VEER NARMAD SOUTH GUJARAT UNIVERSITY
B. Pharmacy

2003-04

FIRST YEAR

Paper No.	Subject	Maximum Marks for					
		Theory			Practical		
		Ex	Se	Total	Ex.	Se	Total
101	General and Dispensing Pharmacy	60	40	100	70	30	100
102	Pharmaceutical Chemistry I (Inorganic)	60	40	100	70	30	100
103	Pharmaceutical Chemistry II (Organic)	60	40	100	70	30	100
104	Pharmacognosy-I	60	40	100	70	30	100
105	Anatomy and Physiology	60	40	100	70	30	100
106	Biochemistry	60	40	100	70	30	100
107	Mathematics and Statistics	60	40	100	70	30	100

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B. PHARM FIRST YEAR

PH-101 GENNERAL AND DISPENSING PHARMACY THEORY
(75 hours)

1. **Evolution of pharmacy and pharmaceutical literature:** History of pharmacy, Historical background and importance of various Pharmacopoeias with special reference to Indian Pharmacopoeia, British Pharmacopoeia, United States Pharmacopoeia, European Pharmacopoeia, International Pharmacopoeia and Extra Pharmacopoeia.
2. **Pharmacopoeial Preparations:** Principles and method of preparation of aromatic water, spirits, elixirs, syrups, glycerine, linctus, solutions, milks and magmas, mucilage and special preparations like pyroxyllins and flexible collodions.
3. **Galenicals:** Principles and methods of extraction, preparation of infusions, decoctions, tinctures, liquid, soft and dry extracts. Introduction and classification of pharmaceutical dosage forms.
4. **Prescription:** Various parts of prescriptions and their functions, handling of prescriptions, sources of errors, care required in dispensing procedures including labeling of dispensed products. Preliminary knowledge of important Latin terms used in prescriptions and their translation into English.
5. **Pharmaceutical calculations and metrology:** Metric and Imperial systems of weight and measures used in prescriptions. Posology, calculations of doses for infants, children, adults and elderly patients; reducing and enlarging formulae; percentage solutions; allegation methods; proof spirits; calculations involving alcohol dilutions; pH and buffer solutions; isotonic solutions; displacement value and calculations involving radioisotopes.
6. **Principles and procedures of dispensing prescriptions:** Principles involved and procedures adopted in dispensing of liquid preparations such as mixtures, suspensions, emulsions, solutions, lotions and liniments; solid dosages forms such as powders, capsules, effervescent powders, tablet triturates and lozenges; paints, sprays, inhalations and poultice.
7. **Incompatibilities:** Definitions, study of types of incompatibilities; physical, chemical and therapeutic; inorganic incompatibilities involving metals and their salts, non-metal, acids and alkalis. Organic incompatibilities involving specific organic salts, purine bases, alkaloids, pyrrozolone derivatives, amino acids, quaternary ammonium compounds, carbohydrates, glycosides, sulfonamides, local anesthetics, dyes, surface-active agents and vitamins. Study of examples of prescriptions containing incompatibilities and their correction and dispensing methods.

PRACTICALS (75 hours)

1. Dispensing of prescriptions falling under the categories of mixtures, solutions, emulsions, creams, powders, suppositories, capsules, pastes, jellies, lozenges, lotions, liniments, inhalations and paints.

2. Identification of various types of incompatibilities in prescriptions. Corrections and dispensing of such prescriptions.

3. Preparation of selected Pharmacopoeial preparations under the category of aromatic waters, spirits, solutions, infusions, tinctures and extracts.

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PH-102 PHARMACEUTICAL CHEMISTRY-I (Inorganic)
THEORY (50 hours)

1. An outline of methods of preparation, uses, storage conditions, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests. (Excluding assays).

2. **Pharmaceutical aids and necessities:** Acids, bases, buffers, antioxidants, water, preservatives, adsorbents, diluents, excipients, suspending agents, colorants, etc.

3. **Major intra and extra cellular electrolytes:** Physiological ions, electrolytes used in replacement therapy, physiological acid base balance, electrolytes used in acid-base therapy, electrolyte combination therapy and inorganic diuretics.

4. **Essential and trace ions:** Copper, zinc, chromium, manganese, molybdenum, selenium, sulphur and iodine.

5. **Gastrointestinal agents:** Acidifying agents, antacids, saline cathartics, protectives and absorbents.

