

SYLLABUS COPY FOR FIRST YEAR B. PHARM

SEMESTER – I

GENERAL CHEMISTRY

3 hrs/ week

S. No.	Topic	Hours
1.	Kinetics and Reaction Mechanism. Kinetic and thermodynamic product control, principle of microscopic reversibility, isotope effect on kinetic effect of reaction medium on the rate of the reaction	5
2.	Transition state theory. General theory of the transition state, the reaction coordinate, rate determining transition state, Curtin principle.	4
3.	Acid-Base Catalysis. General mechanisms of acid and base catalyzed reactions, rates of acid and base catalyzed reactions, Bronsted catalysis correlation of reaction rates with acidity functions.	5
4.	Charge-Transfer complexes and reactions. Definition of Complex, Charge-transfer transition, donors and acceptors, ground state charge transfer contribution.	5
5	Co-ordination Chemistry, Nomenclature, Theories of bonding in coordinate complexes, Stability of complexes and chelation.	5
6.	Brief introduction to the inorganic medicinal compounds: antacid (Magnesium trisilicate and aluminium hydroxide), antimicrobial (hydrogen peroxide and povidone-iodine), astringent (Zinc oxide) and Pharmaceutical aid (talc and barium sulphate)	6

Reference Books:

1. Isrie V. Anslyn and Dennis A. Dougherty, Modern Physical Organic Chemistry, John Wiley, 2006
2. Neil Isaacs, Physical Organic Chemistry, 2nd Edition, Pearson Education 1995
3. Louis P. Hanunett, Physical Organic Chemistry, McGraw Hill Education, 2nd Rev Edition, 1970
4. Edward M. Kosower, An Introduction to Physical Organic Chemistry, John Wiley and Sons, Inc, 1968
5. J.D Lee, A New Concise Inorganic Chemistry, 3rd edition Van Nostrand Reinhold Company Ltd.
6. John H. and Edward B., Inorganic Medicinal and Pharmaceutical Chemistry Varghese Publishing House, 1986.

ORGANIC CHEMISTRY –I**3hrs/ week**

S. No.	Topic	Hours
1.	Structure and Properties of Organic Compounds : Types of bonds in organic compounds, hybridization of orbital's, formation of the same and bonds formed, bond length, bond angles, bond energies, bond polarization	4
2.	Inductive effects, concepts of H-bonding hyperconjugation resonance, Van der Waal's interaction, inclusion phenomena, Acidity and basicity of molecules	4
3.	Concept of Electrophiles and Nucleophiles Calculations for determining empirical and molecular formulae	3
4.	Mechanism and elementary stereochemistry discussion of SN1, SN2 and Sn1 mechanisms, En, E2 and E Discussion of substitution vs. elimination	7
5.	Discussion of the following classes of compounds in brief, with regard to IUPAC nomenclature, sources, methods of preparation, Physical properties and general reactions of hydrocarbons (alkanes, alkenes, alkynes)	5
6.	Addition reaction of alkenes: Markonikov, Anti-Markonikov rules, Hydroboration, Oxymercuration-Demercuration, Ozonolysis, addition of KMnO4 and Addition reactions across conjugated.	6
7.	Aliphatic halogen compounds	2

Reference Books:

1. Robert T. Morrison and Robert N. Boyd, Organic Chemistry, 6th Edition, Pearson Education Pvt. Ltd., 2005
2. Peter Sykes, A Guide book to Mechanisms in organic Chemistry, 6th Edition, Pearson Education, 2007
3. H. Finar, Organic Chemistry, 5th Edition, Pearson Education, 2006
4. Stanley Pine, Organic Chemistry, 5th Edition, McGraw- Hill Companies, 2007
5. Francis Carrey, Organic Chemistry, 4th Edition, McGraw- Hill Companies, 2000

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY - I**3hrs/ week**

S. No.	Topic	Hours
1.	Brief Introduction to human body and organization of human body	1
2.	Structural and functional characteristics of following tissues <ul style="list-style-type: none"> • Epithelial • Connective • Nervous • Muscle 	2
3.	Detailed structure of cell membrane and trans-membrane movement of substances	2

