Course Code	PRY 101	Title of the Course	HUMAN ANATOMY & PHYSIOLOGY	L	T	P	C
Year	I	Semester	ANNUAL	3	1	-	4
Course Objectives	1. This course is designed to impart a fundamental knowledge on the structure and functions of the human body. 2. It also helps in understanding both homeostasis mechanisms and homeostatic imbalances of various body systems. 3. Since a medicament, which is produced by pharmacist, is used to correct the deviations in human body, it enhances the understanding of how the drugs act on the various body systems in correcting the disease state of the organs.						

Course Outcomes	
CO1	Describe the structure (gross and histology) and functions of various organs of the human body, Elementary tissues of the human body, classification, types of movements of joints and disorders of joints.
CO2	Describe the various homeostatic mechanisms and their imbalances of various systems and appreciate the coordinated working pattern of different organs of the Lymphatic system and Urinary system.
CO3	Appreciate the coordinated working pattern of different organs of the Cardiovascular system and Respiratory system.
CO4	Appreciate the coordinated working pattern of different organs of the Endocrine system and Reproductive system.
CO5	Appreciate coordinated working pattern of different organs of Digestive system and Nervous system
CO6	Understand the anatomy physiology of sense organs, physiology of muscle contraction and Sports physiology.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Scope of Human Anatomy & Physiology**	1. Scope of anatomy and physiology, basic terminologies used in this subject (Description of the body as such planes and terminologies) 2. Structure of cell – its components and their functions. 3. Elementary tissues of the human body: epithelial, connective, Muscular and nervous tissues-their sub-types and characteristics. 4. a) Osseous system - structure, composition, and functions of the Skeleton. (Done in practical classes - 6hrs) b) Classification of joints, Types of movements of joints and disorders of joints (Definitions only)	13	1
2	**Hemopoiec system**	**Hemopoietic system** a) Composition and functions of blood **b)** Hematopoiesis and disorders of blood components (definition of disorder) **c)** Blood groups **d)** Clotting factors and mechanism **e)** Platelets and disorders of coagulation **Lymphatic system** a) Lymph and lymphatic system, composition, formation, and circulation. b) Disorders of the lymphatic system (definition only) c) Spleen: structure and functions, Disorders **Urinary system** a) Anatomy and physiology of urinary system b) Formation of urine c) Renin Angiotensin system – Juxtaglomerular apparatus - acid base Balance d) Clearance tests and micturition	12	2
3	**Cardiovascular system** **Respiratory system**	**Cardiovascular system** a) Anatomy and functions of the heart b) Blood vessels and circulation (Pulmonary, coronary, and systemic circulation) c) Electrocardiogram (ECG) d) Cardiac cycle and heart sounds e) Blood pressure – its maintenance and regulation f) Definition of the following disorders g) Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, cardiac arrhythmias **Respiratory system** a) Anatomy of respiratory organs and functions b) Mechanism/physiology of respiration and regulation of respiration c) Transport of respiratory gases d) Respiratory volumes and capacities, and Definition of Hypoxia, Asphyxia, Dybarism, e) Oxygen therapy, and resuscitation	12	**3**
4	**Endocrine system** **Reproductive system**	**Endocrine system** a) Pituitary gland b) Adrenal gland c) Thyroid and Parathyroid glands d) Pancreas and gonads **Reproductive system** a) Male and female reproductive system b) Their hormones – Physiology of menstruation c) Spermatogenesis & Oogenesis d) Sex determination (genetic basis) e) Pregnancy and maintenance and parturition f) Contraceptive devices	13	**4**

5	**Digestive system** **Nervous system**	**Digestive system** a) Anatomy and physiology of GIT b) Anatomy and functions of accessory glands of GIT c) Digestion and absorption d) Disorders of GIT (definitions only) **Nervous system** a) Definition and classification of the nervous system b) Anatomy, physiology, and functional areas of the cerebrum c) Anatomy and physiology of cerebellum d) Anatomy and physiology of midbrain e) Thalamus, hypothalamus, and Basal Ganglia f) Spinal card: Structure & reflexes – mono-poly-planter g) Cranial nerves – names and functions h) ANS – Anatomy & functions of sympathetic & parasympathetic N.S.	13	**5**
6	**Sense organs** **Skeletal muscles** **Sports physiology**	**Sense organs** a) Eye b) Ear c) Skin d) Tongue & Nose **Skeletal muscles** a) Histology b) Physiology of Muscle contraction **c)** Physiological properties of skeletal muscle and their disorders (definitions) **Sports physiology** a) Muscles in exercise, Effect of athletic training on muscles and muscle performance, b) Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise, c)Drugs and athletics	12	**6**

Reference Books:

Guyton arthur, C. *Physiology of human body*. Publisher: Holtsaunders.

Chatterjee,C.C. *Human physiology*. Volume 1&11. Publisher: medical allied agency, Calcutta.

Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H.

Gray's anatomy. Publisher:Churchill Livingstone, London.

e-Learning Source:

https://www.google.co.in/books/edition/Human_Anatomy_And_Physiology/ogQllPqPyVkC?hl=en&gbpv=1&dq=human+anatomy+and+physiology&printsec=frontcover

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	-	2	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-
CO2	3	-	2	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-
CO3	3	-	2	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-
CO4	3	-	2	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-
CO5	3	-	2	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-
CO6	3	-	2	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY 102	Title of the Course	HUMAN ANATOMY & PHYSIOLOGY	L	T	P	C
Year	I	Semester	ANNUAL	-	-	3	-
Course Objectives	1. This course is designed to impart a fundamental knowledge on the structure and functions of the human body. 2. It also helps in understanding both homeostasis mechanisms and homeostatic imbalances of various body systems. 3. Medicament, which is produced by pharmacist, is used to correct deviations in the human body, it enhances the understanding of how the drugs act on the various body systems in correcting the disease state of the organs.						

Course Outcomes	
CO1	Describe the structure (gross and histology) and functions of various organs of the human body, Elementary tissues of the human body, classification, types of movements of joints and disorders of joints.
CO2	Describe the various homeostatic mechanisms and their imbalances of various systems and appreciate the coordinated working pattern of different organs of the Lymphatic system and Urinary system.
CO3	Appreciate the coordinated working pattern of different organs of the Cardiovascular system and Respiratory system.
CO4	Appreciate the coordinated working pattern of different organs of the Endocrine system and Reproductive system.
CO5	Appreciate coordinated working patterns of different organs of the Digestive system and Nervous system.
CO6	Understand the anatomy physiology of sense organs, physiology of muscle contraction and Sports physiology.

Experiment No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	**Study of Tissue**	(a) Study of Tissue of Human Body Epithelial & Muscular Tissue (b) Study of Tissue of Human Body Connective & Nervous Tissue	3	1
2	**Haemotological Experiment**	Study of Appliances used in Haemotological Experiment	3	2
3	**WBC count**	To determine of WBC count of your own blood	3	2
4	**RBC count**	To determine of RBC count of your own blood	3	2
5	**Differential count**	To determine of differential count of your own blood	3	2
6	**ESR**	To determine of Erythrocyte sedimentation rate of your own blood	3	2
7	**Haemoglobin content**	To determine of haemoglobin content of your own blood	3	2
8	**Bleeding time**	Determination of bleeding time of your own blood.	3	2
9	**Clotting time**	Determination of clotting time of your own blood.	3	2
10	**Blood pressure**	To determine the blood pressure with the help of sphygmomanometer	3	2, 3
11	**Blood group**	To determine the blood group of your own blood	3	2
12	**Study of various system**	(a) To Study of axial skeleton system with the help of chart & model (b) To Study of appendicular skeleton system with the help of chart & model (c) To Study of cardiovascular system with the help of chart & model (d) To Study of respiratory system with the help of chart & model (e) To Study of digestive system with the help of chart & model (f) To Study of urinary system with the help of chart & model (g) To Study of nervous system with the help of chart & model (h) To Study of special senses with the help of chart & model (i) To Study of reproductive system with the help of chart & model	3 3 3 3 3 3 3 3 3	1 1 3 3 5 2 5 1 4
11	**Family planning**	To Study of different family planning appliances	3	6
12	**Pregnancy diagnostic test**	To perform pregnancy diagnostic test	3	6
13	**Simple muscle curve**	To record simple muscle curve using gastroenemius sciatic nerve prepration	3	6
14	**Simple summation curve**	To record simple summation curve using gastroenemius sciatic nerve prepration	3	6
15	**Simple effect of temperature**	To record simple effect of temperature using gastroenemius sciatic nerve prepration	3	6
16	**load & after load using gastrocnemius**	To record simple effect of load & after load using gastroenemius sciatic nerve prepration	3	6
17	**simple fatigue curve**	To record simple fatigue curve using gastroenemius sciatic nerve prepration	3	6

e-Learning Source:

https://pharmacyinfoline.com/human-anatomy-physiology-pharm-d/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	0	3	3	0	0	0	0	0	0	2	-	1	-	1	-	-	-
CO2	3	0	3	3	0	0	0	0	0	0	2	-	1	-	1	-	-	-
CO3	3	0	3	3	0	0	0	0	0	0	2	-	1	-	1	-	-	-
CO4	3	0	3	3	0	0	0	0	0	0	2	-	1	-	1	-	-	-
CO5	3	0	3	3	0	0	0	0	0	0	2	-	1	-	1	-	-	-
CO6	3	0	3	3	0	0	0	0	0	0	2	-	1	-	1	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Course Code	PRY103	Title of the Course	PHARMACEUTICS	L	T	P	C
Year	I	Semester	ANNUAL	2	1	0	3
Course Objectives	1. Know the formulation aspects of different dosage forms; 2. Do different pharmaceutical calculation involved in formulation; 3. Formulate different types of dosage forms; and 4. Appreciate the importance of good formulation for effectiveness.						

Course Outcomes	
CO1	Have information on the formulation aspect of different dosage forms
CO2	Perform different pharmaceutical calculations involved in formulations
CO3	Formulate different types of dosage forms
CO4	Appreciate the importance of good formulations for effectiveness
CO5	Understand prescription and take necessary steps

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Dosage Forms**	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 d. Historical background and development of profession of pharmacy and pharmaceutical industry in brief. e. Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.	18	1,2, 4& 5
2	**Liquid Dosage Forms**	a. 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. b. Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.	12	1,3& 4
3	**Powders and Incompatibilities**	a. 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. b. Incompatibilities: Introduction, classification and methods to overcome the incompatibilities.	12	1,3,& 4
4	**Suppositories**	Suppositories and pessaries: Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.	10	1,3,& 4
5	**Galenicals and Surgical Aids**	a. Galenicals: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts. b. Surgical aids: Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.	12	1,3& 4
6	**Pharmaceutical Calculations**	a. Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc. b. Pharmaceutical calculations.	8	2

Reference Books:

1. Cooper and Gunns Dispensing for pharmacy students.
2. A text book Professional Pharmacy by N.K.Jain and S.N.Sharma.
3. Remington's Pharmaceutical Sciences.
4. Register of General Pharmacy by Cooper and Gunn.

e-Learning Source:

1. **IPC:** https://www.ipc.gov.in/
2. **USP:** https://www.usp.org/
3. **BPC:** https://www.pharmacopoeia.com/
4.

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO 6
CO1	-	-	1	1	-	-	-	1	-	-	-	-	-	1	-	-	-	-
CO2	-	-	-	1	-	1	-	-	-	-	-	-	1	1	1	-	-	-
CO3	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO4	-	1	1	1	-	1	+	1	-	1	1	-	1	1	-	-	-	-
CO5	1	1	-	2	2	1	-	-	1	2	1	-	-	1	1	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY 104	Title of the Course	PHARMACEUTICS	L	T	P	C
Year	I	Semester	ANNUAL	-	-	3	-
Course Objectives	1. Know the formulation aspects of different dosage forms. 2. Do different pharmaceutical calculation involved in formulation. 3. Formulate different types of dosage forms. 4. Appreciate the importance of good formulation for effectiveness.						

Course Outcomes	
CO1	Have information on the formulation aspect of different dosage forms.
CO2	Perform different pharmaceutical calculations involved in formulations
CO3	Formulate different types of dosage forms.
CO4	Appreciate the importance of good formulations for effectiveness.
CO5	Understand prescription and take necessary steps.

Experiment No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	Syrups	To prepare & submit Simple syrup, Ephedrine HCl syrup, Vasaka syrup, ferrous Phosphate syrup & Orange syrup.	3	1,2, 3
2	Elixir	To prepare and submit Piperazine citrate elixir, Cascara elixir, Paracetamol elixir.	3	1,2, 3
3	Linctus	To prepare submit Simple Linctus, Pediatric simple Linctus.	3	1,2,3
4	Solutions	To prepare & submit Solution of cresol with soap, Strong solution of ferric chloride, Aqueous Iodine Solution, Strong solution of Iodine, Strong solution of ammonium acetate.	3	1,2,3
5	Liniments	To prepare and submit Liniment of turpentine, Liniment of camphor.	3	1,2,3
6	Suspensions	To prepare and submit Calamine lotion, Magnesium Hydroxide mixture.	3	1,2,3
7	Emulsions	To prepare and submit Cod liver oil emulsion, liquid paraffin emulsion.	3	1,2,3
8	Powders	To prepare and submit Eutectic powder, Explosive powder, Dusting powder, Insufflations.	3	1,2,3
9	Suppositories	To prepare and submit Boric acid suppositories, Chloral suppositories.	3	1,2,3,4
10	Incompatibilities	To find out the type of incompatibility in the given prescription and solve the problem related to mixture .	3	4,5

e-Learning Source:

IPC: https://www.ipc.gov.in/

https://mlrip.ac.in/wp-content/uploads/2022/03/PHARMACEUTICS-I-LAB-MANUAL.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	-	-	1	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	1	-	1	-	-	-	-	-	-	1	1	1	-	-	-
CO3	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO4	-	1	1	1	-	1	+	1	-	1	1	-	1	-	-	-	-	-
CO5	1	1	-	2	2	1	-	-	1	2	1	-	-	1	1	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Course Code	PRY105	Title of the Course	MEDICINAL BIOCHEMISTRY	L	T	P	C
Year	1	Semester	ANNUAL	3	1	0	4
Course Objectives	1. understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases; 2. know the metabolic process of biomolecules in health and illness (metabolic disorders); 3. understand the genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism; 4. know the biochemical principles of organ function tests of kidney, liver and endocrine gland; and 5. do the qualitative analysis and determination of biomolecules in the body fluids.						

Course Outcomes	
CO1	Students will use chemical laboratory methods for the diagnosis, control, treatment, and prevention of diseases.
CO2	Students will use biochemical facts.
CO3	They can use concept of isoenzymes in diagnosis of diseases.
CO4	They can use knowledge of the metabolic process of biomolecules in health and illness (metabolic disorders).
CO5	They can use the knowledge of biochemical principles for organ function tests of kidney, liver and endocrine, gland.
CO6	They can do the qualitative analysis and determination of biomolecules in the body fluids.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to biochemistry** **Enzymes**	Introduction to biochemistry: Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance. 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	1
2	**Biological oxidation** **Carbohydrate metabolism**	Biological oxidation: Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC; Oxidative phosphorylation. 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.	3	2
3	**Lipid metabolism** **Protein and amino acid metabolism**	Lipid metabolism: Oxidation of saturated (β-oxidation); Ketogenesis and ketolysis; biosynthesis of fatty acids, lipids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atherosclerosis, fatty liver, hypercholesterolemia). Protein and amino acid metabolism: protein turnover; 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.	3	3
4	**Nucleic acid metabolism**	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. Introduction to clinical chemistry: Cell; composition; malfunction; Role of the clinical chemistry laboratory.	3	4
5	**Introduction to clinical chemistry, kidney function tests** **Liver function tests**	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). Liver function tests: Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation. (a) Test for hepatic dysfunction-Bile pigments metabolism. (b) Test for hepatic function test- Serum bilirubin, urine bilirubin, and urine urobilinogen. (c) Dye tests of excretory function. (d) Tests based upon abnormalities of serum proteins. Selected enzyme tests.	3	5

6	**Lipid profile tests, Immunochemical techniques** **Electrolytes**	Lipid profile tests: Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides. 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). Electrolytes: Body water, compartments, water balance, and electrolyte distribution. Determination of sodium, calcium potassium, chlorides, bicarbonates in the body fluids.	3	6

Reference Books:

a. Harpers review of biochemistry - Martin

b. Text book of clinical chemistry- Alex Kaplan &Laverve L.Szabo

c. Text book of biochemistry -- Ramarao

d. Principles of biochemistry -- Lehninger

e. Practical Biochemistry-David T.Plummer.

f. Practical Biochemistry-Pattabhiraman.

e-Learning Source:

https://www.google.co.in/books/edition/Medical_Biochemistry/hYZGEAAAQBAJ?hl=en&gbpv=1&dq=medicinal+biochemistry&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	1	1	1	1	1	1	1	-	3	3	3	-	-	-
CO2	3	3	3	1	1	1	1	1	1	1	1	-	3	3	3	-	-	-
CO3	2	3	3	1	1	1	1	1	1	1	1	-	3	3	3	-	-	-
CO4	2	3	3	1	1	2	1	1	1	1	1	-	3	3	3	-	-	-
CO5	3	3	2	1	1	1	1	1	2	1	1	-	3	3	3	-	-	-
CO6	3	3	2	1	1	1	1	2	1	1	1	-	3	3	3	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY106	Title of the Course	MEDICINAL BIOCHEMISTRY	L	T	P	C
Year	I	Semester	ANNUAL	0	0	3	1.5
Course Objectives	1. Discuss the fundamental biochemistry knowledge related to health 2. Explain the clinical significance of the laboratory tests 3. Diagnosis of clinical disorders by estimating biomarkers 4. knowledge of biochemical principles for organ function tests 5. Knowledge of normal range of biomolecules in body fluids						

Course Outcomes	
CO1	Discuss the fundamental biochemistry knowledge related to health
CO2	Explain the clinical significance of the laboratory tests & Diagnosis of clinical disorders by estimating biomarkers
CO3	They can use knowledge of the metabolic process of biomolecules in health and illness (metabolic disorders)
CO4	They can use the knowledge of biochemical principles for organ function tests of kidney and liver
CO5	Knowledge of optimum temperature & pH of body fluids necessary for normal functioning of biochemical process in human body

Experiment No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	**Urinalysis (Urine Test)**	1. Qualitative analysis of normal constituents of urine. 2. Qualitative analysis of abnormal constituents of urine 3. Quantitative estimation of urine sugar by Benedicts reagent method 4. Quantitative estimation of urine chlorides by Volhard's method 5. Quantitative estimation of urine creatinine by Jaffes method 6. Quantitative estimation of urine calcium by precipitation method	3	1,2,3
2	**Blood sugar Test**	1. Preparation of Folin Wu filtrate from blood 2. Quantitative estimation of blood sugar Folin-Wu tube method	3	1,3
3	**Organ Function Test**	Liver 1. Estimation of SGOT in serum 2. Estimation of SGPT in serum 3. Estimation of Proteins in Serum 4. Determination of bilirubin in Serum Kidney 5. Estimation of Urea in Serum 6. Quantitative estimation of blood creatinine 7. Determination of sodium, calcium and potassium in serum	3	1,2,4
4	**Carbohydrate estimation**	1. Determination of Glucose by means of Glucoseoxidase 2. Enzymatic hydrolysis of Glycogen/Starch by Amylases	3	1,3
5	**Factors affecting Enzyme activity**	1. Study of factors affecting Enzyme activity. (pH & Temp.) 2. Preparation of standard buffer solutions and its pH measurements (any two)	3	1,3,5
6	**Estimation of cholesterol and lipids**	1. Experiment on lipid profile tests 2. Quantitative estimation of serum cholesterol by Liebermann Burchards method	3	1,3

e-Learning Source:

Guidelines on Standard Operating Procedures for Clinical Chemistry Guidelines on standard operating procedures for clinical chemistry (who.int)

Blood serum protocols Laboratory Procedure Manual: Biochemistry Profile (cdc.gov)

SOPs for laboratory-Laboratory.pdf (delhi.gov.in)

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	1	3	2	3	1	3	3	-	3	3	3	-	-	-
CO2	3	3	3	3	1	3	2	3	1	3	3	-	3	3	3	-	-	-
CO3	3	3	3	3	1	3	2	3	1	3	3	-	3	3	3	-	-	-
CO4	3	3	3	3	1	3	2	3	1	3	3	-	3	3	3	-	-	-
CO5	3	3	3	3	1	3	2	3	1	3	3	-	3	3	3	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Course Code	PRY 107	Title of the Course	PHARMACEUTICAL ORGANIC CHEMISTRY	L	T	P	C
Year	I	Semester	ANNUAL	3	1	0	4
Course Objectives	1. IUPAC/Common system of nomenclature of simple organic compounds belonging to different classes of organic compounds; 2. Some important physical properties of organic compounds; 3. Free radical/ nucleophyllic [alkyl/ acyl/ aryl] /electrophyllic substitution, free radical/ nucleophyllic / electrophyllic addition, elimination, oxidation and reduction reactions with mechanism, orientation of the reaction, order of reactivity, stability of compounds; 4. Some named organic reactions with mechanisms. 5. Methods of preparation, test for purity, principle involved in the assay, important medicinal uses of some important organic compounds.						

