Dr. Bhimrao Ambedkar University, Agra

A State University of Uttar Pradesh (Paliwal Park, Agra -282004)

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A Documentary Support

for

Matric No. – 1.3.1

Institution integrates cross-cutting issues relevant to **Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework enshrined in Sustainable Development goals and National Education Policy – 2020** into the Curriculum

under the

Criteria – I

(Curriculum Design and Development)

Key Indicator - 1.3

in

Matric No. – 1.3.1

DOCTOR OF PHARMACY(PHARM.D)

2021

PROFESSIONAL ETHICS	ENVIRONMENT & SUSTAINABILITY	NATIONAL EDUCATION POLICY – 2020
HUMAN VALUES	GENDER	

Registrar
Dr. B.R.A. University, Agra

Signature Not Verified
RAJEEV KUMAR
Digitally Signed By Registrar

Institute of Pharmacy and Paramedical Sciences, Agra

(Dr. Bhim Rao Ambedkar University, Agra)

Pharm.D.

Subjects of study and examination scheme for first to sixth year Pharm.D. aregiven in Tables.

TABLES

First Year:

Subject Code	Name of Subject	No. of hours/ Week	No. of hours of Tutorial
(1)	2	(3)	(4)
22PD11T	Human Anatomy and Physiology	3	1
22PD11P	Human Anatomy and Physiology	3	-
22PD12T	Pharmaceutics	2	1
22PD12P	Pharmaceutics	3	-
22PD13T	Medicinal Biochemistry	3	1
22PD13P	Medicinal Biochemistry	3	-
22PD14T	Pharmaceutical Organic Chemistry	3	1
22PD14P	Pharmaceutical Organic Chemistry	3	-
22PD15T	Pharmaceutical Inorganic Chemistry	2	1

22PD15P	Pharmaceutical Inorganic Chemistry	3	-
22PD16T*	Remedial Mathematics^{+}/ Biology^{++}	3	1
22PD16P*	Remedial Biology^{++}	3	-
22PD17T*	Constitution of India	2	-
		$33^{+}/36^{++}/30$	6
	Total hours - For Maths Deficient: 39For Biology Deficient: 42 For No Maths/Bio Deficiency: 35		

+ For mathematics deficit students ++ For Biology deficit students

* College examination only

Second Year:

Subject Code	Name of Subject	No. of hours/ Week	No. of hours of Tutorial
22PD21T	Pathophysiology	3	1
22PD22T	Pharmaceutical Microbiology	3	1
22PD22P	Pharmaceutical Microbiology	3	-
22PD23T	Pharmacognosy & Phytopharmaceuticals	3	1
22PD23P	Pharmacognosy & Phytopharmaceuticals	3	-
22PD24T	Pharmacology-I	3	1
22PD25T	Community Pharmacy	2	1
22PD26T	Pharmacotherapeutics-I	3	1
22PD26P	Pharmacotherapeutics-I	3	-
22PD27T*	Human Rights, Gender Equity and Environmental Studies	2	-
	Total hours	**28**	**6**
	Grand Total	**34**	

Third Year:

Subject Code	Name of Subject	No. of hours/ Week	No. of hours of Tutorial
22PD31T	Pharmacology-II	3	1
22PD31P	Pharmacology-II	3	-
22PD32T	Pharmaceutical Analysis	3	1
22PD32P	Pharmaceutical Analysis	3	-
22PD33T	Pharmacotherapeutics-II	3	1
22PD33P	Pharmacotherapeutics-II	3	-
22PD34T	Pharmaceutical Jurisprudence	2	-
22PD35T	Medicinal Chemistry	3	1
22PD35P	Medicinal Chemistry	3	-
22PD36T	Pharmaceutical Formulations	2	1
22PD36P	Pharmaceutical Formulations	3	-
	Total hours	**31**	**5**
	Grand Total		**36**

Fourth Year:

Subject Code	Name of Subject	No. of hours/ Week	No. of hours of Tutorial
22PD41T	Pharmacotherapeutics-III	3	1
22PD41P	Pharmacotherapeutics-III	3	-
22PD42T	Hospital Pharmacy	2	1
22PD42P	Hospital Pharmacy	3	-
22PD43T	Clinical Pharmacy	3	1
22PD43P	Clinical Pharmacy	3	-
22PD44T	Biostatistics & Research Methodology	2	1
22PD45T	Biopharmaceutics & Pharmacokinetics	3	1
22PD45P	Biopharmaceutics & Pharmacokinetics	3	-
22PD46T	Clinical Toxicology	2	1
	Total hours	**27**	**6**
	Grand Total		**33**

Fifth Year:

Subject Code	Name of Subject	No. of hours/ Week	No. of hours of Tutorial
22PD51T	Clinical Research	3	1
22PD52T	Pharmacoepidemiology and Pharmacoeconomics	3	1
22PD53T	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	2	1
22PD54	Clerkship *	-	1
22PD55P	Project work (Six Months)	20	-
	Total hours	**28**	**4**
	Grand Total		**32**

***** Attending ward rounds on daily basis.

Sixth Year:

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

(i) Six months in General Medicine department, and
(ii) Two months each in three other specialty departments

22PD11T: HUMAN ANATOMY & PHYSIOLOGY (THEORY)

Theory: 3 Hrs. /Week **75 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Explain the anatomy, physiology and functions of various Tissues and cell, organization of cellular system. .
CO2	Classify different types of tissue and explain anatomy and physiology of skeletal system and joints
CO3	Explain Haemopoetic and lymphatic system homeostatic and its altered physiology
CO4	Explain the anatomy and Physiology of cardiovascular and respiratory system and its disorders

CO5	Explain the anatomy and Physiology of digestive ,nervous, urinary and reproductive system and its disorders
CO6	Explain the Anatomy and Physiology of endocrine system and sense organs and its disorders
CO7	Describe the Physiology of muscle contraction and its disorders
CO8	Explain sport physiology , drugs and athletics

1. **Scope and Objectives:** This course is designed to impart a fundamental knowledge on the structure and functions of the human body. It also helps inunderstanding both homeostasis mechanisms and homeostatic imbalances of various body systems. Since a medicament, which is produced by pharmacist, is used to correct the deviations in human body, it enhances the understandingof how the drugs act on the various body systems in correcting the disease state of the organs.

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

   1. describe the structure (gross and histology) and functions of variousorgans of the human body;
   2. describe the various homeostatic mechanisms and their imbalancesof various systems;
   3. identify the various tissues and organs of the different systems of thehuman body;

4. perform the hematological tests and also record blood pressure, heartrate, pulse and respiratory volumes;
5. appreciate coordinated working pattern of different organs of eachsystem; and
6. appreciate the interlinked mechanisms in the maintenance of normalfunctioning (homeostasis) of human body

2. Course materials:

Text books

a) Gerard J. Tortora and Bryan Derrickson. Principles of anatomy and physiology, 14th ed.2013, HarperCollins College New York.
b) Anne Waught & Allison Grant. Ross and Wilson's foundations of Anatomy and Physiology in Health and illness. 12th ed. 2014, Churchill Livingstone, Edinburg.

Reference books

a) Guyton Arthur, C. *Physiology of human body*. 12thed. 2010, Holtsaunders.
b) Chatterjee, C.C. *Human physiology*. Volume I & II. 11th ed. 2016, medicalallied agency, Calcutta.
c) Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H. *Gray'sanatomy.* 37th ed. Churchill Livingstone, London.
d) K. Sembulingam & Prema Sembulingam, Medical Physiology, 6thed.2014, Jaypee Brothers. Newdelhi.

3. Lecture wise program:

	Topics	Hrs
1.	Scope of anatomy and physiology, basic terminologies used in this subject (Description of the body as such planes and terminologies)	02
2	General Physiology: Structure of cell – its components and their functions. Homeostasis, Mechanism of transport across cell membrane, Secondary messengers, Ion channels	04
3	Elementary tissues of the human body: epithelial, connective, muscular and nervous tissues-their sub-types and characteristics	04

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 anddisorders of joints (Definitions only)	01
5	Haemopoetic system a) Composition and functions of blood b) Haemopoesis and disorders of blood components (Definition only) c) Blood groups d) Clotting factors and mechanism e) Platelets and disorders of coagulation	05
6	Lymph a) Lymph and lymphatic system, composition, formationand circulation. b) Spleen: structure and functions, disorders c) Disorders of lymphatic system (Definition only)	04
7	Cardiovascular system a) Anatomy and functions of 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 Hypertension, hypotension, arteriosclerosis, atherosclerosis, angina, myocardial infarction, congestiveheart failure, cardiac arrhythmias	06
8	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, oxygen therapy and resuscitation	05
9	Digestive system a) Anatomy and physiology of GIT b) Anatomy and functions of accessory glands of GIT	06

c) Digestion and absorption
d) Disorders of GIT (Definitions only)

10 Nervous system 08

a) Definition and classification of nervous system.
b) Synapse and neurotransmitter, ménages, ventricles of the brain and CSF
c) Anatomy, physiology and functional areas of cerebrum
d) Anatomy and physiology of cerebellum
e) Anatomy and physiology of mid brain
f) Thalamus, hypothalamus and basal ganglia
g) Spinal card: Structure & reflexes – mono-poly-planter
h) Cranial nerves – names and functions
i) ANS – Anatomy & functions of sympathetic & parasympathetic N.S.

11 Urinary system 05

a) Anatomy and physiology of urinary system
b) Formation of urine
c) Renin angiotensin aldosterone system – Juxtaglomerular apparatus – acid base balance
d) Clearance tests and micturition

12 Endocrine system 06

a) Pituitary gland
b) Adrenal gland
c) Thyroid and Parathyroid glands
d) Pancreas and gonads

13 Reproductive system 07

a) Male and female reproductive system organs anatomy and physiology.
b) Their hormones – physiology of menstruation
c) Spermatogenesis & Oogenesis
d) Sex determination (genetic basis)
e) Pregnancy & maintenance. Parturition
f) Contraceptive devices

14 Sense organs 06

a) Eye
b) Ear
c) Skin
d) Tongue & Nose

15 Skeletal muscles 03

a) Histology
b) Physiology of Muscle contraction
c) Physiological properties of skeletal muscle and their disorders (Definitions only)

16 Sports physiology 03

a) Muscles in exercise, Effect of athletic training onmuscles and muscle performance,
b) Respiration in exercise, CVS in exercise, body heat inexercise, body fluids and salts in exercise,
c) Drugs and athletics

22PD11P: HUMAN ANATOMY & PHYSIOLOGY (PRACTICAL)

Practical: 3 Hrs/Week **75 Hours**

General Requirements: Laboratory napkin, muslin cloth, record, observationbook (100 pages), stationery items, and blood lancet.

Course materials: Textbooks

Goyal, R. K, Natvar M.P, and Shah S.A, Practical anatomy, physiology andbiochemistry, 2011 B.S Shah Prakashan, Ahmedabad.