4.	Components and functions of lymphatic system: <ul style="list-style-type: none"> • Lymphatic organs and tissues • Organization of Lymph vessels • Formation and flow of lymph 	2
5.	Definition and etiology of following diseases in detail <ul style="list-style-type: none"> • AIDS • Autoimmune disease (Rheumatoid arthritis /Grave's disease / Myasthenia Gravis / Rheumatic fever) • Hypersensitivity (Allergy) 	3
6.	Haematology <ul style="list-style-type: none"> • Composition of blood • Functions of blood elements • Erythropoiesis • Synthesis of Haemoglobin • Leucopoiesis • Coagulation of blood • Blood groups 	8
7.	Definition & etiology of following diseases , in detail <ul style="list-style-type: none"> • Anaemias Types of anaemias • Polyeythemia • Leucopenia • Leukocytosis • Thrombocytopenia • Leukemia 	4
8.	Structure and Properties of following muscles <ul style="list-style-type: none"> • Cardiac muscles • Smooth muscles • Skeletal muscles • Neuromuscular transmission and contraction of skeletal muscle • Energy metabolism in the muscle • Types of muscle contractions • Muscle tone 	7
9.	Definition and etiology of following diseases, in detail <ul style="list-style-type: none"> • Spasticity • Tetany 	1

Reference Books:

1. Anne Waugh and Alleon Grant Ross & Wilson's Anatomy & Physiology in Health & 9th Edition (2001) Churchill Livingstone, Edinbrigh, London, Newyork.
2. Gerald J. Tortora & Sandra Reynolds Grabowaski Principle of Anatomy & Physiology 10th Edition (2003) John Wiley & Sons Inc, Newyork, USA
3. Arthur C. Guyton & John Half. Textbook of Medical Physiology 10th Edition (2000) W.B. Saunders Company, Philadelph , Pensylvania, USA
4. B. R. Mackenna & R. Callander Illustrated Physiology 6th Edition 1997, Churchill Livingstone, Newyork Edinburgh, London
5. Praful b. Godkar Textbook of Medical Laboratory Technology 2nd Edition 2006 Bhalani Publishing House, Mumbai
6. V. G. Ranade, P. N. Joshi & Shalini Pradhan A Text book of Practical Physiology 3rd Edition 1982 P.V.G. Prakashan, Pune 30

PHYSICAL PHARMACY - I

(3hrs/ week)

S. No.	Topic	Hours
1.	<p>Gases:</p> <ul style="list-style-type: none"> • Ideal and Real Gases • Vanderwaals phenomenon • Critical phenomenon, critical constants and their determination • Liquefaction of gases – Linde’s process and Claude’s process • Application of Liquefaction in aerosols- introduction to the concept 	6
2.	<p>Physical Properties of Drug Molecules</p> <ul style="list-style-type: none"> • Additive, constructive and colligative properties with examples • Dipole moment, significance to pharmacy, concept of polarisability and molar • Polarisation • Refractive index and molar refraction and application of molar refraction to determine structures. • Viscosity: Definition, Concepts and applications -> Textbook of Pharmacy Subramanyam • Optical rotation and specific rotation and its application 	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, molecular weight determination from osmotic pressure 	9
4.	<p>Thermodynamics</p> <ul style="list-style-type: none"> • Definition, Application and Limitations • Systems –Homogenous, Heterogenous • 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 variable pressure <p>Thermo-chemistry</p> <ul style="list-style-type: none"> • 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 	9

	<p>data</p> <ul style="list-style-type: none"> • Kirehoffs equation, Hess's law of constant heat summation • Second law of thermodynamics • Carrot theorem • Efficiency of heat engine • Entropy • Third law of thermodynamics <p>Free Energy and its applications</p> <ul style="list-style-type: none"> • Pressure and Temperature coefficients of free energy • Maximum net work, Criteria for equilibrium • Chemical potential (only definition) • Gibbs Helmholtz equation • Clausius Clapereyon equation No derivation • Vant Holf equation No derivation 	
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 • Arrhenius theory of electrolytic dissociation-colligative properties, activity coefficient expressing collagative properties. • Theory of strong electrolytes • Degree of dissociation • Kohlrauschs law of independent migration of • Application 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 	9

Reference Books:

1. P. J. Sinko, "Martin's Physical Pharmacy and Pharmaceutical Science" 5th Edition, Lippincotts Willians and Wilkin, Indian Education Distributed by B. I. Publications Pvt. Ltd, 2006.
2. A. Findlay, "Practical Physical Pharmacy" revised and edited by J. A. Ktchener, 8th Edition. Lonmans, Green and Company Ltd 1967.
3. B. S. Bahl, A. Bahl, G. D. Tuli, "Essentials of Physical Chemistry" revised edition, S. Chand and company Ltd, New Delhi, 2006.
4. U. B. Hadkar "A Textbook of Physical Pharmacy", 6th Edition Nirali Prakashan, Pune 2006.
5. U. B. Hadkar, T. N. Vasudevan, K. S. Laddha "Practical Physical Pharmacy" Yucca Publishing House, Dombivali, 1994.