Course Outcomes	
CO1	Demonstrate the methods of preparation, physical properties, reactivity, stability and orbital picture of organic compounds.
CO2	Explain the aromaticity, Resonance, stability, orbital structure, mechanism of addition and nomenclature of organic compounds.
CO3	Explain the nucleophilic [alkyl/ acyl/ aryl] /substitution, elimination, with mechanism, orientation of the reaction, order of reactivity, kinetics, stability of compounds, stereochemistry and rearrangements.
CO4	Understand the electrophilic and free radical addition, cycloaddition reactions.
CO5	Understand the electrophilic aromatic substitution and nucleophilic addition reactions.
CO6	Demonstrate the methods of preparation, test for purity, principle involved in the assay, important medicinal uses of some important organic compounds and nucleophilic acyl substitution reactions.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Structures and Physical properties**	a. Polarity of bonds, polarity of molecules, M.P, Inter molecular forces, B.P, Solubility, non-ionic solutes and ionic solutes, protic and aprotic Solvents, ion pairs, b. Acids and bases, Lowry Bronsted and Lewis theories c. Isomerism 2. Free radicals chain reactions of alkane: Mechanism, relative reactivity and stability 3. Alicyclic compounds: Preparations of cyclo alkanes, Bayer strain theory and orbital picture of angle strain.	16	**1**
2	**Theory of resonance** **Nomenclature of organic compound**	Allyl radical as a resonance hybrid, stability, orbital picture, resonance stabilisation of allyl cations, hyper conjugation, stability of conjugated dienes, mechanisms of 1,4- addition, 1,2 addition belonging to the following classes Alkanes, Alkenes, Dienes, Alkynes, Alcohols, Aldehydes, Ketones, Amides, Amines, Phenols, Alkyl Halides, Carboxylic Acid, Esters, Acid Chlorides and Cycloalkanes.	16	**2**
3	**Nucleophilic aliphatic substitution mechanism** **Dehydrohalogenation of alkyl halides**	Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN2 reactions. Stereochemistry and steric hindrance, role of solvents, phase transfer catalysis, mechanism and kinetics of SN1 reactions, stereochemistry, carbocation and their stability, rearrangement of carbocation, role of solvents in SN1 reaction, Ion dipole bonds, SN2 versus SN1 solvolysis, nucleophilic assistance by the solvents. 1,2 elimination, kinetics, E2 and E1 mechanism, elimination via carbocation, evidence for E2 mechanism, absence of rearrangement isotope effect, absence hydrogen exchange, the element effect, orientation and reactivity, E2 versus E1, elimination versus substitution, dehydration of alcohol, ease of dehydration, acid catalysis, reversibility, orientation.	16	**3**
4	**Electrophilic and free radicals addition**	Reactions at carbon-carbon, double bond, electrophile, hydrogenation, heat of hydrogenation and stability of alkenes, markownikoff rule, addition of hydrogen halides, addition of hydrogen bromides, peroxide effect, electrophilic addition, mechanism, rearrangement, absence of hydrogen exchange, orientation and reactivity, addition of halogen, mechanism, halohydin formation, mechanism of free radicals addition, mechanism of peroxide initiated addition of hydrogen bromide, orientation of free addition, additions of carbene to alkene, cyclo addition reactions.	16	**4**
5	**Electrophilic aromatic substitution** **Nucleophilic addition reaction**	Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent group, mechanism of nitration, sulphonation, halogenation, friedel craft alkylation, friedel craft acylation, reactivity and orientation, activating and deactivating o, p, m directing groups, electron release via resonance, effect of halogen on electrophilic aromatic substitution in alkyl benzene, side chain halogenation of alkyl benzene, resonance stabilization of benzyl radical. Mechanism of aldol condensation, Claisen condensation, Cannizzaro reaction, crossed aldol condensation, Crossed Cannizzaro reaction, benzoin condensation, Perkin condensation. Knoevenagel, Reformatsky reaction, Wittig reaction, Michael addition.	16	**5**
6	**Study of the following official compounds**	Nucleophilic acyl substitution in carboxylic acid derivatives, comparison with nucleophilic addition reaction, ionization of carboxylic acids, acidity of acids, structure of carboxylate ion, effect of substituent on acidity, conversion acids to acid chloride, amide, ester and anhydride, preparation, test for purity, assay and medicinal uses of Chlorbutol, Dimercaprol, Glyceryl trinitrate, Urea, Ethylene diamine dihyrate, Vanillin, Paraldehyde, Ethylene chloride, Lactic acid, Tartaric acid, citric acid, salicylic acid, aspirin, methyl salicylate, ethyl benzoate, benzyl benzoate, dimethyl pthalate, sodium lauryl sulphate, saccharin sodium, mephensin.	16	**6**

Reference Books:
Organic chemistry – J.M.Cram and D.J.Cram
Organic chemistry- Brown
Advanced organic chemistry- Jerry March, Wiley
Organic chemistry- Cram and Hammered, Pine Hendrickson
e-Learning Source:
https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/intro1.htm
https://courses.lumenlearning.com/suny-potsdam-organicchemistry/
https://kpu.pressbooks.pub/organicchemistry/
https://onlinelibrary.wiley.com/doi/book/10.1002/0471648736
https://engineeringbookspdf.com/free-pdf/best-organic-chemistry-book-for-self-study/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PSO1 2	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PS O6
CO1	3	3	1	1	0	0	2	1	0	2	1	-	1	1	3	-	-	-
CO2	3	3	2	2	0	0	2	2	0	2	1	-	2	3	2	-	-	-
CO3	3	3	1	1	0	0	2	2	0	3	1	-	2	3	2	-	-	-
CO4	2	3	1	1	0	0	2	2	0	2	1	-	1	3	2	-	-	-
CO5	3	2	1	1	0	0	1	2	0	2	1	-	2	3	2	-	-	-
CO6	3	3	3	2	0	0	1	2	0	2	1	-	1	2	2	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY108	Title of the Course	PHARMACEUTICAL ORGANIC CHEMISTRY	L	T	P	C
Year	I	Semester	ANNUAL	0	0	3	1.5
Course Objectives	1. To perform various laboratory techniques & processes. 2. To synthesize & identify different organic compounds. 3. To understand different types of reactions & their mechanisms. 4. To understand the reactivity/stability of compounds, reagents, solvents & their uses and purpose. 5. Understand 3D structure & stereochemistry.						

Course Outcomes	
CO1	Understanding of various laboratory techniques like purification of organic compounds by filtration, steam distillation & recrystallization.
CO2	Identification & classification of organic compounds on the basis of their functional groups, physical properties, reactivity and stability.
CO3	Synthesis of various organic compounds and the reaction mechanism involved in the synthesis.
CO4	Stoichiometric calculation and determination of percentage yields of the products obtained by synthesis
CO5	Understanding of 3D structure & conformers and stereochemistry of different organic compounds.
CO6	-

Experiment No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to the various laboratory techniques through demonstration involving synthesis: Acetylation**	1. Synthesis of Acetanilide 2. Synthesis of Aspirin	3	1,3,4
2	**Introduction to the various laboratory techniques through demonstration involving synthesis: Benzoylation**	1. Synthesis of Benzanilide 2. Synthesis of Phenyl Benzoate	3	1,3,4
3	**Introduction to the various laboratory techniques through demonstration involving synthesis: Bromination**	1. Synthesis of P-bromo acetanilide 2. Synthesis of 2,4,6 – tribromo aniline	3	1,3,4
4	**Introduction to the various laboratory techniques through demonstration involving synthesis: Condensation**	1. Synthesis of Dibenzylidene acetone 2. Synthesis of Benzophenone oxime by condensation of benzophenone with hydroxylamine	3	1,3,4
5	**Introduction to the various laboratory techniques through demonstration involving synthesis: Diazotization & coupling**	1. Synthesis of 1-Phenylazo-2-napthol	3	1,3,4
6	**Introduction to the various laboratory techniques through demonstration involving synthesis: Hydrolysis of Esters**	1. Synthesis of Benzoic acid 2. Synthesis of Salicylic acid	3	1,3,4
7	**Introduction to the various laboratory techniques through demonstration involving synthesis: Nitration**	1. Synthesis of m-dinitro benzene 2. Synthesis of Picric acid 3. Nitration of Salicylic acid	3	1,3,4
8	**Introduction to the various laboratory techniques through demonstration involving synthesis: Oxidation**	1. Synthesis of 9, 10 – Antharaquinone from anthracene 2. Synthesis of benzoic acid from toluene or benzaldehyde 3. Synthesis of O-chloro-benzoic acid from O-chloro-tolune	3	1,3,4
9	**Introduction to the various laboratory techniques through demonstration involving synthesis: Reduction**	1. Synthesis of m-phenylene diamine from m-dinitrobenzene 2. Synthesis of Aniline from Nitrobenzene	3	1,3,4
10	**Identification of organic compounds on the basis of chemical tests of functional groups**	Identification of organic compounds & derivatives containing following functional groups – 1. Phenols 2. Amides 3. Carbohydrates 4. Amines 5. Carboxylic acids 6. Aldehyde and ketones 7. Alcohols 8. Esters 9. Hydrocarbons 10. Anilides 11. Nitrocompounds.	3	2
11	**Demonstration of 3D Structure of compounds using models (stereo models)**	Building 3D models of following compounds – 1. Methane 2. Ethane 3. Ethylene 4. Acetylene 5. Cis alkene 6. Trans alkene 7. Inversion of configuration.	3	5

e-Learning Source:
Identification of functional groups (Virtual Lab by CDAC) Tests for the functional groups (Theory) : Chemistry : Amrita Online Lab (olabs.edu.in)
Synthesis of organic compounds (Virtual Lab by CDAC) Preparation of Organic Compounds (Theory) : Chemistry : Amrita Online Lab (olabs.edu.in)
Stereochemistry 3D Models Stereochemistry Home Page (chemtube3d.com)

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	1	2	1	2	1	3	1	3	3	-	1	1	1	-	-	-
CO2	3	2	2	2	1	2	1	3	1	3	3	-	2	2	2	-	-	-
CO3	3	3	3	3	1	3	2	3	1	3	3	-	3	2	3	-	-	-
CO4	3	3	3	2	1	2	1	3	1	3	3	-	2	2	2	-	-	-
CO5	3	3	3	3	1	3	2	3	1	3	3	-	3	3	3	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY 109	Title of the Course	PHARMACEUTICAL INORGANIC CHEMISTRY	L	T	P	C
Year	I	Semester	ANNUAL	2	1	0	3
Pre-Requisite	10+2 (PCM/PCB)	Co-requisite					
Course Objectives	1.To know about fundamentals of Analytical chemistry and also 2.the study of inorganic pharmaceuticals regarding their monographs and also 3. the course deals with basic knowledge of analysis of various pharmaceuticals.						

Course Outcomes	
CO1	To understand different sources of impurities & to develop ideas with the fundamentals of analytical chemistry
CO2	Clarify need and basic principle and applications of different titrations.
CO3	Well acquainted with the principles of limit test and important inorganic compounds of antidotes, respiratory stimulants & medicinal gases.
CO4	Understand the medicinal and pharmaceutical importance of inorganic compounds of acidifiers and antacids.
CO5	Familiar with the difference classes of inorganic pharmaceutical compounds and their analysis.
CO6	To highlight domain of radiopharmaceuticals used in diagnostics and therapy & to describe typical therapeutic classes of inorganic compounds.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	Sources of impurities in pharmaceuticals. Errors in quantitative analysis, classification of errors, concept of accuracy and precision, treatment of analytical results. Principle of volumetric analysis, different methods of analysis, different methods for expressing concentrations of solutions, primary and secondary standards. Acid-base concepts, relative strength of acids and bases, law of mass action, common ion effect, ionic product of water, Henderson-Hasselbalch equation, buffer solutions, theory of indicators, neutralization curves, choice of indicators, mixed and universal indicators.	16	**1**
2	**Non aqueous titration** **Precipitation titrations** **Complexometric titrations** **Gravimetry:**	Theoretical basis, types of solvents, preparations and standardization of titrant solutions, titration of weak acid, weak bases and indicators. standardisation of perchloric acid, lithium and sodium methoxide, tetra butyl ammonium hydroxide. Introduction, types of precipitation titrations, end point detection. Introduction, principle, types of titrations, endpoint detection, Theory of Indicators. Basic concepts, Precipitation techniques, co-precipitation, post–precipitation, various steps involved in gravimetric analysis, pharmaceutical applications.	16	**2**
3	**Limit tests** **Redox titrations** **Medicinal Gases** **Respiratory stimulant**	Definition, importance, general procedure for limit test for chlorides, sulphates, iron, arsenic, lead and heavy metals. Concepts of oxidation–reduction reactions, redox reactions, theory of redox titrations, redox indicators, iodometry and iodimetry, titrations involving cerric sulphate, potassium iodate, potassium bromate, potassium permanganate, titanous chloride. Preparation and uses of the following Oxygen, Carbon dioxide, Helium, Nitrogen and Nitrous Oxide. Antidotes**:** Sodium nitrite, Sodium thiosulphate and Charcoal. Ammonium carbonate.	16	**3**
4	**Acidifiers** **Antacids** **Cathartics**	Dilute hydrochloric acid, Sodium phosphate, Ammonium chloride. Classification, Qualities of an ideal antacid, side effects, advantages, combination therapy, acid neutralizing capacity, Sodium bicarbonate, Potassium citrate, Aluminium hydroxide gel, Dried aluminium hydroxide gel, Magnesium hydroxide, Light and heavy magnesium trisilicate, light and heavy magnesium carbonate, Calcium carbonate, Magaldrate and Bismuth carbonate. Magnesium hydroxide, Magnesium sulphate, Magnesium carbonate and Sodium phosphate.	16	**4**
5	**Electrolyte replenisher** **Electrolytes used in the acid-base therapy** **Essential Trace elements** **Antimicrobials**	Electrolytes used for replacement therapy: Sodium chloride, Potassium chloride, Calcium chloride, Calcium gluconate. Sodium acetate, Potassium acetate, Sodium bicarbonate, Potassium bicarbonate, Sodium citrate, Sodium lactate, Ammonium chloride. Electrolyte combination therapy, Compound sodium chloride solution, Sodium chloride injection and oral rehydration salt. Definition, Physiological role of Iron, Copper, Zinc, Chromium, Manganese, Molybdenum, Selenium, Sulphur and Iodine. Hydrogen Peroxide, Potassium Permanganate, Chlorinated Lime, Iodine, Boric Acid, Silver Nitrate, Selenium Sulphide.	16	**5**
6	**Pharmaceutical Aids** **Dental products:**	Sodium bisulphite, sodium metabisulphite, bentonite, magnesium stearate, zinc stearate, aluminium sulphate, sodium carboxy methyl cellulose, purified water, water for injection and sterile water for injection. **i) Anti-caries Agents:** Role of Fluorides as anti-caries agents, Sodium fluoride. **ii) Dentifrices:** Calcium carbonate, dibasic calcium phosphate, Zinc chloride. Sclerosing agents: Hypertonic saline, Sodium tetra decyl sulphate. **Expectorants:** Potassium citrate and Potassium iodide. Sedative: Potassium bromide. **Sclerosing agents:** Hypertonic saline, Sodium tetra decyl sulphate. **Radiopharmaceuticals:** Introduction, measurement of radioactivity, clinical applications and dosage, hazards and precautions.	16	**6**

Reference Books:

A.H.Beckett & J.B. Stenlake's Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.

Pharmaceutical Inorganic chemistry by Dr. B. G. Chetwal.

Analytical Chemsitry by John H. Kennedy.

I. P. 1985 and 1996, Govt. of India, Ministry of health

e-Learning Source:
https://www.researchgate.net/publication/359103968_Textbook_of_Pharmaceutical_Inorganic_Chemistry
https://pharmaedu.in/pharmaceutical-inorganic-chemistry-notes-pdf-download/
https://www.thepharmacystudy.com/pharmaceutical-inorganic-chemistry-books-pdf-free-download/
https://www.scribd.com/book/431648754/Pharmaceutical-Inorganic-Chemistry

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO 6
CO1	2	0	0	0	0	0	1	1	1	1	2	-	1	2	2	-	-	-
CO2	2	0	0	0	0	0	1	1	1	0	2	-	2	3	2	-	-	-
CO3	2	1	0	0	0	0	1	1	1	0	2	-	1	3	1	-	-	-
CO4	2	1	2	1	1	1	1	2	1	1	2	-	1	3	2	-	-	-
CO5	2	1	2	1	1	1	1	2	1	1	2	-	2	3	2	-	-	-
CO6	2	1	2	0	1	1	1	2	1	1	2	-	1	2	1	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY110	Title of the Course	INORGANIC PHARMACEUTICAL CHEMISTRY	L	T	P	C
Year	I	Semester	ANNUAL			3	1.5
Course Objectives	1.To study about fundamental of analytical chemistry 2.The study of inorganic pharmaceuticals regarding their monograph 3.Basic knowledge of analysis of various pharmaceuticals						

Course Outcomes	
CO1	Understand the principles and procedures of analysis of drugs of Inorganic Pharmaceuticals
CO2	To check impurities by applying limit test
CO3	Synthesis of different inorganic pharmaceutical compounds
CO4	Clarify need basic principles of non-aqueous and acid base titration
CO5	How to assay different classes of inorganic compounds
CO6	Assessment of the analytical results of acid base titration

Experiment No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	**Equipment's study**	General Introduction to Pharmaceutical chemistry Laboratory and study the different laboratory equipment's and glassware's	3	1
2	**Limit test**	To perform limit test of chloride from the given sample	3	2
3	**Limit test**	To perform the limit test of Sulphate from the given sample	3	2
4	**Limit test**	To perform the limit test of Iron from the given sample	3	2
5	**Limit test**	To perform the limit test of Heavy metal from the given sample	3	2
6	**Limit test**	To perform the limit test of Arsenic from the given sample	3	2
7	**Modified limit test**	To perform the modified limit test for Chloride from the given sample	3	2
8	**Modified limit test**	To perform the modified limit test for Sulphate from the given sample	3	2
9	**Synthesis**	To prepare and submit Magnesium carbonate	3	3
10	**Synthesis**	To prepare and submit Calcium carbonate	3	3
11	**Synthesis**	To prepare and submit Potash Alum	3	3
12	**Synthesis**	To prepare and submit Boric acid	3	3
13	**Synthesis**	To prepare and submit Magnesium sulphate	3	3
14	**Identification test**	To perform identification test of Sodium bicarbonate	3	1
15	**Identification test**	To perform identification test of Copper sulphate	3	1
16	**Identification test**	To perform identification test of Barium sulphate	3	1
17	**Identification test**	To perform identification test of Ferrous sulphate	3	1
18	**Assay**	To prepare and standardize 0.1 N Potassium Permanganate solution by 0.1 N oxalic acid	3	5
19	**Assay**	To perform the assay of Potassium iodide	3	5
20	**Assay**	To perform the assay of Sodium Chloride by Volhard's method	3	5
21	**Assay**	To perform the assay of Calcium Gluconate	3	5
22	**Assay**	To perform the assay of Magnesium Sulphate	3	5
23	**Assay**	To perform the assay of Copper Sulphate	3	5
24	**Assay**	To identify the swelling factor of bentonite powder	3	5
25	**Assay**	To estimate the amount of Barium as Barium Sulphate from the given sodium sulphate by gravimetric estimation	3	5

e-Learning Source:

https://recnotes.com/category/pharm-d-lab-experiment/pharm-d-1st-yearlab-experiments/pharmaceutical-inorganic-chemistry-practical/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	0	2	0	0	1	1	1	1	1	2	-	-	-	-	-	-	-
CO2	2	0	2	2	0	1	1	1	1	0	2	-	-	-	-	-	-	-
CO3	2	1	1	2	0	1	1	1	1	0	2	-	-	-	-	-	-	-
CO4	1	1	1	1	0	2	1	2	1	1	2	-	-	-	-	-	-	-
CO5	2	1	1	1	0	2	1	2	1	1	2	-	-	-	-	-	-	-
CO6	1	1	1	2	0	2	1	2	1	0	2	-	-	-	-	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Course Code	MT120	Title of the Course	REMEDIAL MATHEMATICS	SDG Goals	L	T	P	C
Year	I	Semester	ANNUAL		2	1	-	3
Course Objectives	1. Know the theory and their application in Pharmacy. 2. Solve the different types of problems by applying theory. 3. Appreciate the important application of mathematics in Pharmacy							

