PROGRESSIVE EDUCATION SOCIETY'S MODERN COLLEGE OF PHARMACY, NIGDI, PUNE

AUTONOMOUS

AFFILIATED TO

SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF SCIENCE AND TECHNOLOGY

RULES AND SYLLABUS

FIRST YEAR DOCTOR OF PHARMACY (PHARM D) COURSE-

2025 PATTERN (EFFECTIVE FROM ACADEMIC YEAR 2025-2026)

APPENDIX-A

(See regulation 8)

PHARM.D. SYLLABUS

First Year:

Sr.No.	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	**(2)**	**(3)**	**(4)**	**(5)**
1.1	Human Anatomy and Physiology	3	3	1
1.2	Pharmaceutics	2	3	1
1.3	Medicinal Biochemistry	3	3	1
1.4	Pharmaceutical Organic Chemistry	3	3	1
1.5	Pharmaceutical Inorganic Chemistry	2	3	1
1.6	Remedial Mathematics/ Biology	3	3*	1
1.7	Democracy, Election and Governance	2	-	-
	Total hours	**18**	**18**	**6 = (40)**

* For Biology

Scheme of Sessional Practical Examination:

	Revised Practical Marks
Synopsis	05
Major Experiment	10
Minor Experiment	05
Max Marks	**20**
Attendance/Journal/Viva	**10**
Total sessional marks	**30**

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1.1 HUMAN ANATOMY & PHYSIOLOGY (THEORY)

Theory: 3 Hrs. /Week

1. **Scope and Objectives:** This course is designed to impart a fundamental knowledge of the structure and functions of the human body. It also helps in understanding 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 understanding of how the drugs act on the various body systems in correcting the disease state of the organs.

2. **Upon completion of the course the student shall be able to:**
   a. Describe the structure (gross and histology) and functions of various organs of the human body.
   b. Describe the various homeostatic mechanisms and their imbalances of various systems.

   d. Perform the hematological tests and record blood pressure, heart rate, pulse and respiratory volumes.
   e. Appreciate coordinated working pattern of different organs of each system; and
   f. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body

Course materials:

Textbooks

a. Tortora Gerard J. and Nicholas, P. Principles of anatomy and physiology Publisher Harpercollins college New York.
b. Wilson, K.J.W. Ross and Wilson's foundations of anatomy and physiology. Publisher: Churchill Livingstone, Edinburg.

Reference books

a. Guyton arthur, C. *Physiology of human body*. Publisher: Holtsaunders.
b. Chatterjee,C.C. *Human physiology*. Volume 1&11. Publisher: medical allied agency, Calcutta.
c. Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H,*Gray's* London.

	Lecture wise program**: Topics**	3hrs /Week
1.	**Scope of anatomy and physiology:** basic terminologies used in this subject (Description of the body as such planes and terminologies)	**02**
2.	**Structure of cell** – its components and their functions.	**04**
3.	**Elementary tissues of the human body**: epithelial, connective, Muscular and nervous tissues-their sub-types and characteristics	**07**
4.	a) **Osseous system** - structure, composition and functions of the Osseous system b) **Classification of joints**, Types of movements of joints and disorders of joints (Definitions only)	**05**
5.	**Haemopoetic System** (a) Composition and functions of blood (b) Haemopoesis and disorders of blood components (definition of disorder)	**07**

	(c) Blood groups (d) Clotting factors and mechanism (e) Platelets and disorders of coagulation	
6.	**Lymph** (a) Lymph and lymphatic system, composition, formation and circulation. (b) Spleen: structure and functions, Disorders (c) Disorders of lymphatic system (definition only)	**05**
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, Congestive heart failure, Cardiac arrhythmias	**09**
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, Dybarism, Oxygen therapy and resuscitation.	**06**
9.	**Digestive system** a) Anatomy and physiology of GIT b) Anatomy and functions of accessory glands of GIT c) Digestion and absorption d) Disorders of GIT (definitions only)	**05**
10.	**Nervous system** a) Definition and classification of nervous system b) Anatomy, physiology and functional areas of cerebrum c) Anatomy and physiology of cerebellum d) Anatomy and physiology of mid brain e) Thalamus, hypothalamus and Basal Ganglia f) Spinal card: Structure & reflexes g) Cranial nerves – names and functions h) ANS – Anatomy & functions of sympathetic & parasympathetic N.S.	**08**
11.	**Urinary system** a) Anatomy and physiology of urinary system b) Formation of urine c) Renin Angiotensin system – Juxtaglomerular apparatus - acid base Balance d) Clearance tests and micturition	**03**
12.	**Endocrine system** a) Pituitary gland b) Adrenal gland c) Thyroid and Parathyroid glands d) Pancreas and gonads	**07**

