

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus for B.Pharm – First Year

101 PHARMACEUTICS – I (PHYSICAL PHARMACEUTICS)

3 hrs / week

THEORY

1. States of Matter :

State and selected Properties : State of matter, Change in the state of matter, latent heats and vapour pressure, sublimation – critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, Liquid crystals, glassy state, solid – crystalline and amorphous, polymorphism.

2. Micromeritic and Powder Rheology :

Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement of particle shape, specific surface, method for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness and flow properties.

3. Surface and Interfacial phenomenon :

Liquid interface, surface and interfacial tension, surface free energy, measurement of surface and interfacial tension, free energy, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interface, solid-gas and solid-liquid interface, complex films, electrical properties of interface.

4. Viscosity and Rheology :

Newtonian system, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems: pseudoplastics, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity: capillary, falling ball, rotational viscometers.

5. Dispersion systems :

- a. Colloidal dispersions : Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy.
- b. Suspension 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, flocculation in structured vehicle, rheological considerations, emulsions: types, theories, physical stability.

6. Diffusion and Dissolution :

Definitions, steady state of diffusion, procedures and apparatus used, dissolution, Drug release

7. Buffers

Buffer equation & buffer capacity, buffers in pharmaceutical system, preparation, stability, buffered isotonic solutions, measurement and methods of adjusting isotonicity.

8. Polymer Science

Introduction and definitions, types of polymers, pharmaceutical applications, polymers as thickening agents, fabrication technology.

9. Complexation

Definition, pharmaceutical applications of various classes of complexes, Protein binding of drugs, applications, factors affecting protein binding, methods of determine protein binding of drugs.

3 hrs / week

PRACTICALS :

1. Determination of derived properties of powders like density, porosity, compressibility, flow properties and angle of repose, dispersibility etc.,
2. Determination of particle size, particle size distribution and surface area using various methods of particle size analysis.
3. Determination of surface/Interfacial tension, HLB values, critical micelle construction of surfactants. Determination of spreading coefficients.
4. Study of rheological properties of various systems using different viscometers. Study of influence of temperature in viscosity of solution.
5. Preparation and stability study of Emulsions.
6. Preparation of various types of suspension and determination of their sedimentation parameters.
7. Determination of critical solution temperature (C.S.T) and partial of mutual solubility, and effect of additives on C.S.T. and mutual solubility.
8. Experiments involving tonicity adjustment.
9. Preparation of various types of pharmaceutical buffers and determination of buffer capacity.
10. Determination of sensitivity of different types of balance & determination of minimum permissible weights as per pharmacopoeial admissible % errors in weighing.
11. Experiments demonstrating diffusion, dissolution of drugs from formulations.
12. Thermal degradation study, determination of half-life and shelf life pharmaceuticals.

BOOKS RECOMMENDED

1. Physical Pharmacy by Alfred Martin
2. Remington's Pharmaceutical Sciences
3. Bentley's Pharmaceutics by E.A.Rawlins
4. Cooper and Gunn's Tutorial Pharmacy
5. Pharmaceutics : The Science of Dosage Form design – M.E.Aulton
6. Pharmaceutical Dosage Forms and Drug Delivery System by Ansel

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Syllabus for B.Pharm – First Year

102. PHARMACEUTICS – II (UNIT OPERATION - I & ENGINEERING DRAWING)

2 hrs / week

THEORY :

UNIT OPERATION : INTRODUCTION, BASIC LAWS:

