

DETAILED SYLLABUS CONTENT FOR

F.Y. B.Pharm

SEMESTER-I

Physical Organic Chemistry

4 hours / week

Sr. No.	Topic	Hours
1.	<p>Introduction to structure and models of bonding Review of basic bonding concepts – quantum numbers, atomic orbitals, electron configuration, electronic diagrams, Lewis structures, formal charge, VSEPR, hybridization involving s, p and d orbitals, polar covalent bonds, electronegativity, different scales of electronegativity, electrostatic potential surfaces, inductive effects, group electronegativities, hybridization effects, bond dipoles, molecular dipoles, and quadrupoles with examples, resonance, polarizability The teacher could try to relate some of these concepts to drug effects on macromolecular targets</p>	10
2	<p>Modern Theory of Organic Bonding</p>	12
2.1	Molecular Orbital Theory, Strengths and drawbacks Concept of Group orbitals	
2.2	Qualitative Molecular Orbital Theory (QMOT), Rules of QMOT	
2.3	Symmetry and Symmetry Operations, e.g. MH_3 and MH_3Y systems M.Os of planar methyl, Walsh diagram – pyramidal methyl, bonding in planar and pyramidal forms of methyl Consideration of NH_3 and BH_3	
2.4	The orbitals of CH_2 group, M.Os of MH_2 group, molecular orbitals of H_2O	
2.5	Building larger molecules e.g. ethane, ethylene, formaldehyde, methyl chloride, allyl system, boranes	
2.6	Orbitals of reactive intermediates – carbocations, carbenium ions, carbanions, radicals and carbene	
2.7	Bonding in organometallics	
2	<p>Kinetics and Reaction Mechanisms.</p>	12
2.1	Energy surfaces, reaction coordinate diagrams, activated complex/transition state rate and rate constants, reaction order and rate laws	
2.2	Transition state theory and its relationship to Arrhenius Rate law, Boltzmann distributions and dependence on temperature, methods of determination of activation parameters and Arrhenius parameters with some examples	
2.3	Principles of Kinetic Analysis Kinetic Experiments, First order kinetics, second order kinetics, pseudo-first order kinetics, equilibrium kinetics and initial-rate kinetics, some ideas about methods for following kinetics	
2.4	Temperature dependence on Reaction rates, kinetic isotope effects	
2.5	Hammond Postulate, reactivity vs selectivity, Curtin-Hammett Principle, microscopic reversibility, kinetic vs thermodynamic control	
3	<p>Acid-Base Catalysis General principles of catalysis, Forms of catalysis – electrophilic catalysis, acid-base catalysis, nucleophilic catalysis, covalent catalysis, phase transfer catalysis, Brønsted Acid-base catalysis, correlation of reaction rates with acidity functions.</p>	7
4	<p>Charge transfer complexes and reactions Definition of complex, charge-transfer transition, donors and acceptors, ground state charge-transfer contribution The teacher could try to relate these concepts to drugs effects on macromolecular targets</p>	4
	Total	45

In ALL subjects the teacher should adopt the latest edition of the books, hence the specific edition and year of publication have been omitted

Books

1. Eric V Anslyn and Dennis A Dougherty, Modern Physical Organic Chemistry, John Wiley. (Main Book to be adopted for teaching this course).
2. Neil Isaacs, Physical Organic Chemistry, Pearson Education.
3. Louis P Hammett, Physical Organic Chemistry, McGraw Hill Education.
4. Edward M Kosower, An Introduction to Physical Organic Chemistry, John Wiley and Sons, Inc
5. Atkins' Physical Chemistry, Peter Atkins and Julio De Paula, International Student Edition, Oxford University Press.