13.	**Reproductive system** a) Male and female reproductive system b) Their hormones – Physiology of menstruation c) Spermatogenesis & Oogenesis d) Sex determination (genetic basis) e) Pregnancy and maintenance and Parturition f) Contraceptive devices	**07**
14.	**Sense organs** a) Eye b) Ear c) Skin d) Tongue & Nose	**06**
15.	**Skeletal muscles** a) Histology b) Physiology of Muscle contraction c) Physiological properties of skeletal muscle and their disorders (definitions)	**05**
16.	**Sports physiology** a) Muscles in exercise, Effect of athletic training on muscles and muscle performance, b) Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise, c) Drugs and athletics	**04**

1.1 HUMAN ANATOMY & PHYSIOLOGY (PRACTICAL)

Practical : 3 Hrs./Week

General Requirements: Dissection box, Laboratory Napkin, muslin cloth, record,Observation book(100pages), Stationary items, Blood lancet.

Course materials:

Text books

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

Reference books

a. Ranade VG, Text book of practical physiology, Latest edition, Publisher: PVG, Pune
b. Anderson Experimental Physiology, Latest edition, Publisher: NA
c. Deshpande, S. A., Vyawahare, N. S., Amale, P. N., and Shirode, D. S. *Practical Book of Human Anatomy and Physiology*, Latest Edition, Publisher: Nirali Prakashan, Pune

Sr.No.	List of Experiments:
1.	Study of the Compound Microscope
2.	Study of tissues of human body (a) Epithelial tissue. (b) Muscular tissue.
3.	Study of tissues of human body (a) Connective tissue. (b) Nervous tissue.
4.	Study of appliances used in hematological experiments.
5.	Determination of W.B.C. count of blood.
6.	Determination of R.B.C. count of blood.
7.	Determination of differential count of blood.
8.	Determination of (a) Erythrocyte Sedimentation Rate. (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.	To perform pregnancy diagnosis test.
13.	Study of appliances used in experimental physiology.
14.	To demonstrate a Simple Muscle Curve using the Gastrocnemius Sciatic Nerve Preparation (by simulation)
15.	To demonstrate a Simple Summation Curve using the Gastrocnemius Sciatic Nerve Preparation (by simulation)
16.	To demonstrate the Effect of Temperature using the Gastrocnemius Sciatic Nerve Preparation (by simulation)
17.	To demonstrate the Effect of Load & Afterload using the Gastrocnemius Sciatic Nerve Preparation (by simulation)
18.	To demonstrate the Fatigue Curve using the Gastrocnemius Sciatic Nerve Preparation (by simulation)

Scheme for Practical Examination:

	Annual Marks
Synopsis/ Identification	20
Major Experiment	20
Minor Experiment	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

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

1.2 PHARMACEUTICS (THEORY)

Theory: 2 Hrs. /Week

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

2. **Upon completion of the course the student should be able to:**
   a. know the formulation aspects of different dosage forms.
   b. do different pharmaceutical caluculation involved in formulation.
   c. formulate different types of dosage forms; and
   d. appreciate the importance of good formulation for effectiveness.

3. **Course materials:**
   Textbooks
   a. Cooper and Gunns Dispensing for pharmacy students.
   b. A textbook Professional Pharmacy by N.K.Jain and S.N.Sharma.

   Reference books
   a. Introduction to Pharmaceutical dosage forms by Howard C. Ansel.
   b. Remington's Pharmaceutical Sciences.
   c. Register of General Pharmacy by Cooper and Gunn.
   d. General Pharmacy by M.L.Schroff.