Course Outcomes	
	At completion of this subject, it is expected that students will be able to –
CO1	Explain the significance of algebraic expressions and trigonometric concepts in the context of pharmaceutical measurements.
CO2	**Apply** the concepts of **analytical geometry** to interpret and analyze **pharmaceutical data**
CO3	**Apply differentiation techniques** to calculate the rate of change of various pharmaceutical quantities like concentration, dosage rates, or drug release profiles.**Analyze** the behavior of drug concentration over time using **derivatives** to model **pharmacokinetic processes**, such as drug absorption, distribution, metabolism, and excretion
CO4	Apply integration techniques (such as substitution, partial fractions, integration by parts) to calculate pharmaceutical parameters.
CO5	**Solve** practical pharmaceutical problems involving **differential equations.**
CO6	Understand and Apply **Laplace transform techniques** to simplify complex pharmaceutical calculations.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1.	Algebra & Trigonometry	**Algebra:** Determinants, Matrices; **Trigonometry:** Sides and angles of a triangle, solution of triangles.	12	1	-----
2.	Analytical Geometry	**Analytical Geometry:** Points, Straight line, circle, parabola	12	2	----
3.	Differential Calculus	**Differential calculus:** Limit of a function, Differential calculus, Differentiation of a sum, Product, Quotient Composite, Parametric, exponential, trigonometric and Logarithmic function. Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions of two variables	12	3	-------
4.	Integral Calculus	**Integral Calculus:** Definite integrals, integration by substitution and by parts, Properties of definite integrals.	12	4	------
5.	Differential Equations	**Differential equations:** Definition, order, degree, variable separable, homogeneous, Linear, heterogeneous, linear differential equation with constant coefficient, simultaneous linear equation of second order.	12	5	------
6.	Laplace Transform	**Laplace transform:** Definition, Laplace transform of elementary functions, Properties of linearity and shifting.	12	6	-----

Reference Books:	
Text Books	1. Differential calculus By Shantinarayan
	2. Text book of Mathematics for second year pre-university by Prof.B.M.Sreenivas
Reference Books	1. Integral calculus By Shanthinarayan
	2. Engineering mathematics By B.S.Grewal
	3. Trigonometry Part-I By S.L.Loney
e-Learning Source:	
https://recnotes.com/wp-content/uploads/2023/01/remedial-mathematics.pdf	

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1			2								1	1		2	-	-	-
CO2			2								1	1		2	-	-	-
CO3			2								1	1		2	-	-	-
CO4			2								1	1		2	-	-	-
CO5			2								1	1		2	-	-	-
CO6			2								1	1		2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Course Code	PRY111	Title of the Course	REMEDIAL BIOLOGY	L	T	P	C
Year	I	Semester	ANNUAL	3	1	0	4
Course Objectives	1.This is an introductory course in Biology, which gives detailed study of natural sources such as plant and animal origin. 2.This subject has been introduces to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. 3.This subject gives basic foundation to Pharmacognosy.						

Course Outcomes	
CO1	Understanding the Structure and Functions of Animal Cell Organelles.
CO2	Understanding the Structure and Functions of Animal Tissues.
CO3	Understanding the Internal Anatomy and Physiology of Frogs and Correlating it with Human Anatomy & Physiology.
CO4	Understanding the Classification and Taxonomy of Animals within the Animal Kingdom.
CO5	Understanding the Structure and Modifications of Plant Roots, Stems, and Leaves.
CO6	Understanding the General organization of mammals including Poisonous snake.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Study of Animal cell and Study animal tissues**	Study of Animal cell: Protoplasm, Plasma membrane and its functions, cytoplasmic cell organelle's like Mitochondria, Golgi complex, Lysosome, Endoplasmic reticulum, Centrosome and centriole, Ribosomes and Nucleus. Study animal tissues: Classification, Structure and function of Epithelial, connective, muscular, nervous tissue and its types.	28	1,2
2	**Detailed study of frog**	General characteristics and External morphology of frog. Anatomy and physiology of Digestive system, Nervous system, Endocrine system, Respiratory system, Execratory system, Reproductive system, Circulatory system and Sense organs of frog.	25	2,3
3	**Classify the animal kingdom**	Classify the animal kingdom: Study of Pisces, Raptiles, and Aves. General organizations of mammals and its taxonomic order. Study of poisonous animals: Snake bite and its management.	26	2,3
4	**Introduction, structure, functions of plant cell**	Introduction, structure, functions of plant cell, Cell wall, and its constituents. General organizations of plant (cell and cell organelle's) and its inclusions. Plant tissues: Types, structure and functions of Meristem and permanent tissues. Plant kingdom and its classification	27	3,4
5	**Morphology of plants**	Morphology of plants. Root, Stem, Leaf and Its modifications. Inflorescence and Pollination of flowers. Morphology of fruits and seeds. Plant physiology.	27	2,3
6	**Taxonomy**	.Taxonomy of Leguminosae, umbelliferae, Solanaceae, Lilliaceae, Zinziberaceae, Rubiaceae. Study of Fungi, Yeast, Penicillin and Bacteria.	22	2,5

Reference Books:

1. Text books a. Text book of Biology by S.B.Gokhale b. A Text book of Biology by Dr.Thulajappa and Dr. Seetaram
2. A Text book of Biology by B.V.Sreenivasa Naidu, A Text book of Biology by Naidu and Murthy.
3. Botany for Degree students By A.C.Dutta. Outlines of Zoology by M.Ekambaranatha ayyer and T.N.Ananthakrishnan.
4. A manual for pharmaceutical biology practical by S.B.Gokhale and C.K.Kokate.

e-Learning Source:

https://byjus.com/ncert-books-class-11-biology/

https://biology.org.ua/files/lib/Raven_Johnson_McGraw-Hill_Biology.pdf

-

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	2	1	1	2	1	1	1	1	1	-	2	1	1	-	-	-
CO2	2	2	1	2	1	1	2	1	1	1	1	-	1	2	1	-	-	-
CO3	2	1	1	1	2	1	1	1	1	1	2	-	1	1	2	-	-	-
CO4	3	1	1	2	2	1	1	1	1	1	2	-	1	2	2	-	-	-
CO5	2	1	2	1	1	1	1	2	1	1	1	-	2	1	1	-	-	-
CO6	1	1	1	2	1	1	1	1	1	2	-	1	1	2	1	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Course Code	PRY112	Title of the Course	REMEDIAL BIOLOGY	L	T	P	C
Year	I	Semester	ANNUAL	-	-	3	-
Course Objectives	1. Study of natural sources such as plant and animal origin. 2. This subject has been introducing to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. 3. This subject gives basic foundation to Pharmacognosy.						

Course Outcomes	
CO1	Understanding the Structure and Functions of Animal Cell Organelles.
CO2	Understanding the Structure and Functions of Animal Tissues and their types.
CO3	Understanding the Internal Anatomy and Physiology of Frogs and Correlating it with Human Anatomy & Physiology.
CO4	Students will be able to learn about the classification of organisms within the Animal Kingdom and understand the principles of taxonomy.
CO5	Students will be able to list and identify the basic structures and types of modifications of plant roots, stems, and leaves.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	**Introduction of biology Experiments**	To study the cell & cell structure.	3	2
2.	**Animal & Plants cell**	To study the cell wall constituents & cell inclusion.	3	1
3.	**Stem modification**	To study of stem modification.	3	5
4.	**Root modification**	To study of root modification.	3	5
5.	**Leaves modification**	To study of leaves modification	3	5
6.	**Introduction of fruits & seeds**	To study the introduction of fruit & seeds	3	5
7.	**Preparation of permanent slides**	To prepare the permanent slides.	3	3
8.	**Transfer section of senna leaves**	To prepare the transfer section of senna leaves.	3	5
9.	**Transfer section of cassia**	Transfer section of cassia.	3	3
10.	**Transfer section of podophyllum**	Transfer section of podophyllum.	3	3
11.	**Simple plant physiology experiment**	Simple plant physiology experiment	3	3
12.	**Study of frog**	(a) To study the digestive system of frog (b) To study the respiratory system of frog (c) To study the reproductive system of frog	3	3
13.	**Computer based tutorial**	Computer based tutorial.	3	3
e-Learning Source:				
https://pharmacyinfoline.com/remedial-mathematics-biology-pharm-d/				

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)																
PO-PSO CO	PO 1	PO2	PO 3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO1 1	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO6
CO1	2	1	2	1	1	2	1	1	1	1	-	-	-	-	-	-	-
CO2	2	2	1	2	1	1	2	1	1	1	-	-	-	-	-	-	-
CO3	2	1	1	1	2	1	1	1	1	1	-	-	-	-	-	-	-
CO4	3	1	1	2	2	1	1	1	1	1	-	-	-	-	-	-	-
CO5	2	1	2	1	1	1	1	2	1	1	-	-	-	-	-	-	-
CO6																	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Course Code	PMT113	Title of the Course	MEDICAL TERMINOLOGY	L	T	P	C
Year	I	Semester	I	2	0	0	0
Course Objectives	Correctly identify the roles of the four types of word parts in forming medical terms. Identify unfamiliar medical terms using their knowledge of word parts. Define anatomy and physiology and use anatomic reference systems to identify the anatomic position for all major organ systems. Understand disease terms as they relate to the diagnostic coding manual. Use basic prefixes, suffixes, and combining forms to build medical terms. Explain the rules for proper pronunciation and spelling.						

Course Outcomes	
CO1	Correctly identify the roles of the four types of word parts in forming medical terms.
CO2	Identify unfamiliar medical terms using their knowledge of word parts
CO3	Use basic prefixes, suffixes, and combining forms to build medical terms
CO4	Explain the rules for proper pronunciation and spelling
CO5	Relate the terminology to the names, locations, and functions of the major organs of the body systems

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Terminology/Basic Word Structure Introduction to the medical terminology	Introduction to the medical terminology: Rationale for studying medical terminology Spelling and pronunciation of medical terms Basic word parts that form most medical terms: word root, combining form, prefix, and suffix Meaning and pronunciation of medical words	06	1,2
2	Terms Pertaining to the Body as a Whole	Terms applied to the structural organization of the body including building blocks of the body: cells, tissue, organs, systems Terms and abbreviations used to describe direction, planes, and cavities of the body Terms and abbreviations that locate anatomical division of the back and abdomen	06	2,3
3	Prefixes and Suffixes	Basic prefixes and suffixes used in medical terminology Prefixes of position, number, measurement, negation and direction	06	2,3
4	Study of terminology used in specific body systems	common medical terms, abbreviations and synonyms used for symptoms, diseases, disorders, procedures, treatments, and adverse effects of drugs associated with For the following Cardiovascular system Respiration Digestion Urinary Male Reproductive System Female Reproductive System Endocrine Nervous Systems The Senses The Skeleton and Muscular Systems The Skin	06	3,4
5	Terminology related to drugs and their effects	Terms related to causes, diagnosis and treatment of above systems and Cancer Immunity Behavioral disorders Anesthesia	06	2,5

Reference Books:

Betsy J. Shiland, MEDICAL TERMINOLOGY AND ANATOMY FOR ICD-10 CODING ISBN: 978-1-4557-0774-4

Barbara A. Gylys, Mary Ellen Wedding, MEDICAL TERMINOLOGY SYSTEMS A Body Systems Approach, 6th Edition

e-Learning Source:

http://www.frankshospitalworkshop.com/organisation/biomed_documents/Introduction%20to%20Medical%20Terminology.pdf

https://www.pittsburg.k12.ca.us/cms/lib/CA01902661/Centricity/Domain/1210/Medical%20Terminology%20for%20Health%20Professions%207th%20Edition%202012.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	2	2	1	2	1	1	2	2	2	-	1	2	2	-	-	-
CO2	2	2	1	2	1	1	2	1	1	1	1	-	2	1	2	-	-	-
CO3	2	1	2	1	2	1	2	1	1	1	1	-	1	2	1	-	-	-
CO4	3	2	1	2	2	1	1	1	1	2	1	-	2	1	2	-	-	-
CO5	2	1	2	1	2	2	1	2	2	1	2	-	1	2	1	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY201	Title of the Course	PATHOPHYSIOLOGY	L	T	P	C
Year	II	Semester	-	3	1		
Course Objectives	a. Describe the etiology and pathogenesis of the selected disease states; b. Name the signs and symptoms of the diseases; and c. Mention the complications of the diseases						

Course Outcomes	
CO1	Understand details of cell Injury, learn about different types of glucose related disease. Grasp the details about cause and pathogenesis of inflammation. Learn about wound healing process
CO2	Learn about hypersensitivity, autoimmune mechanism, Grasp the knowledge about AIDS and Amylodosis. Understand the differences and properties of T & B Cells. Gain knowledge about immune tolerance
CO3	Gain knowledge about the tumor, cancer, the pattern of spread, invasion, and metastasis. Learn about the etiology and pathogenesis of cancer.
CO4	Gain knowledge about types and management of shock. Understand the biological effects of radiation. Learn about different types of pollutions. Gain information about different types of vitamins, obesity, malnutrition etc.
CO5	Learn the pathophysiology of some common diseases, Understand the mechanism behind the disease
CO6	Learn the pathophysiology of some common infectious diseases. Understand the mechanism of common infectious disease

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Basic principles of cell injury and Adaptation Inflammation	a) Causes, Pathogenesis and morphology of cell injury b) Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen infiltration and glycogen infiltration and glycogen storage diseases c) Pathogenesis of acute inflammation, Chemical mediators in inflammation, Types of chronic inflammation d) Repairs of wounds in the skin, factors influencing healing of wounds	16	1
2	Diseases of Immunity	a) Introduction to T and B cells b) MHC proteins or transplantation antigens c) Immune tolerance - Hypersensitivity Hypersensitivity type I, II, III, IV, Biological significance, Allergy due to food, chemicals and drugs - Autoimmunity Criteria for autoimmunity, Classifications of autoimmune diseases in man, mechanism of autoimmunity, Transplantation and immunologic tolerance, allograft rejections, transplantation antigens, mechanism of rejection of allograft. - Acquired immune deficiency syndrome (AIDS) - Amylodosis	26	2
3	Cancer	Differences between benign and malignant tumors, Histological diagnosis of malignancy, invasions and metastasis, patterns of spread, disturbances of growth of cells, classification of tumors, general biology of tumors, spread of malignant tumors, etiology and pathogenesis of cancer.	09	3
4	Shock, Radiation and Environmental and nutritional diseases	Types of shock, mechanisms, stages and management Biological effects of radiation Environmental and nutritional diseases i) Air pollution and smoking- SO_2,NO, NO_2, and CO ii) Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation.	12	4
5	Pathophysiology of common diseases	Parkinsonism, Schizophrenia, Depression and mania, Hypertension,, Stroke (ischaemic and hemorrhage), Angina, CCF, Atherosclerosis, Myocardial infarction, Diabetes Mellitus, Peptic ulcer and inflammatory bowel diseases, Cirrhosis and Alcoholic liver diseases, Acute and chronic renal failure, Asthma and chronic obstructive airway diseases	19	5
6	Infectious diseases	Sexually transmitted diseases (HIV, Syphilis, Gonorrhoea), Urinary tract infections, Pneumonia, Typhoid, Tuberculosis, Leprosy, Malaria Dysentery (bacterial and amoebic), Hepatitis- infective hepatitis.	14	6

Reference Books:

Pathologic basis of disease by- Cotran, Kumar, Robbins

Text book of Pathology- Harsh Mohan

Text book of Pathology- Y.M. Bhinde

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

e-Learning Source:

https://www.lecturio.com/concepts/cell-injury-and-death/

https://www.physio-pedia.com/Wound_Healing

https://www.visitcompletecare.com/blog/types-of-shock/

https://nios.ac.in/media/documents/SrSec314NewE/Lesson-29.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	1	0	0	1	0	0	0	0	1		0	2	3			
CO2	3	1	1	0	0	1	0	0	0	0	1		0	2	3			
CO3	3	1	1	0	0	1	0	0	0	0	1		0	2	3			
CO4	3	1	1	0	0	1	0	0	0	0	1		0	2	3			
CO5	3	1	1	0	0	1	0	0	0	0	1		0	2	3			
CO6	3	1	1	0	0	1	0	0	0	0	1		0	2	3			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY 202	Title of the Course	PHARMACEUTICAL MICROBIOLOGY	L	T	P	C
Year	II	Semester	ANNUAL	3	1	0	4
Course Objectives	1. know the anatomy, identification, growth factors and sterilization of microorganisms; 2. know the mode of transmission of disease causing microorganism, symptoms of disease, and treatment aspect; 3. do estimation of RNA and DNA and there by identifying the source; 4. do cultivation and identification of the microorganisms in the laboratory; 5. do identification of diseases by performing the diagnostic tests; and appreciate the behavior of motility and behavioral characteristics of microorganisms.						

Course Outcomes	
CO1	To know the history and major divisions of microbes & about nutritional requirement for cultivation of microbes.
CO2	Students can able to know isolation, identification of microbes by different staining techniques.
CO3	Knowledge, application, testing and validation of sterilization in pharmaceutical preparation and evaluation of preservatives in pharmaceutical preparations.
CO4	Demonstrate an understanding of key concepts in immunology, immunization program and importance of booster dose and role of bacterial toxins.
CO5	Knowledge on the principles of biochemical tests and Principles and methods of different microbiological assays of antibiotics and vitamins.
CO6	Students can able to understand various infections (microbial causes, pathogenesis, and transmission of infection, diagnosis, prevention and treatment.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to the science of microbiology.**	Major divisions of microbial world and relationship among them. Different methods of classification of microbes and study of Bacteria, Fungi, Virus, Rickettsiae and Spirochetes. Nutritional requirements, growth and cultivation of bacteria and viruses.	16	1
2	**Introduction of media**	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. 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.	16	2
3	**Sterilization Methods**	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. Study of disinfectants, antiseptics, fungicidal and virucidal agents factors affecting their activation and mechanism of action. Evaluation of bactericidal, bacteriostatic and virucidal activities, evaluation of preservatives in pharmaceutical preparations.	16	3
4	**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.	16	4
5	**Diagnostic tests**	Schick's test, Elisa test, Western Blot test, Southern Blot, PCR, Widal, QBC, Mantaux Peripheral smear. 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}.	16	5
6	**Study of infectious diseases:**	Typhoid, Tuberculosis, Malaria: Study of malarial parasite. Cholera, Hepatitis, Meningitis, Syphilis & Gonorrhea and HIV. Standardization of vaccines and sera.	16	6

Reference Books:

Prescot L.M., Jarley G.P Klein D.A "Microbiology" 2nd edition Mc Graw Hill, Company Inc

Rawlins E.A."Bentley's Text Book of Pharmaceutics" Bailliere Tindals 24-28, London 1988

Forbisher "Fundamentals of Microbiology" Philidelphia W.B. Saunders.

War Roitt, Jonathan Brostoff, David male, "Immunology"3rd edition 1996, Mosby-year book Europe Ltd, London.

e-Learning Source:

https://openstax.org/details/books/microbiology

https://open.umn.edu/opentextbooks/textbooks/404 chrome-

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://rlmc.edu.pk/themes/images/gallery/library/books/Microbiology/Text_Book_of_Microbiology.pdf

http://www.freebookcentre.net/medical_text_books_journals/microbiology_ebooks_online_texts_download.html

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	9	0	1	1	1	1	1	1	-	1	2	1
CO2	2	2	2	1	0	1	2	2	1	1	2	-	2	2	2
CO3	2	2	1	1	0	1	1	1	1	1	2	-	1	2	1
CO4	1	2	2	1	1	1	1	2	1	1	2	-	1	2	2
CO5	2	3	2	1	1	1	1	2	1	1	2	-	2	3	2
CO6	2	3	2	0	1	1	1	2	1	2	3	-	1	2	2

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY203	Title of the Course	PHARMACEUTICAL MICROBIOLOGY	L	T	P	C
Year	II	Semester	ANNUAL	-	-	3	-
Course Objectives	1. To know about various aspects of microorganisms, its classification, morphology, laboratory cultivation identification and maintenance. 2. Its also discusses with sterilization of pharmaceutical products, equipment, media etc.						

