

# VEER NARMAD SOUTH GUJARAT UNIVERSITY

## B. Pharmacy

2003-04

### SECOND YEAR

Paper No.	Subject	Maximum Marks for					
		Theory			Practical		
		Ex	Se	Total	Ex.	Se	Total
201	Physical Pharmacy	60	40	100	70	30	100
202	Pharmaceutical Unit Operations	60	40	100	70	30	100
203	Pharmaceutical Analysis-I	60	40	100	70	30	100
204	Pharmaceutical Chemistry-III (Heterocyclic and Natural Products)	60	40	100	70	30	100
205	Pharmaceutical Microbiology	60	40	100	70	30	100
206	Pharmacology-I	60	40	100	70	30	100
207	Basic Electronics and Computer Applications	60	40	100	70	30	100
208	Mathematics and Statistics	60	40	100	-	-	-

# VEER NARMAD SOUTH GUJARAT UNIVERSITY

## B. Pharmacy

### B. PHARM SECOND YEAR

#### PH-201 PHYSICAL PHARMACY

##### THEORY (75 hours)

- 1. Intermolecular forces and states 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, sublimation-critical point, 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-nonpolar 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 and distribution coefficient.
- 4. 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.
- 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. 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, flocculation agents, deflocculating agents, foaming agents and anti-foaming agents.
- 7. Colloids and macromolecular systems:** Introduction and types, optical, kinetic and electrical properties of colloids, stabilization of colloids, gels-structure, properties and applications in pharmacy.
- 8. Coarse dispersions and emulsions:** 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 and semisolid dispersions.

9. **Micromeritics:** Introduction and pharmaceutical importance, particle size and distribution, particle shape, particle volume, particle number, surface area, methods of 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 and factors affecting flow of powders.
10. **Rheology:** Fundamentals of rheology, types of flow, quantitative measurement of flow, mechanical models to illustrate flow on viscoelasticity, thixotrophy, measurement of thixotrophy, thixotrophy in formulation, rheology of disperse system and pharmaceutical applications of rheology. Methods of viscosity measurements.
11. **Complexation:** Classification, methods of preparation and analysis, crystalline structure of complexes, thermodynamic treatment of stability constants and protein binding.

### **PRACTICAL (75 Hours)**

1. Studies of polymorphs, their identification and properties.
2. Determination of particle size, size distribution and surface area using various methods of particle size analysis.
3. Determination of derived properties of powders like density, porosity, compressibility and angle of repose.
4. Determination of surface/interfacial tension, HLB value and critical micelle concentration of surfactants.
5. Study of rheological properties of various types of systems using different viscometers.
6. Studies of different types of colloids and their properties.
7. Preparation of various types of suspensions and determination of their sedimentation parameters.
8. Stabilities of studies of emulsions.
9. Studies on different types of complexes and determination of their stability constants.
10. Determination of half-life, rate constant and order of reaction.
11. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.  
Experiments involving tonicity adjustments.

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### PH-202 PHARMACEUTICAL UNIT OPERATIONS THEORY (75 hours)