Sr. No	TOPICS	HOURS
1.	<p>States of matter:</p> <ul style="list-style-type: none"> ▪ The Gaseous state: Ideal and Real gases, The Ideal gas Law, Kinetic Molecular Theory, The van der Waals equation for real gases, Critical phenomenon, critical constants and their determination (Problems) ▪ The Liquid state: Liquefaction of gases and methods (Linde's, Claude's and Faraday's method), application of liquefaction in aerosols – introduction to the concept, vapour pressure of liquids, Clausius – Clapeyron equation (No derivation) ▪ The Solid State: Crystalline solids, Polymorphism, Solvates, Amorphous solids, melting point and heat of fusion, melting point and intermolecular forces ▪ The Liquid Crystalline state: Structure, properties and significance of liquid crystals ▪ The Supercritical fluid state 	12
2.	<p>Physical properties of Drug Molecules</p> <ul style="list-style-type: none"> ▪ Additive, constitutive and colligative properties with examples ▪ Dipole moment, Dielectric constant and significance to pharmacy, concept of polarizability, molar polarization ▪ Refractive index and molar refraction, Principle and working of Abbe's refractometer, Application of molar refraction to determine structures ▪ Optical rotation, Specific rotation and its applications 	6
3.	<p>Solutions of Non-electrolytes</p> <ul style="list-style-type: none"> ▪ Units for expressing concentration ▪ Ideal and real solutions, Raoult's law, deviation from Raoult's law Methods to measure vapour pressure lowering and its application (problems) ▪ Distillation of binary mixtures and azeotropic distillation. Concept of steam distillation ▪ Elevation of boiling point and determination of molecular weight (problems). Depression of freezing point and determination of molecular weight (problems) ▪ Osmotic pressure: Concept, methods to determine osmotic pressure, molecular weight determination from osmotic pressure. 	12
4.	<p>Thermodynamics</p> <ul style="list-style-type: none"> ▪ Definition, Applications and Limitations ▪ Homogenous and Heterogenous systems, Types of systems – Open, Closed, Adiabatic, Isothermal ▪ Types of properties – Intensive and Extensive property ▪ Equilibrium and Non-equilibrium states, ▪ Types of processes - Isothermal, Adiabatic, Isobaric, Isochoric, Cyclic process, Reversible and irreversible process ▪ First law of thermodynamics ▪ Enthalpy, heat capacity, $C_p - C_v = R$ (Derivation) ▪ Work of expansion against constant pressure, ▪ Isothermal work of expansion against variable pressure ▪ Thermochemistry: ▪ Heat of reaction, Heat of formation, Heat of combustion, Heat of solution-Differential and Integral heat of solution, ▪ Bond energy – Calculation of Heat of reaction from bond energy data, Kirchoff's equation, Hess's law of constant heat summation ▪ Second law of thermodynamics 	12

	<ul style="list-style-type: none"> ▪ Carnot theorem, Efficiency of heat engine, Entropy ▪ Third law of thermodynamics ▪ Free energy and its applications: Pressure and Temperature coefficients of free energy, Maximum net work, Criteria for equilibrium, ▪ Chemical potential (only definition), ▪ Gibbs Helmholtz equation, ▪ ClausiusClapeyron equation (No derivation), ▪ van't Hoff equation (No derivation) ▪ Problems 	
5.	<p>Properties of solutions of Electrolytes</p> <ul style="list-style-type: none"> ▪ Electrolysis ▪ Faradays laws of electrolysis ▪ Electrolytic conductance, Specific conductance, Equivalent conductance, Molecular conductance ▪ Transport number ▪ Measurement of conductance ▪ Variation of equivalent conductance with dilution ▪ Arrhenius theory of electrolytic dissociation- colligative properties activity coefficient, coefficient expressing colligative properties ▪ Theory of strong electrolytes ▪ Degree of dissociation ▪ Kohlrausch's law of independent migration of ions ▪ Applications of conductivity measurements - Conductometric titrations and solubility of a sparingly soluble salt ▪ Equivalent conductance of a weak electrolyte at infinite dilution ▪ Degree of dissociation of a weak electrolyte ▪ Problems 	6
	Total	48

Books

1. P.J. Sinko, 'Martin's Physical Pharmacy and Pharmaceutical Sciences' Fifth edition, Lippincott Williams and Wilkins, Indian Edition distributed by B.I.Publications Pvt Ltd, 2006.
2. Bahl and Tuli, 'Essentials of Physical Chemistry' S.Chand and Company Ltd. Ramnagar, New Delhi-110055.
3. U.B.Hadkar, 'A Textbook of Physical Pharmacy', 9th Edition, NiraliPrakashan, Pune 2008.
4. U.B.Hadkar, T.N.Vasudevan and K.S. Laddha, 'Practical Physical Pharmacy', Yucca Publishing House, Dombivali, 1994
5. Findlay, 'Practical Physical Pharmacy' revised and edited by J.A. Kitchener, 8th Ed. Longmans, Green and company Ltd. 1967.

Sr.no.	Details	Hours
1.	Brief introduction to human body and organization of human body	1
2.	Structural and functional characteristics of following tissues 1) Epithelial 2) Connective 3) Nervous 4) Muscle	2
3.	Detailed structure of cell membrane and trans-membrane movement of substances	2
4.	Components and functions of lymphatic system • Lymphatic organs and tissues • Organization of lymph vessels • Formation and flow of lymph	3
6.	Pathophysiology of following diseases • AIDS • Autoimmune diseases (Rheumatoid arthritis, Grave's disease, Myasthenia Gravis, Rheumatic fever) • Hypersensitivity and types of hypersensitivity reactions.	2
7.	Haematology • Composition of blood • Functions of blood elements • Erythropoiesis and life cycle of RBC. • Synthesis of Haemoglobin • Leucopoiesis • Immunity: Basics and Types • Coagulation of blood • Blood groups	8
8.	Pathophysiology of following diseases • Anaemias – Types of anaemias • Polycythemia : Physiological and polycythemiavera • Leucopenia • Leukocytosis • Thrombocytopenia • Leukemia	3
9.	Basic mechanism involved in the process of inflammation and repair. • Alteration in vascular permeability and blood flow. • Migration of WBC • Acute and chronic inflammation • Brief outline of the process of repair.	5
9.	Structure and properties of following muscles • Cardiac muscles • Smooth muscles • Skeletal muscles • Neuromuscular transmission and contraction of skeletal muscle • Energy metabolism in the muscle • Types of muscle contractions • Muscle tone	9
Total		35