Course Outcomes	
CO1	To know the history and major divisions of microbes & about nutritional requirement for cultivation of microbes.
CO2	Students can able to know isolation, identification of microbes by different staining techniques.
CO3	Knowledge, application, testing and validation of sterilization in pharmaceutical preparation and evaluation of preservatives in pharmaceutical preparations.
CO4	Demonstrate an understanding of key concepts in immunology, immunization program and importance of booster dose and role of bacterial toxins.
CO5	Knowledge on the principles of biochemical tests and Principles and methods of different microbiological assays of antibiotics and vitamins.
CO6	Students can able to understanding of various infections (microbial causes, pathogenesis, and transmission of infection, diagnosis, prevention and treatment.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	Microbiology	Introduction to microbiology	3	1
2.	Different Laboratory apparatus	To study the apparatus used in experimental microbiology	3	2
3.	Basic instrument	To study about the compound microscope and its parts	3	2
4.	Study of motility of bacteria	To study the motility of bacteria with the help of Hanging drop method	3	2
5.	Staining of bacteria	To perform the simple staining of given microorganism	3	2
6.	Staining of bacteria	To perform the negative staining of the given culture of micro organism	3	2
7.	Staining of bacteria	To perform the gram staining of given culture	3	2
8.	Nutrient broth	To prepare nutrient broth	3	1
9.	Sterilization	To perform the dry heat sterilization of the given glassware	3	3
10.	Sterilization	To perform the moist heat sterilization of given media and glass wares by Autoclave	3	3
11.	Aseptic transfer	To perform aseptic transfer of nutrient broth	3	2
12.	Nutrient agar	To prepare nutrient Agar	3	1
13.	Inoculation of bacteria	To perform inoculation of agar plate by Spread plate method	3	2
14.	Isolation of bacteria	To perform isolation of bacteria from given culture by streaking method	3	2
15.	Assay	To perform the microbial assay of antibiotics using cup plate method	3	5
16.	Sterility testing	To perform sterility testing of pharmaceutical products	3	5
17.	Antibiotic susceptibility test	To perform Antibiotic susceptibility test by antibiotic disc method (Kirby-Bauer method)	3	5
18.	Minimum inhibitory concentration	To determine minimum inhibitory concentration of Phenol	3	5
e-Learning Source:				
https://www.dropbox.com/s/v124abkm3f3l54h/5_6104695205468832200.pdf?dl=0				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	2	1	2	-	1	1	1	1	1	1	1	2	1	-	-	-
CO2	2	2	2	1	-	1	2	2	1	1	2	2	2	2	-	-	-
CO3	2	2	1	1	-	1	1	1	1	1	2	1	2	1	-	-	-
CO4	1	2	2	1	1	1	1	2	1	1	2	1	2	2	-	-	-
CO5	2	3	2	1	1	1	1	2	1	1	2	2	3	2	-	-	-
CO6	2	3	2	-	1	1	1	2	1	2	3	1	2	2	-	-	-

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY204	Title of the Course	PHARMACOGNOSY AND PHYTOPHARMACEUTICALS	L	T	P	C
Year	II	Semester	-	3	1	0	
Course Objectives	a. Understand the basic principles of cultivation, collection and storage of crude drugs; b. Know the source, active constituents and uses of crude drugs; and c. Appreciate the applications of primary and secondary metabolites of the plant.						

Course Outcomes	
CO1	Evaluate crude drugs on the basis of WHO guidelines with respect to its biological sources, macroscopy, microscopy, chemical constituents and uses.
CO2	Describe the concepts of cultivation on the basis of WHO guidelines implicated for improvement of quality of medicinal plants.
CO3	Explain the techniques for classification and report the crude drug adulteration as per the WHO guidelines.
CO4	Identify the primary metabolites on the basis of its classification, chemistry, and methods of analysis to understand its role in health care.
CO5	Discuss natural pesticides on the basis of their mechanism of action for protection of crops.
CO6	State the importance of naturally derived fibers, based on the understanding of its sources, preparation and evaluation, for commercial utility as Pharmaceutical aids.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Definition, history and scope of Pharmacognosy. Study of cell wall constituents and cell inclusions. Detailed study of various cell constituents. Classification of crude drugs	15	1
2	Cultivation of crude drugs	Cultivation, collection, processing and storage of crude drugs. Detailed method of cultivation of crude drugs.	15	2
3	Standardization of crude drugs	Microscopical and powder Microscopical study of crude drugs Different methods of adulteration of crude drugs	15	3
4	Analysis of plant primary metabolites	Carbohydrates and related products. Detailed study carbohydrates containing drugs. (11 drugs). Definition sources, method extraction, chemistry and method of analysis of lipids.	15	4
5	Analysis of plant primary metabolites	Detailed study of oils. Definition, classification, chemistry and method of analysis of protein.	15	4
6	Plant products and Natural pesticides	Study of natural pesticides; Study of plants fibers used in surgical dressings and related products.	15	5, 6

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

e-Learning Source:

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	2	-	2	3	-	-	3	3	-	1	2
CO2	3	-	2	3	-	-	2	-	-	2	3	-	-	-
CO3	3	-	1	2	-	2	1	-	-	2	3	-	1	1
CO4	3	-	1	2	-	1	1	-	-	-	3	-	-	-
CO5	3	-	2	1	-	1	1	-	-	2	3	-	-	-
CO6	3	-	-	1	1	1	-	-	-	2	3	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Course Code	PRY 205	Title of the Course	PHARMACOGNOSY AND PHYTOPHARMACEUTICALS	L	T	P	C
Year	II	Semester	ANNUAL	0	0	3	–
Course Objectives	1.Know the source, active constituents and uses of crude drugs; and 2. Appreciate the applications of primary and secondary metabolites of the plant. 3.To evaluate and analyze the medicinal importance of crude drugs						

Course Outcomes	
CO1	Know the source, active constituents and uses of crude drugs;
CO2	Appreciate the applications of primary and secondary metabolites of the plant.
CO3	Identification of crude drugs by help of macroscopic and microscopic techniques.
CO4	To evaluate the crude drugs on the basis of their chemical tests
CO5	To evaluate crude drugs against adulteration.
CO6	Study of crude drugs

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	Definition, history and scope of Pharmacognosy. Introduction to pharmacognosy laboratory and instruments. Study of cell wall constituents and cell inclusions. Detailed study of various cell constituents. Classification of crude drugs	15	1
2	**Morphological, microscopical and powder study of crude drugs.**	Morphological, microscopical and powder study of crude drugs: *Datura, Podophyllum, Nuxvomica, Senna, Coriander, Quassia, Cinnamon Cinchona, Ephedra, Quassia, Clove, Fennel, Isapgol, Rauwolfia, Liquorice,* Ginger.	15	2
3	**Analysis of oils/Fats**	To determine the iodine value, saponification value,ester value and acid value of crude drugs.	15	3
4	**Chemical test of carbohydrates**	To perform the chemical test of Acacia, Tragacanth, Agar, Starch,	15	4
5	**Chemical test of Lipids**	To perform the chemical test of Castor oil, sesame oil, shark liver oil, beeswax.	15	5
6	**Study of gelatin**	Biological source and chemical test of Gelatin.	15	6

e-Learning Source:

https://recnotes.com/category/pharm-d-notes/pharm-d-2nd-year-notes/pharmacognosy-phytopharmaceuticals-notes/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	1	3	2	1	1	1	-	2	1	1
CO2	-	-	2	3	-	-	2	-	-	-	-	-	-	-	2
CO3	-	-	1	1	1	-	1	-	-	-	-	-	-	-	1
CO4	1	-	1	1	-	-	3	1	-	-	-	-	1	-	1
CO5	-	-	2	1	-	-	1	-	-	-	-	-	-	-	2

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Course Code	PRY206	Title of the Course	PHARMACOLOGY-I	SDG Goals	L	T	P	C
Year	II	Semester	ANNUAL		3	1	0	4
Course Objectives	Upon completion of the subject student shall be able to (Know, do, appreciate) – 1. understands the pharmacological aspects of drugs falling under the above-mentioned chapters; 2. handle and carry out the animal experiments; 3. appreciates the importance of pharmacology subject as a basis of therapeutics; and correlate and apply the knowledge therapeutically							

Course Outcomes	
CO1	Conceptual knowledge of pharmacology basics
CO2	Learning the classification, pharmacodynamic and pharmacokinetic aspects of different drugs
CO3	Precise knowledge about pharmacological aspects of drugs mentioned under different categories of syllabus.
CO4	Application of acquired knowledge to the basics of therapeutics.
CO5	Clinical correlation of different drugs.
CO6	Knowledge of Preclinical and Clinical studies.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**General Pharmacology**	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	16	1,5	-------
2	**Pharmacology of drugs acting on ANS**	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	16	2,3 &4	3.4
3	**Pharmacology of drugs acting on cardiovascular System**	a) Antihypertensives b) Anti-anginal drugs c) Anti-arrhythmic drugs d) Drugs used for therapy of Congestive Heart Failure e) Drugs used for hyperlipidaemias	12	2,3 &4	-----
4	**Pharmacology of drugs acting on Central Nervous System**	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	12	2,3 &4	3.4, 3.5
5	**Pharmacology of Drugs acting on Respiratory tract**	a) Bronchodilators b) Mucolytics c) Expectorants d) Antitussives e) Nasal Decongestants	12	2,3 &4	------
6	**Pharmacology of Hormones and Hormone antagonists**	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	12	2,3 &4	3.1, 3.2, 3.4

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 McGraw 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.

e-Learning Source:

https://pharmacyfunblog.files.wordpress.com/2016/11/kd-tripathi-essentials-of-medical-pharmacologyunitedvrg-2013.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	1	1	1	2	1	1	3	1	1	1	3	3	3	-	-	-
CO2	3	3	3	2	3	2	1	-	2	1	3	3	3	3	-	-	-
CO3	1	2	3	1	1	1	1	2	3	1	1	3	3	2	-	-	-
CO4	3	2	3	3	3	2	3	1	2	3	3	3	3	3	-	-	-
CO5	3	2	3	3	3	2	3	3	3	3	2	3	3	3	-	-	-
CO6	3	3	3	3	3	3	3	3	3	2	2	3	3	2	-	-	-

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY207	Title of the Course	COMMUNITY PHARMACY	SDG Goals	L	T	P	C
Year	II	Semester	ANNUAL		2	1	-	3
Course Objectives	In the changing scenario of pharmacy practice in India, Community Pharmacists are expected to offer various pharmaceutical care services. In order to meet this demand:- 1- The student shall be able to dispense the medicine 2- The student shall be able to respond to minor ailments 3- The student shall be able to provide patient counseling, 4. The student shall be able to provide health screening services							

Course Outcomes	
CO1	Student shall be able to know pharmaceutical care services.
CO2	Student shall be able to know the business and professional practice management skills in community pharmacies.
CO3	Student shall be able to do patient counselling & provide health screening services to public in community pharmacy
CO4	Student shall be able to respond to minor ailments and provide appropriate medication.
CO5	Student shall be able to show empathy and sympathy to patients
CO6	Student shall be able to appreciate the concept of Rational drug therapy.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**Introduction to Community Pharmacy**	Definition, scope, of community pharmacy, Roles and responsibilities of the Community pharmacist, Code of ethics for community pharmacists	4	1,5	3.2, 3.3, 3.6, 3.8, 3.9, 3.b, 3.c, 3.d
2	**Community Pharmacy Management, Inventory control in community pharmacy**	Community Pharmacy Management:-Selection of site, Space layout, and design, Staff, Materials- coding, stocking , Legal requirements, Maintenance of various registers, Use of Computers: Business and health care soft wares Inventory control in community pharmacy:-Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock	11	2	--------
3	**Prescriptions, OTC Medication, Essential Drugs concept and Rational Drug Therapy**	Prescriptions– parts of prescription, legality & identification of medication-related problems like drug interactions OTC Medication- Definition, OTC medication list & Counseling Essential Drugs concept and Rational Drug Therapy, Role of community pharmacist	11	4,6	3.8, 3.b, 3.c, 3.d
4	**Health Education**	WHO Definition of health and health promotion, care for children, pregnant & breastfeeding 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	17	3,4	3.3, 3.7, 3.9
5	**Health screening services, Responding to symptoms of minor ailments**	Health screening services - Definition, importance, methods for screening Blood pressure/ blood sugar/ lung function and Cholesterol testing Responding to symptoms of minor ailments- Relevant pathophysiology, common drug therapy to Pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhea, constipation), Pyrexia, Ophthalmic symptoms, worms infestations	17	3,4	--------
6	**Pharmaceutical care, Patient counseling, Patient medication adherence**	Pharmaceutical care - Definition and Principles of Pharmaceutical care Patient counseling - 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	6	1,3	3.5, 3.7, 3.8, 3.c, 3.d

Reference Books:

Handbook of pharmacy – health care.Edt. Robin J Harman. The Pharmaceutical press.

Comprehensive Pharmacy Review – Edt. Leon Shargel. Lippincott Williams & Wilkins.

Health Education and Community Pharmacy by N.S.Parmar.

Drug store & Business management by Mohammed Ali &Jyoti.

e-Learning Source:

https://www.pharmpress.com/product/9780853697169/community-pharmacy-handbook

https://www.elsevier.com/books/community-pharmacy/rutter/978-0-7020-8020-3

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	1	2	1	1	1	3	1	1	1	1	-	3	-	-	-
CO2	1	-	3	-	2	1	-	-	-	3	2	1	3	1	-	-	-
CO3	1	3	3	-	1	1	-	-	-	-	-	3	1	2	-	-	-
CO4	1	-	-	1	-	2	-	2	3	-	3	1	1	3	-	-	-
CO5	1	-	-	-	-	1	-	-	-	3	-	3	-	2	-	-	-
CO6	2	3	2	-	-	1	1	2	1	-	-	2	1	3	-	-	-

1.LowCorrelation;2-ModerateCorrelation;3-SubstantialCorrelation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY208	Title of the Course	PHARMACOTHERAPEUTICS-I	SDG Goals	L	T	P	C
Year	II	Semester	ANNUAL		3	1	-	-

Course Objectives	
	1. The pathophysiology of selected disease states and the rationale for drug therapy; 2. The therapeutic approach to management of these diseases; 3. The controversies in drug therapy; 4. The importance of preparation of individualized therapeutic plans based on diagnosis; 5. Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects); 6. Describe the pathophysiology of selected disease states and explain the rationale for drug therapy; 7. Summaries the therapeutic approach to management of these diseases including reference to the latest available evidence; 8. Discuss the controversies in drug therapy; 9. Discuss the preparation of individualized therapeutic plans based on diagnosis; and 10. 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).

Course Outcomes	
CO1	Learn about the pharmacotherapy of cardiovascular & respiratory disease states and explain the rationale for drug therapy and management/controversies.
CO2	Understand the pharmacotherapy of the respiratory system and explain the rationale for drug therapy in respiratory diseases.
CO3	Know the pharmacotherapy of the Endocrine system and explain the rationale of drug therapy for endocrine system.
CO4	Understand the general prescribing guidelines for: (a) Pediatric patients, (b) Geriatric patients, (c) Pregnancy and breastfeeding.
CO5	Learn about the pharmacotherapy of Ophthalmology: Glaucoma, Conjunctivitis – viral & bacteria and explain the rationale for drug therapy and management.
CO6	Acquaint with rational drug use: Definition, Role of Pharmacist, Essential drug concept, Rational drug concept, and Rational drug formulations

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**Cardiovascular system**	Hypertension, Congestive cardiac failure, Angina Pectoris, Myocardial infarction, Hyperlipidemias, Electrophysiology of heart and Arrhythmias.	24	1, 3, 4	-------
2	**Respiratory system**	Introduction to Pulmonary function test, Asthma, Chronic obstructive airways disease, Drug induced pulmonary diseases.	24	1, 3, 4	------
3	**Endocrine system**	Diabetes, Thyroid diseases, Oral Contraceptives, Hormones replacement therapy Osteoporosis.	24	1, 3, 4	------
4	**General prescribing guidelines for**	(a) Pediatric patients, (b) Geriatric patients, (c) Pregnancy and breast-feeding.	16	2, 5	3.8, 3.c, 3.d
5	**Ophthalmology**	Glaucoma, Conjunctivitis – viral & bacteria.	12	1, 3, 4	------
6	**Introduction to rational drug use**	Definition, Role of pharmacist, Essential drug concept, Rational drug concept, Rational drug formulations.	20	2	3.7, 3.8, 3.c, 3.d

Reference Books:

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

Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication.

Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.

Applied Therapeutics:The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA

Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.

Relevant review articles from recent medical and pharmaceutical literature.

e-Learning Source:

https://www.physio-pedia.com/Category:Pharmacology_for_Cardiovascular_Disease

https://accessphysiotherapy.mhmedical.com/content.aspx?bookid=442&sectionid=40184176#6095991

https://www.iptsalipur.org/wp-content/uploads/2020/08/BP503T_PCOL_UNIT-IV.pdf

https://ksumsc.com/download_center/Archive/4th/435/435%20TeamWork/Ophthalmology/F1/5.%20Ocular%20Pharmacology%20%26%20Toxicolog y.pdf

https://www.studocu.com/row/document/kenya-medical-training-college/community-health-nursing/essential-drugs-pch-lecture-notes-7/15475071

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	2	2	2	3	2	2	2	3	1	2	3	-	-	-
CO2	3	2	2	2	3	2	3	2	2	3	3	1	2	3	-	-	-
CO3	3	3	3	2	2	2	3	3	3	3	2	1	2	3	-	-	-
CO4	3	3	3	2	2	2	2	2	3	3	2	1	2	3	-	-	-
CO5	2	3	2	2	3	3	3	2	3	2	3	1	2	3	-	-	-
CO6																	

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY209	Title of the Course	PHARMACOTHERAPEUTICS-I	L	T	P	C
Year	II	Semester	ANNUAL	-	-	3	3
Course Objectives	1. The pathophysiology of selected disease states and the rationale for drug therapy; 2. The therapeutic approach to management of these diseases; 3. The controversies in drug therapy; 4. The importance of preparation of individualised therapeutic plans based on diagnosis; 5. Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects); 6. Describes the pathophysiology of selected disease states and explain the rationale for drug therapy; 7. Summarizes the therapeutic approach to management of these diseases including reference to the latest available evidence; 8. Discusses the controversies in drug therapy; 9. Discusses the preparation of individualised therapeutic plans based on diagnosis; and 10. Identifies the patient-specific parameters relevant in initiating drug therapy, and 11. Monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).						

Course Outcomes	
CO1	To understand pharmacotherapeutics and develop skills to contribute to the quality and effective use of medicines.
CO2	Students will be able to apply their knowledge of pathophysiology and therapeutics to understand and manage various common diseases.
CO3	To understand the pathophysiology of selected disease, rationale for drug therapy, and therapeutic approach to management of these diseases
CO4	To understand the controversies in drug therapy and individualized therapeutic plans based on diagnosis
CO5	Students will be able to analyse patient-specific parameters to initiate and monitor drug therapy, including evaluating alternatives, assessing the time-course of clinical and laboratory indices of therapeutic response, and managing adverse effects.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Hospital Postings**	Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion; A minimum of 20 cases should be presented and recorded covering most common diseases.)	17	5
2	**Case Presentation**	Students are required to maintain a record of cases presented and the same should be submitted at the end of the course for evaluation	17	1
3	**Ward Round**	Attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge.	17	3
e-LearningSource:				
https://www.studocu.com/row/document/kenya-medical-training-college/community-health-nursing/essential-drugs-pch-lecture-notes-7/15475071				

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)																
PO-PSO CO	PO 1	PO2	PO 3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO1 1	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO6
CO1	3	2	3	2	2	2	3	2	2	2	3	1	2	3	-	-	-
CO2	3	2	2	2	3	2	3	2	2	3	3	1	2	3	-	-	-
CO3	3	3	3	2	2	2	3	3	3	3	2	1	2	3	-	-	-
CO4	3	3	3	2	2	2	2	2	3	3	2	1	2	3	-	-	-
CO5	2	3	2	2	3	3	3	2	3	2	3	1	2	3	-	-	-

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY301	Title of the Course	PHARMACOLOGY-II	L	T	P	C
Year	III	Semester	ANNUAL	3	1	-	4
Course Objectives	1. To understand the concepts of chemotherapy. 2. To understand regarding the types of antimicrobials with their classification, and pharmaceutical applications/uses.						

