Second B.Pharmacy Prospectus No. 2014145
Semester-III Examination - Winter-2013,
Semester-IV Examination - Summer-2014

संत गाडगे बाबा अमरावती विद्यापीठ
SANT GADGE BABA AMRAVATI UNIVERSITY

आयुर्विज्ञान विद्याशाखा
(FACULTY OF MEDICINE)

PROSPECTUS OF
SEMESTER-III & IV EXAMINATION FOR THE DEGREE OF
BACHELOR OF PHARMACY
(FOUR YEARï EIGHT SEMESTER DEGREE COURSE)
SEMESTER-III EXAMINATION, WINTER-2013
SEMESTER-IV EXAMINATION, SUMMER-2014

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I N D E X
Second B.Pharmacy (Semester-III & IV)
(Prospectus No.2014145)

Syllabus prescribed for B.Pharm. Semester-III
(Implemented from the Academic Session 2011-12)

SEMESTER-III

Subject Code	Subject	Maximum Marks		Total Marks
		Theory	Practical	
.3.1.	Physical I Pharmaceutics-	80	80	160
3.2.	Pharmaceutical Microbiology	80	80	160
3.3.	Pharmaceutical Organic chemistry-I	80	80	160
3.4.	Hospital and Community Pharmacy	80	80	160
3.5.	Pharmaceutical Inorganic chemistry	80	80	160
3.6.	Pathophysiology	80	ð	80
	Total			880

Subject code: T- 3.1
Subject : Physical Pharmaceutics –I
THEORY **45 Hours (3 hrs. /week)**

SECTION-A

1. **States of Matter, Properties of Matter:** Binding forces between molecules**:** States of matter, gaseous, liquid and solid state, amorphous and crystalline states of solids; polymorphism; latent heat and vapor pressure, phase equilibria and phase rule.
2. **Thermodynamics :** Laws of thermodynamics and their applications in Pharmacy.
3. **Solubility and distribution phenomena:** Solubility definitions, expressions, solvent solute interactions, polar solvents-non polar solvents-semipolar solvents, solubility of gases in liquids, effect of pressure- temperature-salting out-chemical reactions of solubility calculations, solubility of liquids in liquids, ideal and real solutions, complete and partial miscibility, influence of foreign substances-

three component systems, dielectric constant and solubility, solubility of solids in liquids, solubility of salts in water-solubility of slightly soluble and weak electrolytes, calculating solubility of weak electrolytes as influenced by pH. Influence of co-solvents on the solubility of drugs, combined effect of pH and solvents, distribution of solutes between immiscible solvents, effect of ionic dissociation and molecular association on partition extraction, preservation action of weak acids in emulsion, distribution co-efficient.

SECTION-B

4. **Coarse Dispersions.** Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, emulsions-types-theories-physical stability, preservation of emulsions, rheological properties of emulsions, phase equilibria and emulsion formulation. Semisolid dispersions.
5. **Kinetics and drug stability:** Rates and orders of reaction influence of temperature and other factors, on reaction rates. Decomposition and stabilization of medicinal agents. Accelerated stability analysis.
6. **Colloids:** Introduction, types of colloidal system, optical properties, kinetic properties, Electric properties of colloids, stabilization of colloids and application in Pharmacy.

Subject code: P- 3.1
Subject : Physical Pharmaceutics –I
PRACTICAL **45 Hours (3 hrs. /week)**

1. Studies on polymorphs, their identification and properties.
2. Studies of different types of colloids and their properties
3. Preparation of various types of suspensions and determination of their Sedimentation parameters.
4. Stability studies of emulsions.
5. Determination of half-life, rate constant and order of reaction.
6. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.
7. Experiments involving tonicity adjustments.

Recommended Books:

1) Remingtonôs Pharmaceutical Sciences.
2) Elements of Physical Chemistry - Glasstone & Lewis
3) Theory & Practice of Industrial Pharmacy - Lachman, Libermann & Kanig.
4) Physical Pharmacy by Martin - Swarbrick & A.Cammarata
5) Bentleyôs Text Book of Pharmaceutics by Rewilins.
6) Tutorial Pharmacy - Cooper & Gunn
7) Physical Pharmaceutics by Milo Gibaldi.
8) Practical Physical Pharmacy by Dr.U.B.Hadkar, T.N.Vasudevan, K.S.Laddha,
9) Practical Pharmaceutical Technology by - Engene
10) Practicals in Physical Pharmacy by CVS Subramaniam.
11) Practicals in Physical Pharmacy by Dr. D. V. Derle.

Subject code: T-3.2

Subject : Pharmaceutical Microbiology

THEORY **45 Hours (3 hrs. /week)**

SECTION-A

1. **Introduction to microbiology**; Classification of microbes and their taxonomy, bacteria, viruses (DNA, RNA and retroviruses), fungi, actinomycetes, rickettasia and spirochaetes.
2. Nutrition, cultivation, isolation and identification of bacteria, viruses, protozoa and fungi.
3. **Microbial spoilage and preservation of pharmaceutical products:** Types of spoilage, factors affecting microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage, preservation of pharmaceutical products, preservatives, evaluation of microbial stability of formulations.

SECTION-B

4. **Infection:** Modes of microbial infection, transmission and control/ prevention of bacterial, fungal, protozoal and viral diseases (and AIDS)
5. **Sterilization:** Different methods, evaluation of sterilization methods, sterility testing of pharmaceutical products as per I.P. and B.P. requirements. Sources of contamination and methods of prevention,

designing of aseptic area, laminar flow equipment, their services and maintenance.

6. **Immunology and Immunological Preparations:** Principles, antigens and haptens, immune system, cellular humoral immunity, Immunological tolerance, bacterial resistance, immunogenetics, antigen-antibody reactions and their applications. Hypersensitivity, active and passive immunization; Vaccines-their preparation, Standardization and storage.