	Topics	2 Hrs. / Week
1.	**a. Introduction to dosage forms -** classification and definitions **b. Prescription:** definition, parts and handling and errors in prescription **c. Posology:** Definition, Factors affecting dose selection. Calculation of children and infant doses.	**6**
2.	Historical background and development of profession of pharmacy and pharmaceutical industry in brief.	**2**
3.	**Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias** such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.	**4**
4.	**Powders and Granules:** Classification advantages and disadvantages, Preparation and evaluation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules.	**6**
5.	**Monophasic Dosage forms:** Theoretical aspects of formulation including adjuvant like stabilizers, colorants, flavours with examples. Study of Monophasic liquids like Solutions, Syrup, Elixer, gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.	**6**
6.	**Biphasic dosage forms:** Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.	**6**

7.	**Suppositories and pessaries:** Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.	**4**
8.	**Galenical's:** Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.	**6**
9.	**Pharmaceutical Calculations:** Freezing point, Molecular weight Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions	**8**
10	**Surgical aids:** Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.	**6**
11	**Incompatibilities:** Introduction, classification and methods to overcome the incompatibilities	**6**

	1.2 PHARMACEUTICS (PRACTICAL) **Practical: 3 Hrs./Week**
	List of Experiments: (Preparation and Evaluation of Following)
1.	**Syrups** a. Simple Syrup I.P b. Syrup of Ephedrine HCl NF c. Syrup Vasaka IP d. Syrup of ferrous Phosphate IP
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 e. Mouthwash / Gargle f. Throat paint
5.	**Liniments** a. Liniment of turpentine IP* b. Liniment of camphor IP
6.	**Suspensions*** a. Calamine lotion b. Magnesium Hydroxide mixture BP
7.	**Emulsions*** a. Cod liver oil emulsion b. Liquid paraffin emulsion
8.	**Powders** a. Eutectic powder b. Explosive powder c. Dusting powder d. Insufflations
9.	**Suppositories** a. Boric acid suppositories b. Chloral suppositories
10.	**Incompatibilities** a. Mixtures with Physical incompatibilities b. Chemical & Therapeutic incompatibilities

Scheme of Practical Examination:

	Annual marks
Synopsis	15
Major Experiment	25
Minor Experiment	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

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

1.3 MEDICINAL BIOCHEMISTRY (THEORY)

Theory : 3 Hrs. /Week

Scope of the Subject: Applied biochemistry deals with complete understanding of the molecular level of the chemical process associated with living cells.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.

1. **Objectives of the Subject** (Know, do, appreciate):

   The objective of the present course is to provide biochemical facts and the principles to the students of pharmacy. Upon completion of the subject student shall be able to –

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

   Text books (Theory)

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

   Reference books (Theory)

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

2. **Lecture wise programme:**

Sr no.	Topic	3 Hrs/ week
I	Introduction to biochemistry**:** Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance.	**3**
II	Enzymes: Definition; Nomenclature; IUB classification; Factor affecting enzymeactivity; Enzyme action; enzyme inhibition. Isoenzymes and their therapeutic and diagnostic applications; Coenzymes and their biochemical role and deficiency diseases.	**8**
III	Carbohydrate metabolism: Introduction, classification, chemical nature and biological role of Carbohydrate, Glycolysis, Citric acid cycle (TCAcycle), HMPshunt, Glycogenolysis, gluconeogenesis, glycogenesis. Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases); Glucose, Galactose tolerance test and their significance; hormonal regulation of carbohydrate metabolism.	**8**

IV	Lipid metabolism**:** Introduction, classification, chemical nature and biological role of Lipid, Oxidation of saturated (B-oxidation); Ketogenesis andketolysis; biosynthesis of fatty acids, lipids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atheroslerosis, fatty liver, hypercholesterolmiea).	8
V	Biological oxidation**:** Coenzyme system involved in Biological oxidation.Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC; Oxidative phosphorylation;	7
VI	Protein and amino acid metabolism**:** Introduction, classification, chemical nature and biological role of Protein and amino acid, protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders; production of bile pigments; hyperbilirubinemia, porphoria, jaundice. Metabolic disorder of Amino acids.	8
VII	Nucleic acid metabolism**:** Introduction, classification, chemical nature and biological role of Nucleic acid, Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; mutation and repair mechanism; DNA replication (semiconservative /onion peel models) and DNA repair mechanism.	8
VIII	Introduction to clinical chemistry: Cell; composition; malfunction; Roll of the clinical chemistry laboratory.	4
IX	The kidney function tests**:** Role of kidney; Laboratory tests for normal function includes- ➢ Urine analysis (macroscopic and physical examination, quantitative and semiquantitative tests.) ➢ Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid) ➢ Urine concentration test ➢ Urinary tract calculi. (stones)	8
X	Liver function tests: Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation. a)Test for hepatic dysfunction-Bile pigments metabolism. b)Test for hepatic function test- Serum bilirubin, urine bilirubin, and urine urobilinogen. c)Dye tests of excretory function. d)Tests based upon abnormalities of serum proteins.	8
XI	Lipid profile tests: Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.	**7**
XII	Immunochemical techniques for determination of hormone levels and proteinlevels in serum for endocrine diseases and infectious diseases. Radio immuno assay (RIA) and Enzyme Linked Immuno Sorbent Assay (ELISA)	**7**
XIII	Electrolytes: Body water, compartments, water balance, and electrolyte distribution. Determination of sodium, calcium potassium, chlorides, and bicarbonates in the body fluids.	**6**

