

Third Semester B.Pharm Syllabus for Admission Batch 2015-16

III SEMESTER									
Theory							Practical		
Subject Group	Subject Code	Course Name	Hours /Week L/T	Credit Theory	University marks	Internal Evaluation	Hours /week L/T	Credit Practical	Marks
PC	15PH301 & 15PH302	Physical Pharmaceutics-I	3-0	3	100	50	3	2	50
BE	15PH303	Pharm. Engineering-I	3-0	3	100	50			
BS	15PH304 & 15PH305	Organic Chemistry-II	3-1	3	100	50	3	2	50
PC	15PH306 & 15PH307	Pharmacognosy-II	3-0	3	100	50	3	2	50
PC	15PH308	Pathophysiology of Common Diseases	3-0	3	100	50			
BS	15PH309	Environmental Science	2-0	2	100	50			
		Total	17-1	17	600	300	12	8	200
		Total Hours/Week 30							
		Total Credits 25 (PC 13 BE 05 BS 07)							
		Total Marks 1100							

Lateral Entry students with D.Pharm qualification are required to take course no. 15PH107, 15PH108 (Communicative English theory and practical) and Course No. 15PH109(Remedial Biology Theory*), 15PH110 (Remedial Biology Practical*) OR 15PH111 Remedial Mathematics* as the case may be in addition to the above courses of 3rd Semester.

*Candidates who did not pass Biology subject in entry qualification (+2 Sc. etc.) examination are required to take Remedial Biology (T&P), and those who did not pass Mathematics subject are required to take Remedial Mathematics. Candidates who passed both Biology and Mathematics can take either Remedial Biology (T&P) or Remedial Mathematics

PHARMACEUTICS-II
(Physical Pharmaceutics - I)

THEORY 3 hours/week

UNIT -I

1. Matter, Properties of Matter: State of matter, properties of matter, latent heats, vapour pressure, sublimation, critical point, eutectic mixtures, relative humidity, liquid complexes, liquid crystals, glassy state, crystalline, amorphous, polymorphism, phase equilibrium and phase rule.

UNIT -II

2. Thermodynamics: Zeroth, first, second and third laws, concept on enthalpy, entropy, absolute temperature scale, Free energy function and applications, Clausius-clapeyron Equation, Van't Hoff equation.

UNIT -III

3. Solutions : Ideal and real solutions, solution of gases in liquids, colligative properties, partition coefficient, conductance and its measurement. Debye Huckel theory.

4. Buffers: Buffer equations and buffer capacity, buffers in pharmaceutical systems, preparation, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

UNIT -IV

5. Solubility & related phenomenon : Solubility expression, Determination of solubility, Solubility of gases in liquids, Solubility of liquids in liquids, Solubility of solids in liquids.

6. Complexation: Classification of complexes, methods of preparation, analysis and applications.

UNIT -V

7. Kinetics and Drug Stability: General considerations & concepts, half-life determination, Influence of temperature, light, solvent, catalytic species, Accelerated stability study, determination of expiry date.

PHARMACEUTICS-II (Physical Pharmacy - II)

PH. 3.2 PRACTICAL 3 hours/ week

(A minimum of 15 experiments shall be conducted)

1. To study phase behaviour of three component system and construct ternary phase diagram
2. Determination of upper critical solution temperature phenol water system
3. To determine molar mass by Rast method and cryoscopic method.
4. To determine the partition coefficient (e.g. benzoic acid between distilled water and benzene)
5. To verify Ostwald dilution law and perform conductometric titration
6. Preparation of pharmaceutical buffers and determination of buffer capacity
7. To determine dissociation constant of weak acid or weak base
8. To determine the heat of solution of a substance by solubility method
9. To determine the solubility of a substance in different solvent
10. Determination of half-life, rate constant and order of reaction.
11. Other experiments based on theory

RECOMMENDED BOOKS:

1. Martin's Physical Pharmaceutical Sciences by P.J.Sinko (Lippincott William and Wilkins, Baltimore)
- 2 Cooper and Gunn's Tutorial Pharmacy edited by S.J. Carter
- 3 Bently's Textbook of Pharmaceutics edited by E.A. Rawlins

Pharm. Engineering-I
(Unit Operations - I)

THEORY 3 hours/ week

UNIT -I

- 1. Heat Transfer:** Heat transfer, overall heat transfer coefficient, sources of heat, steam and electricity as heating media, determination of requirement of amount of steam/ electrical energy, steam pressure, heat exchangers and **heat interchangers, Radiation, black body, Grey body, Stefan Boltzmann equation, Kirchoff's law, application of Fourier's law, Forced and natural circulation and their application.** A few numerical problems may be solved.
- 2. Drying:** Moisture content and mechanism of drying, rate of drying and time of drying calculations. Classification and types of dryers, dryers used in pharmaceutical industries with special reference to Fluidised bed dryer, spray dryer, freeze dryer, vacuum dryer, tray dryer etc. A few numerical problems may be solved.

UNIT -II

- 3. Size Reduction and Size Separation:** Definition, objectives of size reduction and size separation, factors affecting size reduction, laws governing energy and power requirements of mills including ball mill, hammer mill, fluid energy mill, sieve analysis, standards of sieves, size separation equipment shaking and vibrating screens, gyratory screens, cyclone separator, air separator, bag filters, cottrell precipitator, scrubbers, size separators basing on sedimentation theory. A few numerical problems may be solved.

UNIT -III

- 4. Mixing and Homogenization:** Theory of mixing, mixing efficiency, Factors influencing mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments, homogenizers such as **Sigma blade mixer, Planetary mixer, Airjet mixer, jet mixer, Silverson mixer-emulsifier and triple roller mixer.** A few numerical problems may be solved.

UNIT -IV

- 5. Distillation:** Raoult's law, phase diagrams, volatility, simple, steam and flash distillations, principles of rectification, McCabe Thiel method for calculation of number of theoretical plates, Azeotropic and extractive distillation. A few numerical problems may be solved.

UNIT-V

- 6. Evaporation:** Basic concept of phase equilibria, factors affecting evaporation, evaporators, film evaporator, single effect and multiple effect evaporator, **Mathematical problems on evaporation.**
- 7. Filtration:** Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter. Factors affecting filtration, optimum cleaning cycle on batch filters. A few numerical problems may be solved.

**PHARMACEUTICAL CHEMISTRY-III
(Organic Chemistry-II)**

THEORY

3 hours/ week

UNIT -I

Stereochemistry:

Isomerism: Different types of isomerism, their nomenclature and associated physicochemical properties, Structural Isomerism: Chain isomerism, Positional isomerism, Functional isomerism and Metamerism, Keto-Enol tautomerism.

Conformational Isomerism: Conformations of Ethane and Butane.

Geometrical Isomerism: Cis-Trans Isomers and E-Z Isomers, Physical and Chemical properties, Stability of Cis and Trans Isomers.

UNIT -II

Optical Isomerism:

Optical activity, Specific rotation, Asymmetric carbon, Chirality, Fischer projection, Enantiomerism, Diastereoisomerism.

Specification of configuration:

Absolute and Relative configuration (D, L system and R, S system).

External and Internal compensation, Racemic mixture and Resolution of racemic mixture, Racemization, Walden inversion.

Stereoselective and stereospecific reactions

UNIT -III

Benzene and its homologues: Structure of benzene, Resonance, Aromatic character, Huckel Rule. General methods of preparation, Physical properties, Chemical properties: Electrophilic substitution reactions, Friedel crafts reaction, Catalytic hydrogenation.

Orientation of aromatic substitution in mono-substituted benzene

Phenols: General methods of preparation, Physical and Chemical properties

UNIT -IV

Polynuclear Aromatic Hydrocarbons: Preparation and chemical reactions of anthracene and phenanthrene.

Heterocyclic compounds: Nomenclature, preparation and some important reaction of- Furan, Pyrrole, thiophen, indole, imidazole, pyridine, isoquinoline.

