. Solution of cresol with soap IP
   b. Strong solution of ferric chloride BPC
   c. Aqueous Iodine Solution IP
   d. Strong solution of Iodine IP
   e. Strong solution of ammonium acetate IP
5. **Liniments**
   a. Liniment of turpentine IP*
   b. Liniment of camphor IP
6. **Suspensions***
   a. Calamine lotion
   b. Magnesium Hydroxide mixture BP
7. **Emulsions***
   a. Cod liver oil emulsion
   b. Liquid paraffin emulsion
8. **Powders***
   a. Eutectic powder
   b. Explosive powder
   c. Dusting powder
   d. Insufflations
9. **Suppositories***
   a. Boric acid suppositories
   b. Chloral suppositories
10. **Incompatibilities**
    a. Mixtures with Physical
    b. Chemical & Therapeutic incompatibilities

* colourless bottles required for dispensing Paper envelope (white), butter paper and white paper required for dispensing.

Text Books:

1. Carter S.J, Cooper, Gunn's - Dispensing for Pharmaceutical Students, 12th ed. CBS Publishers, New Delhi: 2000.
2. E.A.Rawlins. Bentley's text book of Pharmaceutics, 8th ed. 1997.

Reference Books:

1. L.V Allen, N.G Popovich, H.C. Ansel. Pharmaceutical Dosage form and Drug delivery system, Lippincott Williams and Wilkins, 9th ed. 2nd Indian reprint, Wolters Kluwer (India) Pvt. Ltd., New Delhi: 2011.
2. M.E. Aulton, K. Taylor. Pharmaceutics: The Science & Dosage Form Design, 2nd ed. Churchill Livingstone, Edinburgh: 2002.
3. Alfonso R. Gennaro Remington. The science and practice of pharmacy, Vol I and Vol II, 22nd edition. Edited by Allen L V, Adeboye A, Shane P D, Linda A F, Jointly published by Pharmaceutical Press and Philadelphia College of Pharmacy at University of the Sciences; 2012.

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD103
TITLE OF THE COURSE : MEDICINAL BIOCHEMISTRY (Theory)
L:T:P :3:1:3

Course objectives
- To study the principles and pathways of various biochemical processes and to understand their role in disease processes.

Course Outcomes
- Student will be able to correlate the normal and abnormal biochemical pathways in assessing the health condition of individuals.

Unit – 1 **26 hrs**

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 and diagnostic applications; Coenzymes and their biochemical role and deficiency diseases.
3 **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 -2 **10 hrs**

4 **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, hypercholesterolmiea).
5 **Biological oxidation:** Coenzyme system involved in Biological oxidation . Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC; Oxidative phosphorylation;

Unit -3 **14 hrs**

6 **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.
7 **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.
8 **Introduction to clinical chemistry: Cell**; composition; malfunction; Roll of the clinical chemistry laboratory.

Unit -4 **10 hrs**

9 **The kidney function tests:** Role of kidney; Laboratory tests for normal function includes-

a) Urine analysis (macroscopic and physical examination, quantitative and semiquantitative tests.)
b) Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid)
c) Urine concentration test
d) Urinary tract calculi. (stones)

10 **Liver function tests:** Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation.

11 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.

Unit -5 **15 hrs**

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

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

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

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD173
TITLE OF THE COURSE : MEDICINAL BIOCHEMISTRY (Practical)
L:T:P :3:1:3

Title of the Experiment:

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

** indicate major experiments & * indicate minor experiments

Text Books:

a. Harpers review of biochemistry - Martin
b. Text book of biochemistry – D.Satyanarayana
c. Text book of clinical chemistry- Alex kaplan &Laverve L.Szabo

Reference Books:

a. Principles of biochemistry -- Lehninger
b. Text book of biochemistry -- Ramarao
c. Practical Biochemistry-David T.Plummer.
d. Practical Biochemistry-Pattabhiraman.

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD104
TITLE OF THE COURSE : PHARMACEUTICAL ORGANIC CHEMISTRY (Theory)
L:T:P :3:1:3

Course objectives
- To study different chain of organic compounds with respect to their synthesis and mechanism.

Course Outcomes
- The students will be able to understand the chemistry of organic compounds.

Unit -1

1. General organic chemistry: 8 hrs

(a) Scope, definition and classification.

(b) IUPAC Nomenclature of aliphatic and aromatic organic compounds belonging to the Following classes: alkanes,cycloalkanes, alkenes, alkynes, alcohols, aldehydes, ketones, amides, Amines, phenols, alkyl halides,Ethers, carboxylic acids, esters, acid chlorides and acid anhydrides.

2. Structure and physical properties: 4 hrs

a) Polarity and Dipole moment, Hydrogen bonding and its applications,SP^3,SP^2 and SP Hybridization , Inductive effect, Mesomeric effect, Resonance effect, Protic and aprotic solvents.

b)An introduction to Isomerism- Definition, Classification of structural and stereo isomerism

c) Definition of Electrophiles and Nucleophiles with examples.

3. a) Definition ,formation, classification and stability of free radicals **3 hrs**

b) Free radical chain reactions of alkanes and their mechanism, relative reactivity and stability.

Unit -2

4. a) Definition ,formation, classification and stability of carbocations, Preparation methods of Alkyl halides **8 hrs**

b) Nucleophilic aliphatic substitution mechanism: Nucleophiles and leaving groups, kinetics of first and second order reaction. Mechanism, Stereochemistry of SN_2 and SN_1reaction, Rearrangement of carbocation, N_2 versus SN_1 reactions, Factors Affecting SN_2 and SN_1 reaction

5. Elimination reactions: 7 hrs

Dehydrohalogenation of alkyl halides: 1, 2 elimination, kinetics, E_2 and E_1 mechanisms, E_2 versus E_1 , elimination versus substitution. Dehydration of alcohols and its mechanism, orientation and reactivity in E_1 and E_2 reactions. Saytzeff 's and Hoffman's elimination**.**

Unit -3

6. a) Alicyclic compounds: Preparation of cycloalkanes like propane,Butane,Pentane and Hexane. Bayer's strain theory, theory of Stainless ring, molecular orbital concept. **4 hrs**

7. Electrophilic addition: Reactions at carbon-carbon double bond, hydrogenation and it's mechanism Markovnikov's rule, addition of hydrogen halides, Addition of hydrogen bromides-peroxide effect. Electrophilic addition mechanism. **6 hrs**

b) Definition, formation, classification and stability of carbenes, Mechanism of cycloaddition reactions with examples. Addition of carbenes to alkenes, Diel's Alder reaction**.** **1 hr**

8. (a) conjugated dienes, mechanisms of 1,2 and 1,4-additions with examples, effect of temperature on 1, 2 and 1,4 addition

(b) Formation and orbital picture of allyl radical, Free radical substitution in alkenes**.** **2 hrs**

Unit -4

9. Electrophilic aromatic substitution; Aromaticity of Benzene,. Huckels rule. Effect of substituent groups, determination of orientation, and relative reactivity, classification of substituent groups.Theory of reactivity, Theory of orientation. Mechanism of nitration, sulphonation, halogenation, Friedel Craft's alkylation and Friedel Craft's acylation, Orientation in disubstituted benzenes **10 hrs**

10. a) Definition ,formation, classification and stability of carbanions. **7 hrs**

b) Nucleophilic additions in aldehydes and ketones, mechanisms with examples. Reactions of Grignard reagent. Aldol and crossed Aldol condensation,Claisen condensation, Cannizaro and crossed Cannizaro reaction, Benzoin's, Perkins, Knoevenagels and Reformatsky reaction

Unit -5

11. Carboxylic acids - Ionization of carboxylic acids, acidity of constant, acidity of carboxylic acids, structure of carboxylate ion, effect of substituent on acidity of carboxylic acids, Conversion of carboxylic acids into acid chloride, ester, amide and anhydrides. **6 hrs**

12. Amines –

a) Basicity of Amines, effect of substituents on basicity of aliphatic and Aromatic amine **1 hrs**

b) Definition ,formation, classification,stability and reactivity of nitrenes. **3 hrs**

Hofmann's, Beckmanns, Curtius, Smith, rearrangement with their mechanism

c) Diazotisation and its mechanism,Significance of intermediates in synthetic chemistry. Sandmeyers and Gattermann reaction, coupling reaction of Diazonium salts with phenols and amines **2 hrs**

13. Phenols – Acidity of phenols, effect of substituent on acidity of phenols. Kolbe's reaction, Reimer - Tiemann reaction, Fries rearrangement and Willliamson's synthesis **2 hrs**

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD174
TITLE OF THE COURSE : PHARMACEUTICAL ORGANIC CHEMISTRY (Practical)
L:T:P :3:1:3

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

1. Acetanilde / aspirin (Acetylation)
2. Benzanilide / Phenyl benzoate (Benzoylation)
3. P-bromo acetanilide / 2,4,6 – tribromo aniline (Bromination)
4. Dibenzylidene acetone (Condensation)
5. 1-Phenylazo-2-napthol (Diazotisation and coupling)
6. Benzoic acid / salicylic acid (Hydrolysis of ester)
7. M-dinitro benzene (Nitration)
8. 9, 10 – Antharaquinone (Oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde
9. M-phenylene diamine (Reduction of M-dinitrobenzene) / Aniline from nitrobenzene
10. Benzophenone oxime
11. Nitration of salicylic acid
12. Preparation of picric acid
13. Preparation of O-chlorobenzoic acid from O-chlorotolune
14. Preparation of cyclohexanone from cyclohexanol

II. Identification of organic compounds belonging to the following classes by

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

III. Introduction to the use of stereo models:

Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene, inversion of configuration.