PHARMACEUTICS-I

3hrs/week

S. No.	Topic	Hours
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1.	Historical background to the profession of Pharmacy in India in brief. Brief overview of status of Pharmaceutical industry in India	2
2.	Introduction to Pharmacopoeias. Development of Indian Pharmacopoeia and other Compendia including B.P.,U.S.P., N.F., Ph Eur., International pharmacopoeia and B.P.C.	3
3.	Definition of Drug Concept of dosage form and formulation – Scope of Pharmaceutics Routes of administration and physiological considerations Classification of dosage forms and their applications.	3
4.	Drug administration: Introduction to bioavailability and biopharmaceutics. Concepts of drug efficiency and dose response. Introduction to Absorption, Distribution and fate of drug.	4
5.	Pharmaceutical Calculations: Reduction and enlargement of formula, Formula by weight (w/v, w/w, v /v); in parts.	3
6.	Introduction to Good Manufacturing Practices and Quality Assurance	2
7.	Introduction to galenicals. A method of preparation of extracts includes maceration, percolation, decoction, infusion and digestion.	3
8.	Introduction to alternate systems of medicine: Ayurveda, Homeopathy, Unnani and Siddha.	1
9.	Delivery systems: Non – sterile monophasic liquids. Unit operation of : Filtration and clarification (Theory and equipment for filtration of solid from liquids) and mixing	8
10.	Rheology : Definition and concepts, types of flow, thixotropy and measurement of flow properties	3
	Total	33

Reference Books:

1. L. V. Allen Jr., N. G. Popovich and H. C. Ansel “Ansel’s Pharmaceutical Dosage Forms and Drug Delivery Systems “,8th Edition Lippincotts Williams and Wilkin, Indian Education Distributed by B. I. Publications Pvt. Ltd, 2005
2. P. J. Sinko, “Martin’s Physical Pharmacy and Pharmaceutical Science” 5th Edition, Lippincotts Williams and Wilkin, Indian Edn, Distributed by B. I. Publications Pvt. Ltd,2006
3. M. E. Aulton “Pharmaceutics- The Science of Dosage Form Design” Churchill Livingstone, London, 2002.
4. “Remington- The Science and Practice of Pharmacy “, Vol. I and II, 21st Edn. Lippincotts Williams and Wilkin, Indian Edn. Distributed by B. I. Publications Pvt. Ltd.,2005
5. M. L Shroff “Principles of Pharmacy Part I and II”8th Edn. Five star Enterprises, Calcutta.
6. E. A. Rowling “Bentleys Textbook of Pharmaceutics” 8th Edn. Bailliere Tindall, London, Indian Edn. Published by All India Traveler Book Seller Delhi, 1992.

7. P. C. Dandiya, R. K. Khat and N. K. Gurbani "The Pharmacist Year Book 1993 1st Edn. CBS Publishers and Distributors, Delhi 1993.
8. G. Sonnedecker "Kremers and Urdang's History of Pharmacy" 4th Edn Lippincotts Company, USA, 1976.
9. R. A. Lyman and G. Urdang "American Pharmacy" 5th Edn.
10. James Swarbick "Current concepts in Pharmaceutical Sciences: Dosage form design and bioavailability" Lea and Febiger, Philadelphia, 1973.
11. Harkishan Singh "Pharmacopoeias and Formularies" Vol. I Vallabh Prakashan, Delhi 1994.
12. S. J. Carter "Cooper and Gunn's Tutorial Pharmacy" 6th Edn. CBS Publishers and Distributors, Delhi, 1986.
13. M. J. Stocklosa, H. C. Ansel, "Pharmaceutical Calculations" 8th Edition, Indian Edition by K.M. Varghese Company, Mumbai 1986.

PHARMACEUTICAL ENGINEERING I

3hrs/ week

Note: Only principles and equipments to be covered
No mathematical derivations and numerical problems

S. No.	Topic	Hours
1.	Fluid Flow: <ul style="list-style-type: none"> • Mention fluid properties such as Viscosity, compressibility and surface tension of fluids • Hydrostatics influencing fluid flow • Fluid dynamics – Bernoulli's theorem, flow of fluids in pipes, laminar and turbulent flow. 	4
2.	Heat Transfer: <ul style="list-style-type: none"> • Modes of heat transfer – conduction, convection and radiation. • Fourier's law for slabs and pipes (only equation and factors affecting) • Concepts of thermal conductivity and steady state heat transfer. • Compound resistance in series. • Heat transfer by convection – Natural convection and forced convection, dimensional analysis. Heat transfer between fluid and solid boundary. • Heat transfer by radiation – Kirchhoff's law and Stefan Boltzmann law. (only equation and factors affecting) • Overall heat transfer coefficient • Heat exchangers- tubular and plate 	6
3.	Mass transfer: <ul style="list-style-type: none"> • Mass transfer in turbulent and laminar flow • Concept of interfacial mass transfer. 	2
4.	Pumping: <ul style="list-style-type: none"> • Positive displacement pumps- reciprocating pumps, rotary pumps • Centrifugal pumps • Special pumps 	4
5.	Measurements: <ul style="list-style-type: none"> • Measurement of flow – Classification of flow meters, venture 	4