UNIT -V

Organic reagents used in drug synthesis e.g, Aluminium tert-butoxide, Lithium Aluminium Hydride, N-Bromo-succinimide (NBS), Diazomethane.

**PHARMACEUTICAL CHEMISTRY-III
(Organic Chemistry-II)**

PRACTICAL

3 hours/ week

(A minimum of 15 experiments shall be conducted)

1. Preparation of organic compounds and their derivatives, crystallization and determination of their melting points (minimum three).
2. Estimation of organic compounds using functional groups (minimum three).
3. At least four experiments on analysis of organic compounds containing two functional groups

RECOMMENDED BOOKS:

1. Organic Chemistry by R.T. Morrison and R.N. Boyd. (Prentice Hall of India, New Delhi)
2. Advanced Organic Chemistry by B.S. Bahl and Arun Bahl. (S. Chand, New Delhi)
3. Bentley and Driver's Text Book of Pharmaceutical Chemistry. (Oxford University Press, New Delhi)
4. Organic Chemistry – Reactions and Reagents by O.P. Agarwal. (Krishna Prakashan, Meerut)
5. Organic Chemistry by I.L. Finar Vol. I & Vol. II. (Longman, Singapore)

PHARMACOGNOSY – II (3rd SEM.)

THEORY 3 hours/week

MODULE-I

1. **Volatile Oils:** General methods of extraction of volatile oils from plants, Study of biological source, chemical constituents, chemical tests and uses of volatile oils of Mentha, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Nutmeg, Chenopodium, Valerian, Musk, Palmarosa, Gaultheria.. Detailed Pharmacognosy of Clove, Coriander, Fennel, Sandal wood, Cardamom, Cinnamon and Eucalyptus.

MODULE-II

2. Historical perspectives, prospects for development of plant biotechnology as source of medical agents. Applications in pharmacy and allied fields.

MODULE-III

3. Natural allergens and photosensitizing agents.
4. Antioxidants from plant origin. i.e. Ginkgo biloba, Green Tea, Garlic, momordica, Tomata.

MODULE-IV

5. **Fibres:** Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass wool, polyester and asbestos.

MODULE-V

6. **Pharmaceutical aids:** Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors (Turmeric, Saffron, Anato, Caramel, Cochineal).

RECOMMENDED BOOKS:

1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
2. Trease G.E. and Evans W.C., Pharmacognosy (Bailliere Tindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers, New Delhi)
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)
5. Rangari V D., Text book of Pharmacognosy Vol-I & II.
6. Text Book of Pharmacognosy by S.S.Honda,, V.K Kapoor
7. . Text Book of Industrial Pharmacognosy by A. N. Kalia

**PHARMACOGNOSY - II
PRACTICAL 3 hours/week**

(A minimum of 15 experiments shall be conducted)

- 1-4 Identification of crude drugs mentioned in theory (at least 5)
- 6-7. Study of fibres
- 8-9. Study of pharmaceutical aids.
- 10-14. Microscopic studies of four selected crude drugs and their powders mentioned in theory and their chemical tests.
- 15-17. Identification of plant constituents by TLC methods.

PATHOPHYSIOLOGY OF COMMON DISEASES

THEORY 3 hours/ week

UNIT -I

1. Basic Principles of Cell Injury and Adaptation : Causes of Cellular injury, Pathogenesis, morphology of cell injury, intercellular alterations in lipids, proteins and carbohydrates, Cellular adaptations, atrophy, hypertrophy, hyperplasia, metastasis & dysplasia.

UNIT - II

2. Basic Mechanisms involved in the process of inflammation and repair :

Alteration in vascular permeability and blood flow, migration of WBCs, acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.

UNIT -III

3. Pathophysiology of CVS Disorders:, Hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction.

Pathophysiology of CNS Disorders: Rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania

UNIT -IV

4. Pathophysiology of Endocrine Disorders: Diabetes and other disorders.

Pathophysiology of GI Diseases: Peptic ulcer, asthma, ulcerative colitis.

Hepatic disorders like jaundice, viral hepatitis, hepatocellular carcinoma, cirrhosis & portal hypertension

UNIT -V

5. Pathophysiology of Respiratory Diseases: Asthma.

Pathophysiology of Infectious Diseases: Tuberculosis, urinary tract infections, sexually transmitted diseases, acute and chronic renal failure, anemias and common types of neoplasms like carcinoma of lung, skin, cervix, colon & brief outline on different types of leukemias. Wherever applicable the molecular basis should be discussed.

RECOMMENDED BOOKS:

1. Pathologic basis of diseases by Robbins S.L. (Harcourt India, New Delhi).
2. Pathology Quick Review and MCQs based on Harsh Mohan's Text Book of Pathology (Jaypee brothers medical publishers, New Delhi)

ENVIRONMENTAL SCIENCE

PH. 3.10 THEORY

2 hours/week

UNIT - I

1. Introduction to Environment, Ecological Concepts: Principle, components, Ecosystem Process: Energy, Food Chain, Air cycle etc., Atmospheric chemistry and Soil chemistry
2. Concept in Hydrology: Hydrological cycle, Precipitation, Infiltration, evaporation and evapotranspiration, Rainfall-runoff relationships.

UNIT - II

3. Water Pollution: Physical and chemical properties of water, water quality standards and parameters.
4. Water Treatment: Pre-treatment of water, Conventional process, and advanced water treatment process.
5. Waste Water Treatment: Pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion and its application.

UNIT - III

6. Solid Waste Management: Sources classification and composition of MSW; properties and separation, storage and transportation, Biological treatment, Thermal treatment, Landfill etc.
7. Hazardous Waste Management: Sources and classification of Hazardous waste including Medical hazardous waste and Household waste, Management of hazardous waste: Storage, collection and transportation, treatment and disposal.

UNIT - IV

8. Air Pollution: Air pollution and types of air pollutants, Acid deposition, Global climate change - green house gases.
9. Noise Pollution: Physical Properties of sound, Noise criteria, Noise Standards, Noise measurement, Noise control.

UNIT - V

10. Waste Minimization: Concept, benefits of waste minimization, Elements of waste minimization programme, Waste reduction techniques. Life Cycle Assessment, Environment Impact Assessment, Origin and procedure of EIA, Project Screening of EIA, Scope studies, Preparation and review

B.Pharm (4th Semester Structure)

IV SEMESTER									
Theory							Practical		
Subject Group	Subject Code	Course Name	Hours /Week L/T	Credit Theory	University marks	Internal Evaluation	Hours /week L/T	Credit Practical	Marks
PC	15PH401	Physical Pharmaceutics-II	3-0	3	100	50	3	2	50
BE	15PH402	Pharm. Engineering-II	3-0	3	100	50	3	2	50
PC	15PH403	Biochemistry	3-0	3	100	50	3	2	50
BS	15PH404	Computer Application	3-0	3	100	50	3	2	50
BS	15PH405	Organic Chemistry - III	3-0	3	100	50			
BS	15PH406	Mathematics & Statistics	3-1	3	100	50			
		Total	18-1	18	600	300	12	8	200
		Total Hours/Week							
		Total Credits							
		26 (PC 10 BE 05 BS 11)							
		Total Marks							
		1100							

Lateral Entry students with D.Pharm qualification are required to take course no. 15PH205 (Business Communication in English theory and practical) as the case may be in addition to the above courses of 4th Semester.

**DETAILED SYLLABUS
OF IV SEMESTER
B.PHARM**

Physical Pharmaceutics – II (15PH401)

THEORY 3 hours/week

UNIT -I

1. Micromeritics and powder Rheology : Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle size, volume, shape, surface area, specific surface, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT -II

2. Rheology : Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, Newtonian and non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling sphere, rotational viscometers.

UNIT -III

3. Surface and Interfacial Phenomenon : Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid-gas and solid-liquid interfaces, complex films, electrical properties. Freundlich and Gibbs adsorption isotherms, Langmuir theory of adsorption, BET equation.