6. **Topical agents:** Protectives, anti-microbial and astringents.

7. **Dental products:** Anticaries agents and dentifrices.
   Complexing and chelating agents used in Pharmacy.

8. **Gases and vapors:** Oxygen, anaesthetics and respiratory stimulants.

9. **Miscellaneous agents:** Sclerosing agents, expectorants, emetics, sedatives. Poisons and antidotes.

10. **Inorganic Radio-pharmaceuticals:** Nuclear reactions, nomenclature, methods of obtaining, standard and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions.

PRACTICAL (75 hours)

1. Preparation of following inorganic pharmaceuticals, their identification tests, limit tests and other tests as given in I.P.
   Aluminium hydroxide, barium sulphate, zinc oxide, magnesium sulphate, lithium carbonate, calcium carbonate, ferrous sulphate, potassium citrate and boric acid.
2. Preparation and testing of purified water of Pharmacopoeial standard (I.P.).
3. Semi micro identification tests of mixture and cations and anions (not more than 4) as used in pharmaceuticals.
4. Test for purity for the following:
   1. Swelling power in bentonite
   2. Acid neutralizing capacity in aluminum hydroxide gel.
   3. Ammonium salts in potash alum.
   4. Adsorption property in heavy kaolin.
   5. Presence of iodates in potassium iodide.

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PH-103 PHARMACEUTICAL CHEMISTRY-II (Organic)
THEORY (75 hours)

1. The subject of organic chemistry will be treated in its **modern perspective** keeping for the sake of convenience, the usual classification of organic compounds.

2. **Structure and Properties:** Atomic structure, atomic orbitals, molecular orbital theory, wave equation, molecular orbitals, bonding land antibonding orbitals, covalent bond, hybrid orbitals, intra-molecular and inter-molecular forces, bond dissociation energy, polarity of bond, polarity of the molecule, electro-negativity, inductive effect, resonance hyper conjugation, structure and physical properties.
   Optical activity and chirality, kinds of molecule displaying optical activity, absolute configuration, methods of determining configuration, molecules with more than one chiral center, stereo-specific and stereo-selective synthesis, racemic modification, resolution, cis- trans isomerism, conformational analysis and Bayer's strain theory.

3. **Structure, Nomenclature, Preparation and Reaction mechanisms of:** Alkanes, Alkenes, Alkynes, cyclo-alkanes, dienes, benzene, polyaromatic compounds, arenas, alkylhalides, alcohols, ethers, epoxides, amines, nitro-compounds, phenols, aldehydes and ketones, carboxylic acids and functional derivatives of carboxylic acids.

4. **Reactive intermediates:** Carbocations, carbanions, carbenes, nitrenes and nitrenium ion- their generation and fate.

5. Nucleophilic aromatic substitutions.

6. Alpha, Beta-unsaturated compounds.

7. Conservation of orbital symmetry, rules, electrocyclic, cycloaddition and sigmatropic reactions.

8. Catalysis by transition metal complexes. New organic reagents used in organic synthesis.

PRACTICAL (75 hours)

1. Synthesis of selected organic compounds (Aspirin, p-bromoacetanilide, anthraquinone from anthracene, reduction of nitrobenzene and paracetamol)

2. Identification of organic compounds and their derivatization.

3. Introduction to the use of stereo models.

4. An exercise involving separation of optically active isomer.

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PH-104 PHARMACOGNOSY-I
THEORY (50 hours)

1. Definition, history, scope and development of Pharmacognosy**.**

2. **Sources of drugs:** Biological, marine, mineral and plant tissue cultures.

3. **Classification of drugs:** Alphabetical, morphological, taxonomical, chemical and pharmacological approaches for classification of drugs.

4. **Methods of classification of plants:** Plant taxonomy with special reference to the study of medicinally important families. *Apocynaceae, solanaceae, leguminosae, liliaceae, labiatae, Umbelliferae, Malvaceae* and *compositeae.*

5. **Elementary study of plant genetics:** Polyploidy, mutation, hybridization and chemical races with reference to medicinal and aromatic plants.

6. **Morphology and histology** of plant organs taking suitable examples of medicinal plants.

7. **Cultivation, collection, processing, commerce, conservation** of medicinal plants, factors influencing cultivation of medicinal plants, methods of cultivation, types of soils and fertilizer of common use. Pest management and natural pest control agent.