1. **Flow of fluids:** Introduction, Manometers, Reynolds number, viscosity, its units and measurements, Bernoulli's theorem, fluid head, friction loss, enlargement and contraction losses. Flow meters.
2. **Transportation of fluid:** Pipes, its standard, strength, fittings, joints, flanges, valves and pumps. Transportation of gases, ejectors, compressors, fans and blowers.
3. **Flow of heat:** Conduction, convection and radiation. Heat flow through a cylinder. Surface co-efficient; boiling liquids and condensing vapors. Black body, heaters, heat interchanges and heat insulation
4. **Corrosion:** Corrosion and its prevention.
5. **Evaporation:** Different types of evaporators, condensers, traps, entrapment, separators, evaporator capacity, heat and material balance, Dahring's rule, factors influencing heat transfer co-efficient. Rate of scale formation. Principle and operation of a multiple effect evaporator.
6. **Distillation:** Vapor-liquid equilibrium, boiling point diagram, Raoult's law, Henery's law, constant boiling mixture, equilibrium diagram, equilibrium distillation, differential distillation, rectification, fractionating column, heat and material balance and factors influencing plate efficiency.
7. **Extraction:** Extractors, flow sheet of extraction plant, liquid-liquid extraction, extraction towers, solid-liquid extractors and counter current multistage extractors.
8. **Filtration:** Filters, classification of filters and different types of filtering equipment, Factors affecting rate of filtration. Theory of filtration, limitations of filters, filter aids, centrifuges and sterile filters.
9. **Mixing:** Theory of mixing of liquids with liquids, gases with liquids, solids with solids and types of mixing.
10. **Crystallization:** Crystal forms, theory of crystallization, rate of crystal growth and classification of crystallizers.
11. **Size reduction:** Theory of size reduction, size reduction equipments.
12. **Size separation:** Screen, standards of screen, screen analysis and types of screening equipment. Size separation by settling, classification and sedimentation.
13. **Conveying:** Conveyors, belt and parametric elevation.
14. **Drying:** Classification of dryers and theory of drying. Factors affecting drying, Equipment used in drying-Freeze Dryers.

- 15. Humidity:** Humidity chart and its use. Instruments used in determining humidity. Humidification-Theory and equipment used for humidification. Dehumidification-application and equipment. Refrigeration and air conditioning.

**PRACTICAL (50 hours)**

1. Measurement of flow of fluids, determination of Reynolds Number and calculation of friction loss.
2. Determination of rate of filtration and study of factors affecting filtration.
3. Determination of humidity.
4. Determination of drying rate and drying rate curves.
5. Extraction involving liquid-liquid extraction and solid-liquid extraction.
6. Experiment involving size reduction and size separation.
7. Experiment involving heat transfer.
8. Experiment involving distillation.

# VEER NARMAD SOUTH GUJARAT UNIVERSITY

## B. Pharmacy

### PH-203 PHARMACEUTICAL ANALYSIS –I THEORY (50 hours)

1. **Introduction:** Significance of quantitative analysis in quality control, different techniques of analysis, computation of analytical results, significant figures, concept of error, precision and accuracy, standard deviation, calibration of analytical equipments, fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.
2. **Acid-Base titrations:** Acid base concepts, relative strength of acids and bases, ionization, law of mass action, common ion effect, ionic product of water, pH, Henderson-Hasselbach equation, buffer solutions, neutralization curves, acid-base indicators and their choice and mixed indicators.
3. **Oxidation-Reduction titrations:** Theory and pharmaceutical applications, strength and equivalent weights of oxidizing and reducing agents, measurement of electrode potential, oxidation-reduction curves and redox indicators. Titrations involving potassium permanganate, ceric ammonium sulphate, potassium iodate, potassium bromate, titanous chloride, sodium 2,6-dichlorophenol-indophenol, iodimetry and iodometry.
4. **Precipitation titrations:** Principles of precipitation titrations, titrations involving mercuric nitrate, ammonium or potassium thiocyanate, barium sulphate, argentometric titrations and adsorption indicators.
5. **Gravimetric analysis:** Basic concepts, precipitation techniques, coprecipitation, post-precipitation, various steps involved in gravimetric analysis and their pharmaceutical applications.
6. **Non-aqueous titrations:** Theoretical considerations, scope, limitations, titration of weak acids, weak bases, indicators and precautions.
7. **Complexometric titrations:** Complexation and chelation, Warner's coordination number, stability of complexes, titrants, titration curves, types of Complexometric titrations and methods of end point detection.
8. **Miscellaneous methods of analysis as:** Diazotization titration, Kjeldahl method of nitrogen estimation, oxygen flask combustion and gasometry.

### PRACTICAL (75 Hours)

Standardization of analytical weights and calibration of volumetric apparatus.