UNIT –IV

4. Colloidal Dispersion Systems: Colloidal dispersions, types, optical, kinetic and electrical properties of colloids, protective colloids, applications of colloids in pharmacy;

UNIT –V

5. Coarse Dispersion Systems :

Suspensions: Interfacial properties of suspended particles, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, Emulsions: theories of emulsification, physical stability and rheological considerations.

PHARMACEUTICS-III (Physical Pharmacy – II)

PRACTICAL 3 hours/ week (A minimum of 15 experiments shall be conducted)

1. Determination of particle size and particle size distribution using various methods of particle size analysis (optical microscopy, sieving and sedimentation).
2. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
3. To determine viscosity of liquid using Ostwald viscometers.
4. To determine viscosity of liquid using Brookfield viscometers
5. To determine surface tension of different liquid using Ostwald stalgmometer.
6. To determine interfacial tension between two liquid using Ostwald stalgmometer
7. Determination of HLB value of different surfactant
8. To determine critical micellar concentration of surfactants using Ostwald stalgmometer
9. Preparation of various types suspensions and determination of their sedimentation parameters.
10. Preparation and stability studies of emulsions.
11. Other experiments based on theory

RECOMMENDED BOOKS:

1. Martin's Physical Pharmacy & Pharmaceutical Sciences by P.J.Sinko.(Lippincott Williams and Wilkins, Baltimore)
2. Cooper and Gunn's Tutorial Pharmacy edited by S.J. Carter (CBS Publishers, Delhi)
3. Bentley's Textbook of Pharmaceutics edited by E.A. Rawlins (All India Traveler Book Seller, New Delhi)

Pharm. Engineering-II (15PH402)

THEORY

UNIT -I

1. **Fluid Flow:** Type of flow, Reynold's number, Viscosity, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure. Application of fluid flow. A few numerical problems may be solved.
2. **Dehumidification and Humidity Control:** Basic concepts and definition, wet bulb and adiabatic saturation temperature, psychrometric chart and measurement of humidity, application of humidity, measurement in pharmacy, equipments of dehumidification operations.

UNIT -II

3. **Material Handling Systems:**

Liquid handling – different types of pumps.

Gas handling – various types of fans, blowers and compressors.

Solid handling – Conveyers

UNIT -III

4. **Crystallization:** Characteristics of crystals like – purity, size shape, geometry, habit, forms size and factors affecting them. Solubility curves and calculation of yields, material and heat balances around Swenson Walker Crystallizer. Supersaturation theory and its limitations, nucleation mechanisms, crystal growth, study of various types of crystallizer, tanks, agitated batch, Swenson Walker, single vacuum, circulating magma and Krystal crystallizer, caking of crystals and its prevention, numerical problems on yields.

UNIT -IV

5. **Materials of Construction:** General study of composition, corrosion, resistance, properties and applications of materials of construction with special reference to stainless steel and glass.

6. **Industrial Hazards and safety Precautions:** Mechanical, Chemical, Electrical, fire and dust hazards, industrial dermatitis, accident records etc.

UNIT -V

7. **Centrifugations:** Principles of centrifugation, **classification of centrifuges** industrial centrifugal filters and centrifugal sedimenters such as **perforated basket centrifuge, semi-continuous centrifuge, super centrifuge, De laval clarifier.**

RECOMMENDED BOOKS:

1. Cooper and Gunn's Tutorial Pharmacy Edited by S.J.Carter (CBS Publishers, Delhi)
2. Pharmaceutical Engineering by K.Sanbamurty (New Age International, New Delhi)
3. Chemical Engineering by Badger and Banchemo (Mc Graw Hill, New Delhi)
4. Pharmaceutical Dosage forms by Aulton.(Churchill Livingstone, Edinburg)
5. Pharmaceutical engineering(principles and practice) by C.V.S. Subramanyam,J. Thimma Setty,Sarasija Suresh,Mrs V.Kusum Devi

Pharm. Engineering-II

PRACTICAL 3 hours/ week

(A minimum of 15 experiments shall be conducted)

1. Determination of rate of evaporation.
2. Determination of overall heat transfer coefficient.
3. Experiments based on steam, extractive and azeotropic distillations.
4. Experiments based on determination of radiation constant.
5. Experiments based on sieve analysis.
6. Experiments based on size reduction using ball mill
7. Experiments to illustrate the influence of various parameters on the rate of drying.
8. Measurement of flow of Determination of rate of drying, free moisture content and bound moisture content.
9. Experiments to illustrate solid – solid mixing, determination of mixing efficiency using different types of mixers.
10. fluids and their pressure, determination of Reynolds number.
11. Determination of humidity – use of Dry Bulb and Wet Bulb temperatures and Psychrometric charts.
12. Experiments to demonstrate applications of centrifugation.
13. Experiments based on crystallization.
14. Other experiments based on theory.

BIOCHEMISTRY (15PH403)

THEORY 3 hours/week

UNIT -I

1. Biochemical organization of the cell and transport processes across cell membrane. Outlines of biochemistry of cell division and metastasis.
2. The concept of free energy, determination of change in free energy from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance.

UNIT -II

3. Enzymes: Nomenclature, factors affecting enzyme action, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.
4. Co-enzymes: Vitamins as co-enzymes and their significance, metals as co-enzymes and their significance.

UNIT -III

5. Carbohydrate Metabolism: Chemistry of Carbohydrates, Glycolysis and fermentation and their regulation, Gluconeogenesis, Glycogenolysis, Glycogenesis, and Pentose phosphate Pathway.
6. The Citric Acid Cycle: Significance, reactions and energetic of the cycle, Amphibolic role of the cycle and Anaplerosis.

UNIT -IV

7. Lipid Metabolism: Chemistry of lipids & Fats, Oxidation of fatty acids; β -oxidation & energetics, α -oxidation, ω -oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, control of lipid metabolism, Essential fatty acids & Bio synthesis of eicosanoids (prostaglandins, thromboxanes and leukotrienes), phospholipids and sphingolipids.

UNIT-V

8. Chemistry of Proteins and Nucleic acids: Outlines of the mechanism of protein and nucleic acid synthesis and catabolism. Principles of biological oxidation and detoxification mechanisms.

BIOCHEMISTRY

PRACTICAL 3 hours/week

(A minimum of 15 experiments shall be conducted)

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Colorimetric estimation of blood glucose.
3. Estimation of cholesterol, creatinine, urea and uric acid in biological fluids.
4. Qualitative test for normal and abnormal constituents of urine.
5. Estimation of reducing sugars in urine.
6. Estimation of bilirubin content the blood.
7. Enzymatic hydrolysis of glycogen by alpha and beta amylases.
8. Effect of temperature on the activity of alpha amylases.
9. Estimation of Blood Cholesterol
10. Estimation of SGOT, SGPT by UV Spectrophotometer.
11. Estimation of serum alkaline phosphate and acid phosphatase levels.
12. Estimation of serum sodium, potassium and calcium levels.

RECOMMENDED BOOKS:

1. Harper's Biochemistry R.K.Murray and Others (Prentice Hall of India, New Delhi)
2. Biochemistry by Stryer. (W.H. Freeman, New York)
3. Text Book of Biochemistry by West & Todd (Oxford & IBH Pub., Co., New Delhi)
4. Fundamentals of Biochemistry by Dr.A.C.Deb (New Central Book Agency, Calcutta)
5. Text Book of Biochemistry by Dr.A.V.S.S.Rama Rao (UBS Publishers & Distributors, New Delhi)
6. Text Book of Biochemistry by Dr.Satyanarayana

COMPUTER APPLICATIONS (15PH404)

UNIT-I

Introduction: Introduction computer, Generation and Classifications of computer (According to size and use)

Hardware: Architecture of a microcomputer, CPU, ALU, Internal memory (RAM & ROM), various peripheral devices such as Input devices, Output devices, Storage devices. Various ports and slots such as PCI, Parallel, Serial, PS/2, USB etc.

Number System: Binary, Octal and Hexadecimal Number Systems. Addition and subtraction binary numbers (1's & 2's complement method)

Software: Introduction to software. Different computer languages (such as Machine, Assembly and High-level languages). Classification of application software according their use.