Course Outcomes	
CO1	Understand the MOA, drug interaction and uses of blood forming agents on various blood related disorder.
CO2	Explain the pharmacological aspects of drugs falling under Diuretics and classify them according to their application.
CO3	Analyze the importance and suitability of Antimicrobials/Anticancer drugs in clinical application for better pharmacotherapeutics.
CO4	Correlate and apply the knowledge of immunomodulators therapeutically.
CO5	Apply the knowledge about the importance of toxicity studies behind drug discovery.
CO6	Demonstrate about the genome structure, organization and their practical implication in developing new therapeutic strategies like gene therapy.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Pharmacology of Drugs acting on Blood and blood forming agents**	a) Anticoagulants; b) Thrombolytics and antiplatelet agents c) Haemopoietics and plasma expanders	21	1
2	**Pharmacology of drugs acting on Renal System**	a) Diuretics b) Antidiuretics	05	2
3	**Chemotherapy**	a) Introduction; b) Sulfonamides and co-trimoxazole c) Penicillins and Cephalosporins; d) Tetracyclins and Chloramphenicol; e) Macrolides, Aminoglycosides, Polyene& Polypeptide antibiotics; f) Quinolines and Fluroquinolines g) Antifungal antibiotics; h) Antiviral agents; i) Chemotherapy of tuberculosis and leprosy; j) Chemotherapy of Malaria; k) Chemotherapy of protozoal infections (amoebiasis, Giardiasis); l) Pharmacology of Anthelmintic drugs; m) Chemotherapy of cancer (Neoplasms).	22	2, 3
4	**Immunopharmacology**	Pharmacology of immunosuppressants and stimulants	04	4
5	**Principles of Animal toxicology**	Acute, sub acute and chronic toxicity	05	5
6	**The dynamic cell: The structures and functions of the components of the cell**	a) Cell and macromolecules: Cellular classification, subcellular organelles; macromolecules, large macromolecular assemblies b) Chromosome structure: Pro and eukaryotic chromosome structures, chromatin structure, genome complexity, the flow of genetic information.; c) DNA replication: General, bacterial and eukaryotic DNA replication.; d) The cell cycle: Restriction point, cell cycle regulators and modifiers.; e) Cell signaling: Communication between cells and their environment, ionchannels, signal transduction pathways (MAP kinase, P38 kinase, JNK, Ras and PI3-kinase pathways, biosensors.	04	4

Reference Books:

Molecular Biology of the Cell by Alberts B., Bray, D., Lewis, J., Raff M., Roberts, K and Watson, JD, 3rd edition.

Molecular Cell Biology by Lodish, H., Baltimore, D., Berk, A et al., 5th edition.

Molecular Biology by Turner, PC., McLennan, AG., Bates, AD and White MRH 2nd edition.

Genes VIII by Lewin, B., (2004)

Pharmaceutical Biotechnology, by Crommelin, DJA and Sindelar RD (1997).

Recombinant DNA by Watson, JD., Gilman, M., et al., (1996)

Biopharmaceutical: Biochemistry and Biotechnology by Walsh, G., (1998)

e-Learning Source:

https://docs.google.com/presentation/d/1FrF4VDubM70YnXEA4PUlcUUiWlsT6eeU/edit?usp=sharing&ouid=105314465628702210945&rtpof=true&sd=true

https://docs.google.com/presentation/d/1FrF4VDubM70YnXEA4PUlcUUiWlsT6eeU/edit?usp=sharing&ouid=105314465628702210945&rtpof=true&sd=true

https://docs.google.com/document/d/1zPSVy78H7HHCZGONX0LpTATZrSZJmhk8y7yyPrzkzoI/edit?usp=sharing

https://docs.google.com/document/d/1TkvAxxgqPVAfVNH0CFSYrqwJ_vp6UD8hcoovFrwB8yo/edit?usp=sharing

https://docs.google.com/document/d/148ejj0KAWHf8zL2Sce1nV0hqfllYL68nEvBQJG9TN_Q/edit?usp=sharing

https://docs.google.com/presentation/d/1lpshS-pi91u8JnFo_jksilxK8hHXvFA-/edit?usp=sharing&ouid=105314465628702210945&rtpof=true&sd=true

https://docs.google.com/document/d/0B-YGqKaWOMRkNXZaZWlRLUcwTUk/edit?usp=sharing&ouid=105314465628702210945&resourcekey=0-mOoC6iZJKhh6KXV8utneig&rtpof=true&sd=true

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	1	2	3	2	3	1	-	3	-	-	2	-	-	-
CO2	3	3	3	2	2	3	2	3	1	-	3	-	-	2	-	-	-
CO3	3	3	3	1	1	3	2	3	1	-	3	2	2	2	-	-	-
CO4	3	3	3	2	1	2	2	3	1	1	3	-	-	2	-	-	-
CO5	3	3	3	3	2	2	2	3	-	1	3	2	-	2	-	-	-
CO6														-			

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY302	Title of the Course	PHARMACOLOGY-II	L	T	P	C
Year	III	Semester	ANNUAL	-	-	3	-
Course Objectives	1. To understand the common laboratory animals, their handling, and experimental pharmacology requirements. 2. To understand the concepts of Bioassays using different animal methods (simulation). 3. To perform the different activities of drugs acting on CNS, CVS etc. on different animal models (simulation)						

Course Outcomes	
CO1	Conceptual knowledge of experimental pharmacology basics
CO2	To understand concept of bioassay of drugs on isolated tissue preparation.
CO3	Precise knowledge about commonly used instruments in pharmacological laboratory.
CO4	To know about animals experiments and interpretation of given drugs (in vivo studies).
CO5	Explain the pharmacological aspects of drugs on isolated heart of animals (in vitro studies).

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Laboratory animals and handling**	Study of laboratory animals and their handling (a. Frogs, b. Mice, c. Rats, d. Guinea ,pigs, e. Rabbits).	3	1
2	**Laboratory solutions**	Study of physiological salt solutions used in experimental pharmacology	3	2
3	**Basic instruments**	Study of laboratory appliances used in experimental pharmacology.	3	4
4	**Anesthetic drugs.**	Study of use of anesthetics in laboratory animals.	3	1
5	**Dose response curve of Ach**	To record the dose response curve of Ach using isolated ileum/rectus abdominis muscle preparation.	3	2
6	**Bioassay of Ach (Interpolation)**	To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle. preparation by interpolation method.	3	2
7	**Bioassay of Ach (3-point method)**	To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by three point method.	3	2
8	**Dose response curve of Histamine**	To record the dose response curve of Histamine using isolated guinea-pig lleum preparation.	3	2
9	**Effects of agonist, antagonist**	Study of agonistic and antagonistic effects of drugs using isolated guinea-pig ileum preparation.	3	2
10	**Bioassay(Interpolati on)**	To carry out bioassay of Histamine using isolated guinea-pig ileuminterpolation method.	3	2
11	**Bioassay(3-point)**	. To carry out bioassay of Histamine using guinea pig ileum preparation by three point method	3	2
12	**Routes of administration**	Study the routes of administration of drugs in animals (Rats, Mice, Rabbit).	3	1
13	**Analgesic activity interpretation**	Analgesic property of drug using analgesiometer.	3	4
14	**Antiinflammatory activity interpretation**	Antiinflammatory effect of drugs using rat paw edema method.	3	4
15	**Anticonvulsant activity interpretation**	Anticonvulsant activity of drugs using maximal electroshock and pentylenetetrazole.	3	4
16	**Antidepressant activity interpretation**	Antidepressant activity of drugs using pole climbing apparatus and pentobarbitone induced sleeping time methods	3	4
17	**Locomotor activity interpretation**	Locomotor activity evaluation of drugs using actoplotoneter androtorod.	3	4
18	**Cardiotonic activity interpretation**	Cardiotonic activity of drugs using isolated frog heart and marnmalian heart preparations.	3	5

e-Learning Source:

https://pharmacyfunblog.files.wordpress.com/2016/11/kd-tripathi-essentials-of-medical-pharmacologyunitedvrg-2013.pdf

CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	-	3	3	-	-	-	-	-	-	-	1	1	3	-	-	-
CO2	3	1	1	2	-	-	-	-	-	-	-	1	1	3	-	-	-
CO3	3	3	1	1	-	-	-	-	-	-	-	1	1	3	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	1	1	3	-	-	-
CO5	3	-	-	2	-	-	-	-	-	-	-	1	1	3	-	-	-

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation.

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY303	Title of the Course	PHARMACEUTICAL ANALYSIS	SDG Goals	L	T	P	C
Year	III	Semester	ANNUAL		3	1	-	4
Course Objectives	1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis 2. Execute the chromatographic separation and analysis of drugs. 5. Investigate the pharmaceutical substances using various analytical instruments.							

Course Outcomes	
CO1	Investigate the fundamentals of quality assurance.
CO2	Apprehend the analysis of pharmaceutical substances by chromatographic techniques.
CO3	Recognize the principle, instrumentation and applications of gas chromatography, HPLC, affinity chromatography and electrophoresis.
CO4	Analyze the essentials of electrometric methods.
CO5	Explore the pharmaceutical substances by absorption and emission techniques.
CO6	Deal with the fundamentals of NMR, ESR, mass spectroscopy, polarimetry, X ray diffraction and thermal techniques.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Quality Assurance**	Quality Assurance: a. Introduction, sources of quality variation, control of quality variation. b. Concept of statistical quality control. c. Validation methods- quality of equipment, validation of equipment and validation of analytical instruments and calibration. d. GLP, ISO 9000. e. Total quality management, quality review and documentation. f. ICH-international conference for harmonization-guidelines. g. Regulatory control.	15	1
2	**Chromatography**	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. Ion-exchange chromatography: Introduction, principles, types of ion exchange synthetic resins, physical properties, factors affecting ion exchange, methodology and applications. HPLC: Introduction, theory, instrumentation, and applications. f. HPTLC: Introduction, theory, instrumentation, and applications.	15	2
3	**Chromatography and Electrophoresis**	g. 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. h. Electrophoresis: Principles of separation, equipment for paper and gel electrophoresis, and application. i. Gel filtration and affinity chromatography: Introduction, technique, applications.	20	3
4	**Electrometric Methods**	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,lkovic's equation, effect of oxuhgen on polarographic wave, polarographic wave, polarographic maxima and suppression and applications. d. Amperometric Titration: Introduction, types of electrodes used, refrences and indicator electrode, 20instrumentaions, titration procedure, advantages and disadvantages of Amperometry over potentiometry. Pharma applications.	15	4
5	**Absorption Spectroscopy, Infrared Spectroscopy, Fluorimetric Analysis, Flame Photometry and Atomic Absorption Spectrometry**	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. - Infrared Spectroscopy: Vibrational transitions, frequency – structure correlations, Infrared absorption bands, Instrumentation–IR spectro-meter – sources of IR, Collimating systems, monochromators, sample cells, sample handling in IR spectroscopy and detectors–Thermocouple, Golay Cells, Thermistor, Bolometer, Pyroelectric detector, Applications of IR in pharmacy. - 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,	20	5

		atomic emission spectrometers, photographic and photoelectric detection.		
6	**NMR, ESR, Mass Spectroscopy, Polarimetry, X-Ray diffraction and Thermal Analysis**	NMR & ESR (introduction only): Introduction, theortical 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. i. Thermal Analysis: Introduction, instrumentation, applications, and DSC and DTA..	15	6

Reference Books:

1. Text Book of Pharm. Analysis by Higuchi. T and Hasen. E. B., New York Inter Science Publishers.
2. Quantitative Pharma. Analysis by Jenkins, The Blakiston division, New York.
3. Quantitative Drug Analysis, by Garrot. D, Chapman & Hall Ltd., London.
4. Undergraduate Instrumental Analysis by James. E., CBS Publishers.
5. Instrumental Analysis by Willard and Merritt, EWP, East West Press Ltd., Delhi/Madras.
6. Pharm Analysis by Skoog and West, Sounders Manipal College Publishing.
7. Text Book of Chemical Analysis, by A.I.Vogel, ELBS with Macmillan press, Hampshire.
8. Textbook of Pharm. Analysis by K.A.Connors, John Wiley & Sons, New York, Brisbane, Singapore.
9. Textbook of Pharm. Analysis (Practical) by Beckett & Stenlake, CBS Publishers, Delhi.
10. Textbook of Drug Analysis by P.D. Sethi., CBS Publishers, Delhi.
11. Spectroscopy by Silverstein, John & Wiley & Sons. Inc., Canada & Singapore.
12. How to practise GMP-A Plan for total quality control by P.P. Sharma, Vandana Publications, Agra.
13. The Science & Practice of Pharmacy by Remington Vol-I & II, Mack Publishing Co. Pennsylvania.
14. TLC by Stahl, Spring Verlay.
15. Text Book of Pharm. Chemistry by Chatten, CBS Publications.
16. Spectroscopy by William Kemp, ELBS with Macmillan Press, Hampshire.
17. I.P.-1996, The Controller of Publications, New Delhi.
18. BPC- Dept. of Health, U.K. for HMSO.
19. USP - Mack Publishing Co., Easton, PA.
20. The Extra Pharmacopoeia – The Pharm. Press, London.

e-Learning Source:

https://www.classcentral.com/course/swayam-spectroscopic-techniques-for-pharmaceutical-and-biopharmaceutical-industries-14301

https://www.sciencedirect.com/science/article/pii/S1878535213001056

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6258797/

https://www.google.co.in/books/edition/Pharmaceutical_Analysis/Ub8wod1CJ50C?hl=en&gbpv=1&dq=pharmaceutical+analysis+spectral+chromatography&printsec=frontcover

https://www.google.co.in/books/edition/Pharmaceutical_Analysis_E_Book/YExgDAAAQBAJ?hl=en&gbpv=1&dq=pharmaceutical+analysis+spectral+chromatography&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO2	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO3	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO4	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO5	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO6	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-

1.LowCorrelation;2- moderateCorrelation;3-SubstantialCorrelation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY304	Title of the Course	PHARMACEUTICAL ANALYSIS	L	T	P	C
Year	III	Semester	ANNUAL	-	-	3	-
Course Objectives	1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis 2. Execute the chromatographic separation and analysis of drugs. 3. Investigate the pharmaceutical substances using various analytical instruments.						

Course Outcomes	
CO1	Investigate the fundamentals of quality assurance.
CO2	Apprehend the analysis of pharmaceutical substances by chromatographic techniques.
CO3	Recognize the principle, instrumentation and applications of gas chromatography, HPLC, affinity chromatography and electrophoresis.
CO4	Analyze the essentials of electrometric methods.
CO5	Explore the pharmaceutical substances by absorption and emission techniques.
CO6	Deal with the fundamentals of NMR, ESR, mass spectroscopy, polarimetry, X ray diffraction and thermal techniques.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Quality Assurance**	To study the effect of solvent on the UV-spectra of the given compound.	03	1
2	**Chromatography**	1. To separate and identify sulpha drug by using TLC technique. 2. To separate and identify sulpha drug by using precoated TLC technique 3. To separate and identify amino acid by paper chromatography. 4. Isolate plant pigment by column chromatography. 5. To perform the High Performance Liquid Chromatography of the given sample	03	2
3	**Chromatography and Electrophoresis**	To estimate the given concentration of quinine sulphate sample by fluorimetry.	03	3
4	**Electrometric Methods**	1 To Estimate the dextrose by calorimetry 2 To estimate the concentration of salicylic acid solution by calorimetry 3 To perform conductometric titration of mixture of acid with a strong base	03	4
5	**Absorption Spectroscopy, Infrared Spectroscopy, Fluorimetric Analysis, Flame Photometry and Atomic Absorption Spectrometry**	1 To study the PH on the UV Spectrum of given compound. 2 Comparison of UV Spectrum of a given compound with that of its derivative 3 To study the effect of solvent on the UV-spectra of the given compound 4 Determination of dissociation constant of indication using UV –visible spectroscopy 5 Determination of pKa using pH meter. 6 Estimation of drugs by Fluorimetric technique.	03	5
6	**NMR, ESR, Mass Spectroscopy, Polarimetry, X-Ray diffraction and Thermal Analysis**	1 Online demonstration of DSC and determination of the purity of olive oil using DSC Spectra 2 To interpret NMR spectra. 3 Determination of Na/K by Flame Photometry. 4 Determination of specific rotation.	03	6
e-Learning Source:				
https://www.chemcome.com/wp-content/uploads/2020/11/Principles-of-Instrumental-Analysis-7th-edition-Skoog-by-Douglas-A.-Skoog-F.-James-Holler-Stanley-R.-Crouch-z-lib.org_.pdf				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO2	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO3	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO4	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO5	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-
CO6	3	3	3	3	2	2	3	3	2	2	2	2	3	3	-	-	-

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY305	Title of the Course	PHARMACEUTICAL JURISPRUDENCE	SDG Goals	L	T	P	C
Year	III	Semester	ANNUAL		3	1	-	3

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

Course Outcomes	
CO1	Understand and remember the history of pharmacy profession, scope, objective, new drug policy of pharmaceutical legislation. Learn principles and significance of code of pharmaceutical ethics drafted by PCI.
CO2	Know and understand the rules and regulations framed and amendments made under drugs and cosmetics act, 1940. Know about duties and qualification of drug inspector and government analyst. Understand the retail and wholesale of medicines. Learn about different schedules.
CO3	Remember the rules and regulations framed and amendments made under pharmacy act 1948. Learn about the registration procedure of pharmacist. Understand the functioning of central and state PCI. Understand the rules and regulations framed under medicinal and toilet preparation act 1955. Learn about Bonded and Non Bonded Laboratory and Patent & Proprietary Preparations.
CO4	Know and remember the rules and regulations framed and amendments made under drug and magic remedies, Advertisements which are allowed and banned in India related to pharmacy. Learn about opium cultivation, penalties of violating narcotic drugs and psychotropic substances act.
CO5	Remember and understand the product available in essential commodities list. Know about procedure for calculation of retail and wholesale of drugs. Understand the act which comes under the cruelty of animals. Learn about different penalties and fine for violating these acts.
CO6	Understand the rules, regulations and process for filing a patent. Knowledge about different types of patent. Understand the various aspects of patent act. Learn about different prescription and non-prescription products.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Pharmaceutical Legislations – A brief review. Principle and Significance of professional ethics**	Pharmaceutical Legislations – A brief review.; Principle and Significance of professional ethics. Critical study of the code of pharmaceutical ethics drafted by PCI	3	1
2	**Drugs andCosmetics 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.	6	2
3	**Pharmacy Act –1948** **Medicinal and Toilet Preparation Act –1955**	Objectives Legal Definitions, General Study, Constitution and Functions of State & Central Council, Registration & Procedure, ER. Objectives, Legal Definitions, Licensing, Bonded and Non Bonded Laboratory, Ware Housing, Manufacture of Ayurvedic, Homeopathic, Patent &Proprietory Preparations	5	3
4	**Narcotic Drugs and Psychotropic substances Act-1985 and Rules. Study of Salient Features of Drugs and magic remedies Act and its 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. Study of Salient Features of Drugs and magic remedies Act and its rules	4	4
5	**Study of essential Commodities Act Relevant to drugs price control Order. Prevention Of Cruelty to animals Act-1960.DPCO**	Study of essential Commodities Act Relevant to drugs price control Order. Prevention Of Cruelty to animals Act-1960. Drug Price control Order & National Drug Policy	3	5
6	**Patents & design Act-1970 Brief study ofprescriptionand Non-prescription Products.**	Patents & design Act-1970 Brief study of prescription and Non-prescription Products.	2	6

Reference Books:

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

Jain, NK. A Textbook of forensic pharmacy. Delhi: Vallabhprakashan; 1995

Reports of the Pharmaceutical enquiry Committee

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

Various reports of Amendments.

