<table>
<thead>
<tr>
<th>Subject Group</th>
<th>Subject Code</th>
<th>Course Name</th>
<th>Theory</th>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hours/Week L/T</td>
<td>Credit</td>
</tr>
<tr>
<td>PC</td>
<td>15PH301 &amp;</td>
<td>Physical Pharmaceutics-I</td>
<td>3-0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>15PH302</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE</td>
<td>15PH303</td>
<td>Pharm. Engineering-I</td>
<td>3-0</td>
<td>3</td>
</tr>
<tr>
<td>BS</td>
<td>15PH304 &amp;</td>
<td>Organic Chemistry-II</td>
<td>3-1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>15PH305</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC</td>
<td>15PH306 &amp;</td>
<td>Pharmacognosy-II</td>
<td>3-0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>15PH307</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC</td>
<td>15PH308</td>
<td>Pathophysiology of Common Diseases</td>
<td>3-0</td>
<td>3</td>
</tr>
<tr>
<td>BS</td>
<td>15PH309</td>
<td>Environmental Science</td>
<td>2-0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>17-1</td>
<td>17</td>
</tr>
</tbody>
</table>

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

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

UNIT -IV

UNIT -V

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
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, Mc cabe Thiel method for calculation of number of theoretical plates, Azeotropic and extractive distillation. A few numerical problems may be solved.

UNIT-V

PHARMACEUTICAL CHEMISTRY-III
(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
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:
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)

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, Cocheneal).
RECOMMENDED BOOKS:

2. Trease G.E. and Evans W.C., Pharmacognosy (Bailliere Tindall, Eastbourne)
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)
6. Text Book of Pharmacognsy by S.S.Honda., V.K Kapoor
7. Text Book of Industrial Pharmacognsy 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
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

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
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  

UNIT – I
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.

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.

UNIT – V
### B.Pharm (4th Semester Structure)

#### IV SEMESTER

<table>
<thead>
<tr>
<th>Subject Group</th>
<th>Subject Code</th>
<th>Course Name</th>
<th>Hours/Week L/T</th>
<th>Credit</th>
<th>University marks</th>
<th>Internal Evaluation</th>
<th>Hours/week L/T</th>
<th>Credit Practical</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>15PH401</td>
<td>Physical Pharmaceutics-II</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>BE</td>
<td>15PH402</td>
<td>Pharm. Engineering-II</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>PC</td>
<td>15PH403</td>
<td>Biochemistry</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>BS</td>
<td>15PH404</td>
<td>Computer Application</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>BS</td>
<td>15PH405</td>
<td>Organic Chemistry - III</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BS</td>
<td>15PH406</td>
<td>Mathematics &amp; Statistics</td>
<td>3-1</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>18-1</td>
<td>18</td>
<td>600</td>
<td>300</td>
<td>12</td>
<td>8</td>
<td>200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Total Hours/Week</th>
<th>31</th>
<th>Total Credits</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(PC 10 BE 05 BS 11)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Marks</td>
<td>1100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
Physical Pharmaceutics – II (15PH401)

THEORY 3 hours/week

UNIT -I
1. Micromeretics 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

UNIT -III

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:
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.
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, Viscosiy, 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

UNIT -IV

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)
3. Chamical Engineering by Badger and Banchero (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.
7. Experiments to illustrate the influence of various parameters on the rate of drying.
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.
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
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

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
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.
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:
2. Biochemistry by Stryer.(W.H.Freeman, New York)
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
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: Hostory 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. Looking 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:

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
Sigmatropic reactions: Cope rearrangements, Claisen rearrangements