Text Books:

1. T.R.Morrison and R.Boyd, Text of Organic Chemistry, 6th edition Prentice Hall of India Pvt. Ltd., New Delhi.
2. A text book of organic chemistry by Arun Bhal & B.S. Bhal, S.Chand & Company Pvt Ltd. revised edition

Reference Books:

1. I. L. Finar Organic Chemistry, the Fundamentals of Chemistry. Lingman Publishers Vol-1, 6th edition.
2. Bentley and Driver's textbook of Pharmaceutical Chemistry. L.M. Atherden, 8th edition.
3. T.W.Graham Solomons, Fundamentals of Organic Chemistry, John Wiley & Sons Inc., USA, 5th edition.

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD105
TITLE OF THE COURSE : PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)
L:T:P :3:1:3

Course objectives

- To analyze the purity of the given inorganic sample by limit test and different types of volumetric assay.
- Standardization of secondary standard solution.
- To learn the applications of inorganic substances in the field of pharmacy.

Course Outcomes

- At the end of the course, the students will be able to analyze the inorganic samples for their purity.
- Students will be able to determine the normality / molarity of the given secondary standard solution.
- The students will be able to understand the use of various inorganic substances in pharmacy.

Unit -1

1. **Impurities: 12 hrs**
   a. Sources and effects of impurities in Pharmacopoeial substances, importance of limit test, general principles and procedures for limit tests for chloride, sulphate, iron, arsenic, lead and heavy metals.
   b. Modified procedures for limit tests for chlorides and sulphates in Potassium permanganate, sodium bicarbonate and sodium salicylate.

   NOTE: Definitions, General methods of preparation, Assays (marked by *), storage conditions and medicinal use of inorganic compounds belonging to the below classes.

Unit -2

2. **Gastrointestinal agents 10 hrs**
   a. **Acidifiers:** Dilute HCl, ammonium chloride
   b. **Antacids:** Classification of antacids, Ideal properties of antacids, combination therapy, Aluminium hydroxide gel*, Calcium carbonate, Sodium bicarbonate, Magnesium trisilicate, Magnesium carbonate (light and heavy), Magnesium hydroxide* mixture
   c. **Protective and adsorbents:** Kaolin and Talc,
   d. **Laxatives, Purgatives and Cathartics:** Magnesium sulphate and Sodium sulphate.

3. **Dental products: 3 hrs**
   Dentifrices, anticaries agents, desensitizing agents, calcium carbonate, sodium fluoride, Stannous fluoride, Zinc chloride, Zinc eugenol cement.

4. **Expectorants: 1 hr**
   Ammonium chloride(Formal method)*, Potassium iodide, Potassium citrate

Unit -3

5. **Haematinics: 2 hrs**
   Ferrous sulphate*, ferrous gluconate, ferrous fumarate, Iron dextran injection, Iron and Ammonium citrate.

6. **Emetics:** **1 hr**
   Copper sulphate*, antimony potassium tartrate

7. **Antidotes:** **1 hr**
   Definition, classification and mode of action-Sodium thiosulphate, charcoal, (activated), sodium nitrate

8. **Pharmaceutical Aids:** **2 hrs**
   Definition and classification bentonite, barium sulphate, magnesium stearate, phenyl mercuric acetate, sodium benzoate*
9. **Antioxidants:** **1 hr**
   Definition, sodium metabisulphite.

10. **Sedatives**: **1 hr**
    Classification, difference between sedatives & hypnotics, potassium bromide.

11. **Respiratory stimulant:** Ammonium carbonate. **1 hr**

12. **Topical agents and Dermatological preparations:** **3 hrs**
    a. **Protective:** Zinc oxide*/calamine, xinc stearate,
    b. **Antimicrobials:** Potassium permanganate, chlorinated lime, iodine preparations, boric acid, borax, hydrogen peroxide*

13. **Errors:** **3 hrs**
    Errors in quantitative analysis, classification of errors, concept of accuracy and precision, methods of minimizing errors.

Unit -4

14. Volumetric Analysis **19 hrs**

a. **Titrimetric analysis:** fundamentals and classification.
b. Definition of titration, titrant, Titrand, equivalence point, end point, indicators, Equivalent weight, primary standard and secondary standardswith examples and their properties. Various methods of expressing concentration of primary and secondary standard substance. pH& Buffer system.
c. **Neutralisation titrations:** Examples of neutralization titrations, indicators choice of indicators, theory of indicators, neutralization curves, method of preparation, Standardization and Storage of oxalic acid, sodium hydroxide, hydrochloric acid
d. **Non-Aqueous titrations:** Theory of non-aqueous titrations, classification of solvents used in non-aqueous titrations, levelling and differentiating effects. Estimation of Sodium Benzoate, Perchloric acid, lithium, sodium methoxide and tetra butyl ammonium hydroxide by non-aqueous titrations
e. **Redox titrations:** Principle of redox titrations, Concepts of oxidation and reduction. Redox reactions, strength and equivalent weights of oxidizing and reducing agents, Preparation, standardization and storage of various volumetric solutions such as sodium thiosulfate, ceric ammonium sulphate, potassium permanganate and Iodine solution, theory of Iodometry, Iodimetry, bromometry, titrations with potassium iodate, potassium bromate, 2,6-dichlorophenol indophenols.

f. **Precipitation titrations:** different methods-Mohr's, Modified Mohr's, Volhard's, Modified Volhard's, Fajan's with example, detection of end point.

g. **Complexometric titrations:** Ligands and their classification, principles of Complexometric titrations, indicators, different types of Complexometric titrations (Direct titration, back titration replacement titration, indirect titration), estimation of calcium gluconate*, end point detection, pM indicators, masking and demasking agents.

Unit -5

15. Gravimetry **2 hrs**

Basic concepts, precipitation techniques, co-precipitation, post-precipitation, various steps involved in gravimetric analysis, pharmaceutical analysis.

16. Radio Pharmaceuticals: **3 hrs**

Nuclear radiopharmaceuticals, reactions, Nomenclature, Methods of obtaining their standards and units of activity, measurements of activity, clinical applications and dosage, hazards and precautions.

17. Major intra and extra cellular electrolytes: **6 hrs**

Major physiological ions and electrolytes used for replacement therapy, physiological acid base balance, electrolyte combination therapy, ORS, Sodium chloride* injection, Dextrose and Sodium chloride injection, Calcium gluconate injection

18. Medicinal Gases: **2 hrs**

Ideal properties of Oxygen, Nitrous oxide, Carbon dioxide, Helium, Nitrogen

SEMESTER / YEAR : I YEAR
COURSE CODE : 15PD175
TITLE OF THE COURSE : PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)
L:T:P : 3:1:3

1. **Limit test (6 exercises)**
    a. Limit test for chlorides
    b. Limit test for sulphates
    c. Limit test for iron
    d. Limit test for heavy metals
    e. Limit test for arsenic
    f. Modified limit tests for chlorides and sulphates

2. **Assays (10 exercises)**
    a. Ammonium chloride- Acid-base titration
    b. Ferrous sulphate- Cerimetry
    c. Copper sulpahte- Iodometry
    d. Calcilugluconate- Complexometry
    e. Hydrogen peroxide – Permanganometry
    f. Sodium benzoate – Nonaqueous titration
    g. Sodium chloride – Modified volhard's method
    h. Assay of KI – KIO_3 titration
    i. Gravimetric estimation of barium as barium sulphate
    j. Sodium antimony gluconate or antimony potassium tartarate

3. **Estimation of mixture (Any two exercises)**
    a. Sodium hydroxide and sodium carbonate
    b. Boric acid and Borax
    c. Oxalic acid and sodium oxalate

4. **Test for identity (Any three exercises)**
    a. Sodium bicorbonate
    b. Barium sulphate
    c. Ferrous sulphate
    d. Potassium chloride

5. **Test for purity (Any two exercises)**
    a. Swelling power in Bentonite
    b. Acid neutralising capacity in aluminium hydroxide gel
    c. Ammonium salts in potash alum
    d. Adsorption power heavy Kaolin
    e. Presence of Iodates in KI

6. **Preparations (Any two exercises)**
    a. Boric acids
    b. Potash alum
    c. Calcium lactate
    d. Magnesium suphate

Text Books:

1. A text book Inorganic medicinal chemistry by Surendra N. Pandeya
2. Pharmaceutical Inorganic Chemistry by GR.Chatwal
3. Inorganic Pharmaceutical Chemistry by Anand&Chetwal

Reference Books: (Latest Edition)

1. Beckett AH, Stenlake JB. Practical pharmaceutical chemistry Vol I & II. 4th ed. London;Stahlone Press of University of London.
2. Pandey OP, Bajpai DN, Giri S. Practical Chemistry. S Chand Publishers.
3. Shah, Qadry. Textbook of inorganic pharmaceutical chemistry.
4. Indian Pharmacopoeia. 3rd & 4th eds. Delhi: The Controller of Publications, Ministry of Health and Family welfare, Govt. of India;
5. USP and BP
6. Vogel's textbook of quantitative chemical analysis 5th ed.