	meter, orifice meter, pitot tube, rotameter and current flow meters <ul style="list-style-type: none"> • Pressure measurement – Classification of manometers, simple manometer, U tube manometer and modifications, Bourdon gauge 	
6.	Conveying of Solids: <ul style="list-style-type: none"> • Belt conveyor, Bucket conveyor, screw conveyor and Pneumatic conveyor. 	1
7.	Water Purification: <ul style="list-style-type: none"> • Pretreatment and purification by deionization, reverse osmosis and distillation. 	2
8.	Refrigeration and Air Conditioning: <ul style="list-style-type: none"> • Water vapour- air mixture • Hygrometry • Humidification and dehumidification equipments – spray ponds, natural draft cooling towers and mechanical draft cooling towers. • Refrigeration- equipment and concept of refrigeration load, concepts of brine systems and absorption systems 	4
9.	Centrifugation : <ul style="list-style-type: none"> • Principle , objective and requirements of centrifugation • Equipments- Hydro extractors. 	1
10.	Corrosion: <ul style="list-style-type: none"> • Mechanism and types of corrosion. • Factors influencing rate of corrosion. • Methods of combating corrosion. 	3
11.	Material of Construction: <ul style="list-style-type: none"> • Classification into metals & nonmetals • Ferrous and its alloys – cast iron, mild steel and stainless steel • Copper and its alloys • Nickel and its alloys • Aluminum and its alloys • Glass • Plastics – Classification into thermoplastics and thermosetting plastics Properties and applications of polyvinyl chloride, polyethylene, polypropylene, polystyrene, polyster, ABS, phenolic and epoxy plastics, fluorocarbon plastics, chlorinated plastics and poly carbonate plastics. 	4
	Total	35

Reference Books:

1. K. Sambamurthy "Pharmaceutical Engineering" New Age International Pvt. Ltd. New Delhi, 2001.
2. A. R. Paradkar "Introduction to Pharmaceutical Engineering" 7th Edn. Nirali Prakashan, Pune 2005.
3. W. L. Badger and J. T. Banchemo "Introduction to Chemical Engineering" Mc. Graw Hill Book Company.
4. R. H. Perry and D. W. Green "Perry's Chemical Engineer's Handbook "7th Edn. Chemical Hand Book. Mc Graw Hill Book Company, 1997.

ORGANIC CHEMISTRY LABORATORY- I

4hrs/ week

Organic Sporting: Qualitative analyses of organic compounds – aspects to be covered are solubility characterization and preliminary tests, elements detection, functional group characterization, derivative preparation

Reference Books:

1. Textbook of practical organic chemistry by Vogel, 4th edition, publishers Longman group Ltd.
2. Practical Organic Chemistry by F.G. Mann and B.C. Saunders, 4th edition published by Orient-Longman.
3. Handbook by Kulkarni and Pathak, Published by Dastane Ramchandra and Company

PHYSICAL PHARMACY LAB – I

4hrs/ week

1. Determination of refractive index, molar refraction. Using water as a reference standard to determine refractive index of two organic solvent 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. Demonstration of Landsberger method.
5. Determination of heat of solution.
6. Partition coefficient – Iodine

Reference Books:

1. U. B. Hadkar, T. N. Vasudevan, K. S. Laddha “Practical Physical Pharmacy” Yucca Publishing House, Dombivali, 1994.

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY – Lab

(4hrs/ week)

1. Hematology
 - a. Red Blood Cell (RBC) Count
 - b. Total Leukocyte Count
 - c. Differential Leukocyte (WBC) Count
 - d. Hemoglobin content of blood
 - e. Bleeding & Clotting Time
 - f. Blood groups
 - g. 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 disease with the help of charts slides Name and Importance of following tests:
 1. Electroencephalogram (EEG) in diagnosis of Epilepsy
 2. Electrocardiogram (ECG) in diagnosis of cardiac arrhythmia
 3. Liver Function Tests
 - Serum Bilirubin
 - Serum glutamate oxaloacetate transaminase (SGOT)
 - Serum glutamate pyruvate transaminase (SGPT)
 - Urine Bilirubin
 - Urine Urobilinogen
 4. Kidney Function Tests
 - Serum Creatinine
 - Serum Urea, Uric Acid
 - Blood Urea Nitrogen(BUN)
 5. Blood Glucose
 6. Serum Cholesterol/ Triglycerides
 7. Serum Alkaline phosphatase (ALT)
 8. Serum Acid phosphatase (APT)
 9. Serum Lipase
 10. Serum Amylase
 11. Serum Calcium
 12. Serum lactate dehydrogenase (LDH)
 13. Thyroid Function Tests- T3, T4
 14. Diagnostic tests for infectious diseases like
 - Malaria
 - Tuberculosis
 - Dengue
 - Leptospirosis