1. **Acid-base titrations:** Preparation and standardization of acids and bases, some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures, e.g. boric acid should also be covered.
2. **Oxidation-Reduction titrations:** Preparation and standardization of some redox titrants, e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2,6-dichlorophenol indophenol and ceric ammonium sulphate.
3. **Precipitation titrations:** Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate. Titrations according to Mohr's Volhard's and Fajan's methods.
4. **Gravimetric analysis:** Preparation of Gooch crucible for filtration and use of sintered glass crucible, determination of water of hydration and some exercises related to gravimetric analysis should be covered
5. Preparation and standardization of perchloric acid and sodium/ potassium / lithium methoxide. Estimation of some drugs based on it.
6. Preparation and standardization of EDTA and some assays based on it.

# VEER NARMAD SOUTH GUJARAT UNIVERSITY

## B. Pharmacy

### PH-204 PHARMACEUTICAL CHEMISTRY–III

#### (Heterocyclics and Natural Products)

#### THEORY (75 hours)

1. **Heterocyclic compounds:** Chemistry, preparation and properties of some important mono-heterocyclics containing 3,4,5 and 6 C atoms with one or two heteroatoms like N, O, S and fused systems like indole, benzimidazole, quinoline, isoquinoline, acridine, phenothiazine.
2. **Chemistry of lipids, carbohydrates, proteins, amino acids and nucleic acids.**
3. **Concepts of stereoisomerism** taking examples of natural products.
4. **Classification, chemistry and pharmacological activity** of medicinally important monoterpenes, sesquiterpenes, diterpenes and triterpenoids.
5. **Carotenoids:** Beta-carotenoids, alpha-carotenoids, vitamin A and xanthophylls of medicinal importance.
6. **Glycosides:** Chemistry of digitoxin, digoxin, hecogenin, sennosides, diosgenin and sarasapogenin.
7. **Alkaloids:** Classification and general methods of structural elucidation excluding individual structure elucidation, chemistry and pharmacological activity of atropine and related compounds, quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids.
8. **Chemistry of** medicinally important lignins and quassanoids, flavonoids, purines and xanthines.
9. A brief account of chemistry and medicinal uses of taxol and derivatives, podophyllotoxin and derivatives, coumarin and artemisinin.

#### PRACTICAL (75 Hours)

1. Five exercises in synthesis involving various heterocyclic ring systems.
2. Workshop on molecular modeling of primary, secondary and tertiary structures of proteins. Molecular modeling on double helical structure of nucleic acid showing hydrogen bonding.
3. Analysis of oils and fats as given in I.P.
4. Estimation of functional groups as hydroxyl, amino and carbonyl.

# VEER NARMAD SOUTH GUJARAT UNIVERSITY

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### PH-205 PHARMACEUTICAL MICROBIOLOGY

#### THEORY (50 hours)

1. Classification of microbes and their taxonomy, bacteria, viruses (DNA, RNA and retroviruses), fungi, actinomycetes, rickettsia and spirochaetes, Detail study of structure and function of bacterial cell.
2. Nutrition, cultivation, isolation and identification of bacteria, viruses, protozoa and fungi.
3. Purification of bacterial culture and different staining techniques.
4. Microbial genetics and variation and bacterial enzymes.
5. **Infection:** Modes of microbial infection, transmission and control/prevention of bacteria, fungal, protozoal and viral diseases (and AIDS)
6. **Systematic studies of organisms causing following infections:** Rheumatic fever, pneumonia, gonorrhoea, diphtheria, cerebrospinal meningitis, typhoid, bacillary and amoebic dysentery, cholera, plague, influenza, pertussis, whooping cough, gas gangrene, tetanus, tuberculosis, leprosy, syphilis, rickettsia, rabies, poliomyelitis, dange, small pox, measles, mumps, AIDS and malaria.
7. **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 and evaluation of microbial stability of formulations.
8. Control of microbes by physical and chemical methods and disinfection.
9. **Sterilization:** Different methods, evaluation of sterilization methods and sterility testing of pharmaceutical products as per I.P. and B.P. requirements.
10. **Aseptic techniques:** Sources of contamination and methods of prevention, designing of aseptic area, laminar flow equipment, their services and maintenance.
11. **Immunology:** Important contribution made by different scientists in the development of immunology, microbial invasion, non-specific host resistance and inflammatory response. Haemopoiesis (stem cells, lymphoid differentiation, non-lymphoid differentiation, soluble factors in Haemopoiesis), lymphoid organs (primary and secondary), B, T, and accessory cells and their role in immunity, types of immunity, antigen, antibodies and complement. Immune system- Humoral immunity, cellular immunity, and Hypersensitivity reactions.
12. General methods of preparation, bacterial and viral vaccines, antitoxic sera, bacterial tests and preparations used in diagnosis of diphtheria, tuberculosis, etc. standardization and preservation of immunological products as vaccines and sera.