1.3 MEDICINAL BIOCHEMISTRY (PRACTICAL)

Practical : 3 Hrs./Week

Sr. no	Title
1	Introduction of clinical chemistry laboratory
2	Introduction to instruments used in clinical chemistry laboratory
3	Detection And Identification of Substances of Biological Importance; Carbohydrate
4	Detection And Identification of Substances of Biological Importance; Protiens and Amino Acid
5	Detection And Identification of Substances of Biological Importance; Lipids
6	Qualitative analysis of normal constituents of urine.*
7	Qualitative analysis of abnormal constituents of urine.*
8	Quantitative estimation of urine sugar by Benedict's reagent method.**
9	Quantitative estimation of urine chlorides by Volhard's method.**
10	Quantitative estimation of urine creatinine by Jaffe's method.**
11	Quantitative estimation of urine calcium by precipitation method.**
12	Quantitative estimation of serum cholesterol by Libermann Burchard's method.**
13	Withdrwal of blood and Preparation of Folin Wu filtrate from blood.*
14	Quantitative estimation of blood creatinine.**
15	Quantitative estimation of blood sugar Folin-Wu tube method.**
16	Estimation of SGOT in serum.**
17	Estimation of SGPT in serum.**
18	Estimation of Urea in Serum.**
19	Estimation of Proteins in Serum.**
20	Determination of serum bilirubin**
21	Determination of Glucose by means of Glucoseoxidase.**
22	Enzymatic hydrolysis of Glycogen/Starch by Amylases.**
23	Study of factors affecting Enzyme activity. (pH and Temprature)**
24	Preparation of standard buffer solutions and its pH measurements(any two Buffer)*
25	Experiment on lipid profile tests**
26	Determination of sodium in serum. **
27	Determination of calcium in serum**
28	Determination of potassium in serum**
29	Examination of Sputum by Microscopic Method
30	Methods of Injecting of Drug by Various Route

** indicate major experiments & * indicate minor experiments

Scheme of Practical Examination:

	Annual marks
Synopsis	15
Major Experiment	25
Minor Experiment	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

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

1.4 PHARMACEUTICAL ORGANIC CHEMISTRY (THEORY)

Theory : 3 Hrs. /Week

1. **Scope and objectives**: This course is designed to impart a very good knowledge abouta. 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,
b. Bentley and Driver-Text book of Pharmaceutical chemistry
c. I.L.Finer- Organic chemistry, the fundamentals of chemistry

Reference books

a. Organic chemistry – J.M.Cram and D.J.Cram
b. Organic chemistry- Brown
c. Advanced organic chemistry- Jerry March, Wiley
d. Organic chemistry- Cram and Hammered, Pine Hendrickso

Lecture wise programme: Topics

Unit no.	Unit	3 Hrs/ week
I	**STRUCTURES AND PHYSICAL PROPERTIES:** a. Polarity of bonds, polarity of molecules, Inter molecular forces, M.P, B.P, Solubility, nonionic solutes and ionic solutes, protic and aprotic Solvents, ion pairs b. Acids and bases, Lowry Bronsted and Lewis theories c. Isomerism	(05)
II	**NOMENCLATURE:** IUPAC nomenclature system 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.	(06)
III	**FREE RADICALS CHAIN REACTIONS:** Mechanism, relative reactivity and stability **(Alkane)**	(04)
IV	**ALICYCLIC COMPOUNDS**: a. Preparations of Cyclo Alkanes b. Cyclo addition reactions c. Bayer strain theory and orbital picture of angle strain.	(06)
V	**NUCLOPHILIC ALIPHATIC SUBSTITUTION (Alkyl Halides):**: Duality of mechanisms SN1 and SN2 Mechanisms – a. Mechanism, kinetics, order of reactivity of alkyl halides, b. Stereochemistry and rearrangement of carbocations. c. Factors affecting SN1 and SN2 reactions. d. SN1 versus SN2 Mechanisms	(05)