Reference Books:

1. Anne Waugh And Allison Grant Ross & Wilson's Anatomy & Physiology in Health & Illness 9th Edition (2001) Churchill Livingstone, Edinburgh, London, Newyork.
2. Gerald J. Tortora & Sandra Reynolds Grabowaski Principals of Anatomy & Physiology 10th Edition (2003) John Wiley & Sons Inc, Newyork, USA
3. Arthur C. Guyton & John E. Hall Textbook of Medical Physiology 10th Edition (2000) W. B. Saunders Company, Philadelphia, Pennsylvania, USA.
4. B. R. Mackenna & R. Callander Illustrated Physiology 6th Edition, Churchill Livingstone, Newyork Edinburgh, London.
5. Praful B. Godkar Textbook of Medical Laboratory Technology 2nd Ed. 2006 Bhalani Publishing House, Mumbai
6. V. G. Ranade, P. N. Joshi & Shalini Pradhan, A Textbook of practicalphysiology,3rd Edition 1982 P.V.G. Prakashan, Pune- 030.

SEMESTER – II

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY –II

3hrs/ week

S. No	Topic	Hours
1.	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
2.	Definition and etiology of following diseases, in detail <ul style="list-style-type: none">- Asthma- Pneumonia- Bronchitis- Emphysema- Respiratory Acidosis and Alkosis	3
3.	Reproductive System <ul style="list-style-type: none">- Anatomical and Physiological considerations of male and female reproductive system- Menstrual cycle	4
4.	Definition and etiology of following diseases, in detail <ul style="list-style-type: none">- Infertility- Sexually transmitted diseases (STD)- Dismenorrhea	2
5.	Endocrine System Location hormones and functions of following endocrine glands: <ul style="list-style-type: none">- Pituitary- Thyroid & Parathyroid- Adrenal- Pancreas- Testes & Ovaries- Control of hormone secretion	12
6.	Etiology of hypo and hyper secretion of above endocrine glands and related diseases	5

Reference Books

1. Anne Waugh And Allison Grant Ross & Wilson's Anatomy & Physiology in Health & Illness 9th Edition (2001) Churchill Livingstone, Edinbrigh, London , Newyork
2. Gerald J. Tortora & Sandra Reynolds Grabowaski Principals of Anatomy & Physiology 10th Edition (2003) John Wiley & Sons Inc, Newyork, USA
3. Arthur C. Guyton & John E. Hall Textbook of Medical Physiology 10th Edition (2000) W. B. Saunders Company, Philadelphia, Pennsylvania, USA
4. B. R. Mackenna & R. Callander Illustrated Physiology 6th Edition 1997, Churchill Livingstone, Newyork Edinburgh, London
5. Praful B. Godkar Textbook of Medical Laboratory Technology 2nd Edition 2006 Bhalani Publishing House, Mumbai
6. V. G. Ranade, P. N. Joshi & Shalini Pradhan A Textbook of practical physiology, 3rd Edition 1982 P. V. G. Prakashan, Pune 30

ORGANIC CHEMISTRY – II**3hrs/ week**

S. No.	Topic	Hours
	Discussion of the following classes of compounds in brief, with regard to IUPAC nomenclature, sources, methods of preparation, Physical properties and general reactions, with mechanisms	
1.	Alcohols and ethers	4
2.	Carbonyl compounds (aldehydes and ketones)	5
3.	Carboxylic acids, esters, anhydrides, amides	5
4.	Amines and other nitrogen containing compounds.	6
5.	Aromatic compounds: Concepts of aromaticity and aromatic character, Huckel rule, structure and resonance in benzene; Nomenclature of aromatics: Electrophilic and nucleophilic substitution reactions in aromatic compounds.	10
6.	Preparation and reactivity of polycyclic aromatics – naphthalene's anthracene and phenanthrene	6

Reference Books

1. Morrison and Boyd, Organic Chemistry, 6th Edition, Pearson Education Pvt. Ltd, 2006.
2. Peter Sykes, A Guidebook to Mechanisms in organic Chemistry, 6th Edition, Pearson Education, 2007.
3. I. L. Finar, Organic Chemistry, 5th Edition, Pearson Education, 2006 Stanley Pine, Organic Chemistry, 5th Edition, Mc Graw – Hill Companies, 2007.
4. Francis Carrey, Organic Chemistry, 4th Edition, Mc Graw – Hill Companies, 2000.