Reference books

1. Ranade VG, Textbook of practical physiology, 4rd edition, PVG, Pune
2. Anderson Experimental Physiology, Latest edition, Publisher: NA

List of Experiments:

1. Study of a compound microscope.
2. Study of tissues of the human body
   a) Epithelial tissue.
   b) Muscular tissue.
3. Study of tissues of the human body
   a) Connective tissue.
   b) Nervous tissue.
4. Study of appliances used in hematological experiments.
5. Determination of total WBC count of blood.**
6. Determination of total RBC count of blood.**
7. Determination of differential leukocyte count of blood.*
8. Determination of
   a) Erythrocyte Sedimentation Rate. (ESR)*
   b) Hemoglobin content of blood.*
   c) Bleeding time & clotting time.*
9. Determination of
   a) Blood pressure.
   b) Blood group.*

10. Study of various systems with the help of charts, models & specimens
    a) Skeleton system part I-axial skeleton.
    b) Skeleton system part II- appendicular skeleton.
    c) Cardiovascular system.
    d) Respiratory system.
    e) Digestive system.
    f) Urinary system.
    g) Nervous system.
    h) Special Senses.
    i) Reproductive system.
11. Study of different family planning appliances.
12. Study of pregnancy diagnosis test.
13. Study of appliances used in experimental physiology.
14. Study of record of simple muscle curve using gastroenemius sciatic nervepreparation.
15. Study of simple summation curve using gastroenemius sciatic nervepreparation.
16. Study of simple effect of temperature using gastroenemius sciatic nervepreparation.
17. Study of simple effect of load & after load using gastroenemiussciatic nerve preparation.
18. Study of fatigue curve using gastroenemius sciatic nerve preparation.

Scheme of Practical Examination:

	Sessionals	**Annual**
Identification	04	10
Synopsis	04	10
Major Experiment**	07	20
Minor Experiment*	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03 hrs**	**04 hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity,promptness, viva-voce and record maintenance).

22PD12T: PHARMACEUTICS (THEORY)

Theory: 2 Hrs. /Week **50 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Learn handling of prescription, posology & dose calculation of drug in children. Different types of dosage form
CO2	Discuss history of the profession of Pharmacy in India & Pharmacopeia and its development.
CO3	Explain the different pharmaceutical calculation involved in formulation
CO4	Elaborate basic requirement and formulation of powder and liquid (monophasic & biphasic) dosages form
CO5	Understand basic requirement, formulation and evaluation of suppositories and pessaries
CO6	Explain different types of extraction process mainly maceration & percolation and their application.
CO7	Explain the different types of surgical aids and their application
CO8	Learn type of Pharmaceutical incompatibility

1. **Scope and objectives:** This course is designed to impart a fundamental knowledge on the art and science of formulating different dosage forms. It prepares the students for most basics of the applied field of pharmacy.
   Upon the completion of the course the student should be able to:
   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.

2. **Course materials:**
   Text books
   a) Carter S.J, Cooper and Gunn's Dispensing for Pharmaceutical Students.12ed. 2008, CBS Publishers & Distributors Pvt. Ltd

b) N.K.Jain and S.N.Sharma, A textbook Professional Pharmacy, 6th ed. 2016,Vallabha Prakashan, New Delhi.

Reference books

a) Introduction to Pharmaceutical dosage forms by Howard C. Ansel.3rd.ed,1981
b) Remington's Pharmaceutical Sciences. Vol 1-3, 22th ed. 2010
c) Register of General Pharmacy by Cooper and Gunn. Popular Prakashan
d) General Pharmacy by M.L.Schroff. Five Stars Enterprises

3. Lecture wise programme:

	Topics	Hrs
1	a) Introduction to dosage forms - classification and definitions b) Prescription: definition, parts and handling c) Posology: Definition, Factors affecting dose selection. Calculation of children and infant doses.	06
2	History of profession of Pharmacy in India in relation to pharmacy education, industry and organizationin brief.	03
3	Development of Indian Pharmacopoeia. Salient features of latest edition of IP (IP 2008) and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian National formulary.	03
4	Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions.	06
5	Powders and Granules: Classification advantages and disadvantages, Preparation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules.	05
6	Monophasic Dosage forms: Theoretical aspects of formulation including adjuvant like Vehicles, Organoleptic additives and Stabilizers, with examples. Study of Monophasic liquids (formulation aspects and examples) like gargles, mouthwashes, Throat paint, Ear	06

	drops, Nasal drops, Liniments and lotions, Enemas andcollodions.	
7	Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification and formulation of Suspensions and Emulsions. Test for the type of emulsion and stability problems in emulsions.	06
8	Suppositories: Definition, advantages and disadvantages, types of base, a method of preparation, Displacement value and evaluation.	03
9	Galenicals: Definition, different extraction processes like infusion, Decoction, Maceration and Percolation. Study ofMaceration and Percolation processes	06
10	Surgical aids: Surgical dressings, sutures, ligatures and preparation of surgical catgut.	04
11	Incompatibilities: Introduction, classification, Examples, and methods to overcome Physical and therapeuticincompatibilities	02

22PD12P: PHARMACEUTICS (PRACTICAL)

Practical: 3 Hrs. /Week **75 Hours**

List of Experiments:

1. **Syrups**
   a) Simple Syrup I.P
   b) Syrup of Ephedrine Hydrochloride NF
   c) Orange Syrup
2. **Elixir**
   a) Piperizine citrate elixir BP
   b) Paracetamol elixir BPC
3. **Linctus**
   a) Simple linctus BPC
   b) Pediatric simple linctus BPC
4. **Solutions**
   a) Solution of cresol with soap IP
   b) Aqueous Iodine Solution IP
   c) Strong solution of Iodine IP
   d) Strong solution of ammonium acetate IP
5. **Liniments**
   a) Liniment of turpentine IP*
   b) Liniment of camphor IP
6. **Suspensions***
   a) Calamine lotion
   b) Magnesium Hydroxide mixture BP
7. **Emulsions***
   a) Cod liver oil emulsion
   b) Liquid paraffin emulsion
8. **Powders***
   a) Eutectic powder
   b) Dusting powder
   c) Insufflations
9. **Suppositories***
   a) Boric acid suppositories
   b) Chloral suppositories

10. Incompatibilities

a) Preparations having with Physical Incompatibilities (3 Nos)

***** Colorless bottles required for dispensing Paper envelope (white), butter paperand white paper required for dispensing.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03 hrs**	**04 hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity,promptness, viva-voce and record maintenance).

22PD13T: MEDICINAL BIOCHEMISTRY (THEORY)

Theory: 3 Hrs. /Week **75 Hours**

Course Outcome

At the end of the course students will be able to…

CO No.	Outcome statement
CO1	Explain the concept of transport across cell membrane and energy rich compounds
CO2	Describe the properties, classification, kinetics, inhibitors, importance of enzymes in diagnosis of diseases and therapeutic uses
CO3	Describe the metabolism of carbohydrate and Glucose tolerance test
CO4	Describe the metabolism of lipids in physiological and pathological condition
CO5	Explain Electron transport chain, oxidative phosphorylation
CO6	Describe the metabolism of Protein and amino acids in physiological and pathological condition
CO7	Describe genetic organisation of mammalian genome, translation, replication, transcription, mutation metabolism of Nucleotides
CO8	Explain kidney, liver, lipid profile test and immunochemical techniques

1. Scope and Objectives: Biochemistry deals with complete understanding of the molecular level of the chemical process associated with living cells in normal and abnormal state. Clinical chemistry deals with the study of chemical aspects of human life in health and illness and the application of chemical laboratory methods to diagnosis, control of treatment and prevention of diseases.

The objective of the present course is providing biochemical facts and the principles to the students of pharmacy.

Upon completion of the course student shall be able to –

1. understand the catalytic activity of enzymes and importance of enzymes in diagnosis of diseases and therapeutic agents;
2. know the metabolic pathways 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, liverand endocrine gland; and
5. do the qualitative analysis and determination of biomolecules in the bodyfluids and their clinical significance.

2. Course Materials: Textbooks (Theory)

a. Harper's Illustrated of biochemistry - Robert K. Murray, Darryl K.Granner, Peter A. Mayes,18th ed., 2003. Lange.
b. Satyanarayana U and Chakrapani U, Biochemistry, 4th ed. 2016, ElsevierIndia PVT. LTD, Newdelhi
c. Text book of clinical chemistry- Alex Kaplan &Laverve L.Szabo, 4th ed.1995, Williams and Wilkins Co.,

Reference books (Theory)

a. Principles of biochemistry – Lehninger, 6th ed, 2014, W.H.Freeman andCo., New York
b. Text book of biochemistry – Ramarao, 2009,L.K and S. Publisher
c. Practical Biochemistry-David T.Plummer.3rd. ed. 2014, Tata McGraw HillEducation Pvt. Ltd.
d. Practical Biochemistry-Pattabhiraman.4th ed. 2015,All India Publisher andDistributers.

3. Lecture wise programme:

	Topics	Hrs
1	**Introduction to biochemistry:** Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance.	05
2	**Enzymes**: Definition; Nomenclature; IUB classification; Factor affecting enzyme activity; Enzymeaction; enzyme inhibition. Isoenzymes and their therapeutic and diagnostic applications; Coenzymes and their biochemical role and deficiency diseases.	10
3	**Carbohydrate metabolism**: Glycolysis, citric acid cycle (TCA cycle),HMP shunt, Glycogenolysis, glycogenesis gluconeogenesis. Metabolic disorders of	11

	carbohydrate metabolism (diabetes mellitus and glycogen storage diseases); Glucose tolerance test and its significance; hormonal regulation of carbohydrate metabolism.	
4	**Lipid metabolism:** Oxidation of saturated fatty acid; Ketogenesis and ketolysis; biosynthesis of fatty acids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atheroslerosis, fatty liver,hypercholesterolmiea).	09
5	**Biological oxidation:** Enzymes and Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture, regulation and inhibition); Oxidative phosphorylation and uncouplers of ETC.	04
6	**Protein and amino acid metabolism:** protein turn over; nitrogen balance; general reactions of catabolism of amino acids (Tranamination deamination & decarboxylation). Urea cycle and its metabolic disorders; production of bile pigments; hyperbilirubinemia, porphorias, jaundice. Metabolic disorder of Aminoacids.	08
7	**Nucleic acid metabolism:** Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; DNA damage and repair mechanism; DNA replication (semi conservative).	12
8	**The kidney function tests:** Role of kidney; Laboratory tests for normal function includes- a) Urine analysis (macroscopic and physical examination, quantitative and semi quantitative tests.) b) Test for NPN constituents. (Creatinine /urea clearance, determination of blood/urine creatinine, urea and uric acid) c) Urine concentration test d) Urinary tract calculi. (stones)	04
9	**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.	04

c) Dye tests of excretory function.
d) Tests based upon abnormalities of serum proteins.
e) Selected enzyme activity determination tests.