REFERENCES FOR ANATOMY, PHYSIOLOGY & PATHOPHYSIOLOGY

Latest editions of the following books can be referred

1. Ross & Wilson, Anatomy & Physiology in Health & Illness by Anne Waugh and Allison Grant, Published by Churchill Livingstone
2. Gerard J. Tortora & Bryan Derrickson, Principals of Anatomy & Physiology, Published by John Wiley and Sons, Inc.
3. A. C. Guyton & J. E. Hall, Textbook of Medical Physiology, Published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, USA.
4. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander
Published by Churchill Livingstone
5. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques
6. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India
8. Harsh Mohan, Text book of Pathology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

Objectives

1	To study the importance of environmental science and environmental studies
2	To know the importance of key to the future of mankind.
3	To study continuing problems of pollution, loss of forest, solid waste disposal, degradation of environment, issues like economic productivity and national security
4	Study of Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues.

Sr. No.	Details	Hrs
1	Multidisciplinary Nature of Environmental Studies: <ul style="list-style-type: none"> • Scope and Importance • Need for Public Awareness • Depleting Nature of Environmental resources such as Soil, Water, Minerals, and Forests. • Global Environmental Crisis related to Population, Water, Sanitation and Land. • Ecosystem: Concept, Classification, Structure of Ecosystem, overview of Food chain, Food web and Ecological Pyramid 	5
2	Sustainable Development <ul style="list-style-type: none"> • Concept of sustainable development • Social, Economical and Environmental aspect of sustainable development. • Control Measures: 3R (Reuse, Recovery, Recycle), Appropriate Technology, Environmental education, Resource utilization as per the carrying capacity. 	5
3	Environmental Pollution: <ul style="list-style-type: none"> • Air Pollution: Sources, Effects of air pollution with respect to Global Warming, Ozone layer Depletion, Acid Rain, Photochemical smog, Two Control Measures, Bag house Filter, Venturi scrubber. Case Study: Bhopal Gas Tragedy • Water Pollution: Sources and Treatment, Concept of waste waters - Domestic & Industrial and treatment. Case Study: Minamata Disease. • Land Pollution: Solid waste, Solid waste Management by Land filling, Composting. • Noise Pollution; Sources and Effects • E-Pollution: Sources and Effects. 	10
4	Environmental Legislation: <ul style="list-style-type: none"> • Overview • Ministry of Environment and Forests (MoE&F). Organizational structure of MoE&F. • Functions and powers of Central Control Pollution Board. • Functions and powers of State Control Pollution Board. • Environmental Clearance, Consent and Authorization Mechanism. • Environmental Protection Act • Any two case studies pertaining to Environmental Legislation. 	5
5	Renewable sources of Energy: <ul style="list-style-type: none"> • Limitations of conventional sources of Energy. • Various renewable energy sources. • Solar Energy: Principle, Working of Flat plate collector & Photovoltaic cell. 	5

	<ul style="list-style-type: none"> • Wind Energy: Principle, Wind Turbines. • Hydel Energy: Principle, Hydropower generation. • Geothermal Energy: Introduction, Steam Power Plant 	
6	Environment and Technology <ul style="list-style-type: none"> • Role of Technology in Environment and health • Concept of Green Buildings, Indoor air pollution • Carbon Credit: Introduction, General concept. • Disaster Management: Two Events: Tsunami, Earthquakes, Techniques of Disaster Management • Case Study: Earthquake in Japan 	5
	Total	35

Books

1. Hazardous Waste Incineration, Brunner R.C., McGraw Hill Inc
2. Global Biodiversity Assessment, Heywood V.H and Waston R.T., Cambridge Univ. Press
3. Environmental Science systems & Solutions, Mckinney M.L. and School R.M., Web enhanced edition.
4. Fundamentals of Ecology, Odum E.P., W.B. Saunders Co. USA.
5. Textbook of Environmental studies by ErachBharucha, University Press.
6. Environmental Studies by R. Rajagopalan, Oxford University Press.
7. Essentials of Environmental Studies by Kurian Joseph & Nagendran, Pearson Education
8. Renewable Energy by Godfrey Boyle, Oxford Publications.
9. Perspective Of Environmental Studies, by Kaushik and Kaushik, New Age International
10. Environmental Studies by. AnanditaBasak, Pearson Education
11. Textbook of Environmental Studies by Dave and Katewa, Cengage Learning
12. Environmental Studies by Benny Joseph, Tata McGraw Hill