PHARMACEUTICAL ANALYSIS – I**3 hrs/ week**

S. No.	Topic	Hours
1.	Introduction to the study of monographs of five official compounds – sodium chloride, calcium carbonate. Talc, boric acid and ferrous sulphate.	4
2.	I.P. Limits tests for insoluble matter, soluble matter, nonvolatile matter, volatile matter, residue on ignition and ash value.	3
3.	Various limit tests prescribed in I.P. e.g. chloride, sulphate, arsenic, lead, iron, nitrate, alkali and alkaline earth metals.	3
4.	The theoretical basis and techniques of quantitative analysis, Solute, solvent, solution, solubility product range, concentration, definition of normality, molarit, molality, milliequivalence, strong acids and bases, weak acids and bases, buffers, primary and secondary standards, calculation based on stoichiometry problems, theory of indicators (both external and internal indicators), concept of end point.	5
5.	Classification of theoretical considerations and applications to volumetric analysis.	3
6.	Acid base titrations in aqueous medium titrations, complexometric titrations, redox titrations, argentimetric titrations and non-aqueous titrations with suitable example.	15

7.	Estimation studies of important gases – Oxygen, Nitrogen and Carbon dioxide.	3
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Reference Books

1. A. H. Bekett and J. B. Stanlake, Practical Pharmaceutical Chemistry, 4th edition, CBS Publishers and Distributors, 1997.
2. G. H. Jeffery and J. Bassett, Vogels' Textbook of Quantitative Chemical Analysis, 5th Edition, Longman Scientific and Technical, 1989.
3. Indian Pharmacopoeia, British Pharmacopoeia, USP, Martindale.

PHYSICAL PHARMACY – II

3 hrs / Week

S. No.	TOPICS	Hours
1.	Ionic equilibria and buffers: <ul style="list-style-type: none"> ▪ 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	4
2.	Solubility: <ul style="list-style-type: none"> ▪ Solubility of gases in liquids, henrys law and applications ▪ Miscible liquids and partially miscible liquids ▪ Solubility of solids in liquids, ideal solubility, solubility parameters and prediction of solubility in regular solutions ▪ Partition phenomena and partitioning of weak electrolytes and its 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) <ul style="list-style-type: none"> ▪ 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 applications Problems	8
4.	Catalysis: <ul style="list-style-type: none"> ▪ Definition, types and specificity 	2
5.	Interfacial phenomena: <ul style="list-style-type: none"> ▪ Surface tension, Interfacial tension ▪ Surface free energy ▪ Pressure difference across curved interfaces ▪ Measurement of surface and interfacial tension-Capillary rise method ▪ Drop weight method ▪ Du Nuoy tensiometer method ▪ Spreading of liquids ▪ Spreading coefficient ▪ Adsorption at liquid interfaces 	8

	<ul style="list-style-type: none"> ▪ Surface active agents ▪ 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 ▪ Wetting angle and Contact angle Problems	
6.	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 Problems	3
7.	Colloids: <ul style="list-style-type: none"> ▪ Classification ▪ Preparation, colloid properties such as optical Kinetic and electrical <ul style="list-style-type: none"> ▪ Gold number ▪ Protective colloid ▪ Schultz Hardy rule. 	5

Reference Books

1. P. J. Sinko, "Martin's Physical Pharmacy and Pharmaceutical Sciences" 5th edition, Lippincotts Williams and Wilkin, Indian Edn. Distributed by B. I. Publications Pvt. Ltd., 2006.
2. A. Findlay, "Practical Physical Pharmacy" revised and edited by J. A. Kitchener, 8th Edn. Longmans, Green and company Ltd. 1967.
3. B. S. Bahl, A. Bahl, G. D. Tuli, "Essentials of Physical Chemistry " revised edition, S. Chand and company Ltd., New Delhi, 2006.
4. U. B. Hadkar "A Textbook of Physical Pharmacy", 6th Edn. Nirali Prakashan, Pune 2006.
5. U. B. Hadkar, T. N. Vasudevan, K. S. Laddha "Practical Physical Pharmacy" Yucca Publishing House, Dombivali, 1994.