	e. SN1 Mechanism: role of solvent. Ion dipole bonds, f. SN2 Mechanism: role of solvent. Phase transfer catalysis g. Solvolysis. Nucleophilic assistance by the solvents.	
VI	**DEHYDROHALOGENATION OF ALKYL HALIDES**: 1, 2 elimination. E2 and E1 Mechanisms – a. Mechanisms, Kinetics, elimination via carbocation b. E2 Mechanism: evidence for E2 mechanism, absence of rearrangement, isotope effect, absence hydrogen exchange, the element effect, orientation and reactivity. c. E2 versus E1 d. Elimination versus Substitution, e. Dehydration of alcohol: ease of dehydration, acid catalysis, reversibility, orientation.	(06)
VII	**REACTION AT CARBON-CARBON DOUBLE BOND:** Electrophilic and free radicals addition: a. Hydrogenation, heat of hydrogenation and stability of alkenes, b. Addition of hydrogen halides: Markovnikov's rule c. Addition of hydrogen bromides: peroxide effect, d. Electrophilic addition: mechanism, rearrangement, orientation and reactivity e. Addition of halogen: mechanism, halohydrin formation f. Free radicals addition: mechanism of peroxide initiated addition of hydrogen bromide, orientation of free addition. g. cyclo addition reactions, additions of carbenes to alkenes (refer Unit no. IV)	(07)
VIII	**CARBON-CARBON DOUBLE BOND AS A SUBSTITUENT:** a. Free radical halogenations of alkenes: comparison of free radical substitution with free radical addition. b. Free radical substitution in alkenes: orientation and reactivity, allylic rearrangement.	(03)
IX	**THEORY OF RESONANCE:** a. Allyl radical as a resonance hybrid: stability, orbital picture, resonance stabilisation of allyl radicals, hyper conjugation. b. Allyl cation as a resonance hybrid. c. Nucleophyllic substitution in allylic substrate: SN1 reactivity, allylic rearrangement, resonance stabilization of allyl cation, hyper conjugation. d. Nucleophilic substitution in allylic substrate: SN2 e. Nucleophilic substitution in vinylic substrate: vinylic cation, f. Conjugated dienes: Structure and properties, stability g. Resonance in alkenes: hyper conjugation h. Ease of formation of conjugated dienes: orientation of elimination, i. Electrophilic addition to conjugated dienes: 1,4- addition, 1,2-versus 1,4-addition, rate versus equilibrium. j. Free radical addition to conjugated dienes: orientation and reactivity.	(06)
X	**ELECROPHILIC AROMATIC SUBSTITUTION:** a. Reaction and mechanism of nitration, sulphonation, halogenation, friedel craft alkylation, friedel craft acylation. b. Effect of substituent groups c. Determination of orientation d. Determination of relative reactivity e. Classification of substituent group f. Theory of Reactivity: activating and deactivating g. Theory of orientation: O,P,M directing groups h. Electron release via resonance i. Effect of halogen on electrophilic aromatic substitution	(05)

	j. Electrophilic aromatic substitution in alkyl benzene, side chain halogenation of alkyl benzene, resonance stabilization of benzyl radical.	
XI	**CARBOXYILIC ACIDS:** a. Ionization of carboxylic acids, acidity constants b. acidity of acids c. structure of carboxylate ions d. effect of substituent on acidity, e. Nucleophilic acyl substitution reaction: Role of carboxyl group, conversion of acid-to-acid chloride, esters, amide and anhydride. comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.	(06)
XII	**ALDEHYDES AND KETONES**: Nucleophilic addition reaction mechanism a. Nucleophilic addition using carbanions: Aldol condensation, crossed aldol condensation, Claisen condensation, Perkin condensation, Knoevenagel condensation, Wittig reaction. b. Other Nucleophilic addition reactions: Cannizzaro reaction, crossed Cannizzaro reaction, Michael addition, benzoin condensation, Reformat sky reaction.	(06)
XIII	**AMINES:** a. Basicity of amines b. Amines preparation: Hoffman rearrangement: Migration to electron deficient nitrogen, c. Amines reactions: Sandmeyer's reaction, diazotization and coupling **PHENOLS:** a. Acidity of phenols b. Reactions of Phenols: Williamson synthesis, Fries rearrangement. c. EAS in phenols: Kolbe reaction, Reimer-Tieman reaction.	(08)
XIV	**NUCLEOPHILIC AROMATIC SUBSTITUTION:** Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic.	(07)
XV	**OXIDATION REDUCTION REACTION:** a. Introduction to Redox reactions, examples and applications of Oxidizing and Reducing agents in organic synthesis. b. Oxidation reaction: Oppenauer oxidation c. Reduction reaction: catalytic hydrogenation, Birch reduction, Wolff Kishner reduction.	(05)
XVI	**STUDY OF SOME OFFICIAL COMPOUNDS**: Preparation 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)