8. **Quality control of crude drugs:** Adulteration of crude drugs and their detection by macroscopic and microscopic, physical, chemical and biological methods of evaluation. Microbial load and toxic residue in crude drugs, primary and secondary metabolites.

9. **Introduction of plant constituents:** Definition, properties, chemistry, classification, extraction and isolation, identification tests and therapeutic uses for carbohydrates, lipids, tannins, proteins and resins.

10. **Systematic pharmacognostic study of the following crude drugs:**
    Carbohydrates: Agar, ispaghula, guar gum, alginates, honey, pectin, starch, tragacanth and acacia.
    Lipids: Castor oil, cocoa butter, olive oil, shark liver oil, wool fat, spermaceti, chaulmoogra oil, neem oil, beeswax, cod liver oil and kokum butter.
    Tannins: Gambier, black catachu and myrobalan.
    Proteins: Gelatin, spiriluna, collagen and its products.
    Resins: Podophyllum, cannabis, balsum of tolu, turmeric, ginger, asafetida, capsicum, benzoin, myrrh balsam of Peru, and colophony.

11. **Plant fibres** used in surgical dressing and related products with reference to cotton.

12. **Study of pharmaceutical aids:** Kaolin, bentonite, diatomite, natural colors and talc.

13. **Plant hormones** and their application with respect to cultivation and tissue cultures.

PRACTICAL (75 hours)

1. **Morphological and microscopic studies of the following drugs:**
    a. Leaf- Datura and senna
    b. Bark- Cassia, cinnamom and cinchona
    c. Stem- Ephedra
    d. Wood- Quassia
    e. Flower bud- Clove
    f. Fruits- Fennel and coriender
    g. Seed- Isabgol and nux vomica
    h. Root- Rauwolfia and Liquorice
    i. Rhizome- Ginger and podophyllum.

2. **Experiments on:** Loss on drying, extractive value, ash value, crude fibre and swelling index.

3. **Chemical tests:**
    a. Carbohydrate-Acacia, agar, tragacanth and starch.
    b. Lipids-Specific chemical test for oils.
    c. Proteins- Gelatin.
    d. Resin- Benzoin, asafetida, turmeric and myrrh.
    e. Fibres- Cotton

4. **Taxonomical studies** of families mentioned in theory.

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PH-105 ANOTOMY AND PHYSIOLOGY-I
THEORY (75 hours)

1. **Introduction:** Definition and scope of anatomy, physiology and related sciences.
2. **Cellular basis of physiology:** Structure and functions of sub cellular organelles, cell adhesion molecules and gap junctions, ionic channels and generation of membrane potentials. Structure and molecular mechanism of skeletal and smooth muscle contraction.
3. **Human skeleton:** Anatomical terminology. A study of human skeleton including account of skull, spine and important bones of upper and lower extremities, thoracic and pelvic regions. Brief description of important joints and skeletal muscles.
4. **Circulating body fluids:** Blood and its cellular components, blood groups and blood transfusion, immune mechanisms and haemostasis. Lymph and lymph nodes.
5. **Cardiovascular system:**
   Heart: Structure and molecular mechanism of contraction of cardiac muscle. Anatomy of heart. Origin and spread of cardiac excitation. Cardiac contractibility and its regulation. Cardiac cycle, heart sounds and basic principles of electrocardiogram.
   Systemic circulation: Structure and artery and vein, vascular distensibility, cardiac output, venous return and their regulation. Blood pressure and its regulation. Microcirculation and lymphatic circulation.
   Regional circulation: Pulmonary circulation, cerebral circulation, coronary circulation, placental and foetal circulation.
6. **Nervous system:**
   Cellular physiology of nervous system: Structure, impulse generation and conduction in neuron, glial cells. Anatomy, electrical events and chemical transmission in neuro- effector junction.
   Subdivisions of nervous system: Anatomy and function of various parts of central nervous system. Coverings of C.S.F. and cerebral ventricles.
   Somatic sensations: Classification of somatic senses and sensory receptors. Detection and transmission of tactile, pain and thermal sensations.
   Motor functions: Corticospinal and corticobulbar system. Posture regulating systems; spinal integration, medullary components, midbrain components. The cerebellum, basal ganglia and physiology of overall motor control.
   Central regulation of visceral function: Medulla oblongata and hypothalamus, physiology of regulation of hunger, thirst and body temperature.
   Neural basis of instinctual behavior and emotions: Anatomy and function of limbic system. Physiology of sexual behavior, motivation, fear and rage.
   Higher function of nervous system: Hippocampus, Wrenicke's area and brocas area. Physiology of learning, memory and speech.
   Arousal mechanisms, sleep and electrical activity of nervous system: Reticular formation, reticular activating system, thalamus and cerebral cortex. Electroencephalogram, physiological basis of consciousness and sleep.
   Automatic Nervous System: Anatomical organization, neurohumoral transmitters, adrenergic and cholinergic receptors and responses of effector organs to autonomic nerve impulses.
   Reflexes: Physiological basis of monosynaptic and polysynaptic reflexes.
7. **Sensory organs:**
   Physiology of vision: Anatomy of human eye, image forming mechanism, photoreceptor mechanism, visual pathways and cortex, color vision, other visual function and eye movement.
   Hearing and equilibrium: Anatomy of ear, mechanism of hearing, auditory