SEMESTER / YEAR : II YEAR
COURSE CODE : 15PD201
TITLE OF THE COURSE : PHARMACOLOGY I (Theory)
L:T:P :3:1:0

Course objectives

- Students will provide an opportunity to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs.
- Drugs acting on autonomic nervous system, cardiovascular system, central nervous system, blood and blood forming agents and renal system will be taught.
- the basic practical knowledge relevant to therapeutics will be imparted

Course Outcomes

- understand the pharmacological aspects of drugs falling under the above mentioned chapters;
- appreciate the importance of pharmacology subject as a basis of therapeutics;
- correlate and apply the knowledge therapeutically.

Unit -1

1. **General Pharmacology** **15 hrs**
   a) Introduction, definitions and scope of pharmacology
   b) Routes of administration of drugs
   c) Pharmacokinetics (absorption, distribution, metabolism and excretion)
   d) Pharmacodynamics
   e) Factors modifying drug effects
   f) Drug toxicity - Acute, sub- acute and chronic toxicity.
   g) Pre-clinical evaluations
   h) Drug interactions

   Note: The term Pharmacology used here refers to the classification, mechanism of action, pharmacokinetics, pharmacodynamics, adverse effects, contraindications, Therapeutic uses, interactions and dose and route of administration.

Unit -2

2. **Pharmacology of drugs acting on ANS** **12 hrs**
   a) Adrenergic and antiadrenergic drugs
   b) Cholinergic and anticholinergic drugs
   c) Neuromuscular blockers
   d) Mydriactics and miotics
   e) Drugs used in myasthenia gravis
   f) Drugs used in Parkinsonism

Unit -3

3. **Pharmacology of drugs acting on cardiovascular system 13 hrs**
   a) Antihypertensives
   b) Anti-anginal drugs
   c) Anti-arrhythmic drugs
   d) Drugs used for therapy of Congestive Heart Failure
   e) Drugs used for hyperlipidaemias

Unit -4

4. **Pharmacology of drugs acting on Central Nervous System 20 hrs**
   a) General anesthetics
   b) Sedatives and hypnotics
   c) Anticonvulsants
   d) Analgesic and anti-inflammatory agents
   e) *Psychotropic drugs*
   f) Alcohol and methyl alcohol
   g) CNS stimulants and cognition enhancers
   h) Pharmacology of local anaesthetics

5. **Pharmacology of Drugs acting on Respiratory tract 5 hrs**
   a) Bronchodilators
   b) Mucolytics
   c) Expectorants
   d) Antitussives
   e) NasalDecongestants

Unit -5

6. **Pharmacology of Hormones and Hormone antagonists 5 hrs**
   a) Thyroid and Antithyroid drugs
   b) Insulin, Insulin analogues and oral hypoglycemic agents
   c) Sex hormones and oral contraceptives
   d) Oxytocin and other stimulants and relaxants
7. **Pharmacology of autocoids and their antagonists 5 hrs**
   a) Histamines and Antihistaminics
   b) 5-Hydroxytryptamine and its antagonists
   c) Lipid derived autocoids and platelet activating factor

Text Books:

a. Tripathi, K. D. Essentials of medical pharmacology. 4th Ed, 1999. Publisher: Jaypee, Delhi.
b. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. 16th edition (single volume), 1999. Publisher: Popular, Dubai.
c. Rang, H.P. & Dale, M.M. Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.

Reference Books:

a. 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.
b. Craig, C.R.&Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown.Co
c. Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher: Prentice Hall, Int.
d. Shargel and Leon. Applied Biopharmaceutics and pharmacokinetics. Latest edition. Publisher: Prentice Hall, London.

SEMESTER / YEAR : II YEAR
COURSE CODE : 15PD202
TITLE OF THE COURSE : PHARMACEUTICAL MICROBIOLOGY (Theory)
L:T:P :3:1:3

Course objectives

- Develop a thorough knowledge of application of microbiology with relevance to pharmaceutical industry which involves study of bacteria, fungi and virus.
- Provide conceptual understanding of the various aspects of aseptic techniques and production of sterile immunological products.
- Recent advances in Biotechnology.

Course Outcomes

- Students will be able to isolate and identify sources of microbial contamination in pharmaceutical products.
- Demonstrate a critical awareness of recent techniques applicable to research in pharmaceutical biotechnology and their roles in effective therapeutic treatment.

Unit -1 **15 hrs**

1 Introduction to the science of microbiology. Major divisions of microbial world and Relationship among them.

2 Different methods of classification of microbes and study of Bacteria, Fungi, Virus, Rickettsiae, Spirochetes.

Unit – 2 **15hrs**

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

4 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 -3 **15 hrs**

5 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.

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

Unit – 4 **15 hrs**

7 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.

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

Unit – 5 **15 hrs**

9 Microbial culture sensitivity Testing: Interpretation of results Principles and methods of different microbiological assays, microbiological assay of Penicillin, Streptomycin and vitamin B_2 and B_{12}. Standardisation of vaccines and sera.

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

SEMESTER / YEAR : II YEAR
COURSE CODE : 15PD272
TITLE OF THE COURSE : PHARMACEUTICAL MICROBIOLOGY (Practical)
L:T:P :3:1:3

Title of the Experiment:

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*.
3 Enumeration of micro-organisms (Total and Viable)*
4 Study of the methods of isolation of pure culture.*
5 Bio chemical testing for the identification of micro*-organisms.
6 Cultural sensitivity testing for some micro-organisms.*
7 Sterility testing for powders and liquids.*
8 Determination of minimum inhibitory concentration.*
9 Microbiological assay of antibiotics by cup plate method.*
10 Microbiological assay of vitamins by Turbidometric method**
11 Determination of RWC.**
12 Diagnostic tests for some common diseases, Widal, malarial parasite.**

* Indicate minor experiment & ** indicate major experiment

Text Books:

a. Vanitha Kale and Kishor Bhusari — Applied Microbiology || Himalaya Publishing house Mumbai.
b. Mary Louis Turgeon — Immunology and Serology in Laboratory Medicines|| 2nd edition, 1996 Mosby- Year book inc St. Louis Missouri 63146.
c. Harsh Mohan, — Text book of Pathology|| 3rd edition, 1998, B-3 Ansari road Darya ganj N. Delhi.

Reference Books:

a. Prescot L.M., Jarley G.P Klein D.A —Microbiology|| 2nd- edition Mc Graw Hill Company Inc
b. Rawlins E.A.||Bentley's Text Book of Pharmaceutics|| B ailliere Tindals 24-28 London 1988
c. Forbisher — Fundamentals of Microbiology|| Philidelphia W.B. Saunders.
d. 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, Mosbyyear book Europe Ltd, London.
f. Pharmacopoeia of India, Govt of India, 1996.

SEMESTER / YEAR : II YEAR
COURSE CODE : 15PD203
TITLE OF THE COURSE : PHARMACOGNOSY & PHYTOPHARMACEUTICALS (Theory)
L:T:P :3:1:3

Course objectives

- Students will be aware of 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.

Course Outcomes

- understand the basic principles of cultivation, collection and storage of crude drugs;
- know the source, active constituents and uses of crude drugs; and
- appreciate the applications of primary and secondary metabolites of the plant.

Unit -1 **10 hrs**

1 Introduction.
2 Definition, history and scope of Pharmacognosy.
3 Classification of crude drugs.

Unit -2 **15 hrs**

4 Cultivation, collection, processing and storage of crude drugs.
5 Detailed method of cultivation of crude drugs.
6 Study of cell wall constituents and cell inclusions.

Unit -3 **20 hrs**

7 Microscopical and powder Microscopical study of crude drugs.
8 Study of natural pesticides.

Unit -4 **20 hrs**

9 Detailed study of various cell constituents.
10 Carbohydrates and related products.
11 Detailed study carbohydrates containing drugs.(11 drugs)
12 Definition sources, method extraction, chemistry and method of analysis of lipids.
13 Detailed study of oils.

Unit -5 **10 hrs**

14 Definition, classification, chemistry and method of analysis of protein.

15 Study of plants fibers used in surgical dressings and related products.
16 Different methods of adulteration of crude drugs.

SEMESTER / YEAR : II YEAR
COURSE CODE : 15PD271
TITLE OF THE COURSE : PHARMACOGNOSY & PHYTOPHARMACEUTICALS (Practical)
L:T:P :3:1:3

List of experiments:

Introduction of Pharmacognosy laboratory and experiments.

1. Study of cell wall constituents and cell inclusions.
2. Macro, powder and microscopic study of Datura.
3. Macro, powder and microscopic study of Senna.
4. Macro, powder and microscopic study of Cassia.cinnamon.
5. Macro, powder and microscopic study of Cinchona.
6. Macro, powder and microscopic study of Ephedra.
7. Macro, powder and microscopic study of Quassia.
8. Macro, powder and microscopic study of Clove
9. Macro, powder and microscopic study of Fennel.
10. Macro, powder and microscopic study of Coriander.
11. Macro, powder and microscopic study of Isapgol.
12. Macro, powder and microscopic study of Nux vomica.
13. Macro, powder and microscopic study of Rauwolfia.
14. Macro, powder and microscopic study of Liquorice.
15. Macro, powder and microscopic study of Ginger.
16. Macro, powder and microscopic study of Podophyllum.
17. Determination of Iodine value.
18. Determination of Saponification value and unsaponifiable matter.
19. Determination of ester value.
20. 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) 27 Chemical tests for Gelatin.

Text Books:

a. Pharmacognosy by G.E. Trease & W.C.Evans.
b. Pharmacognosy by C.K.Kokate,Gokhale & A.C.Purohit.