10	**Lipid profile tests:** Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.	02
11	**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).	03
12	**Electrolytes:** Body water, compartments, water balance, and electrolyte distribution, Determination of sodium, calcium in the body fluids.	03

22PD13P: MEDICINAL BIOCHEMISTRY (PRACTICAL)

Practical: 3 Hrs. /Week **75 Hours**

Title of the Experiment:

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

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment**	10	25
Minor Experiment*	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03 hrs**	**04 hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity,promptness, viva-voce and record maintenance).

22PD14T: PHARMACEUTICAL ORGANIC CHEMISTRY (THEORY)

Theory: 3 Hrs. /Week **75 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Learn IUPAC/Common system of nomenclature of simple organic compounds belonging to different classes of organic compounds
CO2	Explain physical properties of organic compounds
CO3	Understand free radical/ nucleophillic [alkyl/acyl/aryl] /electrophillic substitution orientation of the reaction, order of reactivity, stability of compounds
CO4	Learn free radical/ nucleophillic / electrophillic addition orientation of the reaction, order of reactivity, stability of compounds
CO5	Learn free radical/ nucleophillic / electrophillic elimination orientation of the reaction, order of reactivity, stability of compounds
CO6	Describe oxidation and reduction reactions
CO7	Explain some named organic reactions with mechanisms
CO8	Discuss the methods of preparation test for purity, principle involved in the assay, important medicinal uses of some important organic compounds.

1. **Scope and objectives**: This course is designed to impart a very good knowledge about
   a) IUPAC/Common system of nomenclature of simple organic compounds belonging to different classes of organic compounds;
   b) Some important physical properties of organic compounds;
   c) 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;
   d) Some named organic reactions with mechanisms; and
   e) Methods of preparation, test for purity, principle involved in the assay,

important medicinal uses of some important organic compounds.

2. Course materials:

Text books

a. T.R. Morrison and R. Boyd - Organic chemistry,7th ed., 2012, PearsonPrentice Hall, Noida

b. Bentley and Driver-Text book of Pharmaceutical chemistry, 8th ed. 2007, Oxford University Press, New York

c. I.L.Finer- Organic chemistry, the fundamentals of chemistry, 6th ed. 2014,Pearson

Reference books

a. Organic chemistry – J.M.Cram and D.J.Cram

b. Organic chemistry- Brown, 8th ed. 2018, John wiley and sons Inc.

c. Advanced organic chemistry- Jerry March, Wiley, 7th ed., 2013, WileyIndia Pvt.Ltd, New Delhi.

d. Organic chemistry- Cram and Hammered, Pine Hendrickson, 5th ed.,2012, Tata Mc Graw Hill Publishing Pvt Ltd. New Delhi

3. Lecture wise programme:

	Topics	**Hrs**
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 airs, b) Acids and bases, Lowry bronsted and Lewis theories c) Isomerism	05
2	Nomenclature of organic compound belonging to the following classes Alkanes, Alkenes, Dienes, Alkynes, Alcohols, Aldehydes, Ketones, Amides, Amines, Phenols, Alkyl Halides, Carboxylic Acid, Esters, Acid Chlorides and Cycloalkanes.	08
3	Free radicals chain reactions of alkane : Mechanism, relative reactivity and stability	02
4	Alicyclic compounds: Preparations of cyclo alkanes, Bayer strain theory and orbital picture of angle strain.	04
5	Nuclophilic aliphatic substitution mechanism: Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN2	06

	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, SN2 versus SN1.	
6	Dehydro halogenation of alkyl halides: 1,2 elimination, kinetics, E2 and E1 mechanism, elimination via carbocation, evidence for E2 mechanism, absence of rearrangement isotope effect, absence hydrogen exchange, the element effect, orientation and reactivity, E2 versus E1, elimination versus substitution, dehydration of alcohol, ease of dehydration, acid catalysis, reversibility, orientation.	05
7	Electrophillic and free radicals addition: Reactions at carbon - carbon, double bond, electrophile, hydrogenation,heat of hydrogenation and stability of alkenes, markownikoff rule, addition of hydrogen halides, additionof hydrogen bromides, peroxide effect, electrophillic addition, mechanism, rearrangement, orientation andreactivity, addition of halogen, mechanism, halohydinformation, mechanism of free radicals additon, mechanismof peroxide initiated addition of hydrogen bromide,orientation of free addition, additions of carbene to alkene,cyclo addition reactions.	06
8	Carbon-carbon double bond as substituents: Free radical halogenations of alkenes, comparision of free radical substitution with free radical addition, free radical substitution in alkenes, orientation and reactivity, allylicrearrangements.	04
9	Theory of resonance: Allyl radical as a resonance hybrid, stability,orbital picture, resonance stabilisation of allyl radicals, hyper conjugation, allyl cation as a resonance hybrid, nucleophyllic substitution in allylic substrate, SN1 reactivity, allylic rearrangement, resonance stabilisation of allyl cation, hyper conjugation, nucleophilic substitution in allylic substrate, stability of conjugated dienes, resonance in alkenes, hyper conjugation, ease of formation of conjugated dienes, orientation of elimination, electrophilic addition to conjugated dienes, 1,4 - addition, 1,2-versus 1,4-addition, rate versus equilibrium, orientation and reactivity of free radical addition to conjugated dienes.	05

10	Elecrophilic aromatic substitution: Effect of substituent groups, determination of orientation, determination ofrelative reactivity, classification of substituent group,mechanism of nitration, sulphonation, halogenation,friedel craft alkylation, friedel craft acylation, reactivityand orientation, activating and deactivating O,P,Mdirecting groups, electron release via resonance, effect of halogen on electrophilic aromatic substitution in alkylbenzene, side chain halogination of alkyl benzene,resonance stabilization of benzyl radical.	06
11	Nucleophilic addition reaction: Mechanism, ionisation of carboxylic acids, acidity constants, acidity of acids,structure of carboxylate ions, effect of substituent onacidity, nucleophilic acyl substitution reaction, conversionof acid to acid chloride, esters, amide and anhydride. Roleof caboxyl group, comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.	05
12	Mechanism of aldol condensation, claisen condensation, cannizzaro reaction, crossed aldol condensation, crossed cannizzaro reaction, benzoin condensation, perkin condensation. Knoevenagel, Reformatsky reaction, Wittigreaction, Michael addition.	05
13	Hoffman rearrangement: Migration to electr on deficient nitrogen, Sandmeyer's reaction, basicity of amines, diazotisation and coupling, acidity of phenols, Williamson synthesis, Fries rearrangement, Kolbe reaction, Reimer tieman's reactions.	04
14	Nucleophilic aromatic substitution: Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic.	03
15	Oxidation reduction reaction with examples	02
16	Study of the following official compounds- preparation, test for purity, assay and medicinal uses of Chlorbutol, Dimercaprol, Glyceryl trinitrate, Urea, Ethylene diamine dihyrate, Vanillin, Paraldehyde, Ethylene chloride, Lactic acid, Tartaric acid, citric acid, salicylic acid, aspirin, methyl salicylate, ethyl benzoate, benzyl benzoate, dimethyl pthalate, sodium lauryl sulphate, saccharin sodium, mephensin.	05

22PD14P: PHARMACEUTICAL ORGANIC CHEMISTRY (PRACTICAL)

Practical : 3 Hrs./Week **75 Hours**

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

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

II. Identification of organic compounds belonging to the following classes by : Systematic qualitative organic analysis including preparation of derivatives phenols, amides, carbohydrates, amines, carboxylic acids, aldehyde and ketones, alcohols, esters, hydrocarbons, anilides, nitrocompounds.

III Introduction to the use of stereo models:

Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene, inversionof configuration.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03 hrs**	**04 hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity,promptness, viva-voce and record maintenance).

22PD15T: PHARMACEUTICAL INORGANIC CHEMISTRY
(Theory)

Theory: 2 hrs/Week **50 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.
CO2	Explain the various methods of expressing concentration and requirement of primary standards and Describe the preparation and standardization of different reagents used in volumetric analysis
CO3	Explain the principle of acid base, redox, nonaqueous titration with examples.
CO4	Describe the principle of precipitation, complexometric and gravimetric estimation with examples
CO5	Explain the sources of impurities and methods to determine the impurities in inorganic pharmaceuticals
CO6	Explain the method of preparation, assay, properties, medicinal uses of Medicinal Gases, acidifiers, antacids, cathartics, Major extra and intracellular electrolytes.
CO7	Explain the method of preparation, assay, properties, medicinal uses of, antimicrobials, trace elements, pharmaceutical aids, dental products and miscellaneous compounds
CO8	Describe the properties, storage condition and application of radiopharmaceuticals.

1. **Scope and objectives**: This course mainly deals with fundamentals of analytical chemistry and also the study the Inorganic pharmaceuticals regarding their monographs and also the course deals with basic knowledge of analysis ofvarious pharmaceuticals.

   Upon completion of course student shall be able to:

   1. understand the principles and procedures of analysis of drugs and alsoregarding the application of inorganic pharmaceutical;
   2. know the analysis of the inorganic pharmaceuticals their applications

3. appreciate the importance of inorganic pharmaceuticals in preventing andcuring the disease.

2. Course materials:

Text books

a. A.H.Beckett & J.B. Stenlake's -Practical Pharmaceutical Chemistry Vol I &II, Stahl one Press of University of London, 4th edition.2007
b. Text Book of Quantitative Inorganic analysis by Vogel, 10th ed. 2014, Pearson
c. Inorganic Pharmaceutical Chemistry III-Edition P. GunduRao, 3rd, ed. 2017, Nirali prakashan, Newdelhi.

Reference books

a. A text book of Inorganic medicinal Chemistry by Surendra N. Pandey. 2011, K.G. Publisher, Varanasi
b. Inorganic pharmaceutical Chemistry by M.L Schroff
c. Bentely and Driver's Textbook of Pharmaceutical chemistry,8th Ed.,2007 Oxford University Press, Newyork
d. Pharmaceutical Analysis Vol – I, Dr. A.V. Kasture et al., Nirali Prakashan, 13 Edition. 2016
e. Inorganic Pharmaceutical Chemistry by Anand & Chatwal.5th ed. 2017, Himalaya Publication House, Mumbai
f. Analytical chemistry principles by John H. Kennedy.3rd ed.
g. Indian Pharmacopoeia 2018, 8th Edition (4 Volumes) . Govt. of India,Ministry of Health.