Communication Skills**3 hrs/week**

S.No.	(Topic)	Hours
1.0	Remedial study of grammar, Review of grammar and vocabulary. Effective use of dictionary, Phonetics	10
1.1	Conditionals/Tenses, relative clauses, subject–verb agreement, passive voice	
2.0	Written Communication	7
2.1	Discuss a topic of general interest, but related to science in about 300 words. (Analyze, comment, argue, reflect, persuade, etc.) (can also be used for oral presentations by the students, followed by discussion).	
3.0	Oral Communication	5
3.1	Consulting a dictionary for correct pronunciation (familiarity with phonetics symbols and stress-marks only)	
3.2	(ii) Dialogue	
4.0	Scientific Writing	8
4.1	Writing a Scientific Report on a project undertaken or an experiment conducted (theory + practice)	
5.0	Soft Skills	
5.1	Gestures/ postures – Body language, gesture, posture.	2
5.2	Group discussion – Giving up of PREP, REP Technique, how body language during group discussion.	2
5.3	Presentation skills: (i) How to make a Power Point presentation (ii) Body language during presentation; Resume writing: Cover letter, Career objectives, Resume writing (tailor made)	4
5.4	Mock Interview: Each student to face an interview and to demonstrate the above taught skills.	2
	Total	40

Books

1. English Grammar, Beaumont Digty and Colin Granger, An International reference practice book, London, Heinmann.
2. The right word at the right time A guide to the English language and how to use it, Elison John, The Reader's Digest
3. Study writing, Hamplyons Liz & Ben Heasley, Cambridge University Press.
4. Basic Business Communication, LesikerRaymond.V and Maire E Hatley, New York, Tata McGraw Hill

Physical Pharmacy Laboratory -I

4 hrs/week

1. Determination of refractive index, molar refraction. Using water as a reference standard, to determine refractive index of two organic solvents and their mixtures and to determine composition of unknown. To determine RI of a solid (KCl) from two concentrations of solid solutions.
2. Viscosity: To determine the composition of the unknown binary mixture.
3. Polarimetry: Different concentrations of sugar, determination of unknown concentration and specific rotation.
4. Determination of molecular weight by Rast camphor method.
5. Determination of heat of solution of benzoic acid.
6. Partition coefficient of benzoic acid between benzene and water.

Demonstration

Landsberger method.

Books

U.B. Hadkar, T.N.Vasudevan, K.S.Laddha, 'Practical Physical Pharmacy', Yucca Publishing House, Dombivali

Anatomy, Physiology and Pathophysiology – Lab.I

(4 hr./week)

Sr.no.	Details	Hours
1.	Hematology 1. Red Blood Cell (RBC) Count 2. Total Leukocyte Count 3. Differential Leukocyte (WBC) Count 4. Hemoglobin content of blood 5. Bleeding / Clotting Time 6. Blood groups 7. Erythrocyte Sedimentation Rate (ESR) / Hematocrit (Demonstration)	
2.	Study of human skeleton	
3.	Microscopic study of permanent slides Tissues : - Columnar, Cuboidal, Squamous, Ciliated Epithelium - Cardiac / Skeletal / Smooth muscle - Ovary, Testis, Liver, Pancreas, Thyroid, Tongue, Stomach, Intestine, Kidney, Lung, Spinal Cord, Cerebrum, Artery, Vein	
4.	Measurement of blood pressure	
5.	Tutorial / Discussion on some common investigational procedures used in diagnosis of diseases with the help of charts / slides Name and Importance of following tests : 1. Electroencephalogram (EEG) in diagnosis of Epilepsy 2. Use of Positron emission tomography (PET) Computed tomography scan (CT Scan), Single photon emission computed tomography (SPECT) in diagnosis. 3. Use of flow cytometry as a diagnostic tool. 4. Electrocardiogram (ECG) in diagnosis of cardiac arrhythmia 5. Liver Function Tests – - Serum Bilirubin, - serum glutamate oxaloacetate transaminase (SGOT) - serum glutamate pyruvate transaminase (SGPT) - Urine Bilirubin, - Urine Urobilinogen, 6. Kidney Function Tests – Serum Creatinine, – Serum Urea, Uric Acid – Blood Urea Nitrogen (BUN) 7. Blood Glucose 8. Serum Cholesterol / Triglycerides 9. Serum Alkaline phosphatase (ALT) 10. Serum Acid phosphatase (APT) 11. Serum Lipase 12. Serum Amylase 13. Serum Calcium 14. Serum lactate dehydrogenase (LDH) 15. Thyroid Function Tests – T ₃ , T ₄ 16. Prothrombin time (PT) 17. Partial thromboplastin time (PTT) 18. Activated partial thromboplastin time (APTT) 19. Diagnostic tests for infectious diseases like - Malaria - Tuberculosis - Dengue - H1N1 swine flu - Typhoid	

Books

1. McNaught&Callander, Illustrated Physiology by B. R. Mackenna& R. Callander, Published by by Churchill Livingstone
2. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques, Published by Elseviers Publications
3. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India
4. C. L. Ghai, Text book of Practical Physiology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