PHARMACEUTICS – II

S. No.	Topic	Hours
1.	Introduction to per formulation studies with respect to monophasics: <ul style="list-style-type: none"> ▪ Organoleptic properties ▪ Purity ▪ Solubility and techniques of solubilization ▪ Partition coefficient and dissociation constant, Salt formation ▪ Polymorphism and crystal habit ▪ Stability and Interaction with excipients. 	9
2.	Complexion:	2

	<ul style="list-style-type: none"> ▪ Types of complexes and their analysis. 	
3.	Formulation, large scale manufacturing, packaging and Quality Control of non-sterile monophasic liquids: <ul style="list-style-type: none"> ▪ Solutions ▪ Aromatic waters ▪ Syrups ▪ Elixirs ▪ Linctuses ▪ Drops ▪ Glycerites ▪ Paints ▪ Lotions ▪ Liniments ▪ Sprays. 	9
4.	Powder Technology: <ul style="list-style-type: none"> ▪ Fundamental and derived properties of powders and their measurement ▪ Size reduction. ▪ Size separation. 	7
5.	Formulation, large scale manufacturing, Packaging and Quality control of Powders: <ul style="list-style-type: none"> ▪ Dusting powders ▪ Oral rehydration powders ▪ Dry syrup formulations. 	4
6.	Diffusion: <ul style="list-style-type: none"> ▪ Fick's laws and steady state diffusion, measurement of diffusion. Dissolution: <ul style="list-style-type: none"> ▪ Dissolution rate, Noyes – Whitney equation, Hixon-Crowell Law 	4

REFERENCE BOOKS:

1. L. V. Allen Jr., N. G. Popovich and H. C. Ansel "Ansel's Pharmaceutical Dosage Forms and Drug Delivery S. D. systems", 8th Edn. Lippincotts Williams and Wilkin. Indian Edn Distributed by B.I. Publications Pvt. Ltd., 2005.
2. P. J. Sinko," Martin's Physical Pharmacy and Pharmaceutical Sciences" 5th edition, Lippincotts Williams and Wilkin, Indian Edn. Distributed by B. I. Publications Pvt. Ltd., 2006
3. M. E. Aulton "Pharmaceutics- The Science of Dosage form Design" Churchill Livingston, London, 2002.
4. "Remington- The Science and Practice of Pharmacy", Vol. I and II, 21st Edn. Lippincotts Williams and Wilkin, Indian Edn. Distributed by B. I. Publications Pvt. Ltd., 2005
5. E. A. Rowling "Bentleys Textbook of Pharmaceutics" 8th Edn. Bailliere Tindall London, Indian Edn. Published by all India Traveler Book seller Delhi, 1992.
6. R. A Lyman and G. Urdang "American Pharmacy" 5th Edn.
7. James Swarbick "Current concepts in Pharmaceutical Sciences: Dosage form design and bioavailability" Lea and Febiger, Philadelphia, 1973.
8. S. J Carter "Cooper and Gunn's Tutorial Pharmacy" 6th Edn. CBS Publishers and Distributors, Delhi, 1986.
9. Industrial Pharmacy

MICROBIOLOGY

3 hrs/ Week

S. No.	Topic	Hours
1.	Brief history of microbiology: Microbiology, scope and application in pharmaceutical sciences	1
2.	Microscopy: Simple microscope, Compound microscope. Resolving power, magnification, angular aperture, and numerical aperture, oil immersion microscopy to be covered in practical, phase contrast and dark field. Fluorescent and electron microscopy.	3
3.	Staining (All staining with respect to bacteria): Monochromatic staining Gram staining Acid fast staining Capsule, flagella spore, cell wall staining Negative staining Motility	2
4.	Classification of micro-organism as different types	1
5.	Classification of bacteria: Morphology, cell characteristic, habitat nutrition Cultivation of bacteria: Culture media: Cultivation, storage media, enrichment media differential media, microbiological assay media Cultivation of aerobes and an aerobes Pure culture techniques – isolation Preservation of cultures Reproduction and Growth phases, measurement of growth, factors affecting growth, continuous cultivation, enumeration of bacteria Identification of bacteria Overview of bacterial diseases in brief Mycobacterium sp., Salmonella sp., Shigella sp., Staphylococcus Sp., Klebsiella sp., E.coli., Pseudomonas, Clostridium- self study	2 2 2 2 2 2 2 2
6.	Viruses: Morphological characteristic, enumeration, cultivation and reproduction HIV and oneogenic Viruses.	3
7.	Riekketsiae- Diseases	1
8.	Fungi: Morphological characteristics and classification, reproduction, mycosis in brief (Pathogenic fungi like Aspergillus, Dermatophytes. Candida albicans)-	2
9.	Algae: Morphological characteristics, reproduction, economic significance of algae	1
10.	Protozoa: Morphological characteristics and classification, reproduction, Pathogenic protozoa like Amoeba, Paramecium, Trichomonas, Plasmodium	2
11.	Control of micro-organisms: Different techniques of sterilization and their application. Introduction to aseptic techniques(no equipments to be covered) Disinfectants and principles of disinfection.	6