1.4 PHARMACEUTICAL ORGANIC CHEMISTRY (PRACTICAL)

Practical: 3 Hrs./Week

Sr.No.	TITLE	TURNS
I.	Safety measures in an organic chemistry laboratory.	1
II.	Introduction to laboratory techniques: Calibration of thermometer, Determination of melting point, boiling point. Demonstration of distillation and Recrystallization	3
III.	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. M-dinitro benzene (Nitration) 7. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction 8. 9, 10 – Antharaquinone (Oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde 9. M-phenylene diamine (Reduction of M-dinitrobenzene) / Aniline from nitrobenzene 10. Benzophenone oxime 11. Nitration of salicylic acid 12. Preparation of picric acid 13. Preparation of O-chlorobenzoic acid from O-chlorotolune 14. Preparation of cyclohexanone from cyclohexanol	8
IV.	Identification of organic compounds belonging to the following classes by Systematic qualitative organic analysis: Phenols, amides, carbohydrates, amines, carboxylic acids, aldehyde and ketones, Alcohols, esters, hydrocarbons, anilides, nitro compounds.	15
V.	Preparation of suitable solid derivatives from organic compounds.	2
VI.	Introduction to the use of stereo models: Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene, inversion of configuration.	1

Scheme of Practical Examination:

	Annual marks
Synopsis	15
Major Experiment	25
Minor Experiment	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

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

1.5 PHARMACEUTICAL INORGANIC CHEMISTRY (THEORY)

Theory: 2 Hrs. /Week

1. **Scope and objectives:** This course mainly deals with fundamentals of Analytical Chemistry and the study of inorganic pharmaceuticals regarding their monographs 2. The course deals with basic knowledge of analysis of various pharmaceuticals.

2. **Upon completion of the course student shall be able to**:
   a. understand the principles and procedures of analysis of drugs and regarding the application of inorganic pharmaceuticals.
   b. know the analysis of the inorganic pharmaceuticals their applications; and
   c. appreciate the importance of inorganic pharmaceuticals in preventing and curing disease.

3. **Course materials:**

   Textbooks
   a. A textbook Inorganic medicinal chemistry by Surendra N. Pandeya
   b. A. H. Beckett and J. B. Stanlake's Practical Pharmaceutical Chemistry Vol -I & Vol-II
   c. Inorganic Pharmaceutical Chemistry III-Edition P.Gundu Rao

   Reference books
   a. Inorganic Pharmaceutical Chemistry by Anand & Chetwal
   b. Pharmaceutical Inorganic Chemistry by Dr.B.G.Nagavi
   c. Analytical chemistry principles by John H. Kennedy
   d. I.P.1985 and 1996, Govt. of India, Ministry of health

4. Lecture wise programme: Topics

Sr. No.	Topics	Hrs
UNIT I Volumetric Analysis		**25**
1.	**Errors** Introduction to Errors, Types of Errors, Minimization of Errors, Accuracy and Precision, Significant Figures	**02**
2.	**Basics of Volumetric Analysis** Introduction to Volumetric Analysis, Types of Volumetric Analysis, Normality, molarity, molality, Equivalent weight, Calculations for strength, % purity, and assay, Primary standards, Secondary standards, Importance of standardization before titration	**03**
3.	**Acid-base Titrations** Theories of acid base indicators, classification of acid base titrations and neutralization curves.	**04**
4.	**Redox Titrations**	**04**