Subject code: P- 3.2

Subject : Pharmaceutical Microbiology

PRACTICAL **45 Hours (3 hrs. /week)**

1. Preparation of various types of culture media
2. Sub culturing of different microorganism by different methods like Slants, Stabs, Culture plates and isolation of pure culture by streak plate techniques, simple and multiple streaking techniques.
3. Isolation of pure culture of micro-organism from soil sample.
4. Preservation of bacterial strain.
5. Various staining methods.

Recommended Books:

1) Microbiology, Pelzar & Reid
2) Industrial Microbiology, Prescott & Duner
3) Pharmaceutical Microbiology, Malcolm and Harris
4) R.Anathanarayan and C. K.J. Panikar, Textbook of microbiology.
5) S.S. Kori and M. A. Halkai, Pharmaceutical microbiology
6) Tutorial Pharmacy - Cooper & Gunn
7) Applied Microbiology for Pharmacy Biosciences by Vinita Kale and Kishore Bhusari, Himalaya Publishing House, Mumbai.
8) Bergeyôs Manual of Determinative bacteriology.
9) Brock T D, Madigen M T Biology of Microorganism. Prentice Hall, New Jersey USA. Davis, Dulbetco, Eisen Microbiology.
10) Hugo and Russel, Pharmaceutical Microbiology; Blackwell Scienctific Publication, Oxford.
11) Salle A J, Fundamental Principles of bacteriology
12) Practical Microbiology by R. S. Gaud and G. D. Gupta. 2nd Edition, Nirali Prakashan, Pune

Subject code: T- 3.3

Subject : Pharmaceutical Organic chemistry-I

THEORY **45 Hours (3 hrs. /week)**

SECTION-A

Topic

1. **Introduction to Organic Chemistry:** Importance & Properties of Carbon. Quantam Mechanics, Atomic Orbitals, Molecular Orbitals, Pauliõs Exclusion principle, Types of Bonds, Hybridization, Hybrid Orbitals, Intermolecular forces & related properties, Intramolecular Forces, Acids & Bases, Significance of Solubility, Conjugation, Bond Length & Bond Energies. Fundamentals of Molecular Formula, Molecular Weight, Empirical Formula, Factor affecting electron availability. Reaction Mechanism, energy of activation, transition state.
2. **IUPAC** Nomenclature of organic compounds.
3. Brief Description of methods of formation of Alkyl Halides and Nucleophilic Substitution at saturated carbon. SN 1 & SN 2 reaction: Mechanism & stereochemistry (examples of compounds containing one asymmetric carbon atom only)

   Factors affecting Substitution: Substrate structure, Nature of Nucleophile, Nature of Leaving Group and Solvent.
4. **Alkanes :** Common and IUPAC name, properties and reactions of alkanes, mechanism and kinetics of chlorination and halogenation, molecular and empirical formula.

SECTION- B

5. **Alkenes:** Preparations & Reactions. E 1 & E 2 Substitution v/s Elimination. Addition Reaction of Alkenes: mechanism , Regioselectivity (Markonikov & anti-Markonikov) in addition of Hydrogen, Halogen, Hydrogen Halide, Halohydrin Formation, Oxymercuration ï Demercuration Hydroboration- Oxidation, Hydroxylation, Allylic substitution (using NBS) and Ozonolysis .
6. **Conjugated Dienes:** Structure, Electrophilic addition to dienes : 1,2 & 1,4- addition, Diels Alder Reaction : (Mechanism only)
7. **Alkynes:** General methods of preparation and reaction.
8. **Alcohols & Ethers:** General methods of preparation including Grignard reaction. All general reactions including Lucas test. Ethers: General methods of preparation & reaction.

9. **Benzene & Aromaticity:** Huckel rule, Resonance Benzene and derivatives. Mechanism of Electrophilic aromatic Substitution: Halogenation, Nitration, Sulphonation and Friedel Craftõs reaction, Orientation and reactivity in Electrophilic aromatic substitution. Mechanism of nucleophilic aromatic substitution. Addition-Elimination and Elimination-addition (reaction involving benzyne intermediate)

Subject code: P- 3.3

Subject : Pharmaceutical Organic chemistry-I

PRACTICAL **45 Hours (3 hrs. /week)**

1. Preparation, transfer & Storage of Chromic acid mixture.
2. Determination of Physical constants of few organic compounds (both solid & liquid) & calibration of thermometer.
3. Qualitative Analysis single organic compounds.
4. Synthesis of some organic compound.
5. Resolution of Racemic Mixtures.

Reference Books :-

1. Stereochemistry of Carbon Compounds by E.L.Eliel, 32 reprint 2005, Tata McGraw Hill Publishing Co.Ltd.New Delhi.
2. Stereochemistry of organic Compound Principles and applications by Nasipuri, Revised Eddition, New age international Publishers.
3. Organic Chemistry: Morrison & Boyd.
4. A Guidebook of reaction mechanism in organic chemistry: Peter Skyes.
5. Fundamentals of Organic Chemistry : I.L.Finar (vol.I &II)
6. Principles of Organic Chemistry: T.A.Geissman.
7. Basic principles of Organic Chemistry: John D.Roberts & Majorie C.Skyes.
8. Organic Chemistry: Stanley H. Pine.
9. Advanced Organic Chemistry: Reaction, Mechanism & Structure. By Jerry March
10. A Textbook of Organic Chemistry: Arun Bahl, B.S.Bahl.

Subject code: T- 3.4

Subject : Hospital and Community Pharmacy

THEORY **45 Hours (3 hrs. /week)**

SECTION-A

1. **Community pharmacy management:** Introduction to community Pharmacy, Organization and structure of retail and wholesale pharmacy, factors to be considered for location of retail pharmacy, finance, personnel, legal and infrastructure requirements for establishing retail pharmacy, maintenance of records of retail and wholesale pharmacy.
2. **Community pharmacies in primary health care services**: Family planning, first aid, communicable diseases, non communicable diseases. In population control, first aid and prevention of communicable diseases like AIDS, sexual transmitted diseases.
3. **Application of computers in pharmacy**: Drug information centre, disease information services, Records and Reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse drug reactions, idiosyncratic cases, etc.
4. **Patient counseling:** General considerations, importance and steps and procedure involved. Concept of Polypharmacy and its implications. Over-the-counter (OTC) drugs sales, the concept of essential drugs and rational drug use.
5. **Introduction to hospitals and hospital pharmacy:** Historical development.
6. **Hospital Pharmacy:** Objectives and functions, organization, planning and administration of moderrn hospital pharmacy services, location, layout, personnel, qualifications, requirements, and evaluation of hospital pharmacist, Work load and remuneration of hospital pharmacist.