Reference Books:

a. Pharmacognosy by Brady &Tyler.E.
b. Pharmacognosy by T.E.Wallis.
c. Pharmacognosy by C.S. Shah & Qadery.
d. Pharmacognosy by M.A. Iyengar.

SEMESTER / YEAR : II YEAR
COURSE CODE : 15PD204
TITLE OF THE COURSE : COMMUNITY PHARMACY (Theory)
L:T:P :2:1:0

Course objectives

- Students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling, health screening services for improved patient care in the community set up.

Course Outcomes

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

Unit -1 **7 hrs**

1. Definition, scope, of community pharmacy, Roles and responsibilities of Community pharmacist
2. Community Pharmacy Management
   a) Selection of site, Space layout, and design
   b) Staff, Materials- coding, stocking
   c) Legal requirements
   d) Maintenance of various registers
   e) Use of Computers: Business and health care soft wares

Unit – 2 **5 hrs**

3. Prescriptions – parts of prescription, legality & identification of medication related problems like drug interactions.
4. Inventory control in community pharmacy Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock

Unit -3 **10 hrs**

5. Pharmaceutical care Definition and Principles of Pharmaceutical care.
6. Patient counselling Definition, outcomes, various stages, barriers, Strategies to overcome barriers Patient information leaflets- content, design, & layouts, advisory labels Patient medication adherence Definition, Factors affecting medication adherence, role of pharmacist in improving the adherence.
7. Health screening services Definition, importance, methods for screening Blood pressure/ blood sugar/ lung function and Cholesterol testing

Unit -4 **15 hrs**

8. OTC Medication- Definition, OTC medication list & Counselling
9. 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 –5 **13 hrs**

10. Responding to symptoms of minor ailments
    Relevant pathophysiology, common drug therapy to Pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhea, constipation), Pyrexia, Opthalmic symptoms, worms infestations.
11. Essential Drugs concept and Rational Drug Therapy Role of community pharmacist
12. Code of ethics for community pharmacists

Text Books:

a. Health Education and Community Pharmacy by N.S.Parmar.
b. WHO consultative group report.
c. Drug store & Business management by Mohammed Ali & Jyoti.

Reference Books:

a. Handbook of pharmacy – health care.Edt. Robin J Harman. The Pharmaceutical press.
b. Comprehensive Pharmacy Review – Edt. Leon Shargel. Lippincott Williams & Wilkins.

SEMESTER / YEAR : II YEAR
COURSE CODE : 15PD205
TITLE OF THE COURSE : PATHOPHYSIOLOGY (Theory)
L:T:P :3:1:0

Course objectives

- To objective of this course is to provide graduate level instruction in pathophysiology: the study of biochemical and structural and functional changes in cells, tissues and organs which causes or caused by the diseases. The course is designed for graduate students training for a career in biomedical research.

Course Outcomes

- The outcome of the course will be expand and extend the students knowledge of normal structure and function, into the realm of diseases processes. The course also provides a foundation for understanding the medical science literature.

Unit – 1

Cell Injury, Inflammation & Shock **16 hrs**

A i.) Definition of pathology, health and disease. Terminologies used in pathology.
ii) Basic principles of cell injury and adaptation: Causes, pathogenesis and morphology of cell injury, Cellular adaptation's - physiologic and pathologic adaptations, Cellular ageing and death, Antioxidant enzymes-superoxide dismutase, catalase and glutathione peroxidase.

B Inflammation:

i) Definition, causes, signs ,types of inflammation and chemical-mediators.
ii) Pathogenesis of acute inflammation (vascular events, Cellular events, transdate, exudate, edema, phagocytosis).
iii) Pathogenesis of chronic-inflammation and difference between acute and chronic inflammation.
iv) Tissue renewal and repair: regeneration healing and fibrosis
v) Wound healing: process of wound healing, types of cells, factors influencing healing of wounds. Mechanism of repair

C. Shock:

Types, mechanism, stages and Management

Unit -2

A. Diseases of Immunity & Hypersensitivity **12 hrs**

Components of the immune system:

i) Cells involved in immune response- T and B cells, Macrophages, dendritic cells and Natural killer cells.
ii) MHC proteins or transplantation antigens.
iii) Immune Tolerance

B. Auto-immunity:

i.) Mechanism of Autoimmunity.
ii.) Classification of autoimmune diseases in man.
iii.) Transplantation rejection (types and mechanisms).

C. Acquired Immune Deficiency Syndrome (AIDS)

D. Hypersensitivity:

i) Hypersensitivity type I, II, III, IV
ii) Biological significance of hypersensitivity.
iii) Allergy due to food, chemicals and drugs.

Unit – 3

A. Environmental Factors & Cancer: **15 hrs**

i.) General aspects of neoplasia, Definition, terminology, Differences between benign and malignant tumors
ii.) Etiology and pathogenesis of cancer
iii.) General biology and classification of malignant tumors
iv.) Invasions and metastasis of cancer

B. Biological effects of radiation:

Introduction on radiation, strength of radiation, mechanism of action

of ionizing and non-ionizing radiations and their toxic effects.

C. Environment and Nutritional diseases:

i) Obesity
ii) Malnutrition
iii) Pathogenesis of deficiency diseases with special reference to vitamins and minerals
iv) Air pollution and smoking — SO_2, NO and CO

Unit- 4

A. Pathophysiology of non-infectious diseases (etiology, pathogenesis, signs and symptoms) **16 hrs**

i) Peptic ulcer and inflammatory bowel disease
ii) Gastritis
iii) Hypertension
iv) Angina
v) Myocardial Infarction
vi) Congestive cardiac failure
vii) Atherosclerosis
viii) Stroke (Ischemic and Hemorrhage)
ix) Diabetes Mellitus
x) Hypo and hyperthyroidism

xi) Cirrhosis and Alcoholic liver diseases
xii) Asthma and chronic obstructive airway diseases
xiii) Parkinsonism
xiv) Schizophrenia, Depression and Mania
xv) Alzheimer's disease
xvi) Acute and chronic renal failure

Unit - 5

Genetics & Infectious disorders **16 hrs**

A Pathophysiology (causative organisms, mode of transmission, pathogenesis, signs and symptoms)

Hepatitis - infective hepatitis, Sexually transmitted diseases (Syphilis, Gonorrhea), Pneumonia, Typhoid, Urinary tract infections, Tuberculosis, Leprosy, Malaria, Dysentery (Bacterial and amoebic), Dengue and Chikungunya.

B. Genetics and chromosomal disorders:

Mendelian disorders, Cytogenic disorders (Karyotypic abnormalities)

Text Books:

a. Pathologic basis of disease by- Cotran, Kumar, Robbins
b. Text book of Pathology- Harsh Mohan
c. Text book of Pathology- Y.M. Bhinde

Reference Books:

a. Clinical Pharmacy and Therapeutics; Second edition; Roger Walker; Churchill Livingstone publication

SEMESTER / YEAR : II YEAR
COURSE CODE : 15PD206
TITLE OF THE COURSE : PHARMACOTHERAPEUTICS I (Theory)
L:T:P :3:1:3

Course objectives

- to impart knowledge and skills necessary forcontribution to quality use of medicines.
- cover briefly pathophysiology and mostly therapeutics of various diseases.
- Students will be able to understand the pathophysiology of common diseases and their management.

Course Outcomes

- the pathophysiology of selected disease states and the rationale for drug therapy;
- the therapeutic approach to management of these diseases; &the controversies in drug therapy;
- the importance of preparation of individualised therapeutic plans based on diagnosis;
- summarise the therapeutic approach to management of these diseases including reference to the latest available evidence.

Etiopathogenesis and pharmacotherapy of diseases associated with following systems/ diseases

Unit-1 **30 hrs**

1 **Cardiovascular system:** Hypertension, Congestive cardiac failure, Angina Pectoris, Myocardial infarction, Hyperlipidaemias, Electrophysiology of heart and Arrhythmias

Unit – 2 **23 hrs**

2 **Respiratory system :** Introduction to Pulmonary function test, Asthma, Chronic obstructive airways disease, Drug induced pulmonary diseases **Endocrine system:** Diabetes, Thyroid diseases, Oral contraceptives, Hormone replacement therapy, Osteoporosis

Unit – 3 **I7 hrs**

3 **General prescribing guidelines for**

a. Paediatric patients
b. Geriatric patients
c. Pregnancy and breast feeding

Unit – 4 **6 hrs**

4 **Ophthalmology:** Glaucoma, Conjunctivitis- viral & bacterial

Unit -5 **9 hrs**

5 **Introduction to rational drug use** Definition, Role of pharmacist Essential drug concept Rational drug formulations

SEMESTER / YEAR : II YEAR
COURSE CODE : 15PD273
TITLE OF THE COURSE : PHARMACOTHERAPEUTICS I (Theory)
L:T:P :3:1:3

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.

Text Books:

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

Reference Books:

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

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD301
TITLE OF THE COURSE : PHARMACOLOGY II (Theory)
L:T:P :3:1:3

Course Objectives This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, drugs acting on autacoids, respiratory system, GIT, immune system and hormones, and pharmacology of autocoids and hormones will be concentrated. In addition, pharmacology of chemotherapeutic agents, vitamines, essential minerals and principles of toxicology are also taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.