3. Lecture wise programme :

	Topics	**Hrs**
1	Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.	02
2	Fundamentals of volumetric analysis, theories of indicators and methods of expressing concentrations. Primary and secondary standard. Preparation and standardization of various volumetic solutions like sodium hydroxide, hydrochloric acid and sodiumthiosulphate.	04
3	**Acid base titration**: Classification and estimation of strong, weak, and very weak acids and bases.	02

4	**Principles of redox titrations:** Concepts of oxidation and reduction. 03Redox reactions, strength and equivalent weights of oxidizing and reducing agents, theory of redox titrations, cerrimetry, Iodimetry, Iodometry, bromometry, titrations with potassium iodate	0
5	**Non aqueous titration**: Introduction to solvents, classification and estimation of Sodium benzoate.	02
6	**Principles of precipitation titrations:** Different methods-Mohr's, Modified Mohr's, Volhard's, Modified Volhard's, Fajans with example. Estimation of sodium chloride by modified volhardsmethod.	03
7	**Complexometric titration and its classification**: Estimation of Calcium Gluconate by complexometric method. Metal ionindicators.	03
8	**Gravimetry**: Introduction to gravimetric method, steps involved in gravimetric method, precipitants and estimation of Barium sulphateby gravimetric method.	02
9	**Limit test:** Source and effect of impurities in pharmacopoeial substances, importance of limit test, general principle and procedures for limit test, limit test for chloride, sulphate, iron, arsenic and lead and heavy metals. Special procedure for limit testfor chloride and sulphate	06
	General methods of preparation, assays*, storage condition andMedicinal uses of inorganic compounds belonging to the following classes.	
10	**Medicinal gases:** Oxygen, Nitrous oxide, Carbon dioxide	01
11	**Acidifies**: Dil HCl	01
12	**Antacid**: Aluminum hydroxide gel, sodium bicarbonate*, Magnesium triisilicate, Magnesium carbonate (Light and Heavy),Magnesium hydroxide mixture*, Preparation containing combination of antacids.	03
13	**Cathartics**: Magnesium sulphate*, Sodium orthophosphate	01
14	**Major extra and intracellular electrolytes**: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Sodium chloride Injection, Sodium chloride compound injection, Potassium chloride, Potassium chloride injection, Calcium Gluconate and Electrolyte combination therapy and ORS, Physiological acid base balance.	04
15	**Essential trace elements:** Copper, Iron, Iodine and Zinc	01

16	**Antimicrobials:** Potassium permanganate*, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations, Boric acid*.	03
17	**Pharmaceutical aids:** Bentonite, sodium metabisulphite, Barium Sulphate	01
18	**Dental products:** Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodiumfluoride, Stannous fluoride, Zinc Eugenol cement.	02
19	**Miscellaneous compounds:** **i) Expectorants:** Potassium iodide*, Ammonium Chloride* **ii) Haematinics**: Ferrous sulphate*, Ferrous gluconate, Ferrousfumarate, **iii) Emetics**: Copper sulphate*, Sodium potassium tartarate **iv) Poison and Antidote**: Sodium thoisulphate, Activated charcoal	04
20	**Radiopharmaceuticals:** Radio activity, natural radio activity and artificial radio activity. Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopessodium iodide I-121, Ferric citrate Fe-59. Storage conditions, precautions & pharmaceutical applicationof radioactive substances.	02

22PD15P: PHARMACEUTICAL INORGANIC CHEMISTRY (PRACTICAL)

Practical: 3 Hours/week **75 Hours**

(Following experiments to be covered in 25 different practical classes)

1. Limit tests (7 exercises) *
    1. Limit test for chlorides
    2. Limit test for sulphate
    3. Limit test for Iron
    4. Limit test for heavy metals
    5. Limit test for Arsenic
    6. Modifications in limit tests for chloride and sulphates in potassium permanganate, sodium bicarbonate, sodium benzoate and sodium Salicylate.
2. Preparation and standardization of the following (3 exercises)*.
    1. 0.IN NaOH
    2. 0.IN $KMnO_4$
    3. 0.IN Cerric ammonium sulphate
    4. 0.IN $HClO_4$
    5. 0.05M Di sodium EDTA
    6. 0.IN Sodium thiosulphate
3. Assay of the following compounds **
    1. Ammonium chloride-acid base titration (Formal titration)
    2. Ferrous sulphate- (redox) Ceric ammonium sulphate titration
    3. Copper sulphate- (redox) Iodometry
    4. Calcium gluconate-complexometry
    5. Hydrogen peroxide- (redox -Permanganometry)
    6. Sodium benzoate-nonaqueous titration
    7. Sodium chloride-Modified Volhard's method
    8. Assay of KI-KIO_3 titration
    9. Assay of Zinc oxide (acid base back titration)
4. Test for identify for the following (2 exercises)* Sodium bicarbonate Ferrous sulphate Potassium iodide. Calcium chloride
5. Test for purity for the following (2 exercises)*
    1. Swelling power in Bentonite

2. Ammonium salts in Potash alum.
3. Presence of Iodates in KI

6. Preparation of inorganic pharmaceuticals (2 exercises)*
   1. Boric acid
   2. Potash alum
   3. Magnesium hydroxide.
   4. Magnesium sulphate

Scheme of Practical Examination	**Sessional**	**Annual**
Synopsis	05	15
Major Experiment(Experiment indicated by**)	10	25
Minor Experiment(Experiment indicated by*) 1&2	3	20
Viva-Voce	2	10
Max. Marks	20	70
Duration	**03 hrs**	**04 hrs**

Note: Total sessional marks is 30 (20 for practical sessional and 10 marks for regularity,promptness, viva-voce and record maintenance)

22PD16T: REMEDIAL MATHEMATICS/BIOLOGY (THEORY)

Theory : 3 Hrs. /Week **75 Hours**

REMEDIAL MATHEMATICS:

1. **Scope and objectives**: This is an introductory course in mathematics. This subjects deals with the introduction to matrices, determinants, trigonometry, analytical geometry, differential calculus, integral calculus, differential equations, laplace transform.

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

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

2. **Course materials:**

   Text books

   a. Differential calculus By Shantinarayan
   b. Text book of Mathematics for second year pre-university byProf.B.M.Sreenivas

   Reference books

   a. Integral calculus By Shanthinarayan
   b. Engineering mathematics By B.S.Grewal
   c. Trigonometry Part-I By S.L.Loncy

3. **Lecture wise programme:**

	Topics	Hrs
1	**Algebra :** Matrices : Definition, Addition, Subtraction & Multiplication of matrices,Determinants: Determinants of order two and three, Properties of determinants (without Proof). Inverse of square Matrices, Adjoint of square matrix, Solution of linear equation by Matrix method, Cramer's rule, Characteristic equation, Statement of Cayley-Hamilton Theorem (Without Proof) – Pharmaceutical examples	18
2	**Trigonometry :** Relation between Sides and angles of a triangle, solution of triangles – Simple problems	05

3	**Analytical Geometry :**Points, Straight line, Types of straight lines – Y= mx + c, (y-y1) = m*(x-x1), (y-y1) = ((y2-y1)/(x2-x1))*(x-x1) Parallel and Perpendicular straight lines, Angle between two lines, Perpendicular distance from a point to the line, distance between parallellines, Circle: General equation of circle, finding centre and radius of the circle, Parabola: Equation of the parabola y2= 4ax , Simple problems	15
4	**Differential calculus:** Function, Limit, Differentiation, Differentiation of sum, Product, Quotient, Composite, Parametric, exponential, trigonometric and Logarithmic function. Successive differentiation, simple problems.	16
5	**Integral Calculus:** Partial fractions, Definition of integration, integration bysubstitution and integration by parts, Properties of definite integrals, Simple problems.	07
6	**Differential equations:** Definition, order, degree, variable separable, homogeneous differential equation, linear differential equation, exact differential equation, Simple problems	10
7	**Laplace transform:** Definition, Laplace transform of elementary functions, linearity and shifting property , simple problems	04

REMEDIAL BIOLOGY:

1. **Scope and objectives**: This is an introductory course in Biology, which gives detailed study of natural sources such as plant and animal origin. This subject hasbeen 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. This subject gives basicfoundation to Pharmacognosy.

2. **Course materials:**

Text books

a. Textbook Of Pharmaceutical Biology, SB Gokhale CK Kokate, VikashGupta, 7th ed. Nirali Prakashan,
b. A Text book of Biology by Dr.Thulajappa and Dr. Seetaram.

Reference books

a. A Text book of Biology by B.V.Sreenivasa Naidu
b. A Text book of Biology by Naidu and Murthy
c. Botany for Degree students By A.C.Dutta.
d. Outlines of Zoology by M.Ekambaranatha ayyer and T.N.Ananthakrishnan.
e. A manual for pharmaceutical biology practical by S.B.Gokhale andC.K.Kokate, 7th ed. 2012, Nirali Prakahsan, Pune.

3. **Lecture wise programme : PART – A**

Topics	**Hrs**
1. Introduction	02
2. General organization of plants and its inclusions	04
3. Plant tissues	04
4. Plant kingdom and its classification	04
5. Morphology of plants	04
6. Root, Stem, Leaf and Its modifications	05
7. Inflorescence and Pollination of flowers	04
8. Morphology of fruits and seeds	04
9. Plant physiology	04
10. Taxonomy of Leguminosae, umbelliferae, Solanaceae Lilliaceae, Zinziberaceae, Rubiaceae	06
11. Study of Fungi, Yeast, Penicillin and Bacteria	04

PART-B

Topics		**Hrs**
1.	Study of Animal cell	04
2.	Study animal tissues	04
3.	Detailed study of frog	08
4.	Study of Pisces, Reptiles, Aves	05
5.	General organization of mammals	05
6.	Study of poisonous animals	04

22PD16P: REMEDIAL BIOLOGY (PRACTICAL)

Practical : 3 Hrs./Week **75 Hours**

Title of Experiments

1. Introduction of biology experiments (sectioncutting techniques, Mounting andstaining, permanence slide preparation and Microscope)
2. Study of cell wall constituents and cell inclusions
3. Study of Stem modifications
4. Study of Root modifications
5. Study of Leaf modifications
6. Identification of Fruits and seeds
7. Preparation of Permanent slides
8. Simple plant physiological experiments
9. Identification of animals
10. Detailed study of Frog by using computer models
11. Computer based tutorials

Scheme of Practical Examination:

	Sessionals	**Annual**
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity,promptness, viva-voce and record maintenance.