SECTION-B

7. **Hospital formulary:** Organization, formulary content, preparation and Distribution. Pharmacy Procedure manual preparation and publication.
8. **Hospital committees' constitution and function:** Pharmacy and therapeutic committee, Infection control committee, Antibiotic policy, committee, Research and ethics committee.

9. **Hospital Manufacturing:** Economical considerations and estimation of demand, lay out, raw materials, production planning, requirements, manpower requirements and quality assurance, manufacturing of ï Sterile products and non-sterile products. Total parenteral nutrition.
10. **Drug distribution Systems:** Outpatient and Inpatient services, unit dose drug distribution systems, floor ward stock systems, satellite pharmacy services, central sterile services, bed side pharmacy. Role of hospital pharmacist in isotope and non isotope pharmacy.
11. **Controlled drugs dispensing (narcotic Drugs):** Procedures for dispensing and maintenance of records.
12. **Sterilization:** Techniques**,** application of sterilization of surgical dressings, OT and other equipment used in hospital (Cotton, bandage, adhesive tapes, IV sets, B.G.set, ryles tubes, catheters and syringes).

Subject code: P- 3.4

Subject : Hospital and Community Pharmacy

PRACTICAL **45 Hours (3 hrs. /week)**

1. Preparation of patient medication information for glyceryl trinitrate, captopril, digitalis and warfarin.
2. Identification and uses of surgical dressings, instruments, glasswares and Other hospital equipments.
3. Manufacture and testing of non-sterile products used in hospital Normal saline, Dextrose (5% and 20%), Dextrose and Normal Saline (DNS), Ringer Lactate Solution.
4. Identification test for important raw materials used in the manufacture of sterile and non sterile products.
5. Sterilization of various types of surgical instruments and glasswares.
6. Identification of incompatibilities and irrationality in prescription.
7. Demonstration of self-monitoring medical instruments like glucometer, BP apparatus, inhalers, sprays and diagnostic indicators.
8. Project report on availability and use of essential drugs in General hospital.
9. Visit to two-community pharmacy for schedule N compliance.
10. Report on OTC and controlled drugs sales over a period of one week in a local community pharmacy.
11. Project report on visit to nearby community on the rational use of drugs.

12. Exercises on patient counseling in respect of some of selected diseases like tuberculosis, malaria, diabetes, cerebro vascular disease, asthma, diarrhoea, hepatitis.
13. Preparation of patient medication information for glyceryl trinitrate, captopril, digitalis and warfarin.

Reference

1. Text Book of Drug Store and Business Management by R.M. Mehata
2. Hospital Pharmacy - by W.Hassan
3. Text Book of Hospital Pharmacy - by Merchant & Qadry
4. Text book of hospital and clinical pharmacy by Chunawala and Paradakar
5. Text book of hospital and clinical pharmacy by Nand & Khar.

Subject code: T- 3.5

Subject : Pharmaceutical Inorganic chemistry

THEORY **45 Hours (3 hrs. /week)**

SECTION-A

1. **Pharmacopoeia and Monograph:-** Different pharmacopoeia and contents of official monograph.
2. **Purity of pharmaceuticals** and factors affecting purity of pharmaceuticals. Sources of impurities/contamination and methods to control them,, Limit test for chlorides, sulphates, arsenic, iron, lead, heavy metals as per IP.
3. **Pharmaceutical Aids and Necessities:-** Acids,bases, buffers, antioxidants, preservatives, adsorbants, diluents, excipients, suspending agents, colorants etc.
4. **Hardness of water,** methods to remove hardness of water, different official waters and official quality control tests for water.
5. **Major intra and extra cellular electrolytes:-**Physiological ions, Electrolytes used in replacement therapy, Physiological acid base balance, Electrolytes used in acid base theraoy, Electrolyte combination therapy, In organic diuretics.

   Sodium chloride inj, Ringer solution lactated, Ringer injections, Sodium acetate, and potassium bi carbonate, sodium citrate, sodium lactate, ammonium chloride.

6. **Important In organic gases** used in pharmacy:-Oxygen, Nitrogen, Nitrous Oxide, Carbon dioxide, Helium, Ammonia and their compounds as per I.P.
7. **Dental products :-**

· **Anticaries agents:-**fluoride containing compounds, sodium fluoride, stannous fluoride, Phosphate containing compounds.

· **Dentifrices:-**Dentifrices containing fluorides, Dentifrices containing polishing agents, Pumice, Dentifrices containing Desensitizing agents, Zinc chloride, and zinc-Eugenol cement.

SECTION-B

8. **Respiratory stimulants:-**Ammonium carbonate, Aromatic ammonia spirit.

   Expectorants and emetics:-Ammonium chloride, Potassium iodide, Antimony potassium tartarate. Mode of action of all compounds.
9. **Poisons and antidote:-**Classification, Sodium thiosulphate, Sodiumnitrite.
10. **Topical agents:-**
    - **Protectives:-**Talc, Zinc oxide, Calamine, Zinc state, Titanium dioxide, aluminum compound,Silicone polymer.
    - **Antimicrobial And Astringent:-**Hydrogen peroxide solution, Sodium perborate, Zinc peroxide, Potassium permanganate, Sodium hypochloride solution, Iodine solution and Silver nitrate, Mercuric oxide, mercuric chloride and sulphate, boric acid, Selinium sulphide, Zinc sulphate.
11. **Complexing and chelatig agents used in therapy.**
12. **Gastrointestinal agents:-**

    Acidifying agents:-dil Hcl

    Antacids:- Sodium bicarbonate, aluminium hydroxide, aluminium phosphate, Basic aluminium carbonate Calcium phosphate, Magnesium carbonate, Milk of magnesia.