Course Outcomes

a. understand the pharmacological aspects of drugs falling under the above mentioned chapters,
b. carry out the animal experiments confidently,
c. appreciate the importance of pharmacology subject as a basis of therapeutics, and
d. correlate and apply the knowledge therapeutically.

Unit - 1

Chemotherapy

a. Introduction
b. Sulphonamides and Co-trimoxazole
c. Penicillins and Cephalosporins
d. Tetracyclines and Chloramphenicol
e. Macrolides, Aminoglycosides, Plyenes and Polypeptides antibiotics
f. Quinolones and Fluroquinolones
g. Antifungal antibiotics
h. Antiviral agents
i. Chemotherapy of Malaria
j. Chemotherapy of Protozoal infections (Amoebiasis, Giardiasis)
k. Pharmacology of Anthelmintic drugs
l. Chemotherapy of Cancer

UNIT - 2

Pharmacology of drugs acting on Blood and Blood forming agents

a. Anticogulants
b. Thrombolytics and antiplatelet agents

c. Haemopoietics and plasma expanders

Pharmacology of drugs acting on Renal system

a. Diuretics
b. Antidiuretics

Immunopharmacology

Pharmacology of Immunosuppressants and stimulants

UNIT -3

Principles of Animal toxicology: Acute, Subacute and Chronic toxicity.

The dynamic cell: The structure and functions of the components of the cell

a. **Cell and macromolecules**: Cellular classification, subcellular orgenelles, macromolecules, large macromolecular assemblies
b. **Chromosome structure:** Pro and eukaryotic chromosome stractures, chromatin structure, genome complexity, the flow of genetic information.
c. **DNA replication:** General, bacterial and eukoryotic DNA replication.
d. **The cell cycle**: Restriction point, cell cycle regulators and modifiers.
e. **Cell signaling**: Communication between cells and their environment, ion channels, signal transduction pathways (MAP kinase, P38 kinase, JNK, Ras and P13-kinase pathways, biosensors.

Unit - 4

The Gene: Genome structure and function:

a. Gene structure: Organization and elucidation of genetic code.
b. The Gene expression: Expression systems (pro and eukaryotic), genetic elements that control gene expression (nucleosomes, histone, acetylation, HDACS, DNA binding protein families).
c. Transcription and Transcription factors: Basic principles of transcription in pro and eukayotes.

Unit - 5

RNA processing: rRNA, tRNA and mRNA processing.

Protein synthesis: Mechanism of protein synthesis, intiation in eukaryotes, translation control and post- translation events.

Altered gene functions: Mutations, deletions, amplifications, LOH, translocations, trinucleotide repeats and other genetic abnormalities. Oncogenes and tumor suppressor genes. The gene sequencing, mapping and cloning of human disease genes. Introduction to gene therapy and targeting.

Recombinant DNA technology: Principles, processes (gene transfer technology) and applications.

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD371
TITLE OF THE COURSE : PHARMACOLOGY II (Practical)
L:T:P :3:1:3

List of Experiments:

1. Study of laboratory animals and their handling (a. Frogs, b. Mice, c. Rats, d. Guinea pigs, e. 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:

    a) Analgesic property of drug using analgesiometer.
    b) Antiinflammatory effect of drugs using rat-paw edema method.
    c) Anticonvulsant activity of drugs using maximal electroshock and pentylene tetrazole methods.
    d) Antidepressant activity of drugs using pole climbing apparatus and pentobarbitone induced sleeping time methods.
    e) Locomotor activity evaluation of drugs using actophotometer and rotorod.
    f) Cardiotonic activity of drugs using isolated frog heart and mammalian heart preparations.

References Books:

Molecular biology of the Cell by B. Bray, D . Lewis and Watson, JD, 3rd Edition.
Molecular biology by Lodish et al., 5th edition.
Molecular biology by Turner., 2nd edition.

Genes VIII by Lewin, B (2004)
Pharmaceutical Biotechnology, by Crommelin (1997)
Recombinant DNA by Watoson et al., (1996)
Biopharmaceutical : Biochemistry and Biotechnology by Walsh G., (1998).

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD302
TITLE OF THE COURSE : PHARMACEUTICAL ANALYSIS (Theory)
L:T:P :3:1:3

Course objectives	This subject is designed to impart fundamental knowledge on the testing of drugs by various instrumental methods of analysis. This course is to give thorough understanding of the spectroscopy and chromatographic techniques.
Course Outcomes	To understand the component and working of various analytical instruments. Shall be able to analyze the drugs by using above instruments.

Unit-1
1.Spectroscopy:

Theoretical aspects, instrumentation, elements of interpretation of data/spectra and application of analytical techniques be discussed on:

a. **Absorption Spectroscopy:**

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

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.

b. **Infrared Spectroscopy**:

Vibrational transitions, frequency – structure correlations, Infrared absorption bands, Instrumentation–IR spectrometer– 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.

Unit - 2
2.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.

a.**Column Chromatography**: Adsorption column chromatography, Operational technique, frontal analysis and elution analysis. Factors affecting column efficiency, applications and partition chromatography.

b. **TLC**: Introduction, principle, techniques, Rf value and applications.

c. **PC:** Introduction, principle, types of paper chromatography, preparation techniques, development techniques, applications.

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

e. **Electrophoresis**: Principles of separation, equipment for paper and gel electrophoresis, and application.

f. **HPLC**: Introduction, theory, instrumentation, and applications.

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

Unit - 3

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

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

c. **Atomic Absorption Spectrometry:** Introduction, Theory, types of electrodes, instrumentation and applications.

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

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

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

g.Polarimetry: (Introduction only) – Introduction to optical rotatory dispersion, circular dichroism, polarimeter.

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

Unit - 4

4. Electrometric Methods:

Theoretical aspects, instrumentation, interpretation of data/spectra and analytical applications be discussed on the following topics.

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

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

c. **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.

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

Unit - 5

5. i **Quality Assurance:**

Introduction, sources of quality variation, control of quality variation.

a. Concept of statistical quality control.

b. Validation methods- quality of equipment, validation of equipment and validation of analytical instruments and calibration.

c. GLP, ISO 9000.

d. Total quality management, quality review and documentation.

e. ICH- international conference for harmonization-guidelines.

f. Regulatory control.

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

iii. **Gel filtration** and **affinity chromatography**: Introduction, technique, applications.

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

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD372
TITLE OF THE COURSE : PHARMACEUTICAL ANALYSIS (Practicals)
L:T:P :3:1:3

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.

Reference Books:

1. Undergraduate Instrumental Analysis by James. E., CBS Publishers.
2. Instrumental Analysis by Willard and Merritt, EWP, East West Press Ltd., Delhi/Madras.
3. Pharm Analysis by Skoog and West, Sounders Manipal College Publishing.
4. Textbook of Pharm. Analysis (Practical) by Beckett & Stenlake, CBS Publishers, Delhi.
5. Textbook of Drug Analysis by P.D. Sethi., CBS Publishers, Delhi.
6. Spectroscopy by Silverstein, John & Wiley & Sons. Inc., Canada & Singapore.
7. How to practise GMP-A Plan for total quality control by P.P. Sharma, Vandana Publications, Agra.
8. TLC by Stahl, Spring Verlay.

9. Spectroscopy by William Kemp, ELBS with Macmillan Press, Hampshire.
10. I.P.-1996, The Controller of Publications, New Delhi.
11. BPC- Dept. of Health, U.K. for HMSO.
12. USP - Mack Publishing Co., Easton, PA.

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD303
TITLE OF THE COURSE : PHARMACOTHERAPEUTICS II (Theory)
L:T:P :3:1:3

Course Objectives This course is designed to impart knowledge and skills necessary for contribution to rational use of medicines. This will enable the student to understand the pathophysiology of common diseases and their management.

Course Outcomes

- know the various therapeutic approach to management of these diseases
- know the importance of preparation of individualised therapeutic plans based on diagnosis; and monitoring the therapy(side effects, ADR, drug interactions)

Unit – 1 (17hrs)

Bacterial Infectious disease: Guidelines for the rational use of antibiotics and surgical Prophylaxis, Tuberculosis, Meningitis, Respiratory tract infections, Gastroenteritis, Endocarditis, Septicemia, Urinary tract infections

Unit – 2 (15hrs)

Protozoal infectious disease - Malaria, HIV & Opportunistic infections, Fungal infections, Viral infections, Gonarrhoea and Syphillis

Unit -3 (9+6hrs)

Musculoskeletal disorders: Rheumatoid arthritis, Osteoarthritis, Gout, Spondylitis, Systemic lupus erythematous

Dermatological disorders: Psoriasis, Scabies, Eczema, Impetigo.

Unit – 4 (13hrs)

Renal system : Acute Renal Failure, Chronic Renal Failure, Renal Dialysis, Drug induced renal disorders

UNIT – 5 (15hrs)

Oncology: Basic principles of Cancer therapy, General introduction to cancer chemotherapeutic agents, Chemotherapy of breast cancer, leukemia. Management of chemotherapy nausea and emesis

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD373
TITLE OF THE COURSE : PHARMACOTHERAPEUTICS II (Practical)
L:T:P :3:1:3

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.