UNIT-II

Operating Systems: Introduction to various operating systems, Different Type of file manipulation and storage management such as Directory/folder handling, Copy, moving , deleting, searching etc of files. Various storage maintenance tasks such as Checking, Scanning, and Formatting storage device (eg. HDD or Pen drive, DVD etc) by using the Windows-XP & Linux

Application of Computers in Pharmacy: Various use of computer in pharmaceutical research and development, industries, education and hospitals.

UNIT-III

Programming with JAVA

Introduction to programming: Problem Analysis, algorithm, flow chart, coding, execution, debugging & testing and programming documentation.

Introduction to JAVA: History of Java, Introduction to OOP. Idea about class and objects, Java program structure, Java tokens and key words, identifiers, variables & constants, data types, declaration & initialization of variables, Operators and expressions, writing and running simple Java programmes using BlueJ.

UNIT-IV

Control statements: Decision making by using if, if...else, nested if..else, Switch..case statement. Looping statements like while, for, do..while statements.

Input and output in Java: Input the values by using, Scanner & BufferedReader. Output the data by using println() method etc. Exception handling (simple cases only).

Java Methods (functions): Definition, declarations and calling of Java methods, discussion about library methods(functions) to handle mathematical, character, string, date & time problems.

Array: Introduction to array, Declaration & use of 1-D and 2-D array. Sorting and searching in 1-D array.

UNIT-V

Computer Networking: Introduction to Computer networking, Mode of transmission (simplex, duplex, Half-duplex). Classification of networking like LAN, MAN & WAN. Network topologies, Network protocols, OSI layers

Internet: Introduction to internet, TCP/IP, Internet browsers, URL. Introduction to e-mail and its use. Important websites related to pharmaceutical information –like sites for information regarding drugs, medical literature, plants, clinical data, patent sites, FDA, WHO etc.

RECOMMENDED BOOKS:

Computer Fundamentals, P.K.Sinha, BPB Publications

Computer Applications in Pharmacy -William and Fassett

The ABC's of the Internet - Cristain Crumlish, BPB Publications, N. Delhi – 01

PROGRAMMING WITH JAVA - E Balagurusamy, Amazon India

COMPUTER APPLICATIONS (PRACTICAL)

1. Demonstration of computer hardware.
2. Operating system: Windows & Linux
Understanding the sub-directories/folders, copying, moving, deleting & searching of files/folders etc
3. MS-WORD: Create and save a document in Ms-word, text editing, text formatting.
4. MS-EXCEL: Understanding a work sheet, Create and save a work-book file. Input various values of data types into a worksheet cell, using of formulas & functions and plotting of graph using Excel
5. Write Simple Java programmes in BlueJ Environment: At least 10 programmes should be developed in order to learn use of conditional statements, looping statements, Java methods, Array etc.
6. Preparing a presentation by using Power Point.
7. Use of Internet: Use of various search engines, creation and use of e-mail id and groups.

RECOMMENDED BOOKS:

1. Computer Fundamentals, P.K.Sinha, BPB Publications
2. Fundamentals of Computers, V. Rajaraman, Prentice Hall of India Pvt. Ltd., 1986.
3. Computer Applications in Pharmacy -William and Fassett -
4. The ABC's of the Internet - Cristain Crumlish, BPB Publications, N. Delhi – 01
5. Programming with Java - **E Balagurusamy, Amazon India**
6. Complete Reference MS- Office
7. Complete Reference Windows XP.
8. Complete Reference Internet

Organic Chemistry-III (15PH405)

THEORY 3 hours/week

UNIT-I .

Heterocyclic Compounds Containing Two Hetero Atoms

Nomenclature, Synthesis, reaction and medicinal uses of following compounds Pyrazole, Benzimidazole, Oxazole, thiazole, pyrimidine, purine and phenothiazine.

UNIT-II

Carbohydrates: Classification, reducing and non-reducing sugars, chemistry (Excluding structure elucidation) of glucose, fructose, starch and cellulose,

Lipids (Fats and Oils): Classification and structure, physical and chemical properties (saponification, Hydrogenation, oxidation)analysis of (acid value, iodine value, saponification value, Reichert-Meissl value).

UNIT-III

Amino acids and Proteins: Structure of commonly occurring amino acids, Synthesis of amino acids and their physical properties and some characteristic chemical reactions, classification of proteins, physical properties, purification of proteins, concept of polypeptides.

Nucleic acids: Nucleic acids and their components(DNA & RNA bases,Nucleosides,Nucleotides), structure of RNA &DNA.

UNIT-IV

Study the following reactions with mechanism.

Benzoin condensation reaction, Reformatsky reactions, Beckmann rearrangement, Michael addition, Mannich reaction, Oppenaur oxidation, Claisen condensation, Knoevenagel condensation, Perkin reactions and their applications.

UNIT-V

Pericyclic Reaction :

Electrocyclic: [Pericyclic rearrangement](#), Thermal reactions of HOMO and LUMO

Cycloaddition: Woodward–Hoffmann rules for electrocyclic reactions, Diels – Alder reaction.

Sigmatropic reactions: Cope rearrangements, Claisen rearrangements

RECOMMENDED BOOKS:

1. Organic Chemistry by R.T. Morrison and R.N.Boyd.(Prentice Hall of India, New Delhi)
2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl.(S.Chand, New Delhi)
3. Bentley and Driver's Text Book of Pharmaceutical Chemistry.(Oxford University Press, New Delhi)
4. Organic Chemistry – Reactions and Reagents by O. P.Agarwal.
5. Organic Chemistry by I.L. Finar Vol. I & Vol. II.(Longman, Singapore)
6. Advanced Organic Chemistry: Reactions and Mechanisms,by M.S. Singh, Dorling Kindersley (India)

MATHEMATICS AND STATISTICS (15PH406)

THEORY 3 hours/week

UNIT -I

Integration:- Integration as inverse process of differentiation, Definite integrals (simple cases). Integration by (i) Decomposition (ii) by substitution (iii) by parts. Integration of Logarithmic, Trigonometric, Algebraic and exponential functions.

UNIT -II

Differential Equations:- Introduction to differential equations, Formation of differential equations, Solution of differential equations of first order and first degree by the methods of variable separable, Homogeneous, reducible to homogeneous and linear equations, Reducible to linear equations, Exact differential equations. Differential equations of order greater than one with constant coefficients, Pharmaceutical applications.

UNIT -III

Laplace transforms : Theorem, properties and uses (problems)

UNIT -IV

Statistics -I:- Introduction to statistics, Data collection random and non-random sampling methods, Sample size, Diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams, Measures of central tendency, Measures of dispersion, Standard deviation, Measures of skewness, Measures of kurtosis, Correlation and regression analysis, Methods of least squares, Probability and events, Probability theorems, Baye's Theorem on probability.

UNIT -V

Statistics- II:- Probability Distributions – Binomial, Poisson and normal distributions (normal curve and properties), Tests of hypothesis (statistical inference) Standard error, Fiducial (confidence) limits, Tests of significance for small samples- Student's t-distribution and t-tests, Paired t-test, chi-square tests and F-test (Pharmaceutical applications).