- (1) Stoichiometry : Unit processes, material and energy balance, Molecular Unit mole fraction, tie substance, gas laws, mole volume, primary & secondary quantities, equilibrium state, rate process, steady and unsteady state, dimensionless equations, dimensionless groups, different types of graphic representation, mathematical problems.
- (2) Fluid flow : types of flow, Reynolds's number, viscosity, concept of boundary layer, basic equation of fluid flow, values, flow meter, manometer and measurement of flow and pressure.
- (3) Filtration and Centrifugation : Theory of filtration, filter aids, filter media, industrial filter including filter press, rotary filter, edge filter, etc., factors affecting filtration, mathematical problems on filtration, optimum cleaning cycle in batch filters, Principle of centrifugation, industrial centrifugal filters and centrifugal sedimenters.
- (4) Heat Transfer : Source of heat, heat transfer, steam and electricity as heating media, determination of requirement of amount of steam / electrical energy, steam pressure, boiler capacity, mathematical problems on heat transfer, mode and laws of heat transfer.
- (5) Dehumidification and humidity control : Basic concept and definition, wet bulb and Adiabatic saturation temp, psychometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipment's for dehumidification operations.
- (6) Refrigeration and air-conditioning : Principles and application of refrigeration and air-conditioning.
- (7) Material of construction : General study of composition, corrosion, resistance, properties and application of the materials of construction with special reference to stainless steel and glass.
- (8) Industrial hazard and safety precautions : Mechanical, chemical, electrical, fire and dust hazard, industrial dermatitis and accidents records etc.
- (9) Material handling systems (a) Liquid Handling : Different types of pumps, (b) Gas handling : various types of fans, blowers and compressors (c) Solid handling : Bins, bunkers, conveyers, air transport.
- (10) Packing of materials : Function and qualities of package, Hazards encountered by package, protection to be given by package, containers, closures, foils, pressure packs for pharmaceutical products.

PRACTICALS

- (1) To plot graphs using various data.
- (2) Measurement of flow of fluids and their pressure, determination of Reynolds's number and calculation of frictional losses.
- (3) Evaluation of filter media determination of rate of filtration and study of factors affecting filtration.
- (4) Determination of Humidity use of dry bulb and wet bulb thermometers and
- (5) Experiments to demonstrate applications of centrifugation
- (6) Determination of overall heat transfer coefficients, rate of evaporation .
- (7) Elementary knowledge of engineering drawing, concept of elevation, plant orthographic and isometric views. First angle and third angle projections, notation, conventions used in engineering drawing.
- (8) Drawing of simple pharmaceutical machine / parts.
- (9) Any other practical devised form topic covered in theory.

BOOKS RECOMMENDED

1. Cooper and Gunn's Tutorial Pharmacy
2. Chemical Engineering by Badger and Banchemo
3. Handbook of Chemical Engineering by Perry
4. Elementary Chemical Engineering by Max Peters
5. Unit Operations by McCabe and Smith
6. Theory & Practice of Industrial Pharmacy by Lachman & others.
7. Pharmaceutics : The Science of Dosage Form Design by Aulton
8. Elementary Engineering Drawing by N..Bhatt
9. Machine Drawing by N.D.Bhatt

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103 PHARMACEUTICAL CHEMISTRY – I (INORGANIC & PHYSICAL CHEMISTRY)

4 hrs / week

THEORY

PART – I (INORGANIC CHEMISTRY)

Introduction to Pharmacopoeia :

An outline of methods of preparation,. Use, sources of impurities, tests for purity, identity and assay principles with examples including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia monograph details.

1. Gastrointestinal agents :

Acidifying agents, Antacids, protective and Adsorbents, Cathartics : Dil.Hydrochloric acid, Sod.Bicarbonate, Aluminium hydroxide gel, Calcium carbonate, Magnesium oxide, Magnesium trisilicate, Magnesium sulphate, Bismuth subcarbonate, Kaoline, Milk of Magnesia, Activated, Charcoal, Sodium dihydrogen Phosphate, Sodium Potassium tartarate, Combination antacid preparation.

2. Major intra and extra – cellular electrolytes :

Physiological ions, Electrolytes used for replacement therapy, acid – base balance and combination therapy : Sodium chloride and it's preparations, Potassium chloride and it's preparations, Ammonium chloride and it's injection, Sodium acetate, Potassium acetate, Sodium bicarbonate, Sodium citrate, Calcium gluconate, Calcium lactate, Dibasic calcium phosphate, Magnesium sulphate, Sodium dihydrogen Phosphate, Electrolyte combination therapy.

3. Essential and trace elements:

Transition elements and their compounds of pharmaceutical importance : Iron and hematinics, Mineral supplements, Ferrous fumarate, ferrous sulphate, Iodine, Iodine solutions, Potassium iodide.