Text books (Theory)

Clinical Pharmacy and Therapeutics - Roger and Walker, Churchill Livingstone publication

Reference books (Theory)

a. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange
b. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA]

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD304
TITLE OF THE COURSE : PHARMACEUTICAL JURISPRUDENCE (Theory)
L:T:P :2:1:0

Course Objectives

a. practice the Professional ethics;
b. understand the various concepts of the pharmaceutical legislation in India;
c. know the various parameters in the Drug and Cosmetic Act and rules;
d. know the Drug policy, DPCO, Patent and design act;
e. understand the labeling requirements and packaging guidelines for drugs and cosmetics;
f. be able to understand the concepts of Dangerous Drugs Act, Pharmacy Act and Excise duties Act; and
g. other laws as prescribed by the Pharmacy Council of India from time to time including International Laws.

Course Outcomes

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 the Pharmacy Act, dangerous drugs, medicinal and toilet preparation Act etc. Besides this the new drug policy, professional ethics, DPCO, patent and design Act will be discussed.

Unit- 1 **10 hrs**

1. **Pharmaceutical Legislations** – A brief review. **2 hrs**
2. Principle and Significance of professional ethics. Critical study of the code of pharmaceutical ethics drafted by PCI. **3 hrs**
3. **Pharmacy Act –1948.**
   Objectives Legal Definitions, General Study, Constitution and Functions of State & Central Council, Registration & Procedure, ER. **5 hrs**

Unit- 2 **15 hrs**

4. **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, Import, labeling and packaging of Drugs And Cosmetics Provisions Relating to Indigenous Systems. Constitution and Functions of DTAB,DCC,CDL. Qualification and duties –Govt. analyst and Drugs Inspector.

Unit- 3 **8 hrs**

5. Medicinal and Toilet Preparation Act –1955. Objectives, Legal Definitions, Licensing, Bonded and Non Bonded Laboratory, Ware Housing, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietory Preparations. **3 hrs**
6. Prevention Of Cruelty to animals Act-1960. **3 hrs**

7. Patents & design Act-1970. **2 hrs**

UNIT- 4 **9 hrs**

8. Narcotic Drugs and Psychotropic substances Act-1985 and Rules. Objectives, Legal Definitions, General Study, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and regulations, Schedules to the Act. **6 hrs**
9. Brief study of prescription and Non-prescription Products. **3 hrs**

UNIT- 5 **8 hrs**

10. Study of Salient Features of Drugs and magic remedies Act and its rules. **3 hrs**
11. Study of essential Commodities Act Relevant to drugs price control Order. **3 hrs**
12. Drug Price control Order & National Drug Policy (Current). **2 hrs**

Text books (Theory)

Mithal , B M. Textbook of Forensic Pharmacy. Calcutta :National; 1988.

Reference books (Theory)

a. Singh, KK, editor. Beotra's the Laws of Drugs, Medicines & cosmetics. Allahabad: Law Book House; 1984.

b. Jain, NK. A Textbook of forensic pharmacy. Delhi: Vallabh prakashan ; 1995.

c. Reports of the Pharmaceutical enquiry Committee

d. I.D.M.A., Mumbai. DPCO 1995

e. Various reports of Amendments.

f. Deshapande, S.W. The drugs and magic remedies act 1954 and rules 1955. Mumbai: Susmit Publications; 1998.

g. Eastern Book Company .The narcotic and psychotropic substances act 1985, Lucknow: Eastern; 1987.

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD305
TITLE OF THE COURSE : MEDICINAL CHEMISTRY (Theory)
L:T:P : 3:1:3

Course objectives

- The subject deals with the understanding of use of chemical compounds as medicinal agents.
- It includes study of history, development fundamental principles of drug therapy and use of chemotherapeutic agents.

Course Outcomes

- The student will be able to understand the use of chemical agents as drugs to treat various diseases and understand their action in the physiological system.

Unit -1

1.Modern concept of rational drug design: A brief introduction to Quantitative Structure ActivityRelationaship (QSAR), prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules. **6hrs**

A study of the development of the following classes of drugs including SAR, Mechanism of action, synthesis of important compounds, chemical nomenclature, brand names of important marketed products and their side effects.

2. Anti-infective agents
    a) Local anti-infective agents
    b) Preservatives
    c) Antifungal agents
    d) Urinary tract anti-infectives
    e) Antitubercular agents
    f) Antiviral agents and Anti AIDS agents
    g) Antiprotozoal agents
    h) Anthelmentics
    i) Antiscabies and Antipedicular agents **10 hrs**

Unit - 2

3. Sulphonamides and sulphones
4. Antimalarials
5. Antineoplastic agents **15hrs**

Unit - 3

6. Antibiotics **14hrs**

Unit - 4

7. Cardiovascular agents
    a) Antihypertensive agents
    b) Antianginal agents and vasodilators
    c) Antiarrhythmic agents
    d) Antihyperlipidemic agents
    e) Coagulants and Anticoagulants
    f) Endocrine **16 hrs**

Unit - 5

8. Hypoglycemic agents
9.Thyroid and Antithyroid agents
10.Diureties
11.Diagnostic agents
12.Steroidal Hormones and Adrenocorticoids **14hrs**

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD374
TITLE OF THE COURSE : MEDICINAL CHEMISTRY (Practical)
L:T:P : 3:1:3

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.

Reference Books:

a. Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry, Lippincott-Raven Publishers-New York, Philadelphia.
b. William.O.Foye, Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd., New Delhi.
c. Burgers, Medicinal Chemistry, M.E.,WellyMed.Chemistry M.E. WalffedJohnwilley and Sons, Wiley-interscience Publication, New York, Toranto.
d. Indian Pharmacopoeia 1985 and 1996. The Controller of Publications, Civil Lines, Delhi - 54.
e. Current Index of Medical Specialities (CIMS) and MIMS India, MIMS, A.E. Morgan Publications (I) Pvt. Ltd, New Delhi-19.
f. Organic Drug Synthesis-LedniserMitzsher Vol. I and II.
g. The Science and Practice of Pharmacy Vol. 1 and 2, Remington, MACK Publishing Company, Easton, Pennsylvania.

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD306
TITLE OF THE COURSE : PHARMACEUTICAL FORMULATIONS (Theory)
L:T:P : 2:1:3

Course Objectives	Subject deals with the formulation and evaluation of various pharmaceutical dosage forms.
Course Outcomes	Upon completion of the subject student shall be able to (Know, do, appreciate) – a. understand the principle involved in formulation of various pharmaceutical dosage forms; b. prepare various pharmaceutical formulation; c. perform evaluation of pharmaceutical dosage forms; and d. understand and appreciate the concept of bioavailability and bioequivalence, their role in clinical situations.

Unit – 1 **12hrs**

1.Pharmaceutical dosage form- concept and classification

2.**Tablets**: Formulation of different types of tablets, tablet excipients, granulation techniques quality control and evaluation of tablets. Tablet coating, Type of coating, quality control tests for coated tablet.

Unit – 2 **8hrs**

1. **Capsules**; Production and filling of hard gelatin capsules, Raw material for shell, finishing, quality control tests for capsules. Production and filling of soft gelatine capsules, quality control tests for soft gelatin capsules.

UNIT -3 **14hrs**

1.**Liquid orals**: Formulation and evaluation of suspensions, emulsions and solutions. Stability of these preparations

2.**Ophthalmic preparations (Semi – Solids)**: Introduction and classification Factors affecting absorption and anatomy of skin Packaging storage and labeling, Ointments.

Types of Ointment Base Preparation of ointment, Jellies Types of jellies Formulation of jellies Suppositories, Method of preparation, Types Packaging.

Unit – 4 **8hrs**

5. **Parenterals** Introduction Containers used for Parenterals (including official tests)

Formulation of large and small volume Parenterals Sterilization

Unit – 5 **8hrs**

7. Definition and concept of **Controlled and novel Drug delivery systems** with available examples, viz. parentral, trans dermal, buccal, rectal, nasal, implants, ocular

SEMESTER / YEAR : III YEAR
COURSE CODE : 15PD375
TITLE OF THE COURSE : PHARMACEUTICAL FORMULATIONS (Practical)
L:T:P :2:1:3

List of Experiments :

1. **Manufacture of Tablets**
   - **a.** Ordinary compressed tablet-wet granulation
   - **b.** Tablets prepared by direct compression.
   - **c.** Soluble tablet.
   - **d.** Chewable tablet.

2. **Formulation and filling of hard gelatin capsules**

3. **Manufacture of parenterals**
   - **a.** Ascorbic acid injection
   - **b.** Calcium gluconate injection
   - **c.** Sodium chloride infusion.
   - **d.** Dextrose and Sodium chloride injection/ infusion.

4. **Evaluation of Pharmaceutical formulations (QC tests)**
   - **a.** Tablets
   - **b.** Capsules
   - **c.** Injections

5. **Formulation of two liquid oral preparations and evaluation by assay**
   - **a.** Solution: Paracetamol Syrup
   - **b.** Antacid suspensions- Aluminum hydroxide gel

6. **Formulation of semisolids and evaluation by assay**
   - **a.** Salicyclic acid and benzoic acid ointment
   - **b.** Gel formulation Diclofenac gel

7. **Cosmetic preparations**
   - **a.** Lipsticks
   - **b.** Cold cream and vanishing cream
   - **c.** Clear liquid shampoo
   - **d.** Tooth paste and tooth powders.