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

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

e-Learning Source:
https://www.researchgate.net/publication/363728214_Pharmaceutical_Jurisprudence_book

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	1	1	-	-	1	3	-	-	-	1	1	2	3	-	-	-
CO2	3	1	1	-	-	1	3	-	-	-	1	1	2	3	-	-	-
CO3	3	1	1	-	-	1	3	-	-	-	1	1	2	3	-	-	-
CO4	3	1	1	-	-	1	3	-	-	-	1	1	2	3	-	-	-
CO5	3	1	1	-	-	1	3	-	-	-	1	1	2	3	-	-	-
CO6																	

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Course Code	PRY306	Title of the Course	MEDICINAL CHEMISTRY	L	T	P	C
Year	III	Semester	ANNUAL	3	1	-	4
Course Objectives	1.Modern concept of rational drug design 2. 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.						

Course Outcomes	
CO1	Evaluate the pharmacodynamics, pharmacokinetics, stability, therapeutic potential, and synthesis of Local anti-infective agents, Preservatives, Antitubercular agents, Antifungal agents, Urinary tract anti-infectives classes using knowledge of chemical structure and Structure-Activity Relationships (SAR).
CO2	Evaluate the pharmacodynamics, pharmacokinetics, stability, therapeutic potential, and synthesis of the Antiscabies and Antipedicular agents, Antivirals, Antiprotozoals and Anthelmenticsclasses using knowledge of chemical structure and Structure-Activity Relationships (SAR).
CO3	Judge the drug's therapeutic potential, structure activity relationship, pharmacodynamics, pharmacokinetics, stability and synthesis in the following categories based on their understanding of the chemical structure of the drugs: Sulphonamides and sulphones, Antimalarials, Antibiotics and Fluoroquinolones.
CO4	Based on understanding of the chemical structures and Structure-Activity Relationships (SAR) of the following pharmacological classes—Diuretics, Antihypertensives, Antianginals, Antiarrhythmics, Antihyperlipidemics, Coagulants and Anticoagulants—Defend their therapeutic potential, pharmacodynamics, pharmacokinetics, stability, Structure based therapeutic evaluation and synthesis.
CO5	Appraise the therapeutic potential, structure-activity relationship, pharmacology, stability, and synthesis of drugs by utilising knowledge of the chemical structures of drugs that are categorized as Diagnostic agents, Hypoglycemics, Steroidal Hormones and Adrenocorticoids and drugs acting on Endocrine system
CO6	Utilizing an understanding of the chemical structure and Structure-Activity Relationships (SAR) of medications classified as antineoplastics, thyroid and antithyroid agents, Evaluate their pharmacodynamics, pharmacokinetics, stability, synthesis, and therapeutic potential and appraise the modern concept of rational drug designand application of prodrug design.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	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. Anti-infective agents-	a) Local anti-infective agents b) Preservatives c) Antitubercular agents d) Antifungal agents e) Urinary tract anti-infectives	15	1
2	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. Anti-infective agents-	a) Antiscabies and Antipedicular agents b) Antiviral agents and Anti AIDS agents c) Antiprotozoal agents d) Anthelmentics	12	2
3	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.	a) Sulphonamides and sulphones b) Antimalarials c) Antibiotics d) Fluoroquinolones	18	3
4	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. Cardiovascular agents-	a) Diuretics b) Antihypertensive agents c) Antianginal agents and vasodilators d) Antiarrhythmic agents e) Antihyperlipidemic agents f) Coagulants and Anticoagulants	18	4
5	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.	a) Diagnostic agents b) Hypoglycemic agents c) Steroidal Hormones and Adrenocorticoids d) Drugs acting on Endocrine system	12	12
6	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 and the concept of drug design and development	a) Antineoplastic agents b) Thyroid and Antithyroid agents c) Modern concept of rational drug design: A brief introduction to Quantitative Structure Activity Relationship (QSAR), prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules.	15	6

Reference Books:

Beale JM, Block JH, Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Twelfth ed., Lippincott William & Wilkins.

Lemke TL, Williams, DA, Roche VF, Zito SW, Foye's Principles of Medicinal Chemistry, Sixth Edition, Lippincott William & Wilkins, Philadelphia.

Nogrady T, Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York.

Gareth Thomas. Medicinal Chemistry, An Introduction, First Edition, John Wiley & Sons, Ltd, 2000.

The Organic Chemistry of Drug Synthesis, Vol.1-4 by Lednicer Daniel, 1st edition, John Wiley & Sons

Comprehensive Medicinal Chemistry by Hansch C, Vol I-VI, Elsevier Pergamon.

Burger's Medicinal Chemistry by Wolff M E, John Wiley & Sons, New York.

An Introduction to Drug Design by S N Pandeya & I R Dimmock, 1st edition, New Age Intnl Publishers.

e-LearningSource:
https://docs.google.com/file/d/0B-_-XCSU9YXbRE1xT3RKNVNhMDA/edit?resourcekey=0-jo8f9fWuz-RyrcYBU6HBFw

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	1	1	1	1	1	1	1	1	3	3	3	-	-	-
CO2	3	3	3	1	1	1	1	1	1	1	1	3	3	3	-	-	-
CO3	2	3	3	1	1	1	1	1	1	1	1	3	3	3	-	-	-
CO4	2	3	3	1	1	2	1	1	1	1	1	3	3	3	-	-	-
CO5	3	3	2	1	1	1	1	1	2	1	1	3	3	3	-	-	-
CO6	3	3	2	1	1	1	1	2	1	1	1	3	3	3	-	-	-

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY307	Title of the Course	MEDICINAL CHEMISTRY	L	T	P	C
Year	III	Semester	ANNUAL	-	-	3	-
Course Objectives	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.						

Course Outcomes	
CO1	Evaluate the pharmacodynamics, pharmacokinetics, stability, therapeutic potential, and synthesis of Local anti-infective agents, Preservatives, Antitubercular agents, Antifungal agents, Urinary tract anti-infectives classes using knowledge of chemical structure and Structure-Activity Relationships (SAR).
CO2	Evaluate the pharmacodynamics, pharmacokinetics, stability, therapeutic potential, and synthesis of the Antiscabies and Antipedicular agents, Antivirals, Antiprotozoals and Anthelmenticsclasses using knowledge of chemical structure and Structure-Activity Relationships (SAR).
CO3	Judge the drug's therapeutic potential, structure activity relationship, pharmacodynamics, pharmacokinetics, stability and synthesis in the following categories based on their understanding of the chemical structure of the drugs: Sulphonamides and sulphones, Antimalarials, Antibiotics and Fluoroquinolones.
CO4	Based on understanding of the chemical structures and Structure-Activity Relationships (SAR) of the following pharmacological classes—Diuretics, Antihypertensives, Antianginals, Antiarrhythmics, Antihyperlipidemics, Coagulants and Anticoagulants—Defend their therapeutic potential, pharmacodynamics, pharmacokinetics, stability, Structure based therapeutic evaluation and synthesis.
CO5	Appraise the therapeutic potential, structure-activity relationship, pharmacology, stability, and synthesis of drugs by utilising knowledge of the chemical structures of drugs that are categorized as Diagnostic agents, Hypoglycemics, Steroidal Hormones and Adrenocorticoids and drugs acting on Endocrine system
CO6	Utilizing an understanding of the chemical structure and Structure-Activity Relationships (SAR) of medications classified as antineoplastics, thyroid and antithyroid agents, Evaluate their pharmacodynamics, pharmacokinetics, stability, synthesis, and therapeutic potential and appraise the modern concept of rational drug design and application of prodrug design.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Preparation of medicinally important compounds or intermediates required for synthesis of drugs	• Synthesis of benzil from benzoin • Preparation of phenytoin from benzyl • Preparation of 7-Hydroxy-4-methyl coumarin from resorcinol • Synthesis of phenothiazine from diphenylamine • Synthesis of fluorescein from phthalic anhydride	15	CO1
2	Preparation of medicinally important compounds or intermediates required for synthesis of drugs	• Synthesis of eosin from fluorescein • Synthesis of benzimidazole • Synthesis of benztriazole from *o*-phenylene diamine • Synthesis of 2,3-diphenylquinoxaline from *o*-phenylene diamine • Synthesis of isoniazid	15	CO2
3	Assays of important drugs from the course content	• Assay of ascorbic acid • Assay of isoniazid • Assay of diclofenac sodium by acidimetry-alkalimetry (non-aqueous) titration • Assay of metronidazole	12	CO3
4	Monograph analysis of important drugs	• Monograph analysis of paracetamol • Monograph analysis of aspirin • Monograph analysis of ibuprofen • Monograph analysis of sulphacetamide sodium	12	CO4
5	Determination of partition coefficients of compounds for QSAR analysis.	• Partition co-efficient of benzoic acid in benzene and water • Partition co-efficient of iodine in CCl_4 and water	6	CO5
6	Determination of dissociation constants and molar refractivity of compounds for QSAR analysis.	• Dissociation constant of acetic acid • Molar refractivity of compound	6	CO6

Reference Books:

Beale JM, Block JH, Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Twelfth ed., Lippincott William & Wilkins.

Lemke TL, Williams, DA, Roche VF, Zito SW, Foye's Principles of Medicinal Chemistry, Sixth Edition, Lippincott William & Wilkins, Philadelphia.

Nogrady T, Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York.

Gareth Thomas. Medicinal Chemistry, An Introduction, First Edition, John Wiley & Sons, Ltd, 2000.

The Organic Chemistry of Drug Synthesis, Vol.1-4 by Lednicer Daniel, 1st edition, John Wiley & Sons

Comprehensive Medicinal Chemistry by Hansch C, Vol I-VI, Elsevier Pergamon.

Burger's Medicinal Chemistry by Wolff M E, John Wiley & Sons, New York.

An Introduction to Drug Design by S N Pandeya & I R Dimmock, 1st edition, New Age Intnl Publishers.

e-Learning Source:

https://docs.google.com/file/d/0B-_-XCSU9YXbRE1xT3RKNVNhMDA/edit?resourcekey=0-jo8f9fWuz-RyrcYBU6HBFw

	Course Articulation Matrix: (Mapping of Cos with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	1	1	1	1	1	1	1	1	3	3	3	-	-	-
CO2	3	3	3	1	1	1	1	1	1	1	1	3	3	3	-	-	-
CO3	2	3	3	1	1	1	1	1	1	1	1	3	3	3	-	-	-
CO4	2	3	3	1	1	2	1	1	1	1	1	3	3	3	-	-	-
CO5	3	3	2	1	1	1	1	1	2	1	1	3	3	3	-	-	-
CO6	3	3	2	1	1	1	1	2	1	1	1	3	3	3	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY308	Title of the Course	PHARMACEUTICAL FORMULATIONS	SDG Goals	L	T	P	C
Year	III	Semester	ANNUAL		3	1	-	3
Course Objectives	1. Understand the principle involved in formulation of various pharmaceutical dosage forms; 2. Prepare various pharmaceutical formulation; 3. Perform evaluation of pharmaceutical dosage forms; and 4. Understand and appreciate the concept of bioavailability and bioequivalence, their role in clinical situations.							

Course Outcomes	
CO1	Apply the knowledge of formulation components, manufacturing techniques, and quality control tests in the development of tablet dosage forms.
CO2	Know the formulation design, manufacturing, quality control tests and stability concerns for capsules.
CO3	Analyse formulation requirements and evaluation of monophasic and biphasic liquid dosage forms.
CO4	Identify the pre-formulation and formulation requirements and quality control test in the production of parenteral dosage forms.
CO5	Explain the principle, formulation factors, application of semisolid bases and preparation of various types of semisolid dosage forms.
CO6	Understand the concept of Controlled and Novel drug delivery systems and knowledge of technologies involved in developing parenteral, transdermal buccal, rectal, nasal, implants, ocular delivery systems.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**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.	10	1	9.2
2	**Capsules**	Production and filling of hard gelatin capsules, Raw material for shell, finishing, quality control tests for capsules. Production and filling of soft gelatin capsules, quality control tests for soft gelatin capsules.	10	2	9.2
3	**Liquid Orals**	Formulation and evaluation of suspensions, emulsions and solutions. Stability of these preparations.	10	3	9.2
4	**Parenterals**	Introduction Containers used for Parenterals (including official tests) Formulation of large and small volume Parenterals Sterilization	10	4	9.2
5	**Semi – Solids Dosages Forms**	Introduction and classification Factors affecting absorption and anatomy of skin Packaging storage and labelling. Ointments Types of Ointment Base Preparation of ointment. Jellies, Types of jellies Formulation of jellies Suppositories, Method of preparation, Types Packaging	10	5	9.2
6	**Controlled and novel Drug delivery**	Definition and concept of Controlled and novel Drug delivery systems with available examples, viz. parenteral, transdermal, buccal, rectal, nasal, implants, ocular	10	6	9.5

Reference Books:

Remington's Pharmaceutical Sciences

Pharmaceutical dosage forms, Vol, I, II and III by Lachman

Rowlings Text book of Pharmaceutics

USP/BP/IP

e-Learning Source:

https://kupdf.net/download/cooper-and-gunn-39-s-tutorial-pharmacy-by-carter-6th-editn_591152e1dc0d609d41959f01_pdf

	Course Articulation Matrix: (Mapping of Cos with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO2	3	3	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO3	3	3	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO4	3	3	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO5	3	3	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO6																	

1.LowCorrelation;2-ModerateCorrelation;3-SubstantialCorrelation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY309	Title of the Course	PHARMACEUTICAL FORMULATIONS	L	T	P	C
Year	III	Semester	ANNUAL	-	-	3	-
Course Objectives	1. Understand the principle involved in formulation of various pharmaceutical dosage forms. 2. Prepare various pharmaceutical formulations. 3. Perform evaluation of pharmaceutical dosage forms. 4. Understand and appreciate the concept of bioavailability and bioequivalence, their role in clinical situations.						

Course Outcomes	
CO1	Knowledge of formulation and evaluation of tablet dosages forms.
CO2	Understand the formulation design, manufacturing of capsules.
CO3	Knowledge of formulation requirements and evaluation of monophasic and biphasic liquid dosages forms.
CO4	Know the preformulation and formulation requirements and quality control test in the production of parenteral dosages forms.
CO5	formulation and manufacturing of semisolid dosages forms

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	Tablet	To prepare and evaluate paracetamol granules by wet granulation method.	3	1
2.	Tablet	To prepare and evaluate tablet direct compression method.	3	1
3.	Tablet	To prepare effervescent tablet of aspirin by dry granulation method.	3	1
4.	Capsule	To perform the filling and evaluation of hard gelatin capsule	3	2
5.	Parenterals	To prepare and submit EDTA injection.	3	4
6.	Parenterals	To prepare, evaluate and submit 10 ml of Ascorbic acid injection.	3	4
7.	Parenterals	To prepare, evaluate and submit 10ml of calcium gluconate injection.	3	4
8.	Parenterals	To prepare and submit 100 ml of Dextrose sodium chloride infusion.	3	4
9.	Parenterals	To prepare and submit 100 ml of Sodium Chloride Infusion.	3	4
10.	Cosmetic	To prepare and submit 10 gm Tooth Powder	3	5
11.	Cosmetic	. To prepare and submit 10 gm Tooth Paste	3	5
12.	Cosmetic	To prepare and submit 10 gm Cold Cream	3	5
13.	Cosmetic	To prepare and submit 10 gm Vanishing Cream	3	5
14.	Cosmetic	To prepare and submit High Class Lipstick	3	5
15.	Cosmetic	To prepare and submit 25ml of Anti-dandruff Shampoo.	3	5
16.	Liquid orals	To prepare, evaluate and submit 10 ml Paracetamol Suspension	3	3
17.	Liquid orals	To prepare, evaluate and submit 10 ml Magnesium Sulphate Oral Suspension	3	3
18.	Semi Solid Dosage Form	To prepare and submit 10gm of salsilic acid ointment.	3	5
19.	Semi Solid Dosage Form	To prepareand submit 10 gm of Benzoic acid ointment	3	5
20.	Semi Solid Dosage Form	To prepare and submit 10 gm of Diclofenac gel	3	5
21.	Tablet	To perform the film coating of tablets/granules	3	1

e-Learning Source:

https://www.researchgate.net/publication/345750636_Handbook_of_Pharmaceutical_Technology

	Course Articulation Matrix: (Mapping of Cos with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO2	3	3	2	2	2	3	2	1	2	3	3	1	1	1	-	-	-
CO3	3	3	2	2	2	3	2	1	2	3	3	1	1	1	-	-	-
CO4	3	3	2	2	2	3	2	1	2	3	3	1	1	1	-	-	-
CO5	3	3	2	2	2	3	2	1	2	3	3	1	1	1	-	-	-

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY310	Title of the Course	PHARMACOTHERAPEUTICS-II	SDG Goals	L	T	P	C
Year	III	Semester	ANNUAL		3	1	-	4
Course Objectives	1. 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. 2. This will enable the student to understand the pathophysiology of common diseases and their management.							

Course Outcomes	
CO1	Students will learn guidelines for the rational use of antibiotics and surgical prophylaxis, ensuring optimal patient care while minimizing resistance and infections.
CO2	Students shall be able to understand etiopathogenesis, rational pharmacotherapy and management for infectious diseases
CO3	Students will possess in-depth knowledge of musculoskeletal disorders, enabling them to provide effective care for patients
CO4	Students shall be equipped to diagnose and manage renal system diseases, including renal failure and drug-induced disorders.
CO5	Students shall be able to explore basic principles of cancer therapy & chemotherapeutic agents and the management of chemotherapy-induced nausea and emesis.
CO6	Students shall be able to examine the etiology and therapeutic approaches for dermatological conditions

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**Infectious disease**	Guidelines for the rational use of antibiotics and surgical Prophylaxis, Tuberculosis, Meningtis, Respiratory tract infections, Gastroenteristis, Endocarditis, Septicemia, Urinary tract infections, Protozoal infection – Malaria, HIV, &Opprtunistic infections, Fungal infections, Viral infections, Gonarrhaea and Syphillis.	3	1	3.3
2	**Musculoloskeletal disorders**	Rheumatoid arthritis, Oeteoarthritis, Gout, Spondylitis, Systemic lupus erythematosus.	3	2	------
3	**Renal system**	Acute Renal Failure, Chronic Renal Failure, Renal Dialysis, Drug induced renal disorders.	3	3	------
4	**Oncology**	Basic principles of Cancer therapy, Genral introduction to cancer chemotherapeutic agents, Chemotherapy of breast cancer, leukemia. Management of chemotheraphy nausea and emesis.	3	4	-----
5	**Dermatology**	Psoriasis, Scabies, Eczema, Impetigo.	3	5	-----

Reference Books:

Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange

Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication

Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA]

e-Learning Source:

https://www.google.co.in/books/edition/Pharmacology_and_Pharmacotherapeutics/FR4OEAAAQBAJ?hl=en&gbpv=1&dq=PHARMACOTHERAPEUTICS&printsec=frontcover

	Course Articulation Matrix: (Mapping of Cos with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2	1	1	1	1	2	3	1	3	-	-	-
CO2	3	3	2	2	2	2	1	1	1	1	2	3	1	3	-	-	-
CO3	3	3	2	2	2	2	1	1	1	1	2	3	1	3	-	-	-
CO4	3	3	2	2	2	2	1	1	1	1	2	3	2	3	-	-	-
CO5	3	3	2	2	2	2	1	1	1	1	2	3	1	3	-	-	-
CO6	3	3	2	2	2	2	1	1	1	1	2	3	1	3	-	-	-

1.LowCorrelation;2-ModerateCorrelation;3-SubstantialCorrelation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY311	Title of the Course	PHARMACOTHERAPEUTICS-II	L	T	P	C
Year	III	Semester	ANNUAL	-	-	3	1.5
Course Objectives	1. Structure and function of Human body at cellular level. 2. Describe the various homeostatic mechanisms and their imbalance. 3. Appreciate the coordinated working pattern of different organs of each system 4. Explain the gross morphology, structure and functions of various organs of the human body. 5. Identifythe various tissues and organs of different systems of human body. 6. Perform the various experiments related to special senses and nervous system.						