4. Topical agents :

Protective, Astringents and Anti infectives : Talc, Calamine, Zinc oxide, Titanium dioxide, Potassium permanganate, Chlorinated lime, Iodine, Iodine solution, Povidone iodine, Boric acid, Borax, Silver Nitrate, Mild silver protein, Yellow mercuric oxide, Ammoniate mercury, Sublimed and precipitated sulphur, Selenium Sulphate, Alum, Zinc sulphate, Hydrogen peroxide, Antimony potassium tartrate.

5. Gases and Vapours :

Inhalants and Respiratory stimulations : Oxygen, Carbon dioxide, Nitrous oxide, Ammonium carbonate.

6. Dental Products :

Dentrifrice and anti-caries agents : Sodium fluoride, calcium carbonate, Dibasic calcium phosphate, Zinc chloride.

7. Complexing and chelating agents used in therapy : Disodium EDTA, Calcium disodium EDTA, Dimercaprol.

8. Miscellaneous agents :

Sclerosing agents, expectorants, emetics, poisons and antidotes, sedatives etc. Ammonium chloride, Potassium iodide, Antimony potassium tartrate, Sodium nitrate, Sodium thiosulphate, Potassium bromide.

9. Pharmaceutical Aids Used in Pharmaceutical Industry:

1. Acids, Bases, Buffers and water.

Introduction , concepts of acid base, pH & dissociation constant of acid & base, Henderson Hasselbatch equation, mechanism of buffers, physiological buffers, physical & chemical properties of water, hard water and methods of softening hard water, ionic product of water.

Hydrochloric acid, Sulphuric acid, Nitric acid, Phosphoric acid, Boric acid, Strong Ammonium Hydroxide, Sodium hydroxide, Calcium hydroxide, Sodlime, Borate and Phosphate buffers system, purified water, W.F.I., Sterile W.F.I.

2. Anti oxidants, preservatives, filter aids, adsorbent, diluents, excipients, suspending agents, colorants etc. : Sodium nitrate, Sodium thiosulphate, Sodium bisulphide, Sodium metabisulphite, Boric acid, Borax, Activated Charcol, Kaoline, Bismuth subcarbonate, Dibasic calcium phosphate, Calcium sulphate, Bentonite, Aluminium hydroxide.

10. Inorganic Radiopharmaceuticals:

Nuclear radiopharmaceutical, reactions, nomenclature, methods of obtaining their standers and unit of activity, measurements of activity, clinical applications and dosage hazards and precautions. Sodium iodide 131, Ferric chloride 59, Ferrous citrate 59, Barium sulphate.

PART – II (PHYSICAL CHEMISTRY)

1. Behaviour of gases

Gas laws, ideal gas equations, kinetic theory of gases, deviation from ideal behaviour and explanations.

2. The liquid state :

Study of chemical substances using physical properties such as : surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents.

3. Solutions :

Ideal an real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement. Deby Huckel theory.

Thermodynamics :

Zero, First, Second and Third laws. Absolute temperature scale. Thermochemical equations, phase equilibrium and Phase rule.

4. Adsorption :

Freundlich and Gibbs adsorption isotherms, Langmuir theory of adsorption.

5. Photochemistry :

Consequences of light absorption, Jablenski diagram, Beer's Lambert law, Quantum efficiency.

6. Chemical Kinetics & application of Kinetic principles in pharmacy :

Zero, First, Second order reactions, complex reaction, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid, base and enzyme catalysis.

7. Quantum mechanics :

Postulates of quantum mechanics, operators in quantum mechanics, the Schrodinger wave equation.

PRACTICALS :

1. The background and systematic qualitative analysis of inorganic mixture of upto 4 radicals. Six mixture to be analyzed, preferably by semi – micro methods.
2. Limit Tests for Cl,SO₄,As,Heavy metals and Lead along with a few modifications.
3. All identification tests for Pharmacopoeial inorganic pharmaceuticals and qualitative tests for cations and anions should be covered.
4. Volumetric Analysis of few important compounds covered in theory.
5. Experiments on surface tension and viscosity, partition coefficient, adsorption, order of reaction (First and Second), refractive index and molar refraction.