Computer Lab**4 hrs/week**

Sr. No.	Topic	Hours per week
1	Introduction to Computers.	2
2	History of Computer development and respective generation: Abacus, Napier's Bones, Slide rule, Pascal's Calculator. General use of computers in everyday life. Computer Classification: Mainframe, Mini and Micro Computers, comparison of Analog & Digital Computers, Hardware and Software. Calculator and Computer	3
3.1	Operating Systems: Introduction to types of operating systems, UNIX, MS-DOS, etc. RAM, ROM, Virtual Memory etc	3
3.2	Students should learn on Windows and Linux OS based systems use of basic Windows and Linux commands	3
4.1	Type of Languages: Conventional languages; their advantages, limitations; C, Pascal, FORTRAN, Programming of these languages	4
4.2	Students should be taught some programming in BASIC and C	4
5.1	Introduction to Computer Networks: Architecture of seven layers of communications	3
5.2	Students should be taken to a computer lab with has a network and shown the basic connections and operation of different types of networks.	2
6.1	Introduction to Data Structure: Like Queues, list, trees, Binary trees algorithms, Flow chart, Structured Systems, Analysis and development, Ingress-SQL, Gateways etc. Statistics, methodologies.	9
6.2	Basic Language: Constants and Variables: Character set, constants, variables, Naming the variables getting data into memory, LET, INPUT, READ. DATA, Print Statement Expressions: Arithmetic expression, Hierarchy of operations, Rules of Arithmetic, Evaluation of expressions, Relational expressions, Logical operations, Library functions Printer Control: Comma and semicolon control, the TAB function, PRINT, LPRINT Functions and Subroutines: User defined functions, subroutines, subscripted variables The above concepts should be introduced practically to students with examples, while working on a computer system.	
7	Computer Graphics:	2
8	Computer applications in pharmaceutical area and in clinical studies	3

Books

1. Basic Electronics and Computer Applications, Rajiv Khanna, New Age International Publishers
2. Fundamentals of Computers, V. Rajaraman, Prentice Hall of India Pvt. Ltd.
3. Schaums Outline Series, Theory and Problems of Introduction to Computer Science, Francis Scheid, McGraw Hill Book Co.

Detailed Syllabus for

SEMESTER-II

Pharmaceutical Chemistry I

3 hours / week

An outline of methods of preparation, uses, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any, of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia.		
Sr. No.	Topic	Hours per week
1	Acids and Bases: Buffers, Water	3
2	Gastrointestinal Agents : Acidifying agents, Antacids, Protectives and Adsorbents, Cathartics	4
3	Major Intra-and Extra-cellular Electrolytes: Physiological ions. Electrolytes used for replacement therapy, acid-base balance and combination therapy	4
4	Essential and Trace Elements: Transition elements and their compounds of pharmaceutical importance : Iron and haematinics, mineral supplements	4
5	Cationic and anionic components of inorganic drugs useful for systemic effects	3
6	Topical Agents: Protectives, Astringents and Anti-infectives	4
7	Gases and Vapours : Oxygen, Anesthetics and Respiratory stimulants	3
8	Dental Products: Dentifrice, Anti-caries agents	3
9	Complexing and chelating agents used in therapy	3
10	Miscellaneous Agents: Sclerosing agents, expectorants, emetics, poisons and antidotes, sedatives etc. Pharmaceutical Aids Used in Pharmaceutical Industry. Anti-oxidants, preservatives, filter aids, adsorbents, diluents, excipients, suspending agents, colorants etc.	5
11	Inorganic Radio Pharmaceuticals: Nuclear radio pharmaceuticals, Reactions, Nomenclature, Methods of obtaining their standards and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions.	5
	Total	41

Books

1. Inorganic medicinal and pharmaceutical chemistry, J. H. Block, E. B. Roche, T. O. Soine, and C. O. Wilson. Lea &Febiger, Philadelphia, PA.
2. Modern Inorganic Pharmaceutical Chemistry, Clarence A. Discher. Wiley, New York.
3. Remington: the science and practice of pharmacy, Beringer, P. Lippincott Williams & Wilkins.
4. Inorganic Pharmaceutical Chemistry, Bothara, K. G., NiraliPrakashan.
5. Inorganic Pharmaceutical Chemistry, A. S. Dhake, H. P. Tipnis, Career Publication.