RECOMMENDED BOOKS:

1. Integral Calculus by Shanti Narayan.
2. Statistical Methods by S.P. Gupta. (S. Chand, New Delhi)
3. Higher Engineering Mathematics by B.S. Grewal. (Khanna Publishers, Delhi)
4. Mathematical Methods by Potter & Gold Berg. (Prentice Hall of India, New Delhi)

V SEMESTER								
Theory						Practical		
Code	Course Name	Hours/ Week L/T	Credit Theory	University marks	Internal Evaluation	Hours/ week L/T	Credit Practical	Marks
PC	Pharmaceutics-II (Pharmaceutical Technology - I)	3-0	3	100	50	3	2	50
PC	Medicinal Chemistry-I	3-0	3	100	50	3	2	50
PC	Pharm. Analysis-II	3-0	3	100	50	3	2	50
PC	Pharmacology-I	3-0	3	100	50	3	2	50
PC	Pharmacognosy-III	3-0	3	100	50			
PC	Pharmaceutical Microbiology	3-0	3	100	50	3	2	50
	Total	18	18	600	300	15	10	250
	Total Hours/Week 33							
	Total Credits 28 (PC 28)							
	Total Marks 1150							

PHARMACEUTICS-II **(Pharmaceutical Technology-I)**

PH. THEORY 3 hours / week

UNIT -I

Preformulation Studies : Principal areas like

- a. Bulk Characterization : Crystallinity and Polymorphism, Compressibility, hygroscopicity, bulk density, powder flow properties.
- b. **Solubility analysis : pKa, pH solubility profile, Common ionic effect, thermal effects, solubilization partition coefficient and dissolution.**

UNIT -II

Liquid Dosage Forms: Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizer, colors, flavours and others, manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions.

UNIT -III

Semisolid Dosage Forms: Definitions, types, mechanisms of drug permeation, factors influencing permeation, semisolid bases and their selection. General formulation of semisolids: like ointments, creams, pastes & gels, their manufacturing procedure, evaluation and packaging.

Suppositories: Ideal requirements, bases, manufacturing procedure, packaging and evaluation.

UNIT -IV

Tablets: Types of tablets, excipients used, and different granulation techniques used for preparation of tablets, types of tablet press, manufacturing defects and evaluation of tablets. Coating of tablets : Type of coating – Sugar coating, film coating, enteric coating, film defects, materials used and evaluation of coated tablets. Discussion on new materials such as superdisintegrants, equipments like rapid mixers, granulators, fluid bed dryer.

UNIT -V

Capsules: Advantages and disadvantages of capsule dosage forms, materials used for production of hard gelatin capsules, different sizes of capsules, methods of capsule filling, Soft gelatin capsules, capsule shell and content of capsules, importance of base absorption and minim/gm. Quality control and storage of capsule dosage forms.

RECOMMENDED BOOKS :

1. Bently's Textbook of pharmaceuticals edited by E.A. Rawlins (All India Traveller Book Seller, New Delhi)
2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig (Varghese Pub. House, Bombay)
3. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich (B. I. Waverly Pvt. Ltd., New Delhi)
4. REMINGTON: The Science and Practice of Pharmacy, 20th Edition (Lippincott Williams & Wilkins, Baltimore)
5. Pharmaceuticals: The Science of Dosage Form Design by Aulton (Churchill Livingstone, Edinburgh)

PHARMACEUTICS-II
(Pharmaceutical Technology – I)
PRACTICAL **3 hours / week**
(A minimum of 15 experiments shall be conducted)

1. Preparation and evaluation of different types of syrup.
2. Preparation and evaluation of elixirs.
3. Preparation and evaluation of oral rehydration solutions.
4. Preparation and evaluation of different types of suspension such as flocculated, deflocculated suspension, dry suspension, suspensions based on high and low solid content etc.
5. Preparation and evaluation of emulsions by HLB method.
6. Preparation and evaluation of ointment by using different types of base.
7. Preparation and evaluation of creams, gels and pastes.
8. Preparation and evaluation of suppositories by using different base.
9. Granulation by different methods (wet granulation, dry granulation)
10. Preparation of different types of tablets.
11. Evaluation of tablets.
12. Preparation of coated tablets (sugar coating, film coating)
13. Evaluation of film coated and enteric coated tablets.
14. Filling and evaluation of hard gelatin capsules.

MEDICINAL CHEMISTRY – I

THEORY

3 hours/ week

UNIT -I

Basic Principles of Medical Chemistry: Physico-chemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action

Brief concept on QSAR: Hansch analysis – its derivation and discussion on different parameters like electronic parameters, steric factor, and partition coefficient. Free Wilson model.

Virtual drug screening techniques and its applications.

3-D QSAR Analysis: Receptor independent 3-D QSAR Analysis, Receptor dependent 3-D QSAR Analysis

UNIT -II

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

A. Drugs acting on autonomic nervous system:

Cholinergics and Anticholinesterase: Acetylcholine, Carbachol, Bethanechol, methacholine and Neostigmine.

Adrenergic drugs and adrenergic blocking agents: Adrenaline, Salbutamol, Naphazoline, Propranolol, Atenolol

Antispasmodic and anti ulcer drugs: Homatropine, Cyclopentolate, Dicyclanide, Tropicamide.

Neuromuscular blocking agents: Gallamine, succinylcholine

UNIT -III

B. Autacoids :

Antihistamines: Diphenhydramine, Mepyramine, Chlorpheniramine, Promethazine, Chlorcyclizine, Ranitidine.

Eicosanoids : Occurrences, Chemical nature, Medicinal applications

Analgesic – antipyretics, anti-inflammatory (non-steroidal) agents: Aspirin, Paracetamol, Ibuprofen, Naproxan, Diclofenac sodium.

UNIT -IV

Diuretics: Acetazolamide, Chlorthiazide, Furosemide,

Cardiovascular drugs: Clonidine, Methyldopa, Procainamide, Nifedipine, Prazocin, clofibrate.

UNIT -V

Anti-TB and anti-leprosy Drugs: Isoniazid, Ethambutol, Pirazinamide, Dapsone

Antiamoebic agents: Metronidazole, Diloxamidefuroate

Anthelmintics : Thiabendazole, Mebendazole, Niclosamide

Diagnostic Agents: Propylidone, Sodium diatrizoate, Fluorescein sodium.

PHARMACEUTICAL CHEMISTRY-V
(Medicinal Chemistry – I)

PRACTICAL 3 hours/week

(A minimum of 15 experiments shall be conducted)

1. Synthesis of selected drugs and intermediates from the course content.
2. Monographs of selected official drugs including identification tests and tests for purity.

RECOMMENDED BOOKS

1. Wilson and Grisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry.
2. Principles of Medicinal Chemistry by William O.Foye.
3. A Text Book of Medicinal Chemistry by S.N.Pandeya.
4. Medicinal Chemistry by Ashutoshkar.
5. Bentley's and Driver's Text Book of Pharmaceutical Chemistry.
6. Introduction to Medicinal Chemistry by Graham L. Patrick

TENTATIVE
Likely to be Modified

PHARMACEUTICAL ANALYSIS-II

THEORY 3 hours/ week

UNIT -I

1. Gravimetric Analysis: Precipitation techniques, solubility products. The colloidal state, supersaturation, co-precipitation, post precipitation, Digestion, washing of the precipitate, Filtration, Filter papers, and crucibles, Ignition. Thermo gravimetric curves, specific examples like barium sulphate, aluminum as aluminum oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants.

UNIT -II

- 1. Potentiometry and pH Meter**
- 2. Conductometry**

UNIT -III

- 1. Polarography and Amperometry**
- 2. Nephelometry and Turbidimetry.**

UNIT -IV

- 1. Diazotisation titrations, Kjeldahl method of nitrogen estimation,**
- 2. Karl-Fischer titration, Oxygen flask combustion gasometry.**

UNIT-V

- 1. Radioimmuno Assays.**
- 2. Electrophoresis**

PHARMACEUTICAL ANALYSIS-II

PRACTICAL 3 hours/ week

(A minimum of 15 experiments shall be conducted)

- 1. Exercise involving diazotization, Kjeldahl, Karl-Fischer, shall be covered.**
- 2. Exercises based on acid base titration in aqueous and non-aqueous media,**
- 3. Oxidation reduction titrations using potentiometric technique.**
- 4. Determination of acid-base dissociation constants and plotting of titration curves using pH meter.**
- 5. Exercises involving conductometric titrations.**

RECOMMENDED BOOKS:

- 1. Vogel's Text Book of Quantitative Chemical Analysis.**
- 2. Practical Pharmaceutical Analysis by Beckett and Stenlake Vol. I & II.**
- 3. Indian Pharmacopocia Vol. I & II 46**
- 4. Instrumental methods chemical analysis by B.K. Sharma 5. Bentley and Driver's Text Book of Pharmaceutical Chemistry**

PHARMACOLOGY-I

THEORY 3Hrs/Week

UNIT-I

1. General Pharmacology:

- 1.1. Introduction to pharmacology, Source of Drug, Routes of administration with special reference to its advantages and disadvantages.
- 1.2. Pharmacokinetics: Absorption, factors affecting drug absorption, distribution, metabolism and excretion of drug.
- 1.3. Pharmacodynamics: General principle and molecular aspects of drug action with special emphasis on receptors, receptor classification, Drug-receptor interaction, potentiation, antagonism phenomenon.