    Protectives and adsorbants:-Bismuth compounds, Bismuth sub carbonate, Bismuth subgallate, Bismuth sodium tartarate, Kaoline, Activated charcoal, Pectin.

    Saline cathartics:-Sodium phosphate, Sodium potassium tartarate, Magnesium carbonate, Magnesium oxide.

13. **Essential and Trace ions:-**Absorption, distribution, physiological role. Official compounds of Fe, Cu, Zn, Mn, I, chromium, molybdenum, selenium.

    Fe-ferrous sulphate. Iron sorbite injection, ferric ammonium citrate, ferric chloride, Cu-Copper sulphate,14-Iodine, Potassium iodide, Sodium iodide, Zn-Zinc sulphate.

14. **In-organic radio pharmaceutical:-**Fundamental concepts of radioactivity, radiation dosimetry, biological effects of radiation, medicinal application of radioisotopes (therapeutic & diagnostic), radio pharmaceutical preparations, quality control of radio pharmaceutical, radio opaque contrast media.

Note:- For official compounds, general properties assays, storage & uses should be discussed.

Subject code: P-3.5

Subject : Pharmaceutical Inorganic Chemistry

PRACTICAL 45 Hours (3 hrs. /week)

1. Preparation of some inorganic pharmaceutical compounds (minium 5).
2. Semi micro-identification tests of mixtures of cations and anions (not mor than 4) as used in pharmaceuticals.
3. Limit tests for Chloride, Sulphate, Iron, Lead.
4. Prepare and test purified water of Pharmacopoeial standard (I.P.).
5. **Test for purity of following.**
   A) Swelling power in bentonite.
   B) Acid neutralizing capacity in aluminium hydroxide gel.
   C) Ammonium salt in potassium alum.
   D) Adsorption property in heavy kaolin.
   E) Presence of iodates in potassium iodide.

Reference Books :-

1) Inorganic Medicinal and Pharmaceutical Chemistry-J.H.Block, E.B.Roche & I.O.Sonie, Co.Wilson (Varghese Pub.)
2) Bentleys and Driverôs textbook of Pharmaceutical Chemistry revised by L.M.Atherden, 8th edition. Oxford University press, London.
3) Indian Pharmacopoeia, Latest edition.
4) Modern Inorganic Pharmaceutical Chemistry by C.A.Dicher.
5) Concise Inorganic Chemistry-J.D.Lee.

6) Remington the Science and practice of pharmacy by Remington, 20th edition, Lipincott, William and Wilkins.
7) Advanced Inorganic Chemistry, 18th Edition, Cotton & Wilkinson (Willy Eastern Ltd.,Delhi).
8) Vogelôs Text Book of Quantative Inorganic Analysis.
9) Vogels Text Book of Quantative Analysis, 5th edition.
10) Wilson & Gisvoldôs Principles of Organic and Medicinal Chemistry. Harkishan Sing & A.K.Kapoor-Principal of Inorganic Chemistry.
11) Pharmaceutical Inorganic Chemistry by Dhake & Tipnis, 2nd edition.
12) Inorganic Pharmaceutical Chemistry (Practical), 2nd edition, Dhake & Belsare.
13) Harkishan Sing & A.K.Kapoor - Principles of Inorganic Chemistry.

Subject code: T- 3.6

Subject : Pathophysiology

THEORY 45 Hours (3 hrs. /week)

SECTION-A

1. **Cardiovascular System:** Pathophysiology of Hypertension, Ischemic Heart Disease (Angina and Infarction), Congestive Cardiac Failure, Cardiac arrhythmias and Shock.
2. **Disorders of Respiratory tracts:** Pathophysiology of Bronchial Asthma and Pneumonia, tuberculosis, chronic Obstructive Airway Disease
3. **Disorders of Gastrointestinal tracts:** Disorders of oesophagus-Achalasia, gastro-oesophagial reflux and reflux oesophagitis, causes, consequences and management.

   Disorder of stomach, small intestine and large intestine - Peptic ulcer disease-acute ulcer, chronic peptic ulcer, tuberculosis of intestine, Acute intestinal obstruction. Constipation, diarrhea, vomiting Nausea, Flatus etc. Ulcerative colitis, Crohnôs disease and typhoid fever.

SECTION-B

4. **Nervous disorders:** Pathophysiology of Epilepsy, Parkinsonôs and Alzheimerôs Disease, Psychosis, Schizophrenia and Depression
5. **Disorders of Urinary tracts:** Pathophysiology of Urinary Tract Infections, Acute and Chronic Renal Failure.
6. **Endocrine disorders:** Pathophysiology of disorders of pituitary gland- growth hormone- Dwarfism, Gigantism. Adrenal gland-Addisonôs disease. Thyroid gland-Hypo and Hyperthyroidism. Sex

hormones- Hirsuitism, Gynecomastia, virility, impotence etc. Pancreas-Diabetes.

7. **Pain and inflammation:** Pathophysiology of Headache e.g. migraine, cluster headache, muscle contraction, (tension headaches), headaches affecting elderly. Pathophysiology of joint pain like osteoarthritis. Rheumatoid arthritis and gout.

Recommended Books

1. Robbins Pathologic. Basis of Disease Harcourt Asia Pte.ltd. New Delhi
2. Harsh Mohan: Textbook of Pathology, *Jaypee Brothers, Medical Publishers, New Delhi.*
3. Harisons Internal Medicine, *Tata Mc-Graw Hill Publications, Singapore.*
4. Davidsons: Textbook of Medicine. *Tata Mc-Graw Hill Publications, Singapore.*
5. Stahl S. M.. Essential Psychopharmacology Cambridge University Press New Delhi.
6. Dipiro J.L. Pharmacotherapy Handbook. Tata McGraw Hill New Delhi.