BOOKS RECOMMENDED:

1. Indian Pharmacopoeia.
2. Pharmaceutical Inorganic Chemistry – Block and Soine
3. Concise Inorganic Chemistry – J.D.Lee
4. Modern Inorganic Chemistry – Liptrot
5. Elements of Physical Chemistry – Glasstone and Lewis
6. Mellor's Modern Inorganic Chemistry – Parker
7. Inorganic and Theoretical Chemistry – Taylor
8. College Chemistry – Linus Pauling
9. General Chemistry – Linus Pauling
10. Essentials of Physical Chemistry – Bahl and Tuli
11. Bently and Driver's Text book of pharmaceutical chemistry
12. Physical Pharmacy by Alfred Matrin
13. Remington's Pharmaceutical Science
14. Vogel's Qualitive Inorganic Analysis Revised by G.S.Vehla
15. Pharmaceutical Chemistry Part I by Becktt & Stanlake

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104 HUMAN ANATOMY PHYSIOLOGY AND HEALTH EDUCATION

3 hrs / week

THEORY:

1. Scope of anatomy and physiology and their basis terminology used in these subjects.
2. Structure of cell, its components and their functions.
- 3.. Elementary tissues of the human body : Epithelial, connective, muscular and nervous tissues, their sub – types and characteristics.
4. Osseous system: Structure, composition and functions of skeleton, classification of joints, types of movements at joints, disorder of bones and joints.
5. Skeleton muscles: Their gross anatomy physiology of muscles construction, physiological properties of skeletal muscles and their disorders.
6. Homeopathic system: Composition of function of blood and its elements, their disorders, blood groups and their significance, Mechanism of coagulation, disorder of platelets and coagulation.
7. Lymph and lymphatic system: Composition, formulation and circulation of lymph, disorder of lymph and lymphatic system. Basis physiology and function of spleen.
8. Cardiovascular system: Basic anatomy of heart, physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sound and electrocardiogram. Blood pressure and its regulation. Brief outline of cardiovascular disorders like hypertension, hypertension, arteriosclerosis, angina, myocardial infraction, congestive cardiac failure and cardiac arrhythmias.
9. Digestive system : Gross anatomy of g.i. Trace, Function of its different parts including those of liver, pancreas and gall bladder, various g.i.tract and their role in
- 10 Respiratory System: Anatomy of respiratory organ, function of respiration, mechanism and regulation of respiration, respiratory volume and vital capacity.
- 11 Central nervous system: Functions of different parts of brain and spinal cord. Neurohumoral transmission in the CNS. Reflex action, Electroencephalogram, specialized function of the brain, cranial nerves and their functions.
12. Autonomic nervous system: Physiology and function of ANS, Mechanism of the neurohumoral transmission in the ANS.
13. Urinary system : Various parts, structure and function of the kidney and urinary tract. Physiology of urine formation and acid – base balance. Diseases of urinary system.
14. Reproductive System: Male and Female reproductive system and their hormones, Physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis and cogenesis. Pregnancy its maintenance and parturition.
15. Endocrine system: Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenals, pancreas, testis and ovary, their hormones and functions.
16. Local hormones: Histamine, 5-HT, prostaglandin, Tromboxanes, Leukotrienes PAF and peptides, their functions and importance.
17. Sense organs : Basic anatomy and physiology of the eye (vision), and ear (hearing), taste buds, nose (smell) and skin (superficial receptors)
18. (a) Concept of health and disease, causing agent and prevention of disease.
(b) Classification of food requirements, balance diet, nutrition deficiency disorders their treatment and their prevention, specifications for drinking water.
(c) Demography and family planning : Medical termination of pregnancy.

- (d) Brief outline of communicable disease, their causative agents, modes of transmission and its prevention. (Chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea and AIDS).
- (e) First aid : Emergency treatment of shock, snakebites, burns, poisoning, fractures and resuscitations methods.