## **PRACTICAL (50 Hours)**

1. Preparation and sterilization of various types of culture media.
2. Isolation of pure culture of microorganism from various sources and identification of microorganisms including biochemical tests.
3. Preservation of bacterial strain.
4. Microbial limit test as per I.P. specifications.
5. Sterility testing of pharmaceutical products including apparatus, injection, transfusions and other pharmaceuticals
6. Microbial assay of antibiotics/vitamins/amino acids.
7. Sub culturing of aerobic, anaerobic bacteria, fungus and yeast, nutrient stabs and slants preparation.
8. Various staining methods-simple, Gram's acid fast staining and structural staining.
9. Evaluation of antiseptics and disinfectants.
10. Evaluation of sterilizing techniques.
11. Bacteriological examination of water, milk and food products.
12. Microbial viable count in pharmaceutical products and total count of bacteria.
13. Effect of temperature and pH of the medium on the growth of microbes.
14. Demonstration of antigen-antibodies reactions for clinical diagnosis from the available impregnated strips in the market.

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## B. Pharmacy

### PH-206 PHARMACOLOGY-I

#### THEORY (75 hours)

1. **General Pharmacology:** Definition, scope and various branches of pharmacology, historical development of pharmacological thought with special reference to development of pharmacology in India. Routes of drug administration.
2. **Pharmacokinetics:** Mechanisms of principles of absorption, distribution, biotransformation and excretion of drugs.
3. **Pharmacodynamics:** Principles of drug action, molecular mechanism of drug action, concept of receptors, theories of drug receptor interaction, agonist, partial agonist, antagonist, synergism, various types of antagonism, brief description of cellular signaling systems, factors modifying drug action, tolerance and tachyphylaxis.
4. **Bioavailability:** Single dose bioavailability and multiple dose bioavailability.
5. **Pharmacology of drugs acting on autonomic nervous system:** Organization and function of autonomic nervous system, autonomic transmission and cotransmission.
6. **Cholinergic system and drugs:** Cholinergic transmission, cholinergic receptors, parasympathomimetic agents, anticholinesterases and anticholinergic drugs.
7. **Adrenergic system and drugs:** Adrenergic transmission, biosynthesis, storage, release, re-uptake and metabolism of endogenous catecholamines, adrenergic receptors, adrenergic drugs, *alpha and beta* adreno receptors blockers and adrenergic neuron blockers
8. **Drugs acting on autonomic ganglia:** Ganglionic transmission, ganglionic stimulants and ganglion blocking agents. Neuromuscular blocking agents.
9. **Drugs acting on central nervous system:** Synaptic transmission in central nervous system.
10. **General anesthetics:** Theories of anesthesia, stages of anesthesia, inhalation anesthetics, intravenous anesthetics and pre-anesthetic medication.
11. Alcohol and its antabuse.
12. **Sedative-hypnotics:** Barbiturates, benzodiazepines and non-barbiturate hypnotics, Antiepileptic drugs and antiparkinsonian drugs, Alzheimer's diseases.  
Local Anesthetics
13. **Drugs used in mental illness:** Antipsychotic agents, antianxiety drugs, antidepressants, antimanic drugs, hallucinogens.  
Opioid analgesics and antagonists.

Non-opioid analgesics and non-steroidal anti-inflammatory agents and other drugs for arthritis and drugs used in gout.

Central nervous system stimulants and cerebroactive drugs.

Drug abuse and its management.