Reference Books:

1. M. J. Pelezar Jr., E. C. S. Chan and N. R. Krieg "Microbiology Concepts and Applications" McGraw Hill, Inc., USA, 1993.
2. M. Frobisher, R. D. Hinsdill, K. T. Crabtree and C. R. Goodheart "Fundamentals of Microbiology", 9th Edn. Saunders College Publishing, Philadelphia 1968.
3. W. B. Hugo and A. D. Russel "Pharmaceutical Microbiology" 6th Edn, Blackwell Science Ltd. UK, 2003.
4. R. Ananthanarayan and Ck. J. Paniker "Test Book of Microbiology", 7th Edn. Orient Longman Pvt. Ltd, Hyderabad, 2005

PHARMACEUTICAL ANALYSIS LABORATORY – I

4hrs/ week

1. Preparation and standardization of 0.1 N HCl, 0.1 N NaOH, 0.1N Na₂S₂O₃, 0.1 N KMnO₄, 0.1 N Iodin.
2. Assay of Zinc oxide, Magnesium sulphate, Ferrous sulphate, Potassium iodide, Copper sulphate.
3. Titrimetric Analysis : Determination of total alkalinity and sodium carbonate of sodium hydroxide determination of percentage of aspirin, Determination of ascorbic acid
4. Argentometric titration NaCl powder and KCl.
5. I.P. limit tests for: chloride, sulphate, arsenic, heavy metal, iron.

Reference Books:

1. A. H. Bekett and J. B. Stanlake, Practical Pharmaceutical Chemistry, 4th edition, CBS Publishers and Distributors, 1997.
2. G. H. Jeffery and J. Bassett, Vogels' Textbook of Quantitative: Chemical Analysis, 5th Edition. Longman Scientific and Technical 1989.
3. Indian Pharmacopocia, British Pharmacopocia, USP, Martindale

PHARMACEUTICS LAB – I

4hrs/week

List of experiments

Aromatic waters
Chloroform water I.P 66
Concentrated Dill water I.P 66 Concentrated Anise water B.P.C 73
Dill water
Gripe water

Syrups

Syrup I.P 66
Artificial syrup
Cough syrup – Codeine phosphate syrup B.P.C

Linctus

Simple linctus B.P.C
Elixirs
Piperzine citrate elixir B.P.C

Ear drops

Chloramphenicol ear drops B.P.C

Nasal drops

Ephedrine sulphate nasa drops B.P.C

Glycerites

Glycerin of starch I.P 55

Glycerin of boric acid I.P 55

Glycerin of tannic acid I.P 66

Solutions

Aqueous Iodine solution I.P 66

Weak Iodine solution I.P 66

Paracetamol Solubilised Paediatric drops

Cresol with soap solution I.P

Magnesium citrate oral solution N.F XIV

Chlorinated soda solution, surgical B.P.C

Iodine Paint compound B.P.C 68

Powders

Oral rehydration salt (ORS)

Evaluation of liquids for specific gravity and viscosity and powders for bulk density, flow rate and angel of repose

PHYSICAL PHARMACY LAB – II**4hrs/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. Ostwalds isolation method to determine order

NONKINETICS

1. Parnton coefficient - Benzoic acid
2. Surface tension: 1. Determination of surface tension of water, toluene, n-hexane, parachor and critical solution temp determination. 2. Determination of CMC
3. Phenol water : Critical solution temp and composition
4. Determination of molecular weight of a polymer from solution viscosity
5. Adsorption : Surface area determination
6. HLB of A surfactant
7. Potentiometer : Titration and determination of bufler capacity

Reference Books:

1. U. B Hadkar, T. N. Vasudevan, K. S. Laddha "Practical Physical Pharmacy" Yucca Publishing House, Dombivali, 1994.

MICROBIOLOGY LABORATORY**4hrs/ week**

1. Study of microscope and common laboratory equipments
2. Gram staining
3. Monochrome staining

4. Negative staining
5. Cell wall staining
6. Scope staining
7. Capsule staining
8. Motility by hanging drop technique
9. Preparation and sterilization of nutrient broth, agar slants, plates, inoculation techniques.
10. Isolation of pure culture by pour plate and streak plate methods. Colony characterization and growth patterns in broth of cocci and bacilli
11. Total count by Breeds smear method
12. Growth by optical density, total plate count
13. Study of yeast, *Aspergillus* and *Penicillium* with respect to morphology
14. Observation on prepared slides of malarial parasite in blood smear, intestinal amoeba in stools.