22PD17T: CONSTITUTION OF INDIA (THEORY)

Theory: 2 Hours per week **50 Hours**

SYLLABU

SUNIT – I

1. Constitution of India 10 Hours
   a. An introduction to Indian Polity
   b. Meaning and importance of Constitution
   c. Making of the Indian constitution – The Constituent Assembly
   d. Salient features of the Indian Constitution
   e. Preamble of the Indian Constitution and its significance
2. Fundamental Rights and Directive Principles 08 Hours
   a. Fundamental Rights
   b. Directive Principles of the State Policy
   c. Fundamental Duties

UNIT – II

1. Government of the Union 06 Hours
   a. The Union Executive- the President and the Vice-President- The Council ofMinisters and the Prime Minister
   b. The Union Legislature - The Parliament- The Lok Sabha and the RajyaSabha, composition, Powers and functions
   c. Important Committees -Privileges
   d. the Role of the Speaker
2. Government of the States 06 Hours
   a. The Governor- The Council of Ministers and the Chief Minister
   b. The State Legislature- composition powers and functions
3. Democratic decentralization or Panchayath Raj in India 02 Hours

UNIT – III

1. Federation in India 06 Hours
   a. Federal Features Indian federalism, Centre-State relations distribution of legislative powers, Administrative and financial relations between the Unionand the States

b. The Finance Commission, The Planning Commission, National DevelopmentCouncil

c. Military Features

2. The Judiciary 04 Hours

a. The Supreme Court – Organization, Jurisdiction and Role

b. The High Court – Organization, Jurisdiction and Role

c. Judicial Review, Judicial activism, Independence of Judiciary in India

UNIT – IV

1. Electoral Process in India – Election Commission, Organization and Functions 04 Hours

2. Local Governments – Rural and Urban – Organization, Powers and Role 04 Hours

Books for Reference:

1. D.D. Basu: Introduction to the Constitution of India, S C Sarkar & Sons,Kolkatta
2. M V Pylee: An Introduction to the Constitution of India, Vikas PublishingHouse Pvt Ltd, 2009
3. Granville Austin: The Indian Constitution. The Cornerstone of a Nation, OxfordUniversity Press, New Delhi, 1966
4. C K Jain (ed): Constitution of India in Precept and Practice, Lok Sabha Secretariat, New Delhi
5. V.N. Shukla: Constitution of India, Jain Book Depot, New Delhi
6. Granville Austin : The working of a Democratic Constitution: The IndianExperience, New Delhi, Oxford University Press, New Delhi 1999
7. J C Johari: Indian Politics, Vishal Publications, Jalandhar
8. A P Avasthi: Indian Government and Politics, Lakshmi Narain Agarwal, Agra
9. Anup Chand Kapur: Indian Government and Politics, S. Chand and Company,New Delhi
10. V D Mahajan: The Constitution of India. S. Chand and Company, New Delhi.
11. J N Pandey: Constitution Law of India, Allahabad, Central Law Agency, 1998
12. J C Johari: The Constitution of India – A Politico-Legal Study- Sterling Publication Pvt. Ltd, New Delhi
13. R C Agrawal: Constitutional Development and national Movement of India, SChand & Co., New Delhi
14. M Hidayatullah: Democracy in India and the Judicial Process,

Metropolitan,New Delhi

15. K C Markandan: Directive Principles in the Indian Constitution, AlliedPublishers, Mumbai
16. Bidyut Chakrabarty and Rajendra Kumar Pandey: Indian Government andPolitics, SAGE Publications New Delhi
17. India – A Politico-Legal Study- Sterling Publication Pvt. Ltd, New Delhi

22PD21T: PATHOPHYSIOLOGY (THEORY)

Theory: 3 Hrs. /Week **75 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Describe Basic principles of Cell injury Adaptation and explain the concept of inflammation and repair
CO2	Describe Diseases of Immunity a) Introduction to T and B cells b) MHC proteins or transplantation antigens c) Immune tolerance – Hypersensitivity,
CO3	Describe autoimmunity, Classifications of autoimmune diseases in man,mechanism of autoimmunity, allograft, and graft rejection mechanism AIDS, amylodosis
CO4	Classify and explain the etiology and pathogenesis of cancer
CO5	Describe the etiology and pathogenesis of shock , describe the biological effects of radiation Explain the pathogesesis of Environmental and nutritionaldiseases
CO6	Effects of i) Air pollution and smoking- SO2,NO, NO2, and CO ii) Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation.
CO7	Describe the etiology and pathogenesis of Pathophysiology of common diseases a. Parkinsonism b. Schizophrenia c. Depression and mania d. Hypertension, e. Stroke (ischaemic and hemorrhage) f. Angina, CCF, Atherosclerosis, Myocardial infarction g. Diabetes Mellitus h. Peptic ulcer and inflammatory bowel diseases i. Cirrhosis and Alcoholic liver diseases j. Acute and chronic renal failure k. Asthma and chronic obstructive airway diseases

CO8	Describe the etiology and pathogenesis of Infectious diseases Sexually transmitted diseases (HIV, Syphilis, Gonorrhea), Urinary tract infections, Pneumonia, Typhoid, Tuberculosis, Leprosy, Malaria Dysentery (bacterial and amoebic), Hepatitis- infective hepatitis.

1. **Scope and Objectives:** This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic Pathophysiological mechanisms. Hence it will not only help to study the

syllabus of pathology, but also to get baseline knowledge of its application inother subject of pharmacy.

Upon completion of the course student shall be able to -

1. Describe the etiology and pathogenesis of the selected disease states;
2. Name the signs and symptoms of the diseases; and
3. Mention the complications of the diseases.

2. Course Materials: Text books (Theory)

a. Pathologic basis of disease by- Cotran, Kumar, Robbins Elsiver India PvtLtd, Newdelhi, 2015, ed. 9 vol. 1-2
b. Text book of Pathology- Harsh Mohan, 7th ed. 2015, JaypeeBrothers Medical Publishers (P) Ltd., New Delhi,
c. Text book of Pathology- Y.M. Bhinde

Reference books (Theory)

a. Clinical Pharmacy and Therapeutics; 5th.ed. 2012; Walker & Whittlesea, Churchill Livingstone publication

3. Lecture wise Programme:

	Topics	Hrs
1	**Basic principles of cell injury and Adaptation** a) Causes, Pathogenesi s and morphology of cell injury b) Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen infiltration and glycogen infiltration and glycogen storage diseases	05
2	**Inflammation** a) Pathogenesis of acute inflammation, Chemicalmediators in inflammation,Types of chronic inflammation b) Repairs of wounds in the skin, factors influencinghealing of wounds	05
3	**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	10

	- 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	
4	**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.	05
5	**Shock** Types of shock, mechanisms, stages and management	03
6	**Biological effects of radiation**	02
7	**Environmental and nutritional diseases** i) Air pollution and smoking- SO2,NO, NO2, and CO ii) Protein calorie malnutrition, vitamins, obesity,pathogenesis of starvation	04
8	**Pathophysiology of common diseases** Parkinsonism Schizophrenia Depression and maniaHypertension Stroke (ischemic and hemorrhage) Angina, CCF, Atherosclerosis, Myocardial infarctionDiabetes Mellitus Peptic ulcer and inflammatory bowel diseasesCirrhosis and Alcoholic liver diseases Acute and chronic renal failure Asthma and chronic obstructive airway diseases	30
9	**Infectious diseases:** Sexually transmitted diseases (HIV, Syphilis, Gonorrhea), Urinary tract infections, Pneumonia, Typhoid, Tuberculosis, Leprosy, Malaria, Dysentery (bacterial and amoebic), Hepatitis- infective hepatitis.	11

Assignments:

1 Chemical Mediators of inflammation
2 Drug Hypersensitivity
3 Cigarette smoking & its ill effects
4 Biological Effects of Radiation
5 Etiology and hazards of obesity
6 Complications of diabetes
7 Diagnosis of cancer
8 Disorders of vitamins
9 Methods in Pathology-Laboratory values of clinical significance
10 Pathophysiology of Dengue Hemorrhagic Fever (DHF)

Format of the assignment

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

22PD22T: PHARMACEUTICAL MICROBIOLOGY (THEORY)

Theory: 3 Hrs. /Week **75 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Explain the anatomy, identification, growth factors of microorganisms which include bacteria, virus, and fungus.
CO2	Discuss the cultivation and identification of the microorganisms in the laboratory
CO3	Explain different methods of sterilization and its properties and applications in pharmaceutical microbiology
CO4	Discuss the concepts and types, antibody, antigen -antibody reactions
CO5	Define the terms bacterial vaccines, toxoids, immunization programme, importance of booster dose.
CO6	Identification of diseases by performing the diagnostic tests
CO7	Estimation of potency of antibiotic by various microbial assay
CO8	Understand infectious diseases its history, pathogenesis, treatment and control

1. **Scope & Objectives:** Microbiology has always been an essential component ofpharmacy curriculum. This is because of the relevance of microbiology to pharmaceutical sciences and more specifically to pharmaceutical industry. Pharmaceutical biotechnology is the logical extension of pharmaceutical microbiology, which is expected to change the complete drug product scenarioin the future.
   This course deals with the various aspects of microorganisms, its classification,morphology, laboratory cultivation identification and maintenance. Its alsodiscusses with sterilization of pharmaceutical products, equipment, media etc. The course further discusses the immunological preparations, diseases itstransmission, diagnosis, control and immunological tests.

   Upon completion of the course student shall be able to:

   1. Know the anatomy, identification, growth factors and sterilization ofmicroorganisms;
   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
6. Depreciate the behavior of motility and behavioral characteristics of
7. microorganisms.

2. Course Materials: Text books (Theory)

a) Vanitha Kale and Kishor Bhusari "Applied Microbiology" HimalayaPublishing house Mumbai.3rd., 2015.
b) Mary Louis Turgeon "Immunology and Serology in Laboratory Medicines" 2nd edition, 1996 Mosby- Year book inc St. Louis Missouri.
c) Harsh Mohan, "Text book of Pathology" 3rd edition, 1998, B-3 Ansari RoadDaryaganj N. Delhi.

Reference books (Theory)

a) Prescot L.M., Jarley G.P Klein D.A "Microbiology" 2nd- edition Mc GrawHill Company Inc.
b) Rawlins E.A. "Bentley's Text Book of Pharmaceutics" Bailliere Tindals24-28 London 1988.
c) Forbisher "Fundamentals of Microbiology" Philadelphia W.B.Saunders.9th ed.
d) Prescott L.M. Jarley G.P., Klein D.A. "Microbiology." 2ndedition WMC Brown Publishers, Oxford. 1993.
e) War Roitt, Jonathan Brostoff, David male, "Immunology"3rd edition 1996,Mosby- year book Europe Ltd, London.
f) Indian Pharmacopoeia 2018, 8th Edition (4 Volumes). Govt. of India,Ministry of Health.