pathways, vestibular sensation and maintenance of equilibrium.

8. **Chemical senses:** Receptors and pathways of smell and taste. Physiology of olfaction and gustation.
   Respiratory system: Anatomy of respiratory system, mechanism of pulmonary ventilation, pulmonary volumes and capacities, physical principles and mechanisms of gaseous exchange and transport, regulation of respiration, physiological characteristics of emphysema, pneumonia, asthma, tuberculosis, hypoxia, hypercapnia, cynosis, dyspnea and artificial respiration.
9. **Digestive system:** Physiology anatomy of the digestive system, movements and secretions of its different parts and gut reflexes, digestion of various foods and physiology of gastrointestinal absorption.
10. **Excretory system:** Physiological anatomy of the kidneys and urinary tract, urine formation, glomerular filtration and its regulation, tubular reabsorption and secretion, regulation of tubular reabsorption, the countercurrent multiplier and exchange systems, renal clearance tests and micturation.
11. **Acid-base physiology:** Hydrogen ion production, body buffer systems (bicarbonate, phosphate, and proteins), respiratory and renal regulation of acid base balance, correction of acidosis and alkalosis.
12. **Endocrinology and Reproduction:**
    Introduction to endocrinology and general mechanisms of hormone action: Pituitary hormones, their physiological functions, their control by hypothalamus. Formation, secretion and regulation of secretion of thyroid hormones and their functions, diseases of the thyroid. Adrenocortical hormones, their chemistry, secretion, regulation and functions. Abnormalities of adrenocortical secretion. Pancreatic hormones and their metabolic effects and pathophysiology of diabetes mellitus. Parathormone and calcitonin and control of calcium metabolism.
    Reproductive and hormonal functions of the male and female: Spermatogenesis and male sex hormones. Physiological anatomy of female sexual organs, menstrual cycle and puberty, pregnancy, menopause, parturation and lactation.

PRACTICAL (75 Hours)

1. Study of human skeleton and bones e.g. calvicle, scapula, humerus, ulna, radium, cervical, thoracic and sacral vertebrae, pelvic girdle, femur, tibia, fibula and skull.

2. Study of models of organs of various body systems and surgical instruments.

3. **Haematoloty:** Introduction to use and care of microscope, techniques to prick finger, blood smear, TLC, DLC, RBC, platelet count, haemoglobin, reticulocyte count, bleeding time, coagulation time, ESR, packed cell volume, MCV, MCHC and CI.
4. **Human physiology:** The recoding of arterial pulse, pressure, effect of posture and exercise on blood pressure, mean pressure and heart rate, electrocardiogram and man electrical axis, pulmonary function tests, PEFH, Rinne's and Webber's test, tendon reflexes, superficial reflexes, EEG, reaction time and sperm count.
5. **Experimental physiology:** Introduction of physiological equipments and physiological solution, simple muscle twitch, fatigue in muscle-nerve preparation, amphibian heart, rabbit jejunum and rectus abdominus muscle of frog.
6. **Histology:** Identification and study of histology of skeletal, cardiac and smooth muscles, heart, lung, lung, spleen, kidney, pancreas, small intestine, liver, artery, vein, testes and ovary

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PH-106 PHARMACEUTICAL BIOCHEMISTRY
THEORY (50 hours)