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SEMESTER-IV

Subject Code	Subject	Maximum Marks		Total Marks
		Theory	Practical	
4.1	Physical Pharmaceutics-II	80	80	160
4.2	Pharmaceutical Organic chemistry-II	80	80	160
4.3	Pharmaceutical Analysis-I	80	80	160
4.4	Pharmaceutical Biotechnology	80	80	160
4.5	Pharmacology-I	80	80	160
4.6	Basic Computer Applications	80	ð -	80
	Total			880

Syllabus Prescribed for
B. Pharm. Semester – IV

Subject code: T- 4.1
Subject : Physical Pharmaceutics – II
THEORY **45 Hours (3 hrs. /week)**

SECTION-A

1. **Surface and interfacial phenomenon :** Surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, complex films, adsorption at solid liquid-interfaces, surface activity, surface active agents, HLB classification, solubilization-micelle formation, determination of critical micelle concentration, detergency, and wetting agents. Contact angle, flocculating agents, deflocculating agents, foaming agents, anti-foaming agents. Medicinal and pharmaceutical applications.
2. **Micrometerics :** Introduction and pharmaceutical importance, particle size and distribution, particle shape, particle volume, particle number, surface area, methods for determining particle size, particle volume measurement, specific surface, methods for determining

surface area, Derived properties of powders-porosity packing-arrangement-densities, bulkiness-flow properties of powders, angle of repose, factors affecting flow of powders.

SECTION-B

3. **Diffusion and dissolution:** Steady state of diffusion, procedures and apparatus used, diffusion and drug release, diffusion principles in biological systems, vapor sorption and Transmission. Thermodynamics of diffusion.
4. **Rheology :** Fundamentals of rheology, type of flow, quantitative measurement of flow, mechanical models to illustrate flow on viscoelasticity, thixotrophy, measurement of thixotrophy, thixotrophy in formulation, rheology of disperse system, pharmaceutical application of rheology. Methods of viscosity measurements.
5. **Complexation and protein binding:** Classifications, methods of preparation and analysis, crystalling structure of complexes, thermodynamic treatment of stability constants, protein binding.

Subject code: P- 4.1

Subject : Physical Pharmaceutics – II

PRACTICAL **45 Hours (3 hrs. /week)**

1. Determination of particle size, particle size distribution and surface area using various methods of particle size analysis.
2. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
3. Determination of surface/interfacial tension, HLB value and critical micelle concentration of surfactants.
4. Study of rheological properties of various types of systems using different viscometers.
5. Studies on different types of complexes and determination of their stability constants.

Recommended Books:

1) Remingtonôs Pharmaceutical Sciences.
2) Elements of Physical Chemistry - Glasstone & Lewis
3) Theory & Practice of Industrial Pharmacy - Lachman, Libermann & Kanig.
4) Physical Pharmacy by Martin - Swarbrick & A.Cammarata
5) Bentleyôs Text Book of Pharmaceutics by Rewilins.
6) Tutorial Pharmacy - Cooper & Gunn
7) Physical Pharmaceutics by Milo Gibaldi.
8) Practical Physical Pharmacy by Dr.U.B.Hadkar, T.N.Vasudevan, K.S.Laddha,
9) Practical Pharmaceutical Technology by ï Engene
10) Practicals in Physical Pharmacy by CVS Subramaniam.
11) Practicals in Physical Pharmacy by Dr. D. V. Derle.

Subject code: T-4.2

Subject : Pharmaceutical Organic chemistry – II

THEORY **45 Hours (3 hrs. /week)**

Section-A

1. **Stereochemistry:** Isomerism, Stereoisomerism, Geometric Isomerism, Saw-Horse Projection of Molecules, Optical activity, Specific Rotation, Enatiomers, Diastereomers, Racemic modification & its resolution, Conformational isomerism, Meso-Compounds, elements of Symmetry, Chirality, Chiral Centeres, Nomenclature in Stereoisomerism (Configuration: R & S, Z & E, D & L), Sequence Rule. Synthesis & reaction of Chiral Molecules, Stereo selective & Stereo specific Reaction.
2. **Free Radicals:** Structure & stereochemistry, stability, Generation of free radicals (Thermal decomposition, photochemical, oxidation, reduction and electrolysis), Radical anions & cations (definitions & some organic reactions involving them as intermediates), free radical reactions (Kolbe electrolysis, Hunsdiecker reaction, Sandmeyer reaction, Gomberg reaction).
3. **β- Keto esters:** Mechanism of Claisen and Dieckamnn reactions, Use of aceto-acetic ester and malonic ester in Synthesis.

   Unsaturated Compounds: Michael Addition and addition of Grignard Reagent.

4. **Polycyclic Compounds:** Structure, synthesis and reactions of naphthalene, anthracene and phenanthrene involving substituents, carcinogenic hydrocarbons.

SECTION- B

Aldehydes and Ketones: General methods of preparation, mechanism of nucleophilic addition and condensation reactions: Acetal, amine, oximes, hydrazones, smicarbazones, enamine preparation & use.

Addition of Grignard reagent and Hydrides, MPV reduction, Oppenaur oxidation, Aldol condensation, Cannizroõs reaction, Reformatsky reaction, Perkin reaction, Knoevenagel reaction, Haloform Reaction & Mannich reaction.

Carboxylic acids (aromatic & aliphatic): Methods of preparation and reaction. Functional derivatives of carboxylic acids: Acid halides, Anhydrides, Esters and Amides- General Methods of preparation and Mechanism of esterification, transesterification and ester hydrolysis.

Phenols: Prepation and reaction.