Biochemistry I

4 hrs/week

S. No.	Topic	Hrs/Week
1	<p>Introduction to carbohydrates, proteins, lipids</p> <p>Introduction to common monosaccharides ranging from trioses to hexoses</p> <p>Introduction to common disaccharides sucrose, cellobiose, maltose, lactose</p> <p>Introduction to common polysaccharides starch and glycogen</p> <p>Introduction to amino acids, their classification, three letter and one letter codes</p> <p>Introduction to hierarchy of protein structures</p> <p>Introduction to common saturated and unsaturated fatty acids</p> <p>Introduction to triacyl glycerol, phospholipids, sphingolipids</p> <p>Introduction to the concept of glycoproteins, proteoglycans, lipopolysaccharides, glycolipids, lipoproteins, proteolipids with examples.</p>	18
2	<p>Enzyme Kinetics</p> <p>Introduction to the factors affecting enzyme activity, concept of initial velocity, derivation of enzyme kinetic equation based on steady state assumptions, direct, Lineweaver Burk and EadieHofstee plots of enzyme kinetic data. Modulation of enzyme activity by reversible and irreversible inhibitors. Effects of these inhibitors on enzyme kinetic parameters and the detection of type of inhibitors through Lineweaver Burke and EadieHofstee plots. Introduction to the nomenclature of enzymes and names of enzymes that are important drug targets/have diagnostic value and the reactions they catalyze (structures included) (Thymidylate synthase, DHFR, ACE, Renin, HMGCoA reductase, cyclooxygenase, MAO, COMT, 14-alpha demethylase, aromatase, squalene epoxidase, DNA polymerase, Reverse transcriptase, protease, carbonic anhydrase, proton pump ATPase, acetylcholinesterase, telomerase, SGOT, SGPT, LDH, HIV protease, HIV reverse transcriptase, DNA polymerase, cell wall synthesis enzymes.). Examples of drugs modulating enzyme activity (inhibitors) that are used as drugs with emphasis on the inhibition mechanism.</p> <p>Endogenous regulation of enzyme activity (compartmentalization, positive and negative feedback, cascade systems (phospholipase based cascade as an example), repression/induction through repressor/promoter elements (the lac operon), post-translation modification to control enzyme activity (protein kinases).</p>	14
3	<p>Vitamins</p> <p>Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance. Biochemical roles of all the vitamins with details of the mechanisms of their functions. (riboflavin, thiamine, pyridoxal, nicotinamide, biotin, folic acid, ascorbic acid, pantothenic acid, cyanocobalamin, inositol, vitamins A, D, E, K)</p>	14
4	<p>Biochemical Energetics</p> <p>Introduction to the concept of free energy, standard free energy, transformed free energy. Thermodynamically favorable or unfavorable reactions. Spontaneous versus thermodynamically favorable reactions. Oxidations as a source of energy in biological systems. ATP, NADH and FADH₂ as energy carriers. Introduction</p>	6

	to the concepts of anabolism and catabolism. Convergence of metabolic pathways and divergence of anabolic pathways	
5	Digestion Digestion of food and absorption of food (carbohydrates, lipids and carbohydrates). Fate of absorbed nutrients and relationship with regard to immediate use, storage, release and interconversion. Role of liver, kidney, muscle, adipose tissue, brain and special features of rbc's.	3
	Total	55

Books

1. Lehninger, Principles of Biochemistry, Replika Press.
2. Stryer L, Biochemistry, W. H. Freeman & Co.
3. Harper's Biochemistry, Appleton and Lange, USA.
4. Conn E, Stumpf PK, Brueing G and Doi Roy H, Outlines of Biochemistry, Wiley Liss, USA.
5. Wilson and Gisvolds Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams and Wilkins, USA
6. Foye's Principles of Medicinal Chemistry, Lippincott Williams and Wilkins, USA.

Pharmaceutics I

4 hrs/week

Sr. No.	Topic	Hours
1	a) Historical back ground of the Profession of Pharmacy in India in brief b) Brief overview of status of Pharmaceutical Industry in India	1
2	Introduction to Pharmacopoeias: Development of Indian Pharmacopoeia and other compendia including B.P,U.S.P-NF, Ph. Eur, International Pharmacopoeia	2
3	a) Definition of drug and concept of dosage form & formulation-Scope of Pharmaceutics. b) Introduction to route of administration and physiological considerations c) Classification of dosage form and their applications	4
4	Drug Administration: Introduction to absorption, distribution and fate of drug. Introduction to Bioavailability and Biopharmaceutics. Concept of drug efficiency and dose response.	3
5	Pharmaceutical calculations: Reduction and enlargement of formulae, formula by weight(w/v, w/w, v/v), in parts	2
6	Introduction to Good Manufacturing Practices and Quality Assurance	2
7	Introduction to alternate systems of medicine: Ayurveda, Homeopathy, Unnani and Siddha	1
8	Rheology: definition and concept, types of flow, and measurement of flow properties	3
9	Concept of Monophasic liquid dosage forms:-Preformulation and Formulation Aspects: a) Organoleptic properties, Purity, Solubility and solubilisation technique, Dissociation and Partition coefficient, Polymorphism, Stability and Interaction with excipients. b) General consideration of liquid dosage form design & manufacture: Selection of vehicle, stabilizing and organoleptic additives, large scale manufacturing including unit operations like liquid mixing, filtration and clarification-concept and equipments, filling operations, packaging and quality control tests. c) Brief coverage of various monophasic liquid dosage forms: Solutions, Aromatic waters, Syrups, Elixirs, Linctuses, Nasal and Ear drops, Paints, Sprays, Lotions & Liniments. d) Packaging of Pharmaceuticals-General concepts: Package and its components, containers and types of containers, closures and types of closures, packaging material- glass, plastic, metal, rubber and paper, quality control tests.	15
10	Micromeritics& Powder Technology a) Fundamental and derived properties of powders and their measurement b) Size Reduction c) Size separation d) Formulation, Large scale manufacturing (including powder mixing), Packaging and Quality Control of powders. e) Brief coverage of following powders : Dusting powders, Oral Rehydration	10

	powders, Dry Syrup formulations	
11	Complexation : Classification of complexes, Pharmaceutical applications of complexation and Analysis of Complexes	2
12	Diffusion & Dissolution a) Fick's laws and steady state diffusion, measurement of diffusion b) Dissolution rate, Noyes – Whitney equation, Factors affecting dissolution, Intrinsic Dissolution Rate, Hixson – Crowell Law	3
	TOTAL	48