UNIT-II

2. Pharmacology of drugs acting on peripheral (autonomic) nervous system:

- 2.1. Neurohumoral transmission of autonomic nervous system.
- 2.2. Drugs acting on cholinergic system: Cholinergic drugs (parasympathomimetic), Anticholinergic drugs (parasympatholytic).
- 2.3. Drugs acting adrenergic system: Adrenergic drugs (sympathomimetic), Adrenergic blocking drugs (sympatholytic).
- 2.4. Drugs acting on autonomic ganglia: Ganglion stimulant and Ganglion blocking agent.

UNIT-III

3. Pharmacology of drugs acting on peripheral (somatic) nervous system:

- 3.1. Neurohumoral transmission of somatic nervous system.
- 3.2. Neuromuscular blocking agent and peripherally acting skeletal muscle relaxant.
- 3.3. Local anesthetics.

UNIT-IV

4. Pharmacology of drugs acting on central nervous system:

- 4.1. Neurohumoral transmissions in CNS with special emphasis on neurotransmitters like serotonin, dopamine, GABA, Glutamate.
- 4.2. General anesthetics.
- 4.3. Sedative and hypnotics, centrally acting muscle relaxants.
- 4.4. Anti-epileptics.
- 4.5. Opioid analgesics and antagonist.
- 4.6. Nootropic agents.

UNIT-V

5. Psychopharmacological agents:

- 5.1. Antipsychotics/Neuroleptics.
- 5.2. Antidepressant and anti-manic drugs.
- 5.3. Antiparkinsonian drugs

PHARMACOLOGY-I

PRACTICAL

1. Commonly used laboratory instruments, laboratory animals in experimental pharmacology, dose calculation and study of different routes of administration of drugs in rat/mice. (01 Experiment)
2. Commonly used anesthetics used in animal study, some common and standard laboratory techniques like procedure for rendering animal unconscious, blood withdrawal and plasma serum separation. (01 Experiment)
3. Effects of various agonist and antagonist and their characterization using isolated tissue preparations like frog's rectus abdominis muscle, isolated ileum preparation of rat and isolated fundus strip preparation of rat. (03 Experiment)
4. Experiment to explain the concept of reversible antagonism using suitable isolated tissue preparation. (01 Experiment)
5. Experiment to explain the role of choline esterase enzyme and its inhibitor using suitable isolated tissue preparation. (01 Experiment)
6. Effects of autonomic drugs on rabbit's eye. (01 Experiments)
7. Effect of physostigmine and atropine on ciliary movement in frog buccal cavity. (01 Experiments)
8. Experiments on skeletal muscle relaxant activity (01 Experiment)
9. Local anesthetic activity of drugs using suitable animal model. (02 Experiment)
10. Experiments on hypnotic and sedative activity. (01 Experiment)
11. Experiments on central analgesic activity. (01 Experiment)
12. Experiments on anti-epileptic activity. (02 Experiments)
13. Experiments on antidepressant activity. (02 Experiment)
14. Experiments on antipsychotic activity. (01 Experiment)

Books Recommended

1. Essentials of Medical Pharmacology by K.D. Tripathy
2. Pharmacology & Pharmacotherapeutics by Santoshkar & P Sen
3. Pharmacology by Prasun K Das, S.K. Bhattacharya and P. Sen
4. The Pharmacological basis of the Therapeutics by Goodman & Gilman
5. Pharmacology by Rang, Dale & Ritter
6. Basic and Clinical Pharmacology by B.G. Katzung

PHARMACOGNOSY-III

THEORY 3 hours/ week

MODULE -I

1. General methods of isolation and preliminary phytochemical screening of glycosides.
2. Study of the biological source, cultivation, collection, chemical constituents, adulterants, uses, macroscopic, microscopic features and chemical tests of following group of drugs containing –
 - i) Saponins : Liquorice, ginseng, dioscorea, sarasparilla and senega.
 - ii) Cardioactiverols : Digitalis, squill and strophanthus
 - iii) Anthraquinonecathartics : Aloes, senna, rhubarb and cascara.
 - iv) Others :Psoralea, gentian, saffron, chirata and quassia

MODULE -II

3. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.
4. Basic metabolic pathways. Techniques used to study of various pathway. Biogenesis of aromatic aminoacids, steroidal glycosides , tropane alkaloids and indole alkaloids.

MODULE -III

5. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Application of plant tissue cultures with special reference to production of secondary metabolites.

MODULE -IV

6. An introduction to poisonous plants in India.
7. Marine pharmacognosy, novel medicinal agents from marine sources.

MODULE-V

8. Study of Nutraceuticals: General introduction, Classification, minerals & vitamin supplements, Digestive enzymes, Probiotics, Dietary fibres, Cereals & grain, Health drinks.

PHARMACOGNOSY-III

PRACTICAL 3 hours/ week

(A minimum of 15 experiments shall be conducted)

1. Identification of crude drugs listed in theory (Any five)
2. Microscopic study of at least four drugs including the powder study listed in theory.
3. Specific identification tests for crude drugs listed in theory

RECOMMENDED BOOKS:

1. Textbook of Pharmacognosy by C.K.Kokate and D.P.Purohit (NiraliPrakashan, Pune)
2. Trease G.E. and Evans w.e., Pharmacognosy (Baillere Tindall, Eastbourne)
3. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len &Febiger, Philadelphia)
4. Pharmacognosy by T.E. Wallis(CBS Publisher, New Delhi)
5. Staba E.J., Plant Tissue Culture as a source of Bio-medicinals
6. Rangari V D., Text book of Pharmacognosy Vol-I & II.
7. Pharmacognosy&Pharmabiotechnology by AshutoshKar

PHARMACEUTICAL MICROBIOLOGY

THEORY 3 hours/ week

UNIT -I

Scope and future of microbiology. Classification of microbes. Morphological study of Bacteria, Brief introduction about Actinomycetes, Fungi, Rickettsiae, Spirochetes and Viruses and their importance in pharmaceuticals.

UNIT-II

Nutrition, cultivation and isolation of bacteria, actinomycetes, fungi and viruses. Identification of Microbes : Cultural characteristics, Biochemical reactions, Staining techniques (simple staining, Gram staining, negative Staining) of bacteria. Preservation of microbial cultures.

UNIT -III

Microbial genetics – Mutations, Isolation of mutants, factors influencing rate of mutation, mutagens. Transformation, conjugation, transduction.

UNIT -IV

Sterilization, different methods, validation of sterilization methods & equipment. Disinfection, factors influencing disinfectants and antiseptics and their evaluation. Test for sterility – Importance, objectives, methodology as per pharmacopoeial standards, evaluation tests. Microbial limit tests for pharmaceutical dosage forms.

UNIT -V

Microbiological assay of antibiotics – penicillin, Vitamins – vitamin B12 and amino acids – lysine. Industrial production of Ethanol and Lactic acid

PHARMACEUTICAL MICROBIOLOGY

PH. PRACTICAL

3 hours/ week

(A minimum of 15 experiments shall be conducted)

Experiments devised to prepare various types of culture media, sub-culturing of common aerobic bacteria, fungi and yeast. Various staining methods, various methods of isolation of microbes, sterilization techniques and validation of sterilizing techniques, evaluation of antiseptics and disinfectants, Testing the sterility of pharmaceutical products as per I.P. requirements and Microbiological assay of antibiotics.