14. **Autacoids and related drugs:** Histamine, 5-hydroxytryptamine and their antagonist. Plasma kinins and angiotensin. Pentagastrin, substance P and cholecystokinin, Eicosanoids.
15. **Hormones and related drugs:** Introduction to endocrine pharmacology, pituitary hormones, oxytocic and oncolytic agents, thyroid hormones and anti thyroid agents, hormones of pancreas and hypoglycaemic agents, adrenal corticosteroids and corticosteroid antagonists, gonadal hormones and their inhibitors, oral contraceptives and drug regulating calcium homeostasis.
16. Drugs acting on respiratory system: Anti-asthmatics, antitussive agents, Bronchodilators and respiratory stimulants.

#### **PRACTICAL (75 Hours)**

1. **Introduction to experimental pharmacology:** Introduction to commonly used instruments in experimental pharmacology, laboratory animals, anaesthetics employed to anaesthetize laboratory animals, physiological solutions, drug solution and use of molar solutions. Stunning, pithing and euthanasia. Care and handling of laboratory animals.
2. **A.D.M.E. studies:** Study of various routes of administration i.e. intravenous, intramuscular, subcutaneous and intragastric administration. Blood sample collection from experimental animals.
3. **Pharmacology of receptors:** Dose-response relationships, synergism and antagonism.
4. **Pharmacological techniques:** Common evaluation techniques of analgesics, anticonvulsants, local anaesthetics, drugs affecting muscle rigidity and ciliary movements, anti-psychotics, drugs affecting spontaneous motor activity, sedatives and hypnotics.  
Effect of autonomic drugs on rabbit eye.
5. Inotropic and chronotropic effect of drugs and electrolytes on frog heart.

# **VEER NARMAD SOUTH GUJARAT UNIVERSITY**

## **B. Pharmacy**

### **PH-207 COMPUTER APPLICATIONS THEORY (50 hours)**

#### **Introduction to:**

- 1.1 Classification of computer.
- 1.2 Simple Model of computer with related terms.
- 1.3 Input devices like keyboard, mouse etc.
- 1.4 Output devices like printers etc.
- 1.5 Storage devices like Hard-disk, floppy disk, and compact disk.
- 1.6 Application of computers.

#### **Introduction to:**

- 2.1 Software: System software, Application software.
- 2.2 Computer languages: High and low level.
- 2.3 Operating systems.
  - 2.3.1 Functions of Operating system.
  - 2.3.2 Types of Operating system.
  - 2.3.3 Operating system techniques.
  - 2.3.4 Concepts of Windows Operating systems.

#### **Word Processing Packages- Microsoft word**

- 3.1 Features of word processor.
- 3.2 Typing, Editing, Proofing and Reviewing.
- 3.3 Formatting text and paragraphs.
- 3.4 Automatic formatting and styles.
- 3.5 Tables.
- 3.6 Graphics and Frames.
- 3.7 Mail Merge.
- 3.8 Macros.

#### **Spread Sheet Package-Microsoft Excel**

- 4.1 Concepts and features of spread sheets.
- 4.2 Working and editing in work books.
- 4.3 Formatting.
- 4.4 Charts, Maps and graphs.
- 4.5 Importing and exporting files.

#### **Presentation package-Microsoft Power Point**

- 5.1 Creating and editing slides.
- 5.2 Creating and editing objects in the slides.
- 5.3 Animation and slides transition effects.
- 5.4 Creating and running slide show.
- 5.5 Templates.

#### **Database Management system**

- 6.1 Introduction. Basic Database Concepts.
- 6.2 Objectives, Advantages and Disadvantages of DBMS.
- 6.3 Introduction to Microsoft Access.
  - 6.3.1 Creating and modifying tables with MS-Access.
  - 6.3.2 Basic operations like add, delete, update, and search on tables.
  - 6.3.3 Creating reports.
  - 6.3.4 Designing custom forms.

### **Introduction to Internet**

- 7.1 Concepts of different networks.
- 7.2 Internet services and resources.
- 7.3 Use of Internet in various fields.
- 7.4 Web server and Web browser.

### **PRACTICAL (50 Hours)**

**Use of software packages like MS-word, Excel, Power Point and MS- Access.**