3. Lecture wise Programme:

	Topics	**Hrs**
1.	**Introduction to the science of microbiology**. Major divisions of microbial world and Relationship among them.	03
2.	**Morphology & Physiology of Microorganisms** Different methods of classification of microbes and study ofBacteria, Fungi, Virus, Rickettsiae, Spirochetes.	07
3.	**Growth & Nutrition** Nutritional requirements Growth and cultivation of bacteria and virus. Culture Media for aerobic and anaerobic bacteria & fungi.Maintenance of lab cultures.	08

4.	**Isolation and Identification of Bacteria** Different methods-Staining reactions Biochemical reactions.Counting of bacteria -Total and Viable counting techniques.	08
5.	**Sterilization** Detailed study of different methods of sterilization with meritsand demerits. Sterilization methods for all pharmaceutical products. Detailed study of sterility testing of different pharmaceutical preparations. Validation of varioussterilization techniques.	08
6.	**Disinfectants** Study of disinfectants, antiseptics, fungicidal and virucidal agents. Factors affecting their action and mechanism of action. Evaluation of bactericidal, bacteriostatic, virucidal andpreservatives in pharmaceutical preparations.	07
7.	**Immunology** 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 ofbooster dose.	12
8.	**Diagnostic tests** Schick's Test, Elisa test, Western Blot test, Southern BlotPCR Widal, QBC, Mantaux Peripheral smear. Study of malarial parasite.	07
9.	**Microbiological Assays** Microbial culture sensitivity Testing: Interpretation of results Principles and methods of different microbiological assays. Microbiological assay of Penicillin, Streptomycin and vitamin B2 and B12. Standardization of vaccines and sera.	05
10.	**Study of infectious diseases** Typhoid, Tuberculosis, Malaria, Cholera, Hepatitis, Meningitis, Syphilis & Gonorrhea and HIV	10

22PD22P: PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)

Practical: 3 Hrs. /Week **75 Hours**

Title of the Experiment:

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

* Indicate minor experiment & ** indicate major experiment

Assignments:

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

Format of the assignment:

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

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment**	10	25
Minor Experiment*	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03 hrs**	**04 hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity,promptness, viva-voce and record maintenance).

22PD23T: PHARMACOGNOSY & PHYTOPHARMACEUTICALS (THEORY)

Theory : 3 Hours/Week **75 Hour**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Describe the history and scope of Pharmacognosy
CO2	Describe the Cultivation, Collection, Processing, Storage and Conservation of Medicinal Plants
CO3	Describe the various cell wall constituents and cell inclusions
CO4	Describe the morphology and microscopy of different plant parts
CO5	Discuss regarding natural pesticides and their sources; describe the various plant fibers used in surgical dressings and related products
CO6	Describe the pharmacognosy and chemistry of carbohydrates, lipids, proteins and elaborate on their sources
CO7	Discuss the various therapeutic applications of herbs, poisonous plants; describe Herb-drug interaction, Edible Vaccines and Marine Pharmacognosy
CO8	Describe different types of secondary metabolites (Alkaloids, Glycosides, Essential oils, Flavonoids, Resins and Tannins), their general properties, classification, test for identification and isolation techniques

1. Scope and objectives: This subject has been introduced for the pharmacy course in order to make the student aware of medicinal uses of various naturally occurring drugs their history, sources, distribution, method of cultivation, active constituents, medicinal uses, identification tests, preservation methods, substitutes and adulterants.

Upon completion of the course student shall be able to:

1. Understand the basic principles of cultivation, collection and storage of crude drugs
2. Know the source, active constituents and uses of crude drugs and
3. Appreciate the applications of primary and secondary metabolites of the plant.

2. Course materials:

Text books

a. Pharmacognosy by G.E. Trease & W.C. Evans. 16th ed., 2009, SaundersElsevier

b. Pharmacognosy by C.K. Kokate, S.B. Gokhale & A.C. Purohit. 54thed. 2017,Nirali Prakashan, Pune.

Reference books

a. Pharmacognosy by R. Brady & V.E. Tyler.9th ed.,1988, L E A and Febiger,

b. Pharmacognosy by T.E. Wallis.5th ed. 2005, CBS Publishers and Distributors, New Delhi

c. Pharmacognosy by C.S. Shah & J.S. Quadry.17th ed. 2014,B.S.shahPrakashan,New delhi.

d. Pharmacognosy by M.A. Iyengar.11th ed. 2008, Manipal University, Manipal

3. Lecture wise programme:

Topics	**Hrs**
1. Introduction.	01
2. Definition, history and scope of Pharmacognosy	02
3. Classification of crude drugs viz. alphabetical, morphological, 03 taxonomical, chemical, pharmacological,and chemotaxonomical methods.	
4. Cultivation, collection, processing and storage of crude drugs. Conservation of medicinalplants.	06
5. Detailed methods of cultivation, collection and storage of following crude drugs a) Senna b) Cinchona c) Cardamom d) Opium e) Isapgol f) Ergot h) Ginger	07.
6. Study of cell wall constituents and cell inclusions.	02
7. Study of morphology and microscopy of different plants parts i. Leaf: Datura, Senna ii. Bark: Cinnamon (Cassia), Cinchaona iii. Wood: Quassia iv. Stem: Ephedra v. Root: Rauwolfia, Liquorice vi. Rhizome: Ginger, Podophyllum. vii. Flower buds: Clove. viii.Fruits: Coriander, Fennel	10

ix . Seeds: Isapgol, Nux Vomica.

8. Study of natural pesticides. Pyrethrum, Neem, Tobacco 02
9. Carbohydrate: 07
   a) Detailed study of Carbohydrates and related products.
   b) Biological source, method of production,chemical constituents, tests, uses and adulterants of
   i) Honey ii) Acacia iii) Agar iv) Sterculia v) Tragacanth vi) Cellulose and its products vii) Pectin viii) Guar gum ix) Sodium alginate.
10. Proteins: 03
   a) Definition classification, chemistry andmethod of analysis of proteins
   b) Study of collagen, Gelatin and its products
11. Lipids: 07
   a) Definition, sources, method extraction, chemistry and method of analysis of Lipids.
   b) Study of method of production, chemical constituents, tests, uses and adulterants of thefollowing drugs.
   i) Castor oil ii) Shark liver oil iii) Chaulmoogra oil iv) Wool fat v) Bees wax vi) Spermaceti vii) Cocoa butter viii) Olive oil
12. Therapeutic application of herbal drugs, poisonous plants,herbal- drug interaction, edible vaccines, marine Pharmacognosy. 04
13. Introduction, definition, classification, general properties, chemicaltests and general method of isolation of Alkaloids, Glycosides, Essential Oils, Flavonoids, Resins and Tannins. 15
14. Study of plants fibers used in surgical dressings and related products. 02
15. Different methods of adulteration of crude drugs and general methods of detection of adulterants. 04

22PD23P: PHARMACOGNOSY & PHYTOPHARMACEUTICALS (PRACTICAL)

Practical: 3 Hrs./Week **75 Hours**

General Requirements: Laboratory Napkin, Observation Book (150 pages), Zerobrush, Needle, Blade, Match box.

List of experiments:

1. Introduction of Pharmacognosy laboratory and experiments.
2. Macro, powder and microscopic study of Datura.
3. Macro, powder and microscopic study of Senna.
4. Macro, powder and microscopic study of Cassia Cinnamon.
5. Macro, powder and microscopic study of Cinchona
6. Macro, powder and microscopic study of Ephedra.
7. Macro, powder and microscopic study of Quassia.
8. Macro, powder and microscopic study of Clove
9. Macro, powder and microscopic study of Fennel.
10. Macro, powder and microscopic study of Coriander.
11. Macro, powder and microscopic study of Isapgol.
12. Macro, powder and microscopic study of Nux vomica.
13. Macro, powder and microscopic study of Rauwolfia.
14. Macro, powder and microscopic study of Liquorice.
15. Macro, powder and microscopic study of Ginger.
16. Macro, powder and microscopic study of Podophyllum.
17. Determination of Acid Value.
18. Determination of Saponification value and Iodine Value.
19. Chemical tests for Acacia and Tragacanth
20. Chemical tests for Agar and Starch
21. Chemical tests for Gelatin & Lipids (Castor oil, shark liver oil, Beer wax)
22. Isolation of Glycyrrhizin.
23. Isolation of Quinine.
24. Isolation of Volatile oil.
25. TLC of Quinine.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	04	10
Identification	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03 hrs**	**04 hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity,promptness, viva-voce and record maintenance).

22PD24T: PHARMACOLOGY – I (THEORY)

Theory: 3 Hrs. /Week **75 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Describe the history and scope of pharmacology, general pharmacology, pharmacokinetics, and pharmacodynamics.
CO2	Explain neurotransmission and the pharmacology of drugs acting on ANS
CO3	Describe the pharmacology of drugs acting on Cardio Vascular System
CO4	Explain the pharmacology of drugs acting on Central Nervous System
CO5	Explain the pharmacology of Local Anaesthetics.
CO6	Explain the pharmacology of drugs acting on Respiratory System
CO7	Explain the pharmacology of Hormones and their antagonist.
CO8	Explain the pharmacology of Autocoids and their Antagonist

1. **Scope & Objectives:** This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, apart from general pharmacology, drugs acting on autonomic nervous system, cardiovascular system, central nervous system, blood and blood forming agentsand renal system will be taught.

Upon completion of the course student shall be able to:

1. Understand the pharmacological aspect of drugs falling under the abovementioned chapters.
2. Handle and carry out the animal experiments.
3. Appreciate the importance of pharmacology subject as a basis of therapeutics.
4. Correlate and apply the knowledge therapeutically.

Text books (Theory)

a) Tripathi, K. D. Essentials of medical pharmacology. 6th edition, 2008.Publisher: Jaypee, Delhi.
b) Satoskar, R.S. and Bhadarkar, S.D. Pharmacology andPharmacotherapeutics. 20th edition, 2008. Publisher: Popular, Mumbai.
c) Rang, H.P. & Dale, M.M. Pharmacology. 5th edition, 2003. Publisher:Churchill living stone.

Reference books (Theory)

a) Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological basis of therapeutics.11th edition, 2006. Publisher McGraw Hill, Pergamon Press.
b) Craig, C.R. & Stitzel, R.E. Modern Pharmacology. 5th edition, 1997. Publisher: Little Brown Co.
c) Katzung, B.G. Basic and clinical pharmacology. 9th edition 2004. Publisher: Prentice Hall, Int.
d) Shargel and Leon. Applied Biopharmaceutics and Pharmacokinetics. Latest edition 2002. Publisher: Prentice Hall, London.