Course Outcomes	
CO1	Gain knowledge of the basic structural organisation of human body; Understand the levels of organization at cellular level.
CO2	Understand the structural and functional classification of skeletal system.
CO3	Learn the role of blood and lymph; Understand the function of Lymphatic system.
CO4	Learn the concepts of Peripheral Nervous System and special senses.
CO5	Understand the structural and functional classification of Cardio-vascular system.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	Case study	Case study of Fungal Infection	3	1
2.	Case study	Case study of Respiratory tract infection.	3	1
3.	Case study	Case study of Urinary tract infection	3	1
4.	Case study	Case study on Tuberculosis	3	1
5.	Case study	Case study on Meningitis	3	1
6.	Case study	Case study of Asthma.	3	1
7.	Case study	Case study on GIT disease	3	1
8.	Case study	Case study of HIV infection.	3	1
9.	Case study	Case study on Tuberculosis (case II)	3	1
10.	Case study	Case study on UTI (case II)	3	1
11.	Case study	Case study of Rheumatoid Arthritis	3	2
12.	Case study	Case study of gout.	3	2
13.	Case study	Case study of Acute Kidney failure.	3	3
14.	Case study	Case study of Chronic Kidney failure	3	3
15.	Case study	Case study on Leukaemias	3	4
16.	Case study	Case study on Lymphomas	3	4
17.	Case study	Case study on nausea and vomiting-I	3	4
18.	Case study	Case study on nausea and vomiting-II	3	4
19.	Case study	Case study on Psoriasis-I	3	5
20.	Case study	Case study on Psoriasis-II	3	5

e-Learning Source:

https://arch.ilizone.in/2021/course/view.php?id=561&notifyeditingon=1

	Course Articulation Matrix: (Mapping of Cos with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2	1	1	1	1	2	1	3	3	-	-	-
CO2	3	3	2	2	2	2	1	1	1	1	2	1	3	3	-	-	-
CO3	3	3	2	2	2	2	1	1	1	1	2	1	3	3	-	-	-
CO4	3	3	2	2	2	2	1	1	1	1	2	2	3	3	-	-	-
CO5	3	3	2	2	2	2	1	1	1	1	2	1	3	3	-	-	-

1. Low Correlation; 2-Moderate Correlation; 3-Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY401	Title of the Course	PHARMACOTHERAPEUTICS-III	SDG Goals	L	T	P	C
Year	IV	Semester	ANNUAL		3	1	-	4

Course 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 individualized therapeutic plans based on diagnosis; e. The 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. 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 individualized 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).

Course Outcomes	
CO1	Develop treatment strategies for peptic ulcer disease, GERD, and IBD using clinical guidelines and patient-specific factors.
CO2	Apply pharmacological principles to manage alcoholic liver disease, viral hepatitis, jaundice, and drug-induced liver disorders, ensuring drug safety.
CO3	Evaluate and manage anemia, venous thromboembolism, and drug-induced blood disorders, ensuring proper drug selection and monitoring.
CO4	Optimize drug therapy for epilepsy, Parkinson's disease, Alzheimer's disease, and stroke based on patient response and evidence-based guidelines.
CO5	Implement pharmacotherapeutic interventions for schizophrenia, affective disorders, anxiety, sleep disorders, and OCD, ensuring efficacy and safety.
CO6	Assess and improve pain management plans for neuropathic pain, headaches, and neuralgias, ensuring opioid safety. Evaluate pharmacotherapy using evidence-based medicine, clinical guidelines, and research for better treatment decisions.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1.	**Gastrointestinal system**	Peptic ulcer disease, gastro esophageal reflux disease, inflammatory bowel disease,	12	1	-----
2.	**Liver disorders**	Alcoholic liver disease, viral hepatitis including jaundice, and drug induced liver disorders.	12	2	3.5
3.	**Haematological system**	Anaemias, venous thromboembolism, drug induced blood disorders.	12	3	-------
4.	**Nervous system**	Epilepsy, Parkinsonism, Alzheimer's disease, stroke.	12	4	------
5.	**Psychiatry disorders**	Schizophrenia, affective disorders, anxiety disorders, sleep disorders, obsessive compulsive disorders	12	5	------
6.	**Pain & Evidence Based Medicine**	Pain management including pain pathways, neuralgias, headaches and evidence based medicine.	12	6	-----

Reference Books:

1. Pharmacotherapy: A Pathophysiologic Approach by Joseph T. Dipiro. 11th Edition.
2. Clinical Pharmacy and Therapeutics by Roger Walker. 5th Edition.
3. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA
4. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.
5. Pathologic basis of disease - Robins SL, W.B. Saunders Publication.
6. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication.

e-Learning Source:

https://www.google.co.in/books/edition/Pocket_Handbook_of_GI_Pharmacotherapeuti/x3SjDDjlW00C?hl=en&gbpv=1&dq=Pharmacotherapeutics-III&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO2	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO3	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO4	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO5	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO6	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY402	Title of the Course	PHARMACOTHERAPEUTICS-III	L	T	P	C
Year	IV	Semester	ANNUAL	-	-	3	1.5
Course Objectives	To describe the pathophysiology of selected disease states and explain the rationale for drug therapy; To summarize the therapeutic approach to management of these diseases including reference to the latest available evidence; To discuss the controversies in drug therapy; To discuss the preparation of individualised therapeutic plans based on diagnosis; and 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).						

Course Outcomes	
CO1	Students understand the pathophysiology & diagnosis of GIT & liver disorder and their management/controversies including 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).
CO2	Students have ability to explore the pathophysiology & diagnosis of hematological disorder and their management/controversies.
CO3	Students have ability to effectively communicate the pharmacotherapy of CNS disorder and their management/controversies.
CO4	Students analyzed the pathophysiology & diagnosis of Psychiatric disorder and their management/controversies including patient-specific parameters relevant in initiating drug therapy and monitoring therapy.
CO5	Students analyzed the pathophysiology & diagnosis of Schizophrenia, affective disorders, anxiety disorders, sleep disorders, obsessive compulsive disorders and their management/controversies including patient-specific parameters relevant in initiating drug therapy and monitoring therapy.
CO6	Students analyze the Pharmacotherapeutics of Pain management including pain pathways, neuralgias, headaches and evidence based medicine.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	Case study	Case study on Gastrointestinal & Liver disorders	12	1
2.	Case study	Case study on Haematological disorders	12	2
3.	Case study	Case study on Nervous system disorders	12	3
4.	Case study	Case study on Psychiatry disorders	12	4
5.	Case study	Case study on Pain and its managements	12	5

e-Learning Source:

https://www.google.co.in/books/edition/Pharmacology_and_Pharmacotherapeutics/FR4OEAAAQBAJ?hl=en&gbpv=1&dq=PHARMACOTHERAPEUTICS&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO2	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO3	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO4	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO5	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO6	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY403	Title of the Course	BIOPHARMACEUTICS & PHARMACOKINETICS	SDG Goals	L	T	P	C
Year	IV	Semester	ANNUAL		3	1	-	3
Course Objective	1. Upon completion of the course, the candidate shall have the ability to calculate 2. Pharmacokinetic parameters from the given data, apply principles of pharmacokinetics in the design of new formulations and conduct bioavailability and bioequivalence studies.							

Course Outcomes	
CO1	Know the process of absorption, distribution, excretion and biotransformation.
CO2	Explain basic concepts of biopharmaceutics and pharmacokinetics.
CO3	Calculate Pharmacokinetic parameters from the given data.
CO4	Apply principles of pharmacokinetics in the design of new formulations.
CO5	Conduct bioavailability and bioequivalence studies.
CO6	Applications of pharmacokinetics parameters in pharmacy practice.

UnitNo.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**Introduction to Biopharmaceutics**	Introduction to Biopharmaceutics a. Absorption of drugs from gastrointestinal tract. b. Drug Distribution. c. Drug Elimination.	15	1	9.5
2	**Pharmacokinetics**	Introduction to Pharmacokinetics. a. Mathematical model b. Drug levels in blood. c. Pharmacokinetic model d. Compartment models e. Pharmacokinetic study.	12	2	9.5
3	**Compartment models**	A. One compartment open model. a. Intravenous Injection (Bolus) b. Intravenous infusion. B. Multicompartment models. a. Two compartment open model. b. IV bolus, IV infusion and oral administration	15	3	9.5
4	**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	12	4	9.5
5	**Nonlinear Pharmacokinetics.**	Introduction to Nonlinear pharmacokinetics a. Introduction b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters. B. Noncompartmental Pharmacokinetics. a. Statistical Moment Theory. b. MRT for various compartment models. c. Physiological Pharmacokinetic model.	18	5	9.5
6	**Bioavailability and Bioequivalence**	Introduction to bioavailability. a. Bioavailability study protocol. b. Methods of Assessment of Bioavailability	15	1	9.5

Reference Books:

Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.

Biopharmaceutics and Pharmacokinetics; By Robert F Notari

Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA

Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi

Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.

Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott.

e-Learning Source:

https://toaz.info/doc-view

Course Code	PRY404	Title of the Course	BIOPHARMACEUTICS & PHARMACOKINETICS	L	T	P	C
Year	IV	Semester	ANNUAL	-	-	3	-
Course Objectives	1. Upon completion of the course, the candidate shall have the ability to calculate Pharmacokinetic parameters from the given data, 2. Apply principles of pharmacokinetics in the design of new formulations and conduct bioavailability and Bioequivalence studies.						

Course Outcomes	
CO1	Explain basic concepts of bio pharmaceutics and pharmacokinetics
CO2	Calculate Pharmacokinetic parameters from the given data.
CO3	Apply principles of pharmacokinetics in the design of new formulations.
CO4	Conduct bioavailability and bioequivalence studies.
CO5	Applications of pharmacokinetics parameters in pharmacy practice.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	Introduction to dissolution apparatus	Improvement of dissolution characteristics of slightly soluble drugs by some methods.	3	1
2.	Introduction to buffers	Comparison of dissolution studies of two different marketed products of same Drug.	3	1
3.	Preparation of standard curve	Influence of polymorphism on solubility and dissolution.	3	5
4.	Drug release study	Protein binding studies of a highly protein bound drug and poorly protein bound Drug.	3	4
5.	Drug release study	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.	3	4
6.	Drug release study	Bioavailability studies of some commonly used drugs on animal/human model.	3	4
7.	Calculation of Pharmacokinetics Parameters.	Calculation of Ka, Ke, t1/2, Cmax, AUC, AUMC, MRT etc. from blood profile data.	3	2
8.	Calculation of Pharmacokinetics Parameters.	Calculation of bioavailability from urinary excretion data for two drugs.	3	2
9.	Calculation of Pharmacokinetics Parameters.	Calculation of AUC and bioequivalence from the given data for two drugs.	3	2
10.	Drug absorbtion study.	In vitro absorption studies.	3	4
11.	Bio equivalency study.	Bio equivalency studies on the different drugs marketed.(eg) Tetracycline, Sulphamethoxzole, Trimethoprim, Aspirin etc., on animals and human volunteers.	3	4
12.	Absorbtion study.	Absorption studies in animal inverted intestine using various drugs.	3	4
13.	Calculation of Pharmacokinetics Parameters.	Effect on contact time on the plasma protein binding of drugs.	3	4
14.	Calculation of Pharmacokinetics Parameters.	Studying metabolic pathways for different drugs based on elimination kinetics data.	3	2
15.	Calculation of Pharmacokinetics Parameters.	Calculation of elimination half-life for different drugs by using urinary elimination Data and blood level data.	3	2
16.	Calculation of Pharmacokinetics Parameters.	Determination of renal clearance.	3	2

e-Learning Source:

https://www.slideshare.net/grakbph040/biopharmaceutics-and-pharmacokinetics-practical-manual

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-
CO2	3	3	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-
CO3	3	3	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-
CO4	3	3	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-
CO5	3	3	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY405	Title of the Course	HOSPITAL PHARMACY	SDG Goals	L	T	P	C
Year	IV	Semester	ANNUAL		3	1	4	4

Course Objectives

1. To prepare students as health care experts with emphasis on inter-professional healthcare team based patient care.
2. To develop the skills in monitoring of the National Health Programmes and schemes, oriented to provide preventive and promotive health care services to the community.
3. To impart applied knowledge related to clinical discussions, attending ward rounds, follow-up progress of patients, case presentation at discharge are imbibed through hospital postings.
4. To develop a trained clinical pharmacist who functions effectively as a member of a health care team organized to deliver the health and family welfare services in the existing socio-economic environment.
5. To promote health, wellness and disease prevention by developing the rational use of drugs.
6. To understand the clinical aspects of drug development, such as phases, ethical issues, and roles and responsibilities of clinical trial personnel, design of clinical study documents, data management and safety monitoring in clinical trials.

Course Outcomes	
CO1	Describe the organizational structure of hospital & hospital pharmacy
CO2	Understand budget and implementation of different drug policies & committees in the hospital
CO3	Appreciate various procedure for procuring and warehousing along with drug distribution methods and inventory management in the hospital pharmacy
CO4	Know the manufacturing practices of various formulations at hospital set-up
CO5	Develop and maintain the knowledge through continuing Professional development programs and ability in Handling and packaging of radiopharmaceuticals
CO6	Explain the professional relations and practices of hospital pharmacist

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Target
1	**Hospital**	Its Organization and functions. Hospital pharmacy-Organization and management. Organizational structure-Staff, Infrastructure & workload statistics. Management of materials and finance, Roles & responsibilities of hospital pharmacist	2	1	3.8, 3.d
2	**The Budget**	Preparation and implementation Hospital drug policy 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	2	2	3.7, 3.8, 3.c, 3.d
3	**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	2	3	3.7, 3.8, 3.a, 3.c, 3.d
4	**Manufacture of Pharmaceutical preparations**	a) Sterile formulations – large and small volume parenterals b) Manufacture of Ointments, Liquids, and creams c) Manufacturing of Tablets, granules, capsules, and powders d) Total parenteral nutrition	2	4	-----
5	**Continuing professional development programs**	Education and training Radio Pharmaceuticals – Handling and packaging	2	5	3.8, 3.9
6	**Practice in Hospital**	Professional Relations and practices of hospital pharmacist.	2	6	3.4, 3.7

Reference Books:

WHO consultative group report.

R.P.S. Vol.2. Part –B; Pharmacy Practice section.

Handbook of pharmacy – Health care. Edt. Robin J Harman. The Pharmaceutical press.

e-Learning Source:

https://www.google.co.in/books/edition/Hospital_Pharmacy/kdAMf8f8RPwC?hl=en&gbpv=1&dq=hospital+pharmacy+pharm+d&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	2	2	2	1	1	1	1	2	1	3	3	-	-	-
CO2	3	3	2	2	2	2	1	1	1	1	2	2	3	3	-	-	-
CO3	3	3	2	2	2	2	1	1	1	1	2	3	3	2	-	-	-
CO4	3	3	2	2	2	2	1	1	1	1	2	2	3	2	-	-	-
CO5	3	3	2	2	2	2	1	1	1	1	2	1	3	2	-	-	-
CO6	3	3	2	2	2	2	1	1	1	1	2	2	1	1	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY406	Title of the Course	HOSPITAL PHARMACY	L	T	P	C
Year	IV	Semester	ANNUAL	-	-	3	-
Course Objectives	1. Assessment of drug interactions in given prescriptions. 2. Manufacture of parenteral formulations, powders. 3. Drug information queries and inventory control						

Course Outcomes	
CO1	Know various drug distribution methods.
CO2	Know the professional practice management skills in hospital pharmacies.
CO3	Provide unbiased drug information to the doctors.
CO4	Know the manufacturing practices of various formulations in hospital set up.
CO5	Appreciate the stores management and inventory control including practice based research methods.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Target
1.	**Management**	Design and Management of Hospital pharmacy department for a 300 bedded hospital.	3	1	
2.	**P.T.C**	Pharmacy and Therapeutics committee-Organization, function and limitations.	3	2	
3.	**Hospital formulary**	Development of hospital formulary for 300 bedded teaching hospital.	3	4	
4.	**ABC analysis**	Preparation of ABC analysis of drugs sold in one month from the pharmacy.	3	5	
5.	**Evaluation of clinical trials**	Different phases of clinical trials with elements to be evaluated.	3	2	
6.	**Drug information**	Various sources of drug information and systemic approach to provide unbiased drug information.	3	3	
7.	**Drug interaction**	Evaluation of prescriptions generated in hospital for drug interaction and find out the suitable management.	3	2	
e-Learning Source:					
https://www.google.co.in/books/edition/Hospital_Pharmacy/kdAMf8f8RPwC?hl=en&gbpv=1&dq=hospital+pharmacy+pharm+d&printsec=frontcover					

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	2	2	1	1	1	-	-	1	3	3	-	-	-
CO2	3	3	2	1	2	2	1	1	1	-	-	2	3	3	-	-	-
CO3	3	3	2	1	2	2	1	1	1	-	-	3	3	2	-	-	-
CO4	3	3	2	1	2	2	1	1	1	-	-	2	3	2	-	-	-
CO5	3	3	2	1	2	2	1	1	1	-	-	1	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY407	Title of the Course	CLINICAL PHARMACY	SDG Goals	L	T	P	C
Year	IV	Semester	ANNUAL	3 GOOD HEALTH AND WELL-BEING	3	1	-	4
Course Objectives	1. Monitor drug therapy of patient through medication chart review and clinical review; 2. Obtain medication history interview and counsel the patients; 3. Identify and resolve drug related problems; 4. Detect, assess and monitor adverse drug reaction; 5. Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states; and 6. Retrieve, analyze, interpret and formulate drug or medicine information.							

Course Outcomes	
CO1	Monitor drug therapy of patient through medication chart review and clinical review;
CO2	Obtain medication history interview and counsel the patients.
CO3	Identify and resolve drug related problems, Retrieve, analyze, interpret and formulate drug or medicine information
CO4	Detect, assess and monitor adverse drug reaction.
CO5	Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
CO6	Retrieve, analyze, interpret and formulate drug or medicine information.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Target
1	**Definitions, development and scope of clinical pharmacy** **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	3	1	**3.7, 3.8**
2	**Introduction to daily activities of a clinical pharmacist-II** **Patient data analysis**	a. Medication history b. Patient counseling c. Drug utilisation evaluation (DUE) and review (DUR) d. Quality assurance of clinical pharmacy services. The patient's case history, its structure and use in evaluation of drug therapy & Understanding common medical abbreviations and terminologies used in clinical practices.	3	2	**3.3,, 3.7**
3	**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	**3**	**5**	**3.7,3.8**
4	**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	3	3	**3.9, 3.b**
5	**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.	3	4	**3.7, 3.8**
6	**Communication skills, including patient counselling techniques, medication history interview, presentation of cases.** **Pharmaceutical care concepts**	Communication skills, including patient counselling techniques, medication history interview, presentation of cases. a. Pharmaceutical care concepts. b. Critical evaluation of biomedical literature. c. Medication errors.	3	5	**3.7, 3.3.8**

Reference Books:
Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia.
Basic skills in interpreting laboratory data - Scott LT, American Society of Health System Pharmacists Inc.
Biopharmaceutics and Applied Pharmacokinetics - Leon Shargel, Prentice Hall publication.
A textbook of Clinical Pharmacy Practice; Essential concepts and skills, Dr.G.Parthasarathi, Karin Nyfort-Hansen and MilapNahata Orient Langman Pvt.Ltd. ISSBN8125026
Australian drug information -Procedure manual. The Society of Hospital Pharmacists of Australia.
Clinical Pharmacokinetics - Rowland and Tozer, Williams and Wilkins Publication.
Pharmaceutical Statistics. Practical and clinical applications. Sanford Bolton, Marcel Dekker, Inc.

e-Learning Source:
https://www.google.co.in/books/edition/Clinical_Pharmacy_Education_Practice_and/9Jp7DwAAQBAJ?hl=en&gbpv=1&dq=CLINICAL+pharmacy+pharm+d&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	2	2	2	3	2	2	2	3	1	2	3	-	-	-
CO2	3	2	2	2	3	2	3	2	2	3	2	1	2	3	-	-	-
CO3	3	3	3	2	2	2	3	3	3	3	3	1	2	3	-	-	-
CO4	3	3	3	2	2	2	2	2	3	3	2	1	2	3	-	-	-
CO5	2	3	2	2	3	3	3	2	3	2	3	1	2	3	-	-	-
CO6	2	2	3	2	2	3	3	2		2	2	1	2	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY408	Title of the Course	CLINICAL PHARMACY	L	T	P	C
Year	IV	Semester	ANNUAL	-	-	3	-
Course Objectives	Upon completion of the subject student shall be able to (Know, do, appreciate) – 1. Monitor drug therapy of patient through medication chart review and clinical review; 2. Obtain medication history interview and counsel the patients; 3. Identify and resolve drug related problems; 4. Detect, assess and monitor adverse drug reaction; 5. Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states; and 6. Retrieve, analyse, interpret and formulate drug or medicine information.						