1. **Biochemical organization of the cell and transport processes across cell membrane.**
2. **Bioenergetics:** Introduction concept of free energy, role of high-energy nucleotide phosphates, production of ATP and its biological significance.
3. **Enzymes:** Nomenclature, enzyme kinetics and its mechanism of action, mechanism of inhibition, isozymes, enzymes and isozymes in clinical diagnosis.
4. **Co-enzymes:** Vitamins as co-enzymes and their biological significance and metals as coenzymes.
5. **Carbohydrate metabolism:** Glycolysis, fermentation, glucogenesis, glycogenolysis, glycogen formation, metabolism of galactose and galactosemia, pentose phosphate pathway, uronic acid pathway, citric acid cycle-significance and abnormalities of carbohydrate metabolism.
6. **Lipid metabolism:** Oxidation of fatty acids (Beta, Alpha and Omega oxidations). Ketone bodies and their significance, biosynthesis of saturated and unsaturated fatty acids, phospholipids, sphingolipids, control of lipid metabolism, essential fatty acids, and biosynthesis of eicosanoids (prostaglandins, prostacyclines, thromboxanes and leukotrienes). Abnormalities of lipid metabolism.
7. **Biological oxidation and its biochemical importance.**
8. **Nitrogen and sulphur cycle.**
9. **Metabolism of ammonia and nitrogen containing monomers:** Nitrogen balance, biosynthesis and catabolism of amino acids, assimilation of ammonia, urea cycle, metabolic disorders of urea cycle, metabolism of sulphur containing amino acids, porphyrin biosynthesis, formation of bile pigments, porphyries, and hyperbilirubenemia.
10. Nucleic acid metabolism, purine and pyrimidine metabolism, disorders of purine metabolism, purine and pyrimidine biosynthesis, purine-pyrimidine nucleotides inter-conversion, inhibition of nucleotide biosynthesis,. Biosynthesis of DNA and RNA. Abnormalities of nucleic acid metabolism and genetic disorders.
11. Genetic code, protein synthesis and inhibition of protein synthesis.
12. Regulation of gene expression.
13. Brief account genetic engineering and polymerase chain reaction.

PRACTICAL (75 HOURS)

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Study of amino acids by paper chromatography and gel electrophoresis.
3. Separation of serum proteins by electrophoresis on cellulose acetate.
4. Quantitative estimation of proteins.
5. Quantitative estimation of amino acids.
6. The determination of glucose by means of the enzyme glucose oxidase.
7. Enzymatic hydrolysis of glycogen by alpha and beta-amylases.
8. Effect of temperature on the activity of alpha –amylase.
9. Estimation of SGOT and SGPT in the serum.
10. Estimation of cholesterol, creatinine, urea, and uric acid in biological fluids.
11. Estimation of phospholipids in serum.
12. Estimation of serum alkaline phosphatase and acid phosphatase levels.
13. Estimation of bilirubin contents in the blood.
14. Estimation of serum Na^+, K^+ and Ca^+ levels.

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PH-107 MATHEMATICS AND STATISTICS
THEORY (75 hours)

An introductory review of elementary algebra, trigonometry, analytical plane geometry and mensuration.

1. **Differential calculus:** Continuity and limit, differentiation, derivability and deviation, RH derivatives and LH derivatives, differential general theorems and derivation, derivatives of trigonometric functions (including inverse trigonometric functions) logarithmic differentiation, partial differentiation, maxima and minima (elementary)

2. **Integral calculus:** Integration as inverse process of differentiation, definite integrals, integration by substitution and by parts, integration of algebraic functions, evaluation of area and volume in simple cases.

3. **Differential equations:** Formation and derivation, order and degree, first order and degree, linear equations with constant co-efficience, homogeneous linear equations (first method of solution only); Simultaneous differential equations which are linear and of first order.

4. **Laplace transformations:** Definition, transforms of elementary functions, properties of linearity and shifting, inverse Laplace transforms, transforms of derivatives, solution of ordinary and simultaneous differential equations.

5. **Statistics:** Significant digits and rounding of numbers, data collection, random and non-random sampling methods, sample size, data organization, diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams, standard deviation and standard error of means, co-efficient of variation, confidence (fiducial) limits, probability and events, Bayes theorem, probability theorem, probability distribution, elements of binomial and poisson distribution, normal distribution curve and properties, kurtosis and skewness; correlation and regression analysis, method of least squares, non linear regression; statistical inference, students and paired t-test, F-test and elements of Anova. Applications of statistical concepts in pharmaceutical sciences.