Sulphonic Acids : Prepation and reactions

Subject code: P- 4.2

Subject : Pharmaceutical Organic chemistry – II

PRACTICAL 45 Hours (3 hrs. /week)

1. Qualitative Analysis of Binary Mixtures
   a. Solid-Solid mixtures (minimum 10)
   b. High vacuum (fractional) distillation of liquid-liquid mixtures (minimum 2)
2. Synthesis of some compounds having importance as intermediates in medicinal organic chemistry involving single step reactions.
3. Study and use of stereo models to improve the understanding of the concepts studied in theory.

Recommended Books

1. Advanced Organic Chemistry by E.S. Gould, 4/Ed. Wiley Eastern Edition.
2. Principles of Organic Synthesis by Norman, 3/Ed., Nelson Thorns Publication.
3. Organic Chemistry by Morrison & Boyd, 7/Ed, Pearson Education.

4. Heterocyclic Chemistry by Joule and Mill, 4/Ed., Blackwell Publishing Oxford.
5. Organic Chemistry by Fieser & Fieser, Vol. I-X, 1/Ed. Asia Publishing House.
6. Modern Hetrocylic Chemistry By Leao Payrettee.
7. Organic Synthesis- The disconnection approach by Stuart Warren, John Wiley & Sons.
8. Vogelõs Textbook of Practical Organic Chemistry by A. I. Vogel, 5/Ed., Pearson Education.
9. Handbook of Organic Analysis (Qualitative and Quantitative) by H. T. Clarke, 1/Ed. Arnold-Heinemann.
10. Textbook of Practical Heterocyclic Chemistry by Fitten and Smalley.
11. Synthesis of Drugs-Synthone approach Vol. 1, by Radhakrishnan Ayer, J. R. Rao,
12. M. S. Degani, S. A. Ghone, K. Mohanraj, 2/Ed, 2008, Sevak Publication Pvt. Ltd.
13. Quantitative organic Analysis by Siggsa & Honna, 4/Ed., A Wiley Interscience Publication. John Wiley & Sons.
14. Organic Synthesis, Vol. I to X, John Wiley & Sons Ins. New York.

Subject code: T-4.3

Subject : Pharmaceutical Analysis – I

THEORY 45 Hours (3 hrs. /week)

SECTION-A

1. **Introduction** : Significance of quantitative analysis in quality control, different techniques of analysis, preliminaries and definition. Concept of error, classification of errors and means to minimize errors, precision and accuracy, Defination of terms mean, mode, median, SD, percent CV, statistical tests of significance, t-test, F-test, Q-test and application of all above tests to chemical data. Fundamentals of volumetric analysis, methods of expressing concentrations, primary and secondary standards, calculation of equivalent weight & stochiometry.

   Official methods of control:-Standardization of pharmaceutical chemicals, Raw material analysis RMA and finished product analysis FPA, a brief introduction to manufacturing variations, storage conditions & shelf life of different dosage forms.

2. **Aqueous Acid – Base Titrations:** Acid base concept, law of mass action, Neutralization curves, end point detection. Theory of

indicators, choice of indicators, mixed indicators. Application to I.P. products: assay of Aspirin power, Benzoic acid powder.

3. **Complexometric Titrations:-** Concept of complexation and chelation, formation of complex, its stability & factors affecting stability, Warnerôs co-ordination number. Titration curves, types of complexometric titration, method of end point detection, metallochrome indicators (no structure).

   Application to I.P. products: Assay of zinc sulphate powder, Calcium gluconate powder, Calcium gluconate Injection.

SECTION-B

4. **Oxidation Reduction Titrations :** Theory of redox titrations, strength and equivalent weight of oxidizing and reducing agents. Oxidation ï reduction curves, Redox indicators. Titration involving potassium permanganate, Potassium dichromate, potassiumbromate, potassium iodate cerium (IV) sulphate, Iodine (iodimetry and iodometry), titanious chloride.

   Application to I.P. products: Ferrous sulphate, Ascorbic acid, Methylene blue, Isoniazide, Hydrogen peroxide.

5. **Nonaqueous titrations :** Types of solvents, end point detection Karl-fischer method. Application to I.P. products: Mebendazole powder, Atenolol powder, Norfloxacin powder.

6. **Precipitation Titration:-** Precipitation reactions, factor affecting solubility of precipitate. Principal of precipitation titration. Titration involving mercuric nitrate, ammonium or potassium thiocynate.

   Argentometric titration: Theory (Moharôs, Volhardôs, Guy lussac & Fajanôs Method Adsorption indicator). Application to I.P. products: Assay of sodium chloride & potassium chloride, injection.

7. **Sodium nitrite titration :** Theory, Application to I.P. product: Assay of sulphanilamide.

Subject code: P- 4.3

Subject : Pharmaceutical Analysis – I

PRACTICAL **45 Hours (3 hrs. /week)**

1. Standardization of analytical weights and calibration of volumetric apparatus.

2. Preparation and standardization of secondary standard reagents and assay of drugs official in I.P. of following categories.

3. **Acid – Base titration :** Preparation and standardization of acids and some bases. Assay involving Direct and Back titration some official assay procedures eg., Boric acid, Benzoic acid, Aspirin.

4. **Complexometric titration :** Preparation and standardization of EDTA solution. Assay of magnesium sulphate, lead nitrate, calcium gluconate.

5. **Precipitation titration :** Preparation and standardization of titrants like silver nitrate and ammonium thiocynate. Titration according to Mohrôs, Volhardôsand Fajanôs method.

6. **Oxidation-Reduction titration :** Preparation and standardization of redox titrants such as Potassium permanganate, potassium dichromate, Iodine, Sodium thiosulphate, cerric ammonium sulphate. Assay of Ferrous sulphate powder, oxalic acid, strong and weak iodine solution, Lugolôs solution, titanous chloride.

7. **Non-aqueous titration :** Preparation and standardization of perchloric acid, sodium/potassium/lithium methoxide. Assay of Norfloxacin powder/tablet, Mebendazole powder/tablet, and atenolol powder/ tablet.