1. Sterilization
2. Preparation of Culture media
3. Isolation of microbes (Bacteria and Fungus)
4. Morphological identification of microbes
5. Gram's staining Technique
6. Evaluation of disinfectants
7. Microbiological assay of antibiotics
8. Sterility testing

RECOMMENDED BOOKS:

1. Microbiology of Pelczar and Kreig.
2. Text Book of Microbiology by Anantanarayana and Panicker.
3. Prescott, Harley and Klein's Microbiology
4. Shah and Shah (Pharmaceutical Microbiology)
5. Microbiology by Tortora
6. Microbiology by R P Singh
7. A textbook of Microbiology by R C Dubey
8. Industrial Microbiology by L E Casida
9. Textbook of Medical microbiology by Satish Gupte.

VI SEMESTER								
Theory						Practical		
Code	Course Name	Hours/ Week L/T	Credit Theory	University marks	Internal Evaluation	Hours/ Week L/T	Credit Practical	Marks
PC	Pharmaceutics-III (Pharm. Tech-II)	3-0	3	100	50	3	2	50
PC	Medicinal Chemistry-II	3-0	3	100	50	3	2	50
PC	Pharmacology-II	3-0	3	100	50	3	2	50
PC	Pharmacognosy-IV	3-0	3	100	50	3	2	50
PC	Pharm. Biotech	3-0	3	100	50			
PC	Pharmaceutical Jurisprudence	2-0	2	100	50			
	Total	17	17	600	300	12	08	200
	Total Hours/Week 29							
	Total Credits 25 (PC 25)							
	Total Marks 1150							

Hospital / Industrial Training for six weeks during summer vacation - 4 credits

PHARMACEUTICS - III
(Pharmaceutical Technology II)

PH. THEORY 3 hours / Week

UNIT -I

1. Parenteral Products: Introduction to parenteral products and routes of administration. Formulation: Vehicles, additives, containers and closures. Facilities: Design of aseptic area, environmental control, traffic control, housekeeping, surface disinfection, air control, personnel. Processing: Cleaning of equipment, containers and closures, filling, sealing, sterilization, packaging and labeling. Evaluation of parenteral products

UNIT-II

2. Ophthalmic Preparations: Introduction, pharmacological categories of ophthalmic drugs, pharmaceutical requirements, packaging, administration. Contact lenses & its care and use solutions & evaluation of upcoming products.

UNIT-III

3. Pharmaceutical Aerosols: Definition, applications, components of aerosol package: Propellants, container, valve and actuator types. Formulation of pharmaceutical aerosols, manufacturing and filling methods, quality control tests.

UNIT -IV

4. Micro-encapsulation: Types of microcapsule, applications of microencapsulation in pharmacy, microencapsulation by co-acervation phase separation, multi orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, solvent evaporation and pan coating, evaluation of microcapsules.

UNIT -V

5. Packaging of Pharmaceutical Products: Packaging components: glass, plastic, metal, fibrous material, specifications and methods of evaluation of packaging component, Closure and Closure liners, Tamper Resistant Packaging, Regulatory and quality consideration.

PHARMACEUTICS - III
(Pharmaceutical Technology II)

PRACTICAL

1. Preparation of SVP and LVP.
2. Evaluation of parenterals such as sterility test, pyrogen test (Rabbit and LAL test), clarity test, leakage test etc.
3. Filling and sealing of ampoules under aseptic condition.
4. Preparation and evaluation of ophthalmic solution, suspension, emulsion and ointment etc.
5. Preparation and evaluation of aerosols.
6. Preparation and evaluation of microcapsules by different methods such as ionic gelation, solvent evaporation, coacervation phase separation method etc.
7. Evaluation of glass containers.
8. Water vapor permeation studies.

RECOMMENDED BOOKS :

1. Bently's Textbook of pharmaceuticals edited by E.A. Rawlins
2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig

MEDICINAL CHEMISTRY – II

THEORY 3 hours/week

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

UNIT -I

Drugs acting on the Central Nervous System:

- **General Anaesthetics** : Anesthetic ether, Halothane, Thiopental sodium.
- **Local Anaesthetics** : Benzocaine, Procaine, Lignocaine,
- **Hypnotics and Sedatives**: Phenobarbitone, Cyclobarbitone, , Diazepam
- **Opioid analgesics** : Pethidine, Methadone.

UNIT -II

- **Anticonvulsants** : Phenytoin, Ethosuximide, Primidone,
- **Antiparkinsonism drugs**: Levodopa, Amantidine
- **CNS stimulants** : Nikethemide, Ethamivan, Amphetamine
- **Psychopharmacological agents** (neuroleptics, antidepressants, anxiolytics):

Chlorpromazine, Haloperidol, Imipramine, Phenelzine, Chlordiazepoxide, Alprazolam.

UNIT -III

Antibiotics: General study including classification, synthesis of Methicillin, Ampicillin, Amoxicillin and Chloramphenicol

Anti-viral including anti-HIV agents: Acyclovir, Zidovudine

Immunosuppressives and immunostimulants: To study only the general concept

Anti Malarial Drugs: Chloroquine, Pamzquine, Mepacrine, Proguanil, Pyrimethamine.

Antineoplastic agents: Chlorambucil, Thiotepa, Busulfan, 5-Flurouracil

UNIT -IV

Thyroid and Anti thyroid drugs: Thyroxine, Liothyronine, Propylthiouracil, Carbimazole

Insulin, Insulin preparations and oral hypoglycaemic agents: Chlorpropamide, Tolbutamide, Glibenclamide, Phenformin.

UNIT -V

Enzyme Inhibitors: A detailed study of the following types of enzyme inhibitors, related drugs and their pharmaceutical significance;

- a) Phosphodiesterase (PDE) inhibitors.
- b) Angiotensin converting enzyme (ACE) Inhibitors

Medicinal Chemistry – II

PRACTICAL

3 hours/week

(A minimum of 15 experiments shall be conducted)

1. Synthesis of selected drugs from the course content
2. Monographs of selected official drugs including identification tests and tests for purity.

RECOMMENDED BOOKS:

1. Wilson and Grisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry
2. Principles of Medicinal Chemistry by William O.Foye
3. A Text Book of Medicinal Chemistry by S.N.Pandeya
4. Medicinal Chemistry by Ashutoshkar
5. Bentley's and Driver's Text Book of Pharmaceutical Chemistry.

PHARMACOLOGY-II

THEORY 3Hrs/Week

UNIT-I

1. Pharmacology of drugs acting on cardiovascular system:

- 1.1. Cardiac glycosides and drug for heart failure.
- 1.2. Antihypertensive drug.
- 1.3. Antianginal and vasodilator drug.
- 1.4. Antiarrhythmic drug.

UNIT-II

2. Pharmacology of drugs acting on haemopoetic system:

- 2.1. Haematinics.
- 2.2. Coagulants, anticoagulants, fibrinolytics and antiplatelet drug.
- 2.3. Hypolipidimic drugs.

UNIT-III

3. Autacoids:

- 3.1. Amine autacoids: Histamine and their antagonist (special reference to H₁ receptor antagonist), Serotonin and serotonin antagonist.
- 3.2. Lipid derived autacoids: Prostaglandin and other eicosanoids (Thromboxane, leukotrine).
- 3.3. Peptide autacoids: Angiotensin, bradykinin.
- 3.4. Non-steroidal anti-inflammatory drugs.

UNIT-IV

4. Drugs acting on respiratory system:

- 4.1. Anti-tussive and expectorant.
- 4.2. Anti-asthmatic drugs.
- 4.3. Respiratory stimulant.

UNIT-V

5. Drug acting on urinary system:

- 5.1. Diuretics.
- 5.2. Antidiuretics.