3. Lecture wise Programme:Topics Hrs

1. **General**
   Pharmacology 16
   a) Introduction, definitions and scope of pharmacology
   b) Routes of administration of drugs
   c) Pharmacokinetics (absorption, distribution, metabolism & excretion)
   d) Pharmacodynamics
   e) Factors modifying drug effects
   f) Drug toxicity – Basic concepts, acute, sub-acute & chronic toxicity.
   g) Pre-clinical evaluation
   h) Drug interactions
   ***Note*:** The term Pharmacology used here refers to the classification, mechanism of action, pharmacokinetics, pharmacodynamics, adverse effects, contraindications, therapeutic uses, interactions and dose and route of administration.
2. **Pharmacology of drugs acting on ANS** 09
   a) Introduction to neurotransmission
   b) Adrenergic and antiadrenergic drugs

c) Cholinergic and anticholinergic drugs
d) Neuromuscular blockers
e) Mydriatics and miotics
f) Drugs used in myasthenia gravis
g) Drugs used in Parkinsonism

3. **Pharmacology of drugs acting on cardiovascular system** 09
   a) Antihypertensives
   b) Anti-anginal drugs
   c) Anti-arrhythmic drugs
   d) Drugs used for therapy of Congestive Heart Failure
   e) Drugs used for hyperlipidaemias
4. **Pharmacology of drugs acting on Central Nervous System** 20
   a) Excitatory and inhibitory neurotransmitters of CNS
   b) General anesthetics
   c) Sedatives and hypnotics
   d) Anticonvulsants
   e) Analgesic and anti-inflammatory agents
   f) Psychotropic drugs
   g) Alcohol and methyl alcohol
   h) CNS stimulants and cognition enhancers
   i) Centrally acting skeletal muscle relaxants
   j) Drug dependence, abuse and tolerance. List of drugs causing such problems
5. **Pharmacology of Local anaesthetics** 02
6. **Pharmacology of Drugs acting on Respiratory tract** 05
   a) Bronchodilators
   b) Mucolytics
   c) Expectorants
   d) Antitussives
   e) Nasal Decongestants
7. **Pharmacology of Hormones and Hormone antagonists** 08
   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
8. **Pharmacology of autocoids and their antagonists** 06
   a) Histamines and Antihistaminics
   b) 5-Hydroxytryptamine and its antagonists
   c) Lipid derived autocoids and platelet activating factor

22PD25T: COMMUNITY PHARMACY (THEORY)

Theory: 2 Hrs. /Week **50 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Describe the business and professional practice management skills in community pharmacies
CO2	Analyse and manage the prescriptions in the community pharmacy
CO3	Management of various inventory control techniques in community pharmacy
CO4	Explain the pharmaceutical care services
CO5	Understand various methods of patient counselling.
CO6	Describe the methods of health screening
CO7	Recognize the minor ailments and develop the health promotions in the community
CO8	Explain the rational drug therapy

1. **Scope & Objectives:** This course is designed to ensure that students are skilled and knowledgeable to provide various pharmaceutical care services topatients and general practitioners in the community setup.
   Upon completion of the course, the student shall be able to:
   1. Handle the prescriptions and manage the community pharmacies
   2. Deliver the pharmaceutical care services in the community pharmacies.
   3. Respond to minor ailments and provide health education
   4. Promote rational drug therapy.

2. **Course Materials: Text Books:**
   a. Health Education and Community Pharmacy by N.S.Parmar.1st ed.2012,CBS
   b. WHO consultative group report.
   c. Drug store & Business management by Mohammed Ali & Jyoti.2017, CBS,Publishers & Distributors.

Reference books:

a. Handbook of pharmacy – health care. Edt. Robin J Harman. 2nd. ed. 2001,The Pharmaceutical Press.
b. Comprehensive Pharmacy Review – 7th ed. Leon Shargel. LippincottWilliams & Wilkins.

Special requirements:

1. Either the college is having model community pharmacy (meeting the schedule N requirement) or sign MoU with at least 4-5 community pharmacies nearby to the college for training the students on dispensingand counseling activities.
2. Special equipments like Sphygmomanometer, Glucometer, Peak flow meter, and apparatus for cholesterol estimation.

3. Lecture wise programme:

	Topics	**Hrs**
1.	**Definition and scope of community pharmacy** **Roles and responsibilities of Community pharmacist**	02
2.	**Community Pharmacy Management** a) Selection of site, Space layout, and design b) Staff, Materials- coding, stocking c) Legal requirements d) Maintenance of various registers e) Use of Computers: Business and health care softwares	04
3.	**Prescriptions** – parts of prescription, legality &identification of medication related problems like drug interactions.	02
4.	**Inventory control in community pharmacy** Definition, various methods of Inventory Control ABC,VED, EOQ, Lead time and safety stock	03
5.	**Pharmaceutical care**. Definition and Principles of Pharmaceutical care	02
6.	**Patient counselling** Definition, outcomes, various stages, barriers, strategies to overcome barriers Patient information leaflets- content, design, layouts & advisory labels	04
7.	**Patient medication adherence** Definition, Factors affecting medication adherence androle of pharmacist in improving the adherence	02
8.	**Health screening services** Definition, importance, methods for screening blood pressure/ blood sugar/lung function and Cholesterol	03

	testing	
9.	**OTC Medication - Definition, OTC medication list & Counselling**	03
10.	**Health Education** WHO Definition of health and health promotion, care for children, pregnant & breast feeding women and geriatric patients.	02
11.	Commonly occurring communicable diseases, causative agents, Clinical presentations and prevention of communicable diseases – Tuberculosis, Hepatitis, Typhoid, Amoebiasis, Malaria, Leprosy, Syphilis, Gonorrhea and AIDS	09
12.	Balance diet, treatment & prevention of deficiency disorders	02
13.	Family planning – role of pharmacist	01
14.	Responding to symptoms of minor ailment Relevant	08
15.	pathophysiology and common drug therapy to Pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhea, constipation), Pyrexia, Opthalmic symptoms and worms infestations.	
16.	**Essential Drugs concept and Rational** Drug Therapy Role of **community pharmacist**	02
17	**Code of ethics for community pharmacists**	01

22PD26T: PHARMACOTHERAPEUTICS-I (THEORY)

Theory: 3 Hrs. /Week **75 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Describe the etiopathogenesis of selected disease states
CO2	Discuss the various methods involved in the diagnosis of selected disease state
CO3	Interpret and analyze the selected laboratory results of specific disease states
CO4	Describe the therapeutic approach to manage the selected diseases
CO5	Discuss the rationale for drug therapy of the selected disease
CO6	Identify the controversies in drug therapy
CO7	Develop the individualized therapeutic plans based on diagnosis
CO8	Describe the general prescribing guidelines for special population
CO9	Explain role of pharmacist in promoting rational drug use and essential drug concept

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

   At completion of this course it is expected that students will be able to understand:

   1. The pathophysiology of selected disease states and the rationale for drugtherapy
   2. The therapeutic approach to management of these diseases
   3. The importance of preparation of individualized therapeutic plans based on diagnosis
   4. 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)
   5. Describe the pathophysiology of selected disease states and explain the

rationale for drug therapy

6. Summarise the therapeutic approach to management of these diseases including reference to the latest available evidence
7. Discuss the controversies in drug therapy
8. Discuss the preparation of individualised therapeutic plans based on diagnosis
9. 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)

2 Course Materials: Text Books:

a) Clinical Pharmacy and Therapeutics; 5th.ed. 2012; Walker & Whittlesea, Churchill Livingstone publication

b) Pharmacotherapy: A Pathophysiology approach - Joseph T. Dipiro et al.10th ed.,2016, Appleton & Lange

Reference Books

a) Pathologic basis of disease by- Cotran, Kumar, Robbins Elsiver India Pvt Ltd,
Newdelhi,2015, ed. 9 vol. 1-2

b) Pathology and Therapeutics for Pharmacists - A Basis for Clinical Pharmacy Practice - Green and Harris, 3rd. ed.,Chapman and Hall publication

c) Clinical Pharmacy and Therapeutics – Eric T. Herfindal, 5th ed. 2016, Williams and Wilkins Publication

d) Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda- Kimble MA, 10th ed. 2013, Wolters Kluwer Lippincot williams &Wilkins,
Newyork

e) Avery's Drug Treatment, 4th Ed., 1997, Adis International Limited.

f) Relevant review articles from recent medical and pharmaceuticalliterature.

3 Lecture wise Programme

Etiopathogenesis and pharmacotherapy of diseases associatedwith following systems/ diseases

	Topics	**Hrs**
1.	**Cardiovascular system** Hypertension, Congestive cardiac failure, Angina Pectoris, Myocardial infarction, Hyperlipidemia, Electrophysiology of heart and Arrhythmias	26
2.	**Respiratory system** Introduction to Pulmonary function test, Asthma, Chronic obstructive airways disease, Drug inducedpulmonary diseases	12
3.	**Endocrine system** Diabetes, Thyroid diseases, Oral contraceptives,Hormone replacement therapy, Osteoporosis	16
4.	**General prescribing guidelines for** 4.1 Paediatric patients 4.2 Geriatric patients 4.3 Pregnancy and breast feeding	10
5.	**Ophthalmology:** Glaucoma, Conjunctivitis- viral & bacterial	06
6.	**Introduction to rational drug use** Definition, Role of pharmacist in promoting rationaldrug use and essential drug concept.	05

22PD26P: PHARMACOTHERAPEUTICS-I (PRACTICAL)

Practical: 3 Hrs. /Week **75 Hours**

Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion; attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge. Students are required to maintain a record of cases presented andthe same should be submitted at the end of the course for evaluation. A minimum of 15 cases should be presented and recorded covering most common diseases.

Assignments

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

Assignments

Format of the assignment

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

Scheme of Practical Examination

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03 hrs**	**04 hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity,promptness, viva-voce and record maintenance)

22PD27T: HUMAN RIGHTS, GENDER EQUITY AND ENVIRONMENTAL STUDIES (THEORY)

Theory: 2 Hours per Week **50 Hours**

UNIT – I: HUMAN RIGHTS

1. **Human Rights** – Meaning; Universal Declaration of Human Rights 04 Hours
2. **Human Rights Advocacy:** Global Advocacy of Human Rights; 07 HoursAmnesty International and other organization ; People's Union for Civil Liberty (PUCL); Human Rights Commission in India; Minority Commission in India; Remedies against violation of HumanRights in India
3. **United Nations and Human Rights:** Civil and Political Rights: 04 HoursEconomic, Social and Cultural Rights

UNIT II: GENDER EQUITY

1. **Sex and Gender** – Masculinity and Feminity – Patriarchy, 04 HoursMatriarchy, Gender Roles and Attributes, Gender Division of Labour – Gender bias, Gender Stereotypes – Need for GenderSensitization
2. **Women's Status in India:** Important indicators – sex ratio, 04 Hourseducation, health, nutrition, maternal and infant mortality, work participation rates, political participation
3. **Contemporary Women's issues:** Discrimination against girl child; 04 HoursViolence against women; Problems of Health and Nutrition; Women's Education and gender bias in education; Trafficking ofWomen; Globalization and impact on women
4. **State Initiative on Gender Issues:** Constitution rights of women; 04 HoursLaws pertaining to women; National and State Commission for women

UNIT III: ENVIRONMENTAL STUDIES

1. **Environment:** Components of Environment Concepts of Ecology; 05 HoursEcological factors: Soil, air, water; Eco System – Pond and Forest as Ecosystem; Human Population Growth
2. **Environmental Pollutions:** Types of Pollution – a) soil, air, water 07 Hours b) noise and radioactive pollution; Sources of Pollution and theireffects**;** Control measures: Legal and administrative