	Concepts of oxidation and reduction, Types of redox titrations (Principles and applications) cerimetry, iodimetry, iodometry, bromometry, dichrometry, permagnatometry, and iodatometry.	
5.	**Non aqueous Titrations** Introduction, solvents, acidimetry and alkalimetry titration, indicators, and estimation of sodium benzoate	**03**
6.	**Precipitation Titrations** Introduction, types of precipitation titration (Mohr's method, Gay Lussac's method, Volhard's, Modified Volhard's, Fajans method), indicators, and estimation of sodium chloride.	**03**
7.	**Complexometric Titrations** Introduction, classification, metal ion indicators, masking and demasking reagents, and estimation of calcium gluconate.	**03**
8.	**Theory of Indicators** Ostwald theory, chromophore theory, and physicochemical theory.	**03**
UNIT II Miscellaneous		**35**
1.	**Gravimetry** Principle and steps involved in gravimetric analysis. purity of the precipitate co-precipitation and post precipitation, and estimation of barium sulphate.	**02**
2.	**Limit Tests** Sources and types of impurities, principle involved in the limit test for chloride, sulphate, iron, arsenic, lead and heavy metals, and modified limit test for chloride and sulphate.	**03**
3.	**Medicinal Gases** Introduction to medicinal gases, storage and handling, and applications in pharmacy and medicine.	**03**
4.	**Acidifiers** Ammonium chloride and dil. HCl.	**01**
5.	**Antacids** Ideal properties of antacids, combinations of antacids, sodium bicarbonate, aluminium hydroxide gel, and magnesium hydroxide mixture.	**03**
6.	**Cathartics** Magnesium sulphate, sodium orthophosphate, kaolin, and bentonite.	**02**

7.	**Electrolyte Replenishers** Functions of major physiological ions, electrolytes used in the replacement therapy: sodium chloride, potassium chloride, calcium gluconate, oral rehydration salt (ORS), and physiological acid base balance.	**04**
8.	**Essential Trace Elements** Introduction to trace elements, essential trace elements (iron (Fe), zinc (Zn), copper (Cu), iodine (I), selenium (Se), chromium (Cr) manganese (Mn) cobalt (Co) molybdenum (Mo) fluoride (F)), clinical aspects, and therapeutic use.	**02**
9.	**Antimicrobials** Mechanism, classification, potassium permanganate, boric acid, hydrogen peroxide, chlorinated lime, iodine and its preparations.	**04**
10.	**Pharmaceutical Aids** Introduction, types of pharmaceutical aids and their uses.	**03**
11.	**Dental Products** Dentifrices, role of fluoride in the treatment of dental caries, desensitizing agents, calcium carbonate, sodium fluoride, and zinc eugenol cement.	**02**
12.	**Miscellaneous Compounds** Astringents: zinc sulphate, and potash alum Expectorants: Potassium iodide, Ammonium chloride	**03**
13.	**Radio Pharmaceuticals** Radio activity, measurement of radioactivity, properties of α, β, γ radiations, half-life, storage conditions, precautions and pharmaceutical application of radioactive substances.	**03**

1.5 PHARMACEUTICAL INORGANIC CHEMISTRY (PRACTICAL)

Practical: 3 Hrs./Week

Sr. No.	Title of Experiments	Turn
1.	**Limit test** a. Limit test for chlorides b. Limit test for sulphates c. Limit test for iron d. Limit test for heavy metals e. Limit test for arsenic f. Modified limit tests for chlorides and sulphates	**6**
2	**Assays** a. Ammonium chloride- Acid-base titration b. Ferrous sulphate- Cerimetry c. Copper sulphate- Iodometry d. Calcium gluconate- Complexometry e. Hydrogen peroxide – Permanganometry f. Sodium benzoate – Non-aqueous titration g. Sodium chloride – Modified Volhard's method h. Assay of KI – KIO3 titration i Gravimetric estimation of barium as barium sulphate j. Sodium antimony gluconate or antimony potassium tartrate	**10**
3	**Estimation of mixture** a. Sodium hydroxide and sodium carbonate b. Boric acid and borax c. Oxalic acid and sodium oxalate	**3**
4	**Test for identity** a. Sodium bicarbonate b. Barium sulphate c. Ferrous sulphate d. Potassium chloride	**4**
5.	**Test for purity (Any three exercises)** a. Swelling power in bentonite b. Acid neutralizing capacity in aluminium hydroxide gel c. Ammonium salts in potash alum	**3**

	d. Adsorption power heavy Kaolin e. Presence of Iodates in KI	
6.	**Preparations** a. Boric acids b. Potash alum c. Calcium lactate d. Magnesium sulphate	**4**

Scheme of Practical Examination:

	Annual marks
Synopsis	15
Major Experiment	25
Minor Experiment1&2	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

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

1.6 REMEDIAL MATHEMATICS (THEORY)

Theory : 3 Hrs. /Week

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.