Books

2. Lachman Leon, Lieberman Herbert A, Kanig Joseph L., "The Theory and Practice of Industrial Pharmacy, Varghese Publishing House, Mumbai.
3. Lieberman Herbert A., Rieger, "Pharmaceutical Dosage Forms – Dispersed Systems", Volume 1/2/3, Marcel Dekker Inc, New York.
4. Remington, The Science and Practice of Pharmacy, Vol I & II, B.L. Publications Pvt. Ltd.
5. Martin A., Physical Pharmacy, 4th Edition, Lea &Febiger, Philadelphia, London.
6. M.E. Aulton, Ed, Pharmaceutics-The Science of Dosage Form Design, Churchill Livingstone Medical Divn. Of Longman Group, UK Ltd.
7. Rawlings, Bentley's Text Book of Pharmaceutics, BailliereTindall, London.
8. AtmaramPawar, "Introduction to Pharmaceutics", Career Publications, Nashik.

Sr. No	TOPICS	HOURS
1.	Ionic equilibria and buffers <ul style="list-style-type: none"> ▪ Arrhenius Theory, Bronsted – Lowry Theory, Lewis Electronic Theory ▪ Sorensens pH scale, calculation of pH, effect of pH on ionization of weak acids and bases, calculation of fraction unionized ▪ Buffers in pharmaceutical and biological systems, concept of tonicity, isotonic buffer solutions, application of buffers and concept of tonicity in pharmacy ▪ Problems 	5
2.	Solubility and distribution phenomenon <ul style="list-style-type: none"> ▪ Solvent – solute interactions ▪ Solubility of gases in liquids, Henry's law and applications ▪ Solubility of liquids in liquids, miscible and partially miscible liquids ▪ Phase equilibria and Phase rule (one, two and three component systems) ▪ Solubility of solids in liquids, ideal and non ideal solutions, solubility parameters and prediction of solubility in regular solutions ▪ Partition phenomenon and partitioning of weak electrolytes and applications 	6
3.	Chemical kinetics <ul style="list-style-type: none"> ▪ Molecularity, order of a reaction and specific rate constant ▪ Zero order, First order and Second order reaction (problems) ▪ Methods to determine order of a reaction ▪ Energy of activation, Arrhenius equation and application ▪ Collision theory and transition state theory ▪ Accelerated stability studies – concepts and application ▪ Problems 	8
4.	Interfacial phenomena <ul style="list-style-type: none"> ▪ Surface tension, Interfacial tension, Surface free energy, Pressure differences across curved interfaces, Measurement of surface and interfacial tension-capillary rise method ▪ Drop weight method, Du Nuoytensimeter method, Spreading of liquids, Spreading coefficient, Hydrophilic-Lipophilic balance ▪ Types of monolayers at liquid interfaces, Soluble monolayers, Gibbs adsorption equation (No derivation), Insoluble monolayers and film balance, Adsorption at solid interfaces, Adsorption isotherms, Freundlich adsorption isotherm, Langmuir adsorption isotherm, Wetting angle and contact angle ▪ Problems 	8
5.	Electromotive force <ul style="list-style-type: none"> ▪ Electrochemical cell ▪ Types of electrodes ▪ Nernst equation and cell emf ▪ pH meter and measurement of pH ▪ Ion sensitive electrodes ▪ Oxidation reduction indicators ▪ Concentration cells 	4
6.	Colloids <ul style="list-style-type: none"> ▪ Classification, ▪ Preparation, colloid properties such as optical, kinetic and electrical ▪ Gold number ▪ Protective colloid ▪ Schultz Hardy rule 	5

	TOTAL	36
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Books

1. P.J. Sinko, 'Martin's Physical Pharmacy and Pharmaceutical Sciences', Lippincott Williams and Wilkins, Indian Edition distributed by B.I.Publications Pvt. Ltd.
2. Bahl and Tuli, 'Essentials of Physical Chemistry' S.Chand and Company Ltd. Ramnagar, New Delhi.
3. U.B.Hadkar, 'A Textbook of Physical Pharmacy', NiraliPrakashan, Pune.
4. U. B.Hadkar, T.N.Vasudevan and K.S.Laddha, 'Practical Physical Pharmacy', Yucca Publishing House, Dombivali.
5. A. Findlay, 'Practical Physical Pharmacy' revised and edited by J.A. Kitchener, Longmans, Green and company Ltd.