8. Assay of sulpha drugs by Dizotization

Recommended Books

1. Vogelôs Text Book of Quantitative Chemical Analysis, 6/Ed., Pearson Education.
2. Quantitative analysis by V.Alexyev, Student Edition, CBS Publisher & Distributor.
3. Fundamentals of Analytical Chemistry by skoog, West, Holler, Harvest, 8/ED., Thomson Brookslcole.
4. Pharmaceutical Analysis by Higuchi, Reprint 2004, CBS Publisher & Distributors.
5. The Quantitative analysis of drugs by Garrat D C, 3/Ed., CBS Publisher & Distributors.
6. Quantitative analysis by Day RA & Underwood AL, 5/Ed., Prentice Hall of India Pvt. Ltd. New Delhi.
7. Analytical Chemistry by Christian GD, 6/ED., John Wiley & sons.
8. A Textbook of Pharmaceutical Analysis by Connors KA, 4/Ed., John Wiley & Sons.

9. Practical Pharmaceutical Chemistry Part-I by Beckett AH & Stanlake JB, 4/Ed., CBS Publisher & Distributors.
10. Handbook of Instrumental Techniques for Analytical Chemistry by Frank Settle, First Indian Reprint 2004, Pearson Education.
11. Pharmaceutical Analysis Vol.II, K.R.Mahadik, S.G.Wadodkar, H.N.More, Nirali Prakashan.

Subject code: T-4.4

Subject : Pharmaceutical Biotechnology

THEORY **45 Hours (3 hrs. /week)**

SECTION-A

1. **Cell culture methods:** Comprehensive study of cell and organ culture methods.
2. **Replication of DNA:** Semi conservative replication, Meselson & stahlôs Experiments, replication initiation, elongation and termination, enzymes and proteins involved in prokaryotic and eukaryotic replication.
3. **Protein synthesis:** Genetic code and its significance, Transcription and Translation; Initiation, elongation and termination, structure and role of RNA Polymerase in eukaryotes and prokaryotes. role of RNA and proteins involved in the process.
4. **Genetic Recombination:** Introduction to genes and gene therapy. Transformation, conjugation, tansduction, protoplast fusion and genecloning and their applications. Development drugs produced by biotechnology such as Humatrope, HB erythroprotine.

SECTION-B

5. **Antibiotics & other fermented products:** Historical development of antibiotics Antimicrobial spectrum and methods used for their standardization. Screening of soil for organisms producing antibiotics, fermenter its design, control of different parameters. Isolation of mutantôs factors influencing rate of mutation. Design of fermentation process. Isolation of fermentation products with special reference to penicillin, streptomycin, tetracycline and vitamin B 12.

6. **Microbial Transformation:** Introduction, types of reactions mediated by micro organisms, design of biotransformation processes, selection on organisms, biotransformation process and its improvements with special reference to steroids.
7. **Bacterial Enzyme:** Enzyme immobilization, Techniques of immobilization of enzymes, factors affecting enzyme kinetics. Immobilization of bacteria and plant cells.

Subject code: P-4.4

Subject : Pharmaceutical Biotechnology

PRACTICAL **45 Hours (3 hrs. /week)**

1. Microbial limit test as per I.P. specifications.
2. Sterility testing of pharmaceutical products.
3. Microbial assay of antibiotics/vitamins/amino acids.
4. Bacteriological examinations of water, milk & food products.
5. Demonstration of an experiment to illustrate the production of an antibiotic by fermentation.
6. Immobilization of enzymes and study of itôs activity.
7. Experiments to illustrate microbial bio-transformation (Demonstration).

Recommended Books:

1) Kielslich K, Ed Biotechnology Vol 6a, Verleg Chemie, Switzerland.
2) Lewin Benjamin, Gene V Microbiology.
3) Peppler, Microbial Technology, Vol II & I.
4) Prescott L M, Jarely G P, Klein D A, Microbiology, WmC Borown Publishers, Oxford.
5) Prescott and Dunn, Industrial Microbiology, McGraw Hill Book Company Inc.Inc. NY.
6) Salle A. J., Fundamental Principles of bacteriology.
7) Shotton E and Ridgaway K., Physical Pharmaceutics Oxford University Press, London.
8) Stanier R. Y., Ingraham, General Microbiology, Wheellis and Painter.
9) Ward O.P. Fermentation Technology, Principles, Processes & Products Open University Press, Milton Keynes, UK.
10) Microbiology, Pelzar & Reid
11) R.Anathanarayan and C. K. J. Panikar, Textbook of microbiology.
12) Practical Microbiology by R. S. Gaud and G. D. Gupta. 2nd Edition, Nirali Prakashan, Pune

Subject code: T-4.5
Subject : Pharmacology-I
THEORY **45 Hours (3 hrs. /week)**

SECTION-A

1 **Introduction of Pharmacology:** Definitions, scope and general principles of pharmacology, various branches of pharmacology, Nature and sources of drugs, routes of drug administration.

2 **Bioassays**: Types, principles and applications, merits and demerits of bioassays. Official bioassay of drugs as per IP.

3 **Adverse drug effects:** Introduction to adverse drug effects. Mechanism and types of allergic reactions. Predictable and unpredictable adverse drug reactions e.g. side effects, secondary effects, toxic effects, intolerance, idiosyncrasy, drug allergy, photosensitivity, drug dependence, drug withdrawal reactions, teratogenicity.

4 **Pharmacokinetics:** Biological membranes- structure, types, properties and functions of biological membranes, Physicochemical factors and processes in transfer of drugs across the biological membranes, Drug absorption, Bio-availability, factors affecting drug absorption and bio-availability.

Distribution, Metabolism (Biotransformation) and Excretion (Elimination) of drugs and factors affecting all these processes.

SECTION-B

5 **Pharmacodynamics:** Introduction to pharmacodynamics. Principles and mechanism of drug action. Factors modifying drug action. Concept of drug summation, drug synergism, drug antagonism and its types.

Drug Receptors- Basic discussion about receptors, classification and families of receptors, receptors theory, drug effects and regulation of receptors. Quantitation of drug receptor interactions and their effects, dose response relationships and therapeutic index.