3 hrs / week

PRACTICALS:

1. Study of human skeleton
2. Study of different systems with the help of charts and models
3. Microscopic study of different tissues and organs from permanent slides
4. Estimation of haemoglobin in blood, determination of bleeding time, clotting time, R.B.C count, TLC, D.L.C and E.S.R
5. Recording of body temperature, pulse rate and blood pressure, basic understanding of electrocardiogram PQRST waves and their significance.
6. Determination of Viral capacity experiments on spirometry.
7. Physiological experiments on nerve – muscle preparation and heart.

BOOKS RECOMMENDED:

1. Martini, F : Fundamentals of anatomy and physiology (Prentice hall, 2nd ed.1992)
2. Seely, R.R. et.al. : Anatomy and physiology (Mosby), 3rd ed.1995
3. Guyton, A.C. and Hall, J.E : Text book of medical physiology (W.B. Saunders Co. Philadelphia) 8th ed.1991
4. West J.B. Best and Taylor's physiological basis of medical practice (Williams and Wilkins, Baltimore) 12th ed. 1989)
5. Torora G.J. and Anagnodokos, N.P. : Principles of anatomy and physiology (Haper and Colling Publishers , New York) 7th ed. 1992
6. Gandhi T.P. et.al. : Human anatomy, physiology and health education (B.S. Shah Prakashan, Ahmedabad) 9th ed. 1998
7. Joshi, Vijaya D. : Preparatory manual for undergraduates' physiology (B.I. Churchill Livingstone) 1995
8. Chattergee, C.C. : Human physiology (Medical allied Calcutta), 10th ed. 1985
9. Clancy, John and MoVicer, A.J.: Physiology and anatomy (Edward Arnold) 1995
10. Subhash Shalya : Human Physiology (C.B.S.Publishers, New Delhi) 1st ed.1994
11. Chaurasia, B.D.: Human Anatomy (3 Volumes C.B.S.Publishers, New Delhi) 3rd ed.1995.
12. Ross and Wilson's : Anatomy and Physiology in health and illness (Churchill Livingstone) 8th ed.1995
13. Parmar N.S. : Health Education and Community Pharmacy (C.B.S. Publishers, New Delhi) 1995
14. Goyal R.K.et.al. : Practical Anatomy Physiology and biochemistry (B.S. Shah Prakashan, Ahmedabad) 1994
15. Garg K. et.al. : A text book of histology (C.B.S Publishers, New Delhi) 2nd ed.1991
16. Lesson C.R. er.al.: A text book of histology (W.B.Saunders Co.) 5th ed.
17. Ague, Anne M.R. : Atlas of anatomy (Williams and Wilkins) 9th ed.1991
18. Van de Graff and Crewely J.L. : A photographic atlas for the anatomy and physiology lab.(Mortan Publishing Co.)3rd ed.1996
19. Ghai C.L. : A text book of practical physiology (Jaypee Brothers Medical Publishers P.Ltd.)4th ed. 1998

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105 PHARMACOGNOSY – I

THEORY:

2 hrs / week

1. Definition, history, scope and development of pharmacognosy.
2. Source of drugs: Biological, marine, mineral and plant tissue culture as source of drugs.
3. Classification of drugs: e.g. alphabetical, taxonomical, pharmacological and chemical.
4. Plant taxonomy & study of following families with special reference to medicinally important plants: Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Gramineae, Libiaceae, Cruciferae, Papaveraceae
5. Cultivation, collection, processing and storage of crude drugs. Factors influencing cultivation of medical pest control agents, plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medical plants.
6. Quality control of crude drugs : Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation.
7. An Introduction to chemical constitution of drug : Their isolation, classification and properties.
8. Systematic Pharmacognostic study of following:
 - a. Carbohydrates and derived products: Agar, Guar gum, Gum acacia, Honey, Isabgol, Pectin, Starch, Sterculia and Tragacanth.
 - b. Lipids : Bees wax, Castor oil, Cocoa butter, Cod – liver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice bran oil, shark liver oil and wool fat.
 - c. Study of drugs containing resins and resin combinations: Colophony, Podophyllum, Jalap, Cannabis, Capsicum, Myrrh, Asafoetida, Balsam of Peru, Benzoin, Turmeric and Ginger.
 - d. Study of tannins containing drugs: Gambir, black catechu, gall and myrobalan.
 - e. Volatile oils: General methods of obtaining volatile oils from plants. Study of volatile oils of Mentha, Coriander, Cinnamon, Cassia, Lemon Peel, Orange peel, Lemon Grass, Citronella, Caraway, Cumin, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood.
 - f. Study of fibers used in pharmacy : such as cotton, silk, wool, nylon, glasswool, polyester and asbestos.
 - g. Study of pharmaceutical aids like diatomite, kaoline, bentonite and gelatin.
 - h. Cytogenetic glycosides, amino acids in plant tissues carbohydrates (gums, mucilage)
9. Phytochemical screening : selection of method (Preparation of an extract), Screening for alkaloids, polycyclic compounds, saponins, sterols, cardenolides and bufadienolide, flavonoids and leucoanthocyanidins, tannins and poly phenols, anthraquinones.