3. **Conservation and Preservation of Environment:** Natural resources and their conservation – water, soil and forest; Agencies involved in environmental protection in India**;** Environmental Movements in India**;** Legal and administrative measures forenvironmental protection 07 Hours

BOOKS FOR REFERENCE:

A. Human Rights

1. S. Davidson: Human Rights, Buckingham, Open University,
2. Nirmal Chiranjivi: Human Rights in India, New Delhi, OxfordUniversity Press

B. Gender Equity

1. Usha Sharma (ed): Gender Mainstreaming and Women's Rights,Authors press, New Delhi, 2004
2. Mohini Chatterjee: Feminism and Gender Equity, AavishkarPublishers Jaipur
3. Neera Desai and Maithreyi Krishnaraaj, Women's Studies in India:Some perspectives. Popular Prakashan, Mumbai, 1986
4. Desai Neera and Thakkar Usha: Women in Indian Society, NationalBook Trust, India, 2001
5. Tharabai S.B: Women's Studies in India, APH Publication Corporation, New Delhi, 2000
6. Sushma Yadav and Anil Datta: Gender Issues in India, Radha Publications, New Delhi, 2003

C. Environmental Studies

1. N.K. Chakravarthy: Environmental Protection and Law, Ashis Publishing House, New Delhi
2. Eugene P. Odum: Basic Ecology, Savndus College, London
3. Kumar N: Air Pollution and Environmental Protection, Mittal Publication, New Delhi
4. Trivedi R K and Singh, UK: Environmental Laws on Wild Life, MittalPublication, New Delhi
5. K.A. Agarwal: Wild Life in Indian Conservation and Management, Nishi Publications
6. Erach Baruch: Text Book For Environmental Studies, UGC, NewDelhi and Bharati Vidyapeeth Institute Environment Education and

Research, Pune
7. Erach Baruch: The Biodiversity of India, Mapin Publishing Pvt Ltd.,Ahmedabad
8. Jadhav H & Bhosale, VM: Environmental Protection andLaws, Himalaya Publishing House, New Delhi
9. Trivedi R K and PK Goel: Introduction to Air Pollution, Techno-Science Publication

22PD31T: PHARMACOLOGY – II (THEORY)

Theory: 3 Hrs. /Week **75 Hours**

Course Outcome

At the end of the course students will be able to...

CO No.	Outcome statement
CO1	Explain the pharmacology drugs acting on blood and blood forming agents
CO2	Explain the drugs acting on urinary system
CO3	Discuss pharmacology drugs acting on GI system
CO4	Explain pharmacology of chemotherapeutic agents
CO5	Explain pharmacology drugs acting on immune system
CO6	Discuss principles of toxicology and bioassay
CO7	Discuss Structure and functions of the components of the cell.
CO8	Discuss different aspects of genes and their regulatory functions.

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

   Upon completion of the subject student shall be able to:

   1. Understand the pharmacological aspects of drugs falling under theabove mentioned chapters.
   2. Carry out the animal experiments confidently.
   3. Appreciate the importance of pharmacology subject as a basis oftherapeutics.
   4. Correlate and apply the knowledge therapeutically.
   5. Understand different aspects of genes and their regulatory functions.

2. Course materials: Text books (Theory)

a) Tripathi, K. D. Essentials of medical pharmacology. 8th edition, 2018.Publisher: Jaypee, Delhi.
b) Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and Pharmacotherapeutics. 24th edition (single volume), 2015. Publisher: Popular, Mumbai.
c) Rang, H.P. and Dale, M.M. Pharmacology. 8th edition, 2016. Publisher:Churchill Living stone.
d) Alberts, B., Bray, D., Lewis, J., Raff M., Roberts, K and Watson, JD Molecular Biology of the Cell by, 6th. Edition, 2012, Publisher: GarlandScience.

Reference books (Theory)

a) Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological basis of therapeutics. 12th edition, 2014. Publisher: McGraw Hill, Pergamon press.
b) Craig, C.R. and Stitzel, R.E. Modern Pharmacology. 6th edition 2012. Publisher: Little Brown and company.
c) Katzung, B.G. Basic and clinical pharmacology. 14th edition 2014. Publisher: Prentice Hall, International.
d) Gupta, P.K. and Salunkhe, D.K. Modern Toxicology. Volume I, II and **III.**2010. Publisher: B.V. Gupta, Metropolitan Book Co. (p) Ltd, New Delhi.
e) Crommelin, DJA and Sindelar RD. Pharmaceutical Biotechnology. 3rdedition 2008. Publisher: Infarma Healthcare.
f) Watson, JD., Gilman, M., et al. Recombinant DNA. 3nd edition 2008.Publisher: Scientific America.
g) Walsh, G. Biopharmaceutical: Biochemistry and Biotechnology. 2013.Publisher: John Wily.
h) Derelanko MG. Handbook of toxicology. 3rd edition 2014; Publisher:CRC Press.

Text books (Practical)

a) Kulkarni, S. K. and Dandia, P. C. Hand book of experimental pharmacology. 2012, Vallabha prakashan, Delhi.

Reference books (Practical)

a) Macleod, L.J. Pharmacological experiments on intact preparations 1970: Churchill livingstone.
b) Macleod, L.J. Pharmacological experiments on isolated preparations.,1970,: Churchill livingstone.
c) Ghosh, M.N. Fundamentals of experimental pharmacology. 6rd edition,2015; Publisher: Scientific book agency, Kolkata.
d) Ian Kitchen. Textbook of in vitro practical pharmacology.1984.Publisher: Black well Scientific.

3. Lecture wise Programme:

Topics	**Hrs**
1. **Pharmacology of drugs acting on Blood and blood forming agent**	06
a) Anticoagulants	
b) Thrombolytics and antiplatelet agents	
c) Haemopoietics and plasma expanders	
2. **Pharmacology of drugs acting on Renal System**	03
a) Diuretics	
b) Antidiuretics	
3. **Pharmacology of drugs acting on Gastrointestinal Tract**	06
a) Antiulcer drugs, Antacids	
b) Laxatives and purgatives	
c) Emetics and antiemetics	
d) Appetizers, digestants and carminatives	
4. **Chemotherapy**	22
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)	

5. **Immunopharmacology** 03
   Pharmacology of immunosuppressants and stimulants
6. **Principles of Animal toxicology** 02
   a) Acute, subacute and chronic toxicity.
   b) Principles involved in the various toxicityscreening methods available for drugs in the laboratory animals.
7. **The dynamic cell: The structures and functions of the components of the cell** 11
   a) Cell and macromolecules: Cellular classification, subcellularorganelles, macromolecules, large macromolecular assemblies
   b) Chromosome structure: Pro and eukaryotic chromosome structures, chromatinstructure, genome complexity, the flow of genetic information.
   c) DNA replication: General, bacterial and eukaryotic DNAreplication.
   d) The cell cycle: Restriction point, cell cycle regulators and modifiers.
   e) Cell signaling: Communication between cells and their environment, ion-channels, signal transduction pathways (MAP kinase, P38 kinase, JNK, Ras and PI3-kinase pathways, biosensors.
8. **The Gene: Genome structure and function:** 18
   a. Gene structure: Organization and elucidation of genetic code.
   b. Gene expression: Expression systems (pro and eukaryotic), genetic elements that control gene expression (nucleosomes, histones, acetylation, HDACS, DNA binding protein families.
   c. Transcription and Transcription factors: Basic principles of transcription in pro and eukaryotes. Transcription factors that regulate transcription in pro and eukaryotes.
   d. RNA processing: rRNA, tRNA and mRNA processing.
   e. Protein synthesis: Mechanisms of protein synthesis, initiation in eukaryotes, translation control and post-translation events
   f. Altered gene functions: Mutations, deletions, amplifications, LOH, translocations, trinucleotide repeats and other genetic abnormalities. Oncogenes and tumor suppressor genes.
   g. The gene sequencing, mapping and cloning of human disease genes.
   h. Introduction to gene therapy and targeting.

i. Recombinant DNA technology: principles. Processes (gene transfer technology) and applications

9. **Bio-assay methods** 04

Scope, principles involved in general methods, bioassay designing, applications and limitations.

22PD31P: PHARMACOLOGY – II (PRACTICAL)

Practical: 3 Hrs./Week **75 Hours**

List of Experiments:

1. Study of laboratory animals and their handling (a. Frogs, b. Mice, c. Rats, d. Guinea pigs, e. Rabbits).
2. Study of physiological salt solutions used in experimentalpharmacology.
3. Study of laboratory appliances used in experimental pharmacology.
4. Study of use of anesthetics in laboratory animals.
5. To record the dose response curve of Acetylcholine usingisolated rat ileum/rectus abdominis muscle preparation.
6. To carry out bioassay of Ach using isolated rat ileum/rectus abdominismuscle preparation by interpolation method.
7. To carry out bioassay of Ach using isolated ileum/rectus abdominismuscle preparation by three point method.
8. To record the dose response curve of Histamine using isolated guinea-pig ileum preparation.
9. To carry out bioassay of Histamine using isolated guinea-pig ileumpreparation by interpolationmethod.
10. To carry out bioassay of Histamine using guinea-pig ileum preparationby three point method.
11. Study of agonistic and antagonistic effects of drugs using isolated guinea-pig ileum preparation.
12. To study different routes of administration of drugs in animals (Rats,Mice, Rabbits).
13. Study of theory, principle, procedure involved and interpretation of givenresults for the following experiments:
    a. Analgesic property of drug using analgesiometer (tail flick andhotplate).
    b. Antiinflammatory effect of drugs using rat-paw edema method.
    c. Anticonvulsant activity of drugs using maximal electroshock andpentylene tetrazole methods.
    d. Antidepressant activity of drugs using pole climbing apparatus.
    e. Pentobarbitone induced sleeping time in mice.
    f. Locomotor activity of drugs using actophotometer.
    g. Cardiotonic activity of drugs using isolated frog heart and mammalianheart preparations.

h. Skeletal muscle relaxant activity of the drugs using rotarod.
i. Drugs effect on the blood pressure, heart rate and respiratory rate ofdog.

14. Simulated experiments
    a) Effect of drugs on frog's isolated heart.
    b) Effect of drugs on rabbit eye.
    c) Effect of drugs on ciliary motility of frog's esophagus.

Scheme of Practical Examination:

	Sessionals	**Annual**
Identification	02	10
Synopsis	04	10
Major Experiment (Bioassay)	08	30
Minor Experiment (Interpretation of given Graph/ simulatedexperiment)	04	10
Viva	02	10
Max Marks	**20**	**70**
Duration	**3 hrs**	**4 hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity,promptness, viva-voce and record maintenance).