6 **Pharmacology of drugs acting on autonomic nervous system**: Organisation and function of autonomic nervous system, autonomic transmission and cotransmission.

Cholinergic system and Drugs, Anticholinergic drugs. Adrenergic system and drugs, Antiadrenergic drugs.

Subject code: P- 4.5
Subject : Pharmacology-I
PRACTICAL **45 Hours (3 hrs. /week)**

1. Care and handling of common laboratory animals.
2. Introduction to animal physiology with their biochemical reference value in various animal species.
3. Study of different parameters of animals e.g. body weight, life span, B.P, temperature etc.
4. Study of laboratory animals and various preparations of them used in animal experimentation.
5. Study of laboratory appliances used in experimental pharmacology.
6. Study of various physiological salt solutions used in experimental pharmacology.
7. Study of various anesthetics employed to anesthetize the laboratory animal.
8. Study of various routes of administration in animals
9. To study the blood sample collection from experimental animals.
10. To study the influence of various route of administrations on sleeping time by using suitable drugs.
11. To study the absorption of suitable drugs from intestine preparation from rat, mice, or goat.
12. To study the effects of autonomic drugs on the rabbit eye with special reference to physostigmine sulphate and atropine.
13. To study the Hypnotic property of drug/drugs using mice/rats as experimental animals.

Note

- Suitable animal preparation- Any experiment suitable to demonstrate the concept- It could be either in-vivo or in-vitro, The animal selected may be mice, rat, rabbit, guinea pig as admissible as per prevailing Government/CPCSEA guidelines. In case of in-vitro preparations- any tissue preparation from above animals or various tissues from goat may be obtained from slaughter house/ abattoir /butcher shop.
- Agonist- Any agonist that can exhibit activity using the given preparation as reported in standard books/journals may be selected e.g.-Adrenaline and other catecholamines, Acetyl Choline, Histamine, Serotonin, oxytocin etc.

- Antagonist- Any antagonist that can exhibit blocking activity of above mentioned agonists in the given preparation as reported in standard books/journals may be selected.

Recommended Books

1. Goodman Gilman, The Pharmacological basis of therapeutics. Mc-graw Hill New Delhi.
2. Foster R.W. Basic Pharmacology, Arnold, New Delhi.
3. Stahl S. M.. Essential Psychopharmacology Cambridge University Press New Delhi.
4. Dipiro J.L. Pharmacotherapy Handbook. Tata McGraw Hill New Delhi.
5. Official books - Indian Pharmacopoeia, British Pharmacopoeia, United States Pharmacopoeia.
6. Tripathi K.D. Essentials of medical Pharmacology Jaypee New Delhi.
7. Barar F.S.K. Essentials of Pharmacotherapeutics, S. Chand & Company Ltd. New Delhi.
8. Rang H.P., Dale M.M. et. al. Pharmacology. Churchill L Ivingstone, New Delhi.
9. Katzung B.G .Basic & Clinical Pharmacology Mc-graw Hill, New Delhi.
10. Lewisôs Pharmacology. Churchill Livingstone London.
11. Harvey R.A., Champe P.C. Lippincottôs Illustrated Reviews-Pharmacology. Lippincott Williams & Wilkins, Pennsylvania.
12. Ghosh M.N. Fundamentals of Experimental pharmacology. Hilton & Company Kolkata.
13. Vogel G.H. Drug discovery and evaluation. Springer Germany.
14. Goyal R.K. Practicals in pharmacology. B.S. Shah Prakashan Ahmedabad.
15. Kulkarni S.K. Handbook of Experimental Pharmacology. Vallabh Prakashan. New Delhi.
16. Pillai, K. K. Experimental Pharmacology. CBS Publishers New Delhi.
17. Grover, J.K. Experiments in Pharmacy and Pharmacology Vol-II. CBS publishers New Delhi.

18. Perry W. L. M. Pharmacological Experiments on Isolated preparations. E.&S.Livingstone, London.
19. Kasture S.B.Text book of Experimental Pharmacology, Career Publication Nashik.
20. Official books - Indian Pharmacopoeia, British Pharmacopoeia, and United States Pharmacopoeia.
21. Related research papers from various journals.

Subject code: T-4.6

Subject : Basic Computer Applications

THEORY **45 Hours (3 hrs. /week)**

SECTION-A

1. Introduction to computers and Operating Systems

Introduction: Definition of Electronic Digital Computers and their characteristics like speed, Storage, Accuracy, Diligence, Automation and versatility. Classification and types of computers, Structure of Computer (Block diagram of computer), Function of different units of computer, memory, RAM, ROM, Input and Output devices, Secondary Storage Devices, Concept of Operating Systems, Definition, Elements of MS-DOS, Unix and Windows.

2. Electronic Communication and computer networks

Software: Types of Communication, Data Transmission, Networks, Types of Networks, Internet, electronic mail, e-commerce.

SECTION-B

3. Computer Languages and basic application software

Software: Computer Languages - Machine language, Assembly Language, High Level Languages and their comparison. Introduction to Compilers and Interpreters (Definition and Comparison). Types of Software, Word Processor - MS-Word, Features, application. Spreadsheet - MS-Excel, Features, application. Data Base

Management System MS-Access, Features, application Presentation Graphics - Microsoft Power Point, Features, application.

4. Computer applications

Applications: In general, Scientific and research, Role of computer in Pharmaceutical and Clinical studies, In Drug Information Storage, Pharmacokinetics, Drug Design and Pharmaceutical Analysis.

References:

1. Computer and Commonsense (4th Edition) ï Roger Hunt, John Shelly
2. Computer Today (3rd Edition) ï Donald Landers.
3. Computer Medicine ï S.Rose
4. Computer Applications in Pharmacy ï William and fassett
5. MS-CIT ï Computing Essentials ï Timothy J.Oôleary, Linda I Oôleary.
6. Introduction to Biostatastics & Computer Science ï Y.I.Shah, Dr.A.R.Paradkar, M.G.Dhayagure