PRACTICAL

1. Morphological characteristics of plant families mentioned in theory.
2. Microscopic measurement of cells and cell contents : starch grains, calcium oxalate crystals and phloem fibers.
3. Determination of leaf constants such as stomatal index, stomatal number, vein islet number, vein termination number and palisade ratio.
4. Preparation of Herbarium sheet.
5. Identification of crude drugs mentioned in theory.
6. Study of fibers and pharmaceutical aids.
7. Microscopic studies of crude drugs and their powders underlined in the category of volatile oils.

BOOKS RECOMMENDED:

1. Botany for degree students – A.C.Dutta (Oxford Uni.Press)
2. A text book of zoology – R.D. Vidyarthi (s.Chand & Co.)
3. Pharmacognosy – C.K.Kokate (Nirali Prakashan)
4. A text book of Pharmacognosy – C.S.Shah & J.S.Quadry (B.S.Shah Prakashan)
5. Pharmacognosy – Tylor & Brady (Lee & Febiger)
6. Pharmacognosy of Powdered crude drugs – M.A.Lyenger.(Manipal Power Press)
7. Treaste & Evan's Pharmacognosy – (W.B.Sunders Co.)
8. Pharmacognosy – Wallis

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106 BIOSTATISTICS AND ADVANCED MATHEMATICS

2 hrs / week

THEORY

1. Biostatistics

- a. Basic concepts of Statistics : Data, Data Graphic, frequency distribution measures of central tendency (Mean, Median, Mode, Harmonic mean, Geometric mean and scattering of data, Range, Mean, Deviation, Standard deviation, SEM Applications in Pharmaceutical Validation)
- b. Introduction to probabilities : Binomial and Normal probabilities distribution.
- c. Sample and sampling method : Sample size and its significance. Sampling techniques and their application in pharmacy.
- d. Hypothesis testing [t - statistics (Application in dissolution testing of solid dosage forms) chi – square test]
- e. Correlation analysis, Correlation coefficient, Spearman's rank correlation coefficient.
- f. Linear regression analysis (application in Beer's Lambert's Curve, stability study), introduction to curve fitting techniques.
- g. Analysis of variance : Introduction and application of the test in the pharmacokinetic study.

2. Differential equations :

Revision of integral calculus, definition and formation of differential equations of first order and first degree variable, separable homogeneous and liner differential equation and equations reducible to such types, liner differential equations of order greater than one with constant coefficients, complementary function and particular integral simultaneous liner differential equation, pharmaceutical applications.

3. Laplace Transformation

Definition, transforms of elementary functions, properties of linearity and shifting inverse laplace transforms, transforms, transforms of derivatives, solutions of ordinary and simultaneous differential equations.