8. **Tablet coating (demonstration)**

Text books (Theory)

a. Pharmaceutical dosage forms, Vol, I,II and III by lachman
b. Rowlings Text book of Pharmaceutics

c. Tutorial Pharmacy – Cooper &Gun

Reference books (Theory)

a. Remington's Pharmaceutical Sciences
b. USP/BP/IP

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD401
TITLE OF THE COURSE : PHARMACOTHERAPEUTICS III (Theory)
L:T:P : 3:1:3

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

2. **Objectives:** At completion of this subject it is expected that students will be able to understand –
   a. the pathophysiology of selected disease states and the rationale for drug therapy;
   b. the therapeutic approach to management of these diseases;
   c. the controversies in drug therapy;
   d. the importance of preparation of individualised therapeutic plans based on diagnosis;
   e. 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);
   f. describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
   g. to summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;
   h. to discuss the controversies in drug therapy;
   i. to discuss the preparation of individualised therapeutic plans based on diagnosis; and
   j. 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).

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD471
TITLE OF THE COURSE : PHARMACOTHERAPEUTICS III (Practical)
L:T:P : 3:1:3

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.

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

Title of the topic

1. **Gastrointestinal system:** Peptic ulcer disease, Gastro Esophageal Reflux Disease, Inflammatory bowel disease, Liver disorders - Alcoholic liver disease, Viral hepatitis including jaundice, and Drug induced liver disorders.
2. **Haematological system:** Anaemias, Venous thromboembolism, Drug induced blood disorders.
3. **Nervous system:** Epilepsy, Parkinsonism, Stroke, Alzheimer's disease,
4. **Psychiatry disorders:** Schizophrenia, Affective disorders, Anxiety disorders, Sleep disorders, Obsessive Compulsive disorders
5. Pain management including Pain pathways, neuralgias, headaches.
6. Evidence Based Medicine

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.

Text Books

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

Reference Books

a. Pathologic basis of disease - Robins SL, W.B.Saunders publication

b. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication
c. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA
d. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.
e. Relevant review articles from recent medical and pharmaceutical literature.

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD402
TITLE OF THE COURSE : HOSPITAL PHARMACY (Theory)
L:T:P : 2:1:3

Course 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.

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

a. know various drug distribution methods;
b. know the professional practice management skills in hospital pharmacies;
c. provide unbiased drug information to the doctors;
d. know the manufacturing practices of various formulations in hospital set up;
e. appreciate the practice based research methods; and
f. appreciate the stores management and inventory control.

Unit – 1

1 Hospital - its Organisation and functions

2 Hospital pharmacy-Organisation and management

a) Organizational structure-Staff, Infrastructure & work load statistics
b) Management of materials and finance
c) Roles & responsibilities of hospital pharmacist

3 The Budget – Preparation and implementation

Unit -2

4 Hospital drug policy

a) Pharmacy and Therapeutic committee (PTC)
b) Hospital formulary
c) Hospital committees
   - Infection committee
   - Research and ethical committee
d) developing therapeutic guidelines
e) Hospital pharmacy communication - Newsletter

Unit -3

5. Hospital pharmacy services

a) Procurement & warehousing of drugs and Pharmaceuticals
b) Inventory control
   Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock
c) Drug distribution in the hospital
   i) Individual prescription method
   ii) Floor stock method
   iii) Unit dose drug distribution method

d) Distribution of Narcotic and other controlled substances
e) Central sterile supply services – Role of pharmacist

Unit -4

6. Manufacture of Pharmaceutical preparations

i Sterile formulations – large and small volume parenterals
ii Manufacture of Ointments, Liquids, and creams
iii Manufacturing of Tablets, granules, capsules, and powders
iv Total parenteral nutrition

Unit -5

7. **Continuing professional development programs**
Education and training

8. **Radio Pharmaceuticals – Handling and packaging**

9. **Professional Relations and practices of hospital pharmacist**

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD472
TITLE OF THE COURSE : HOSPITAL PHARMACY (Practical)
L:T:P : 2:1:3

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.

Text books: (latest editions)

a. Hospital pharmacy by William .E. Hassan
b. A text book of Hospital Pharmacyby S.H.Merchant & Dr. J.S. Qadry. Revised by R.K.Goyal & R.K. Parikh

References:

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

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD403
TITLE OF THE COURSE : CLINICAL PHARMACY (Theory)
L:T:P : 3:1:3

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

a. monitor drug therapy of patient through medication chart review and clinical review;
b. obtain medication history interview and counsel the patients;
c. identify and resolve drug related problems;
d. detect, assess and monitor adverse drug reaction;
e. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states; and
f. retrieve, analyse, interpret and formulate drug or medicine information.

Unit – 1 **38 hrs**

1. **Definitions, development and scope of clinical pharmacy**

2. **Introduction to daily activities of a clinical pharmacist**
   a. Drug therapy monitoring (medication chart review, clinical review, pharmacist interventions)
   b. Ward round participation
   c. Adverse drug reaction management
   d. Drug information and poisons information
   e. Medication history
   f. Patient counseling
   g. Drug utilisation evaluation (DUE) and review (DUR)
   h. Quality assurance of clinical pharmacy services

Unit -2 **6 hrs**

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

4. **Clinical laboratory tests used in the evaluation of disease states, and interpretation of test results**
   a. Haematological, Liver function, Renal function, thyroid function tests
   b. Tests associated with cardiac disorders
   c. Fluid and electrolyte balance
   d. Microbiological culture sensitivity tests
   e. Pulmonary Function Tests

Unit – 3 **8 hrs**

5. **Drug & Poison information**
   a. Introduction to drug information resources available
   b. Systematic approach in answering DI queries
   c. Critical evaluation of drug information and literature

d. Preparation of written and verbal reports
e. Establishing a Drug Information Centre
f. Poisons information- organization & information resources

Unit -4 **8 hrs**

6. **Pharmacovigilance**
   a. Scope, definition and aims of pharmacovigilance
   b. Adverse drug reactions - Classification, mechanism, predisposing factors, causality assessment [different scales used]
   c. Reporting, evaluation, monitoring, preventing & management of ADRs
   d. Role of pharmacist in management of ADR.

Unit -5 **15 hrs**

7. Communication skills, including patient counselling techniques, medication history interview, presentation of cases.

8. Pharmaceutical care concepts

9. Critical evaluation of biomedical literature

10. Medication errors

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD473
TITLE OF THE COURSE : CLINICAL PHARMACY (Practical)
L:T:P : 3:1:3

Students are expected to perform 15 practicals in the following areas covering the topics dealt in theory class.

a. Answering drug information questions (4 Nos)
b. Patient medication counselling (4 Nos)
c. Case studies related to laboratory investigations (4 Nos)
d. 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.

Text books (Theory)

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

References

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

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD404
TITLE OF THE COURSE : BIOSTATISTICS & PHARMACOKINETICS (Theory)
L:T:P : 2:1:0

Unit - 1

1 **Research Methodology**

a) Types of clinical study designs:
Case studies, observational studies, interventional studies,

b) Designing the methodology

c) 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.

d) Report writing and presentation of data

Unit -2

2 **Biostatistics**

2.1 a) Introduction

b) Types of data distribution

c) Measures describing the central tendency distributions- average, median, mode

d) Measurement of the spread of data-range, variation of mean, standard deviation, variance, coefficient of variation, standard error of mean.

2.2 **Data graphics**

Construction and labeling of graphs, histogram, piecharts, scatter plots, semilogarthimic plots

Unit - 3

2.3 **Basics of testing hypothesis**

a) Null hypothesis, level of significance, power of test, P value, statistical estimation of confidence intervals.

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

c) Level of significance (Non-parametric data)- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal-Wall is test (one way ANOVA)

d) Linear regression and correlation- Introduction, Pearsonn's and Spearmann's correlation and correlation co-efficient.

e) Introduction to statistical software: SPSS, Epi Info, SAS.

Unit -4

2.4 **Statistical methods in epidemiology**

Incidence and prevalence, relative risk, attributable risk

3.. **Computer applications in pharmacy**

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 - 5

Computer In Community Pharmacy

Computerizing the Prescription Dispensing process

Use of Computers for Pharmaceutical Care in community pharmacy Accounting and General ledger system

Drug Information Retrieval & Storage :

Introduction – Advantages of Computerized Literature Retrieval

Use of Computerized Retrieval

Reference books:

a . Pharmaceutical statistics- practical and clinical applications, Sanford Bolton 3rd edition, publisher Marcel Dekker Inc. NewYork.

b. Drug Information- A Guide for Pharmacists, Patrick M Malone, Karen L Kier, John E Stanovich , 3rd edition, McGraw Hill Publications 2006

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD405
TITLE OF THE COURSE : BIOPHARMACEUTICS & PHARMACOKINETICS(Theory)
L:T:P : 3:1:3

Unit - 1

1. Biopharmaceutics

1. Introduction to Biopharmaceutics
   a. Absorption of drugs from gastrointestinal tract.
   b. Drug Distribution.
   c. Drug Elimination.

Unit -2

2. Pharmacokinetics

2. Introduction to Pharmacokinetics.

   a. Mathematical model
   b. Drug levels in blood.
   c. Pharmacokinetic model
   d. Compartment models
   e. Pharmacokinetic study.

Unit - 3

3. One compartment open model.
   a. Intravenous Injection (Bolus)
   b. Intravenous infusion.

4. Multicompartment models.
   a. Two compartment open model.
   b. IV bolus, IV infusion and oral administration

Unit -4

5. Multiple – Dosage Regimens.
   a. Repititive Intravenous injections – One Compartment Open Model
   b. Repititive Extravascular dosing – One Compartment Open model
   c. Multiple Dose Regimen – Two Compartment Open Model

6. Nonlinear Pharmacokinetics.
   a. Introduction
   b. Factors causing Non-linearity.
   c. Michaelis-menton method of estimating parameters.