2. **Upon completion of the course the student shall be able to : –**
   a. Know Trignometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications;
   b. solve the problems of different types by applying theory; and
   c. appreciate the important applications of mathematics in pharmacy.

3. **Course materials:**
   Text books
   a. Differential calculus By Shantinarayan
   b. Text book of Mathematics for second year pre-university by Prof.B.M.Sreenivas
   Reference books
   a. Integral calculus By Shanthinarayan
   b. Engineering mathematics By B.S.Grewal
   c. Trigonometry Part-I By S.L.Loney

4. **Lecture wise programme**Topics

Sr. No.	Topics	3hrs/ week
1.	**Algebra :** Determinants, Matrices.	14
2.	**Trigonometry :** Sides and angles of a triangle, solution of triangles	12
3.	**Analytical Geometry :**Points, Straight line, circle, parabola.	08
4.	**Differential calculus:** Limit of a function, Differential calculus,Differentiation of a sum, Product, Quotient Composite, Parametric,exponential, trigonometric and Logarithmic function. Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions of two variables	20
5.	**Integral Calculus:** Definite integrals, integration by substitution and byparts, Properties of definite integrals.	14
6.	**Differential equations:** Definition, order, degree, variable separable, homogeneous, Linear, heterogeneous, linear, differential equation with constant coefficient, simultaneous linear equation of second order.	14
7.	**Laplace transform:** Definition, Laplace transform of elementaryfunctions, Properties of linearity and shifting.	08

1.6 BIOLOGY (THEORY) :

1. **Scope and objectives**: This is an introductory course in Biology, which gives detailedstudy of natural sources such as plant and animal origin. This subject has been introduces to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. This subject gives basic foundation to Pharmacognosy.
2. **Course materials:**

   Text books

   a. Text book of Biology by S.B.Gokhale
   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 and C.K.Kokate.
3. **Lecture wise programme :**Topic

Sr. No.	Title of Experiments
	PART – A
1	Introduction
2	General organization of plants and its inclusions
3	Plant tissues
4	Plant kingdom and its classification
5	Morphology of plants
6	Root, Stem, Leaf and Its modifications
7	Inflorescence and Pollination of flowers
8	Morphology of fruits and seeds
9	Plant physiology
10	Taxonomy of Leguminosae, umbelliferae, Solanaceae, Lilliaceae, Zinziberaceae, Rubiaceae
11	Study of Fungi, Yeast, Penicillin and Bacteria
	PART – B
12	Study of Animal cell
13	Study animal tissues
14	Detailed study of frog
15	Study of Pisces, Raptiles, Aves
16	Genearal organization of mammals
17	Study of poisonous animals

1.6 BIOLOGY (PRACTICAL)

Practical : 3 Hrs./Wek Title:

Sr. No.	Title of Experiments
1	Introduction of biology experiments
2	Study of cell wall constituents and cell inclusions
3	Study of Stem modifications
4	Study of Root modifications
5	Study of Leaf modifications
6	Identification of Fruits and seeds
7	Preparation of Permanent slides
8	T.S. of Senna, Cassia, Ephedra, Podophyllum.
9	Simple plant physiological experiments
10	Identification of animals
11	Detailed study of Frog
12	Computer based tutorials

Scheme of Practical Examination :

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

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

1.7 Democracy, Election and Governance

Theory: 2 Hrs. /Week

Objectives:

1. To introduce the students meaning of democracy and the role of the governance
2. To help them understand the various approaches to the study of democracy and governance

Module 1 Democracy- Foundation and Dimensions

a. Constitution of India
b. Evolution of Democracy- Different Models
c. Dimensions of Democracy- Social, Economic, and Political

Module 2 Decentralization

a. Indian tradition of decentralization
b. History of panchayat Raj institution in the lost independence period
c. 73rd and 74th amendments
d. Challenges of caste, gender, class, democracy and ethnicity

Module 3 Governance

a. Meaning and concepts
b. Government and governance
c. Inclusion and exclusion

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