4. Differential of rational, trigonometric exponential and logarithmic functions, tangents and normal, maxima and minima, graphs of an elementary function (Simple curve tracing) indefinite integration of rational, trigonometric, exponential and logarithmic functions.
5. Rollers Theorems, ingrangles and Cauchy's mean value theorems and 'I' Hospital along with suitable illustrations.
6. Mathematical modeling, mathematical models in biology, medicine and pharmacy

BOOKS RECOMMENDED:

1. Pharmaceutical Statistics – S.Bolton
2. Higher Engineering Mathematics by B.S.Grerwal
3. Mathematical Statistics by J.N.Kapur & H.C.Saxena
4. Laplace transforms by Murray R. Spiegel
5. Differential Equations with application by Heman Betz Paul B. Bureham
6. Elements of probability and statistics : M.L.Baisnale and M.Jas 1993, Tata McGraw Hill Publishing Co.
7. A text book of Matrices : Shairti Narayan 1994, S.Chand & Co.
8. Differential Calculus : Shairti Narayan 1997, Shyam Lah Charitable Trust
9. Theory and problems of advanced Calculus (Sic metric) edition : Murray R.Spiegel Scharun's outline series, McGraw Hill Biik Co.
10. Differential equations Frank Ayres Jr. 1st ed. : Scharun's outline series, McGraw Hill Book Co.
11. Differential equation - a first course : Guterman and Nitecki 2nd ed. Saunder's College Publishing
12. Integral Calculus Shairti Narayan 1997 S.Chand & Co.

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107 COMPUTER APPLICATIONS IN PHARMACY

2 hrs/ week

THEORY

- a) Introduction to computers – Introduction to i/o devices, storage devices, binary conversion, computer classification, application of computers in pharmacy.
- b) Introduction to DOS commands : File name and different extensions, Internal and External commands, introduction to Windows. Use of Menubar, Taskbar, Desktop, My Computer, Control Panel, Window Explorer, Network Neighbourhood, Recycle Bin.
- c) Ms-Excel – preparation of templates for application in pharmaceutical chemistry, Pharmaceutical technology, pharmacology and pharmacognosy for example statistical treatment of data for Beer's Lambert's curve, solution of problems based on physical chemistry, pharmaceutical engineering, stability study, area under the curve, bio-assay, bioequivalence study, extraction, Rf value and other elementary problems of pharmaceutical importance. Special attention must be given to arithmetic expressions.

Hierarchy of operation, library function such as logarithm, squareroot, standard deviation, sum, average, t-test, ANOVA etc. Drawing graphs in EXCEL – line graph, Histogram, pie – chart, at least one graph for each discipline of chemistry, pharmaceutical technology, pharmacology and pharmacognosy – Editing chart features such as formatting charts, adding legends and changing data.

d) **WORD PROCESSING MS-WORD-97**

Word Essentials

Typing and editing

Autocorrect and Autotext – Reusing Text and Graphics

Formatting Text

Formatting Paragraphs, Formatting and sorting Lists

Page Design and Layout

Page setup: Margin, Page Numbers and other Items

Spell check and Grammar use of Thesaurus

Newspaper – Style Columns

Working with Tabs

Opening, Saving and Protecting Documents

Printing, Assembling Documents with Mail Merge

- e) Introduction to E-mail and Internet - Demonstration of sites of pharmaceutical interest.
- f) BASIC Language : Elementary programming in BASIC Language – Algorithm, flow chart, solution of problems based on biostatistics and other simple problems of pharmaceutical interest.
- g)

PRACTICAL:

3 hrs / week

Practical based on the topics covered in theory MS-EXCEL stress must be given to topics of pharmaceutical interest only (e.g. statistical analysis of pharmaceutical data, stability study, area under curve, calculation of molecular weight, calculation of solubility, buffers, filtration, acid – base titration, oxidation reduction, physical pharmaceutics, pharmaceutical engineering, etc.

The equation will be provided at the time of examinations.

Practical based on pharmaceutical applications of students and paired – t- test – SD – SEM. Chi – square test – ANOVA regression analysis (application to stability testing) ANOVA (application in pharmacokinetics)

Assignment: Computerization of any two practical taught in first B.Pharm (text, tables, figures, calculation steps, etc.)

BOOKS RECOMMENDED:

1. Ms-Office – APTECH, TMH Publications
2. Working in Microsoft Office by Ron Mansfield
3. Ms-Excel : Taxali
4. PC for Window made simple
5. Basic Programming by E.Balaguruswamy
6. Basic Programming by V.K.Jain
7. Martin, et.al., physical pharmaceutics