Anatomy, Physiology and Pathophysiology – II**4 hrs/week**

Sr.no.	Details	Hours
1.	Principles of cell injury and adaptation <ul style="list-style-type: none">• Causes of cell injury• Pathogenesis and morphology of cell injury.• Cellular adaptation• Cellular atrophy and hypertrophy.	3
2.	Disturbances of growth of cells <ul style="list-style-type: none">• Differences between benign and malignant tumor• Classification of malignant tumors• Etiology and pathogenesis of cancer- Invasion, metastasis and patterns of spread of cancer.	3
3.	Biological effects of radiation <ul style="list-style-type: none">• Nuclear radiation• U.V. radiation.• X-ray and other radiations.	2
4.	Anatomy and Physiology of Respiratory System <ul style="list-style-type: none">• Exchange of gases• External and internal respiration• Mechanism and regulation of respiration• Lung volumes and lung capacities	4
5.	Pathophysiology of following diseases <ul style="list-style-type: none">• Asthma• Pneumonia• Bronchitis• Emphysema• Respiratory Acidosis and Alkosis	2
6.	Endocrine System Anatomy and physiology of following endocrine glands : <ul style="list-style-type: none">• Pituitary• Thyroid & Parathyroid• Adrenal• Pancreas	9
7.	Pathophysiology of hypo and hyper secretion of above endocrine glands and related diseases	4
8.	Nervous System Neurons, Neurotransmitter and neurotransmission Anatomy and physiology of : <ul style="list-style-type: none">• Central Nervous System (CNS)<ul style="list-style-type: none">- Autonomic Nervous System (ANS) <ul style="list-style-type: none">- Cranial and spinal nerves- Sensory and Motor pathways	9
9.	Pathophysiology of following diseases <ul style="list-style-type: none">• Epilepsy• Parkinsonism• Alzheimer's Disease• Cerebral Hypoxia• Stroke (Cerebrovascular disease)• Anxiety & Depression• Mania and Schizophrenia	3

10.	Structure and Function of following sensory organs <ul style="list-style-type: none"> • Eye • Ear • Tongue • Nose • Skin 	6
	Total	45

Books

Latest editions of the following books can be referred

1. Ross & Wilson, Anatomy & Physiology in Health & Illness by Anne Waugh and Allison Grant, Published by Churchill Livingstone
2. Gerard J. Tortora& Bryan Derrickson, Principals of Anatomy & Physiology, Published by John Wiley and Sons, Inc.
3. A. C. Guyton & J. E. Hall, Textbook of Medical Physiology, Published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, USA.
4. McNaught&Callander, Illustrated Physiology by B. R. Mackenna& R. Callander, Published by Churchill Livingstone
5. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques
6. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India
8. Harsh Mohan, Text book of Pathology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

Pharmaceutical Chemistry Lab. I

4 hours / week

1. The background and systematic qualitative analysis of inorganic mixtures of up to four radicals.
2. Six mixtures to be analyzed, preferably by semi-micro methods.
3. Identification tests for pharmacopoeial inorganic pharmaceuticals and qualitative tests for cations and anions should be covered.

Pharmaceutics Lab. - I

4 hrs./week

List of experiments

Aromatic waters

Chloroform water I.P.'66.

Concentrated Dill water I.P.'66.

Concentrated Anise water B.P.C. '73.

Gripe water.

Syrups

Syrup I.P.'66

Artificial syrup

Cough syrup-Codeine phosphate syrup B.P.C.

Linctus

Simple linctus B.P.C.

Elixirs

Piperazine citrate elixir B.P.C.

Ear drops

Chloramphenicol ear drops B.P.C.

Nasal drops

Ephedrine sulphate nasal drops B.P.C.

Glycerites

Glycerine of starch I.P.'55

Glycerine of boric acid I.P.'55

Glycerine of tannic acid I.P.'66

Solutions

Aqueous iodine solution I.P.'66

Paracetamol solubilised paediatric drops

Cresol with soap solution I.P.

Magnesium citrate oral solution NF XIV.

Chlorinated soda solution, surgical B.P.C.

Iodine paint compound B.P. C.'68.

Powders

Oral rehydration salt (ORS)

Evaluation of a) liquids for specific gravity and viscosity and b) powders for bulk density, flow rate and angle of repose

Physical Pharmacy Laboratory. II

4 hrs/week

Kinetics:

1. Relative strength: Hydrochloric acid/Sulphuric acid
2. **Second order reaction (saponification)**
3. Determination of order by equal fraction method (first order reaction)
4. Ostwald's isolation method to determine order

Non-kinetics

1. Surface tension – 1. Determination of surface tension of water, toluene, n – hexane, parachor and critical solution temperature determination. 2. **Determination of CMC**
2. Phenol water – Critical solution temperature and composition
3. Determination of molecular weight of a polymer from solution viscosity
4. **Adsorption – Surface area determination**

Demonstrations

1. HLB of a surfactant
2. **Potentiometry – Titration and Determination of buffer capacity**

Books

1. U.B. Hadkar, T.N.Vasudevan, K.S.Laddha, 'Practical Physical Pharmacy', Yucca Publishing House, Dombivali.