RECOMMENDED BOOKS:
6. Advanced Organic Chemistry: Reactions and Mechanisms, by M.S. Singh, Dorling Kindersley (India)
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 different 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 - 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, Fudicial (confidence) limits, Tests of significance for small samples - Students 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)
4. Mathematical Methods by Potter & Gold Berg. (Prentice Hall of India, New Delhi)
<table>
<thead>
<tr>
<th>Code</th>
<th>Course Name</th>
<th>Hours/Week L/T</th>
<th>Credit Theory</th>
<th>University marks</th>
<th>Internal Evaluation</th>
<th>Hours/week L/T</th>
<th>Credit Practical</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>Pharmaceutics-II (Pharmaceutical Technology - I)</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>PC</td>
<td>Medicinal Chemistry-I</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>PC</td>
<td>Pharm. Analysis-II</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>PC</td>
<td>Pharmacology-I</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>PC</td>
<td>Pharmacognosy-III</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC</td>
<td>Pharmaceutical Microbiology</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>18</strong></td>
<td><strong>18</strong></td>
<td><strong>600</strong></td>
<td><strong>300</strong></td>
<td><strong>15</strong></td>
<td><strong>10</strong></td>
<td><strong>250</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total Hours/Week</strong></td>
<td><strong>33</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>28</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Marks</strong></td>
<td><strong>1150</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PHARMACEUTICS-II
(Pharmaceutical Technology—I)

PH. THEORY 3 hours / week

UNIT -I
Preformulation Studies: Principal areas like
a. Bulk Characterization: Crystallinity and Polymorphism, CompresIBILITY, hygroscopicity, bulk density, powder flow properties.
b. Solubility analysis: 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, flavors and others, manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions.

UNIT -III

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 pharmaceutics 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)
4. REMINGTON: The Science and Practice of Pharmacy, 20th Edition (Lippincott Williams & Wilkins, Baltimore)
5. Pharmaceutics: 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)
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, Dicloamine, 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, Methylldopa, Procanamide, 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: Propylidione, 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
3. A Text Book of Medicinal Chemistry by S.N. Pandeya.
5. Bentley’s and Driver’s Text Book of Pharmaceutical Chemistry.
6. Introduction to Medicinal Chemistry by Graham L. Patrick
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.
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 Pharmacopoeia Vol. I & II 46
4. Instrumental methods chemical analysis by B.K. Sharma 5. Bently 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.
   1.3. 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.

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
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) Cardioactive sterols : Digitalis, squill and strophanthus
   iii) Anthraquinone cathartics : 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.

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
7. Pharmacognosy&Pharmabiotechnology by Ashutosh Kar
PHARMACEUTICAL MICROBIOLOGY

THEORY 3 hours/ week

UNIT -I

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
# B.Pharm Structure & Syllabus for Admission Batch 2015-16

## 6th Semester

### VI Semester

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

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

*Likely to be Modified*
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

UNIT-III

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

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 pharmaceutics 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, Impiramine, Phanelzine, Chlordiazepoxide, Alprazolam.

UNIT -III
Antibiotics: General study including classification, synthesis of Methecillin, Ampicillin, Amoxycillin and Chloramphenicol
Anti-viral including anti-HIV agents: Acyclovir, Zidovudine
Immunosupressives and immunostimulants: To study only the general concept
Ant Malarial Drugs: Chloroquine, Pamzquine, Mepacrine, Proguanil, Pyrimethamine.
Antineoplastic agents: Chlorambucil, Thiotepa, Busulfan, 5-Flourouracil

UNIT -IV
Thyroid and Anti thyroid drugs: Thyroxine, Liothyronine, Propthyiouracil, Carbimazole
Insulin, Insulin preparations and oral hypoglycaemic agents: Chlorpropamid, 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

(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.

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.

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

THEORY

UNIT I

1. General methods of extraction, isolation and chemical tests of Alkaloids.
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- Belladona, 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:
   - Amla, Satavari, Bhilwua, Bael, Bach, Rasna, Punarnava, Gokhru, Shankhpushpi, Brahmi
   - Adusa, Arjuna, Laohsun, Guggul, Gymnema, Neem, Tulsi, Shilajit and Spirulina.

UNIT III


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:
2. Pharmacognosy by T.E. Wallis.
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
hours/week 3

UNIT -I
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

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.Man
6. Text Book of Microbiology by Anantanarayana and Panicker.
8. Molecular Biotechnology by B R Glick.
9. Molecular Biotechnology by Gingold
PHARMACEUTICAL JURISPRUDENCE & ETHICS

Subject Code: THEORY 2

UNIT - I


UNIT - II


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.


UNIT - IV


UNIT - V


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