PHARMACOLOGY-II

PRACTICAL

1. Effects of electrolytes on isolated frog's heart. (01 Experiment)
2. Experiments on inotropic and chronotropic effect of drug in isolated frog heart. (01 Experiment)
3. To study the effect of cardiac glycoside on normal and hypodynamic heart of frog. (01 Experiment)
4. To record the DRC of Ach, histamine and serotonin using suitable isolated tissue preparation.(03 Experiment)
5. Bioassay of Ach/histamine/5-HT by matching method using suitable isolated tissue.(01 Experiment)
6. Bioassay of Ach/histamine/5-HT by bracketing method using suitable isolated tissue. (01 Experiment)
7. Bioassay of Ach/histamine/5-HT by interpolation method using suitable isolated tissue. (01 Experiment)

PHARMACOGNOSY-IV

Subject Code: **THEORY** **3 hours/ week**

UNIT-I

1. General methods of extraction, isolation and chemical tests of Alkaoids.
2. Systematic study of source, cultivation, collection, chemical constituents, adulterants, uses, macroscopic, microscopic features and chemical tests of the following alkaloids containing drugs.
Pyridine- Piperidine Tobacco, Arica, Lobelia
Tropane- Belladonna, Hyoscyamus, Daturas, Withania.
Quinoline and Isoquinoline- Cinchona, Ipecac, Opium
Indole- Ergot, Rauwolfia, Catharanthus, Nux-vomica, Physostigma
Imidazole- Pilocarpus
Steroidal- Veratrum and Kurchi
Alkaloid amines- Ephedra, Colchicum
Glycoalkaloid- Solanum
Xanthine alkaloid- Coffee, Coca.

UNIT-II

3. Study of traditional drugs, common vernacular names, botanical source, chemical constituents, uses and marketed formulations (any two) of the following drugs :
4. Amla, Satavari, Bhilwua, Bael, Bach, Rasna, Punarnava, Gokhru, Shankhapusphi, Brahmi
Adusa, Arjuna, Lahsun, Guggul, Gymnema, Neem, Tulsi, Shilajit and Spirulina.

UNIT-III

5. Holistic concept in traditional system of medicine. Introduction of ayurvedic preparation like Asvas, Aristas, Guticas, Tailas, Lehyas and Bhasmas.

UNIT-IV

6. Utilization and production of phytoconstituents such as Quinine, Calcium sennosides, Podophyllotoxin, Diosgenin and Tropane alkaloids.

UNIT-V

7. Separation of phytoconstituents by using Chromatographic techniques.
 - i. Paper chromatography
 - ii. Column chromatography
 - iii. Thin layer chromatography

PHARMACOGNOSY-IV

PRACTICAL 3 hours/week

(A minimum of 15 experiments shall be conducted)

1. Identifications of crude drugs listed in theory. (any five)
2. Microscopic study of characters of six – selected drugs given in theory in entire and powder form.
3. Specific chemical tests of some alkaloidal crude drugs listed in theory.
4. Standardization of some traditional drug formulations.
5. TLC & Paper chromatography characterisation of medicinal plant extracts.

RECOMMENDED BOOKS:

1. Trease G.E. and Evans W E., Pharmacognosy.
2. Pharmacognosy by T.E. Wallis.
3. Pharmacognosy by C.K. Kokate.
4. Kalia A N., Text book of Industrial Pharmacognosy.
5. Rangari V D., Text book of Pharmacognosy Vol-I & II.
6. Atal C K., Cultivation and utilization of medicinal and aromatic plants of India.
7. Peach and Tracey M.V., Modern method of plant analysis.

PHARMACEUTICAL BIOTECHNOLOGY

Subject Code: **THEORY** **3**
hours/week

UNIT -I

1. Brief introduction to Biotechnology with reference to Pharmaceutical sciences.
2. **Immunology and Immunological Preparations:** Principles of immunology and immunological products, antigens, antibodies, Immune system- cellular and humoral immunity, immunological tolerance, Hypersensitivity, Active and passive immunization.

UNIT -II

3. **Genetic Code and Protein Synthesis:** Genetic code, components of protein synthesis, inhibition of protein synthesis. Brief account of protein engineering and Polymerase Chain Reactions.
4. **Genetic Recombination:** Gene cloning and its applications. Hybridoma Technology- Production, Purification and Applications.

UNIT -III

5. **Microbial Transformation:** Introduction to Microbial biotransformation and applications.
6. Immuno blotting techniques- ELISA, Western blotting, Southern blotting. Mutation.

UNIT -IV

7. Fermenter, its design, control of different parameters. Design of fermentation process,
8. Isolation of fermentation products with special reference to Penicillin, Citric acid and Vitamin B12.

UNIT -V

9. **Enzyme Biotechnology:** Methods of Enzyme Immobilization and applications.
10. **Biosensors:** Working and application in pharmaceutical industry.
11. Study of enzymes such as Pencillinase, Streptokinase and Amylases and Proteases etc.

RECOMMENDED BOOKS :

1. Industrial Microbiology by Casida.
2. Industrial Microbiology by A.H. Patel.
3. Industrial microbiology by Prescott and Dunn.
4. Pharmaceutical Biotechnology by Vyas and Dixit.
5. Molecularbiology and Genetic Engineering by A.M.Narayanan, A.M.Selvaraj, A.Mani
6. Text Book of Microbiology by Anantanarayana and Panicker.
7. Concepts in Biotechnology by Balasubramanium.
8. Molecular Biotechnology by B R Glick.
9. Molecular Biotechnology by Gingold

PHARMACEUTICAL JURISPRUDENCE & ETHICS

Subject Code:

THEORY

2

hours/week

UNIT -1

1. Origin and Nature of Pharmaceutical Legislations in India: A brief review, Religion, Ethics, Law, Study of drugs enquiry committee, Health survey and development committee.

2. Pharmacy Act, 1948: Introduction, Objectives, Pharmacy Council of India- Constitution and Functions, Education Regulations, State and Joint State Pharmacy Council- Constitution and Functions, Registration of Pharmacists, Offences and Penalties.

UNIT -II

3. Code of Pharmaceutical Ethics: Introduction, General introduction to code of pharmaceutical ethics, Pharmacist in relation to his Job, Pharmacist in relation to his Trade, Pharmacist in relation to Medical profession and Pharmacist in relation to his Profession.

4. Drugs Price Control Order (DPCO), 1995: Introduction, Prices of Bulk drugs, Retail prices of formulations.

UNIT -III

5. Drugs and Cosmetics Act 1940 and Rules 1945: Introduction, Legal definitions of Schedules to the Act and Rules; Import of Drugs, Manufacture of Drugs, Sale of Drugs, Administration of the Act- Drugs Technical Advisory Board, Drugs Consultative Committee, Central drugs Laboratory, Government Analysts, Licensing authorities, Drugs Inspectors.

6. Drugs and Magic Remedies (Objectionable Advertisements) Act, 1954: Introduction, Definitions, Prohibited advertisements, Classes of Exempted advertisements, Prohibition on Import and Export of Advertisements, Offences and Penalties.

UNIT -IV

7. Medical Termination of Pregnancy Act 1971 & Rules 1975: Introduction, Provisions for termination of pregnancy, Offences and Penalties.

8. Narcotic Drugs and Psychotropic Substances Act, 1985 and Rules: Introduction, Definitions, Administrative Agencies, Offences and Penalties.

UNIT-V

9. Medicinal and Toilet Preparations (Excise Duties) Act, 1955: Introduction, Manufacture In Bond and Outside bond, Export of alcoholic preparations, Offences and Penalties.

10. Prevention of Cruelty to Animals Act, 1960: Introduction, Experimentation on Animals, CPCSEA Guidelines, Offences and Penalties.

RECOMMENDED BOOKS:

1. A Textbook of Forensic Pharmacy by B.M.Mithal
2. A Textbook of Forensic Pharmacy by N.K.Jain
3. Drugs and Cosmetics Act and Rules published by Government of India
4. Pharmacy Act, Published by Government of India
5. Law of Drugs
6. Drug Cases published by International Law Book Co. Delhi (Reference)
7. A text book of Forensic Pharmacy by G. Vidya Sagar, T.V. Narayan