Unit - 5

7. Noncompartmental Pharmacokinetics.
   a. Statistical Moment Theory.
   b. MRT for various compartment models.
   c. Physiological Pharmacokinetic model.

8. Bioavailability and Bioequivalence.
   a. Introduction.

b. Bioavailability study protocol.
c. Methods of Assessment of Bioavailability

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD474
TITLE OF THE COURSE : BIOPHARMACEUTICS & PHARMACOKINETICS (Practical)
L:T:P : 3:1:3

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 protein bound drug and poorly protein bound drug. 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, $t_1/2$, 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.

References:

a. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi
b. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia.
c. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
d. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
e. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
f. Biopharmaceutics; By Swarbrick
g. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal, Vallabh Prakashan Pitampura, Delhi
h. Cilincal Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
i. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
j. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
k. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James, C. Roylan, Marcel Dekker Inc, New York 1996.

SEMESTER / YEAR : IV YEAR
COURSE CODE : 15PD406
TITLE OF THE COURSE : CLINICAL TOXICOLOGY (Theory)
L:T:P : 2:1:0

Unit -1 **13 hrs**

1. General principles involved in the management of poisoning
2. Antidotes and the clinical applications.
3. Supportive care in clinical Toxicology.
4. Gut Decontamination.
5. Elimination Enhancement.
6. Toxicokinetics.

Unit -2 **14 hrs**

7. Clinical symptoms and management of acute poisoning with the following agents

   a) Pesticide poisoning: organophosphorous compounds, carbamates, organochlorines, pyrethroids.
   b) Opiates overdose.
   c) Antidepressants
   d) Barbiturates and benzodiazepines.
   e) Alcohol: ethanol, methanol.
   f) Paracetamol and salicylates.
   g) Non-steroidal anti-inflammatory drugs.
   h) Hydrocarbons: Petroleum products and PEG.
   i) Caustics: inorganic acids and alkali.
   j) Radiation poisoning

Unit -3 **10 hrs**

8. Clinical symptoms and management of chronic poisoning with the following agents – Heavy metals: Arsenic, lead, mercury, iron, copper

9. Venomous snake bites: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries.

Unit – 4 **7 hrs**

10. Plants poisoning. Mushrooms, Mycotoxins.
11. Food poisonings
12. Envenomations – Arthropod bites and stings.

Unit – 5 **6 hrs**

Substance abuse:

Signs and symptoms of substance abuse and treatment of dependence

a) CNS stimulants :amphetamine

b) Opioids
c) CNS depressants
d) Hallucinogens: LSD
e) Cannabis group
f) Tobacco

References:

a. Matthew J Ellenhorn. ELLENHORNS MEDICAL TOXICOLOGY – DIAGNOSIS AND TREATMENT OF POISONING. Second edition. Williams and Willkins publication, London
b. V V Pillay. HANDBOOK OF FORENSIC MEDICINE AND TOXICOLOGY. Thirteenth edition 2003 Paras Publication, Hyderabad

SEMESTER / YEAR : V YEAR
COURSE CODE : 15PD501
TITLE OF THE COURSE : CLINICAL RESEARCH (Theory)
L:T:P : 3:1:0

Unit -1 — 15 hrs

1. Drug development process:

Introduction

Various Approaches to drug discovery

1. Pharmacological 2. Toxicological
3. IND Application
4. Drug characterization
5. Dosage form

Unit -2 — 16 hrs

2. Clinical development of drug:

1. Introduction to Clinical trials
2. Various phases of clinical trial.
3. Methods of post marketing surveillance
4. Abbreviated New Drug Application submission.
5. Good Clinical Practice – ICH, GCP, Central drug standard control organisation (CDSCO) guidelines

Unit -3 — 14 hrs

6. Challenges in the implementation of guidelines
7. Ethical guidelines in Clinical Research
8. Composition, responsibilities, procedures of IRB / IEC
9. Overview of regulatory environment in USA, Europe and India.

Unit -4 — 13 hrs

10. Role and responsibilities of clinical trial personnel as per ICH GCP
    a. Sponsor
    b. Investigators
    c. Clinical research associate
    d. Auditors
    e. Contract research coordinators
    f. Regulatory authority

Unit -5 **17 hrs**

11. Designing of clinical study documents (protocol, CRF, ICF, PIC with assignment)

12. Informed consent Process

13. Data management and its components

14. Safety monitoring in clinical trials.

References :

a. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.

b. 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.

c. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.

d. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.

e. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.

f. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.

g. Goodman & Gilman: JG Hardman, LE Limbard, 10th Edn. McGraw Hill Publications, 2001.

SEMESTER / YEAR : V YEAR
COURSE CODE : 15PD502
TITLE OF THE COURSE : PHARMACOEPIDEMIOLOGY & PHARMACOECONOMICS (Theory)
L:T:P : 3:1:0

Unit – 1 **14 hrs**

1. Pharmacoepidemiology :

Definition and scope:

Origin and evaluation of pharmacoepidemiology need for pharmacoepidemiology, aims and applications.

Measurement of outcomes in pharmacoepidemiology

Outcome measure and drug use measures

Prevalence, incidence and incidence rate. Monetary units, number of prescriptions, units of drugs dispensed, defined daily doses and prescribed daily doses, medication adherence measurement

Unit -2 **26 hrs**

Concept of risk in pharmacoepidemiology

Measurement of risk, attributable risk and relative risk, time-risk relationship and odds ratio

Pharmacoepidemiological methods

Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods

Drug utilization review, case reports, case series, surveys of drug use, cross – sectional studies, cohort studies, case control studies, case –cohort studies, meta – analysis studies, spontaneous reporting, prescription event monitoring and record linkage system.

Unit -3 **12 hrs**

Sources of data for pharmacoepidemiological studies

Ad Hoc data sources and automated data systems.

Selected special applications of pharmacoepidemiology

Studies of vaccine safety, hospital pharmacoepidemiology, pharmacoepidemiology and risk management, drug induced birth defects.

Unit -4 **19 hrs**

2. Pharmacoeconomics:

Definition, history, needs of pharmacoeconomic evaluations

Role in formulary management decisions

Pharmacoeconomic evaluation

Outcome assessment and types of evaluation

Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods: Cost – minimization, cost- benefit, cost – effectiveness, cost utility.

Unit -5 **4 hrs**

3. Applications of Pharmacoeconomics
Software and case studies

SEMESTER / YEAR : V YEAR
COURSE CODE : 15PD503
TITLE OF THE COURSE : CLINICAL PHARMACOKINETICS & PHARMACO-THERAPEUTICS DRUG MONITORING (Theory)
L:T:P : 2:1:0

Unit -1

1. **Introduction to Clinical pharmacokinetics.**

2. **Design of dosage regimens:**
   Nomograms and Tabulations in designing dosage regimen, Conversion from intravenous to oral dosing, Determination of dose and dosing intervals, Drug dosing in the elderly and pediatrics and obese patients.

3. **Pharmacokinetics of Drug Interaction:**
   a. Pharmacokinetic drug interactions
   b. Inhibition and Induction of Drug metabolism
   c. Inhibition of Biliary Excretion.

Unit -2

4. **Therapeutic Drug monitoring:**
   a. Introduction
   b. Individualization of drug dosage regimen (Variability – Genetic, Age and Weight , disease, Interacting drugs).
   c. Indications for TDM. Protocol for TDM.
   d. Pharmacokinetic/Pharmacodynamic Correlation in drug therapy.
   e. TDM of drugs used in the following disease conditions: cardiovascular disease, Seizure disorders, Psychiatric conditions, and Organ transplantations.

Unit -3

5. **Dosage adjustment in Renal and hepatic Disease.**
   a. Renal impairment
   b. Pharmacokinetic considerations
   c. General approach for dosage adjustment in Renal disease.
   d. Measurement of Glomerular Filtration rate and creatinine clearance.
   e. Dosage adjustment for uremic patients.
   f. Extracorporeal removal of drugs.
   g. Effect of Hepatic disease on pharmacokinetics.

Unit -4

6. **Population Pharmacokinetics.**
   a. Introduction to Bayesian Theory.
   b. Adaptive method or Dosing with feed back.
   c. Analysis of Population pharmacokinetic Data.

Unit -5

7. **Pharmacogenetics**
   a. Genetic polymorphism in Drug metabolism: Cytochrome P-450 Isoenzymes.
   b. Genetic Polymorphism in Drug Transport and Drug Targets.
   c. Pharmacogenetics and Pharmacokinetics / Pharmacodynamic considerations

VI PHARM.D
INTERNSHIP

1) **SPECIFIC OBJECTIVES :**

i) to provide patient care in cooperation with patients, prescribers, and other members of an interprofessional 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 or behavioral or administrative, and clinical sciences that may impact therapeutic outcomes.

ii) 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.

iii) to promote health improvement, wellness, and disease prevention in co-operation with patients, communities, at-risk population, and other members of an interprofessional team of health care providers.

iv) to demonstrate skills in monitoring of the National Health Programmes and schemes, oriented to provide preventive and promotive health care services to the community.

v) 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.

vi) to communicate effectively with patients and the community.

2) **OTHER DETAILS :**

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.

iii) 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.

3. 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 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 (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

A Score of less than 3 in any of above items will represent unsatisfactory completion of internship.

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