Course Outcomes	
CO1	Monitor drug therapy of patient through medication chart review and clinical review;
CO2	Obtain medication history interview and counsel the patients.
CO3	Identify and resolve drug related problems, Retrieve, analyze, interpret and formulate drug or medicine information
CO4	Detect, assess and monitor adverse drug reaction.
CO5	Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Target
1.	**Answering drug information questions**	Case studies & Answering drug information questions (4 Nos)	10	3	
2.	**Patient medication counselling**	Case Studies & Patient medication counselling (4 Nos)	10	2	
3.	**Case studies related to laboratory investigations**	Case studies related to laboratory investigations (4 Nos)	10	5	
4.	**Patient medication history interview**	Patient medication history interview. (3 Nos)	7.5	2	
e-Learning Source:					
https://www.google.co.in/books/edition/A_Text_Book_of_Clinical_Pharmacy_Practic/FGDQZaqk9lYC?hl=en&gbpv=1&dq=CLINICAL+pharmacy+PRACTICAL+pharm+d&printsec=frontcover					

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2	3	2	2	2	3	1	2	3	-	-	-
CO2	3	2	2	2	3	2	3	2	2	3	2	1	2	3	-	-	-
CO3	3	3	3	2	2	2	3	3	3	3	3	1	2	3	-	-	-
CO4	3	3	3	2	2	2	2	2	3	3	2	1	2	3	-	-	-
CO5	2	3	2	2	3	3	3	2	3	2	3	1	2	3	-	-	-
CO6	2	2	3	2	2	3	3	2		2	2	1	2	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY409	Title of the Course	BIOSTATISTICS & RESEARCH METHODOLOGY	SDG Goals	L	T	P	C
Year	IV	Semester	ANNUAL		3	1	-	3

Course Objectives

1. To prepare students as health care expert with emphasis on inter-professional health care team based patient care.
2. To develop the skills in monitoring of the National Health Programmes and schemes, oriented to provide preventive and promotive health care services to the community.
3. To impart applied knowledge related to clinical discussions, attending ward rounds, follow-up progress of patients, case presentation at discharge are imbibed through hospital postings.
4. To develop a trained clinical pharmacist who functions effectively as a member of health care team organized to deliver the health and family welfare services in existing socio-economic environment.
5. To promote health, wellness and disease prevention by developing the rationale use of drugs.
6. To understand the clinical aspects of drug development, such as phases, ethical issues, and roles and responsibilities

Course Outcomes	
CO1	Learn the basic concept for research, designing of methodology and clinical study, determination of sample size and report writing.
CO2	Understand the basic concepts of biostatistics, measures of central tendency and spread and data graphics.
CO3	Explain the basics of hypothesis testing, different parametric and non-parametric tests and use of statistical software such as SPSS, Epi Info, and SAS
CO4	Discuss the statistical methods in epidemiology to solve different types of problems.
CO5	Appreciate the importance of Computer in hospital and Community Pharmacy.
CO6	Develop the ability and confidence in completing drug information and literature retrieval and evaluation tasks.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Target
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	2	1	
2.	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	2	2	
3.	Basics of testing hypothesis	Null hypothesis, level of significance, power of test, P value, statistical estimation of confidence intervals. Level of significance (Parametric data)- students t test (paired and unpaired), chi Square test, Analysis of Variance (one-way and two-way), Level of significance (Non-parametric data)- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal-Wallis test (one way ANOVA) Linear regression and correlation- Introduction, Pearsonn's and Spearmann's correlation and correlation co-efficient. Introduction to statistical software: SPSS, Epi Info, SAS.	2	3	
4.	Unit-IV	Statistical methods in epidemiology Incidence and prevalence, relative risk, attributable risk	**2**	4	
5.	Unit-V	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. Computer in Community Pharmacy Computerizing the Prescription Dispensing process Use of Computers for Pharmaceutical Care in community pharmacy, Accounting and General ledger system			
6.	Drug Information Retrieval & Storage	Introduction – Advantages of Computerized Literature Retrieval Use of Computerized Retrieval	**2**	6	

Reference Books:

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

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

e-Learning Source:

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	2	2	2	1	1	1	1	2	3	3	3	-	-	-
CO2	3	3	2	2	2	2	1	1	1	1	2	3	3	3	-	-	-
CO3	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO4	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO5	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO6	3	3	2	2	2	2	1	1	1	1	2	1	1	1	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY410	Title of the Course	CLINICAL TOXICOLOGY	SDG Goals	L	T	P	C
Year	IV	Semester	ANNUAL	3 GOOD HEALTH AND WELL-BEING	3	1	0	4
Course Objectives	Developing general working knowledge of the principles and practice of clinical toxicology							

Course Outcomes	
CO1	Differentiate the clinical signs and symptoms of various acute poisonings.
CO2	Manage the clinical signs and symptoms of different chronic poisonings.
CO3	Distinguish the clinical symptoms of chronic poisoning by heavy metals.
CO4	Plan public health care professionals in the management of emergency cases.
CO5	Evaluate, minimize and prevent the substance abuse cases in local population.
CO6	Knowledge about different antidotes for the management of clinical toxicology.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Target
1.	General principles involved in the management of poisoning	General principles involved in the management of poisoning Antidotes and the clinical applications. Supportive care in clinical Toxicology	20	1,2	-------
2.	General principles involved in the management of poisoning	Gut Decontamination. Elimination Enhancement. Toxicokinetics.	23	2,3	-----
3.	Clinical symptoms and management of acute poisoning	Pesticide poisoning: organophosphorous compounds, carbamates, organochlorines, pyrethroids. Opiates overdose. Antidepressants Barbiturates and benzodiazepines. Alcohol: ethanol, methanol. Paracetamol and salicylates Non-steroidal anti-inflammatory drugs. Hydrocarbons: Petroleum products and PEG. Caustics: inorganic acids and alkali. Radiation poisoning	28	2,3	3.9, 3.a
4.	Clinical symptoms and management of chronic poisoning	Clinical symptoms and management of chronic poisoning with the following agents - Heavy metals: Arsenic, lead, mercury, iron, copper Venomous snake bites: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries.	26	3,4	3.9, 3.a
5.	Plants poisoning	Plants poisoning. Mushrooms, Mycotoxins. Food poisonings Envenomations – Arthropod bites and stings.	27	2,3	3.9
6.	Substance abuse	Signs and symptoms of substance abuse and treatment of dependence CNS stimulants :amphetamine Opioids CNS depressants Hallucinogens: LSD Cannabis group Tobacco	20	2,5	3.a

Reference Books:

Matthew J Ellenhorn. ELLENHORNS MEDICAL TOXICOLOGY – DIAGNOSIS AND TREATMENT OF POISONING. Second edition. Williams and Willkins publication, London

V VPillay. HANDBOOK OF FORENSIC MEDICINE AND TOXICOLOGY. Thirteenth edition 2003 Paras Publication, Hyderabad

e-Learning Source:

http://www.prip.edu.in/img/ebooks/VV-Pillay-Modern-Medical-Toxicology-4th-Edition.pdf

http://pustaka.unp.ac.id/file/abstrak_kki/EBOOKS/A%20textbook%20of%20Modern%20Toxicology.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	2	3	2	2	3	2	2	3	2	-	-	-
CO2	3	2	3	2	2	3	2	2	2	2	3	3	2	2	-	-	-
CO3	3	2	2	3	2	3	2	3	3	3	3	3	2	3	-	-	-
CO4	3	2	3	2	2	3	2	2	3	3	3	3	2	2	-	-	-
CO5	3	2	3	3	3	2	2	3	3	2	2	2	2	3	-	-	-
CO6	2	3	1	1	2	3	2	2	2	3	1	2	3	1	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY501	Title of the Course	CLINICAL RESEARCH	SDG Goals	L	T	P	C
Year	V	Semester	ANNUAL		3	1	0	4
Course Objectives	1. This course is designed to impart knowledge and skills necessary for contribution to Clinical research in new drug development. 2. Chapters deal to cover briefly knowledge of Clinical trial and its documentation of new drug development 3. This will enable the student to understand the pathway of drug in clinical trial.							

Course Outcomes	
CO1	Understand the fundamental ideas behind the drug development process, including what it is, how it varies from standard care, and why it is carried out.
CO2	To establish that clinical research designs and the regulatory approval process are effective.
CO3	Become familiar with the numerous regulatory documents and guidelines, and assess the most significant domestic, international, and health care regulatory, and product development, consequences.
CO4	Effectively manage and access the ethical aspects of clinical trial activity.
CO5	To ensure that high-quality research is conducted, become familiar with the roles and duties of the professionals involved in conducting clinical research.
CO6	Acknowledge the clinical trial safety monitoring and reporting processes, and regulate the trial Co-ordination process.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Target
1.	**Drug development process**	Introduction, Various Approaches to drug discovery, Pharmacological, Toxicological, IND Application, Drug characterization, Dosage form	3	1	------
2.	**Clinical development of drug**	Introduction to Clinical trials, Various phases of clinical trial, Methods of post marketing surveillance, Abbreviated New Drug Application submission.	3	2	3.9, 3.b
3.	**Good Clinical Practice**	ICH, GCP, Central drug standard control organization (CDSCO) guidelines, Challenges in the implementation of guidelines, Ethical guidelines in Clinical Research, Composition, responsibilities, procedures of IRB / IEC, Overview of regulatory environment in USA, Europe and India.	3	3	3.b
4.	**Role and responsibilities of clinical trial personnel as per ICH GCP**	Sponsor, Investigators, Clinical research associate, Auditors, Contract research coordinators, Regulatory authority	3	4	3.b, 3.c
5.	**Designing of clinical study documents (protocol, CRF, ICF, PIC with assignment)**	Informed consent Process, Data management and its components, Safety monitoring in clinical trials.	3	5	------

Reference Books:

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

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.

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

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

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

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

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

e-Learning Source:

https://www.google.co.in/books/edition/Principles_and_Practice_of_Clinical_Rese/o6-F8I4LJLgC?hl=en&gbpv=1&dq=CLINICAL+RESEARCH&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	1	2	2	1	1	2	2	2	2	-	-	-
CO2	3	2	2	2	2	1	2	2	1	2	2	2	2	2	-	-	-
CO3	3	2	2	2	2	1	2	2	1	2	2	2	2	2	-	-	-
CO4	3	2	2	2	2	1	2	2	1	2	2	2	2	2	-	-	-
CO5	3	2	2	2	2	1	2	2	1	2	2	2	2	2	-	-	-
CO6	3	2	2	2	2	1	2	2	1	2	2	2	2	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY502	Title of the Course	PHARMACOEPIDEMIOLOGY & PHARMACOECONOMICS	SDG Goals	L	T	P	C
Year	V	Semester	ANNUAL		3	1	-	4
Course Objectives	1. Pharmacoepidemiology can help assess patterns and appropriateness of drug utilization, 2. Provide explanations for poor compliance, quantify the frequency and severity of side effects, and aid in the design and evaluation of interventions to improve drug use and outcomes.							

Course Outcomes	
CO1	Differentiate the various methods used in Pharmacoepidemiology.
CO2	Evaluate and identify the various risks in Epidemiological studies.
CO3	Assessment of data used in Pharmacoepidemiology and Pharmacoeconomic.
CO4	Demonstrate ability in the design, conduct and evaluation of Pharmacoeconomic studies.
CO5	Applications of Pharmacoepidemiology and Pharmacoeconomics in clinical settings.
CO6	Interpretation the result in Pharmacoepidemiology and Pharmacoeconomic.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Target
1.	**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.	28	1,2	3.3, 3.4
2.	**Concept of risk in pharmacoepidemiology**	Measurement of risk, attributable risk and relative risk, time-risk relationship and odds ratio.	15	2,3	3.8, 3.c, 3.d
3.	**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.	28	2,3	3.8, 3.c, 3.d
4.	**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, and drug induced birth defects	27	3,4	3.1, 3.2, 3.4, 3.8, 3.b
5.	**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, and cost – effectiveness, cost utility.	27	2,3	3.8, 3.c, 3.d
6.	**Applications of Pharmacoeconomics**	Applications of Pharmacoeconomics: Software and case studies.	20	2,5	3.8, 3.c, 3.d

Reference Books:

K.Park , Park's textbook of preventive and social medicine(21st edition), M/s BanarsidasBhanot Publishers,Jabalpur,2011.

Brian L Strom and Stephen E Kimmel, Textbook of pharmacoepidemiology by Brian L Strom and Stephen E Kimmel(4th edition),John wiley& Sons Ltd, England, 2005.

Stephen P Glasser,Essentials of clinical research(1st edition),Springer-Verlag, New York, 2008.

e-Learning Source:

https://pharmareview.files.wordpress.com/2011/10/pharmacoepidemiology.pdf

https://pharmacystblog.files.wordpress.com/2019/05/textbook-of-pharmacoepidemiology.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	2	3	2	2	3	2	2	3	3	-	-	-
CO2	3	2	3	2	2	3	2	2	2	2	3	3	2	2	-	-	-
CO3	3	2	2	3	2	3	2	3	3	3	2	2	3	2	-	-	-
CO4	3	2	3	2	2	3	2	2	3	3	3	3	2	2	-	-	-
CO5	3	2	3	3	3	2	2	3	3	2	3	3	3	3	-	-	-
CO6	2	2	2	2	1	1	1	1	2	2	1	2	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY503	Title of the Course	CLINICAL PHARMACOKINETICS & THERAPEUTIC DRUG MONITORING	SDG Goals	L	T	P	C
Year	V	Semester	ANNUAL		2	1	-	3
Course Objectives	1. Know the basics of pharmacokinetic parameters and their application. 2. Understand concept of nomograms for elderly and pediatric patients for effective therapy. 3. Know the advantages of individualization of dosage regimen and therapeutic drug monitoring. 4. Understand the concept of population pharmacokinetics and pharmacogenomics.							

Course Outcomes	
CO1	Students can understand the basic principles of clinical pharmacokinetics
CO2	Students shall able to design dosage regimen for individual patients
CO3	Students shall able to analyze and resolve pharmacokinetics drug interactions
CO4	Students shall able to adjust the dose in different disease conditions
CO5	Students can understand therapeutic drug monitoring forsafe and effective therapy
CO6	Understand the concept of population pharmacokinetics and Pharmacogenetics

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Target
1.	**Clinical Pharmacokinetics-Introduction**	a. Introduction to Clinical pharmacokinetics. b. 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.	12	1,& 2	-------
2.	**Pharmacokinetics of Drug Interaction**	a. Pharmacokinetic drug interactions b. Inhibition and Induction of Drug metabolism c. Inhibition of Biliary Excretion.	2	4	------
3.	**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.	18	1, 3& 4	-------
4.	**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.	10	1,3& 4	-------
5.	**Population Pharmacokinetics**	a. Introduction to Bayesian Theory. b. Adaptive method or Dosing with feed back. c. Analysis of Population pharmacokinetic Data.	12	1,3& 5	3.8, 3.c, 3.d
6.	**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	8	1,3& 5	-------

Reference Books:

Clinical Pharmacokinetics 6th Edition. John E. Murphy

Concepts in Clinical Pharmacokinetics 4th Edition. Joseph T. DiPiro

Applied Clinical Pharmacokinetics. 2nd Edition. Larry A. Bauer

e-Learning Source:

Access Pharmacy:https://accesspharmacy.mhmedical.com/content.aspx?sectionid=41488039&bookid=513

Future Learn:https://www.futurelearn.com/courses/pharmacokinetics-and-dosing-regimen-in-renal-disease

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	1	-	-	1	-	-	2	1	1	1	1	1	3	-	-	-
CO2	2	1	1	2	2	-	1	2	1	1	2	1	1	3	-	-	-
CO3	2	-	-	3	2	-	2	2	2	1	2	2	1	3	-	-	-
CO4	3	3	-	2	2	-	2	2	3	1	3	3	1	3	-	-	-
CO5	2	2	-	2	2		3	2	3	1	2	1	1	3	-	-	-
CO6															-		

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Course Code	PRY504	Title of the Course	PHARMACOTHERAPEUTICS-III	SDG Goals	L	T	P	C
Year	V	Semester	ANNUAL		3	1	-	4

Course 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 individualized therapeutic plans based on diagnosis; e. The 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. 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 individualized 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).

Course Outcomes	
CO1	Develop treatment strategies for peptic ulcer disease, GERD, and IBD using clinical guidelines and patient-specific factors.
CO2	Apply pharmacological principles to manage alcoholic liver disease, viral hepatitis, jaundice, and drug-induced liver disorders, ensuring drug safety.
CO3	Evaluate and manage anemia, venous thromboembolism, and drug-induced blood disorders, ensuring proper drug selection and monitoring.
CO4	Optimize drug therapy for epilepsy, Parkinson's disease, Alzheimer's disease, and stroke based on patient response and evidence-based guidelines.
CO5	Implement pharmacotherapeutic interventions for schizophrenia, affective disorders, anxiety, sleep disorders, and OCD, ensuring efficacy and safety.
CO6	Assess and improve pain management plans for neuropathic pain, headaches, and neuralgias, ensuring opioid safety. Evaluate pharmacotherapy using evidence-based medicine, clinical guidelines, and research for better treatment decisions.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1.	**Gastrointestinal system**	Peptic ulcer disease, gastro esophageal reflux disease, inflammatory bowel disease,	12	1	-----
2.	**Liver disorders**	Alcoholic liver disease, viral hepatitis including jaundice, and drug induced liver disorders.	12	2	3.5
3.	**Haematological system**	Anaemias, venous thromboembolism, drug induced blood disorders.	12	3	-------
4.	**Nervous system**	Epilepsy, Parkinsonism, Alzheimer's disease, stroke.	12	4	------
5.	**Psychiatry disorders**	Schizophrenia, affective disorders, anxiety disorders, sleep disorders, obsessive compulsive disorders	12	5	------
6.	**Pain & Evidence Based Medicine**	Pain management including pain pathways, neuralgias, headaches and evidence based medicine.	12	6	-----

Reference Books:

1. Pharmacotherapy: A Pathophysiologic Approach by Joseph T. Dipiro. 11th Edition.
2. Clinical Pharmacy and Therapeutics by Roger Walker. 5th Edition.
3. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA
4. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.
5. Pathologic basis of disease - Robins SL, W.B. Saunders Publication.
6. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication.

e-Learning Source:

https://www.google.co.in/books/edition/Pocket_Handbook_of_GI_Pharmacotherapeuti/x3SjDDjlW00C?hl=en&gbpv=1&dq=Pharmacotherapeutics-III&printsec=frontcover

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO2	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO3	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO4	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO5	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-
CO6	3	3	3	1	1	2	2	1	1	1	2	3	1	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Course Code	PRY505	Title of the Course	PHARMACOTHERAPEUTICS-III	L	T	P	C
Year	V	Semester	ANNUAL	-	-	3	1.5
Course Objectives	To describe the pathophysiology of selected disease states and explain the rationale for drug therapy; To summarize the therapeutic approach to management of these diseases including reference to the latest available evidence; To discuss the controversies in drug therapy; To discuss the preparation of individualised therapeutic plans based on diagnosis; and 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).						

Course Outcomes	
CO1	Students understand the pathophysiology & diagnosis of GIT & liver disorder and their management/controversies including 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).
CO2	Students have ability to explore the pathophysiology & diagnosis of hematological disorder and their management/controversies.
CO3	Students have ability to effectively communicate the pharmacotherapy of CNS disorder and their management/controversies.
CO4	Students analyzed the pathophysiology & diagnosis of Psychiatric disorder and their management/controversies including patient-specific parameters relevant in initiating drug therapy and monitoring therapy.
CO5	Students analyzed the pathophysiology & diagnosis of Schizophrenia, affective disorders, anxiety disorders, sleep disorders, obsessive compulsive disorders and their management/controversies including patient-specific parameters relevant in initiating drug therapy and monitoring therapy.
CO6	Students analyze the Pharmacotherapeutics of Pain management including pain pathways, neuralgias, headaches and evidence based medicine.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	Case study	Case study on Gastrointestinal & Liver disorders	12	1
2.	Case study	Case study on Haematological disorders	12	2
3.	Case study	Case study on Nervous system disorders	12	3
4.	Case study	Case study on Psychiatry disorders	12	4
5.	Case study	Case study on Pain and its managements	12	5

e-Learning Source:

https://www.google.co.in/books/edition/Pharmacology_and_Pharmacotherapeutics/FR4OEAAAQBAJ?hl=en&gbpv=1&dq=PHARMACOTHERAPEUTICS&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO2	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO3	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO4	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO5	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-
CO6	3	3	2	2	2	2	1	1	1	1	2	3	2	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD