PONDICHERRY UNIVERSITY

Puducherry – 605 014.

BACHELOR OF PHARMACY [LATERAL ENTRY]

**** B.PHARM. (LE) ****

SYLLABUS AND REGULATIONS

2007 -08

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PONDICHERRY UNIVERSITY
Puducherry

REGULATIONS OF THE UNIVERSITY

I. SHORT TITLE AND COMMENCEMENT

These regulations shall be called "THE REGULATIONS FOR THE **BACHELOR OF PHARMACY (LATERAL ENTRY) DEGREE COURSE** OF PONDICHERRY UNIVERSITY, Puducherry".

They shall come into force from the academic year 2007-2008 session.

The regulation and syllabi are subject to modifications by the standing Under Graduate Board of Studies for paramedical courses from time to time.

II. REGULATIONS

1. ELIGIBILITY FOR ADMISSION:

Students who have acquired a Diploma in Pharmacy from Pharmacy Council of India recognized institutions and who are registered Pharmacist in any of the State Pharmacy Council are eligible for lateral entry to Pharmacy Degree programme.

2. DURATION OF THE COURSE AND COURSE OF STUDY:

a. The period of certified study and training of the B.Pharm. (LE) degree course shall be of Three academic years.

b. The candidates selected for B.Pharm.(LE) shall be admitted directly into II year of B.Pharm. (Regular System). The course of study of B.Pharm. (LE) will be six Semesters i.e. from III Semester to VIII Semester.

3. MEDIUM OF INSTRUCTION:

English shall be the medium of instruction for all the subjects of study and for examinations of the Course.

4. MINIMUM WORKING DAYS IN AN ACADEMIC YEAR:

Each academic year shall consist of not less than 180 working days (Minimum 90 working days per semester).

5. REGISTRATION:

A Candidate admitted into B.Pharm. (Lateral Entry) Degree course in any one of the affiliated institutions of the PONDICHERRY UNIVERSITY, Puducherry shall submit the prescribed application form for registration duly filled along with prescribed fee and declaration in the format, to the Academic Officer of this University through the affiliated institution within 60 days from the cut-off date prescribed for admission.

6. ATTENDANCE REQUIRED FOR APPEARING EXAMINATION:

a) Examination will be conducted in both theory and practical as prescribed. Candidates will be permitted to appear for the University Examinations in the subject, only if they secure not less than 80% of attendance in each subject of the respective semester / year.

b) A student who does not meet the minimum attendance requirement in a semester or year must repeat the course along with the next batch of students.

7. CONDONATION FOR LACK OF ATTENDANCE:

Condonation of shortage of attendance in aggregate up to 10% (between 70% and 80%) in each semester may be granted by the College Academic Committee and as per the regulations of University.

8. INTERNAL ASSESSMENT:

Internal assessment will be done in each subject of study and the marks will be awarded to the candidates as detailed in the scheme of examinations. The marks awarded will be on the basis of the candidate's performance in the assignments, class tests, laboratory work, preparation and presentation of seminars as assessed by the teachers.

9. EXAMINATIONS:

The University Examinations will be conducted in the semester pattern for all the three years, each year consisting of two semesters.

The particulars of subjects for various examinations and distribution of marks are detailed in the Table II.

The examination for the main subjects will be conducted by the University and the marks for the non-examination subjects will be awarded by the subject handling faculty and forwarded to University by the concerned college.

The Pondicherry University practical examinations shall be jointly conducted by one internal and one external examiner duly appointed by the University.

10. ELIGIBILITY / MAXIMUM DURATION FOR THE AWARD OF THE DEGREE:

The candidates shall be eligible for the Degree of Bachelor of Pharmacy (Lateral Entry) when they have undergone the prescribed course of study for a period of not less than three years in an institution approved by the University and have passed the prescribed examinations in all subjects.

The maximum period to complete the course successfully should not exceed a period of six years.

11. MARKS QUALIFYING FOR A PASS:

50% of marks in the University Theory examination.
50% of marks in the University Practical examination.
50% of marks in aggregate in Theory, Practical, Viva-voce examination and Internal assessment taken together.

12. DECLARATION OF CLASS:

- A successful candidate obtaining 75% and more marks in the grand total aggregate in the first attempt shall be declared to have passed with **Distinction**.

- A successful candidate obtaining 60% and more but less than 75% of marks in the grand total aggregate shall be declared to have passed with **First Class**.

- A successful candidate obtaining 50% and more but less than 60% of marks in the grand total aggregate shall be declared to have passed with **Second Class**.

- Ranks shall be declared on the basis of the aggregate marks obtained by a candidate in the University Examination subjects of the course. Only those candidates who have passed all the subjects in all examination in the first attempt shall be eligible for the award of **Rank**.

III. SCHEME OF EXAMINATION

Examination Duration : 3 Hours

S.No.	Subjects	UE Max	UE Min	IA Max	IA Min	Total Max.	Total Min.
	Semester – III						
2.3.1	Mathematics & Statistics (Theory)	80	40	20	-	100	50
2.3.1	Pharmaceutical Chemistry – III (Organic chemistry – I) (Theory)	80	40	20	-	100	50
2.3.2	Pharmaceutical Chemistry – IV (Organic chemistry – II) (Theory)	80	40	20	-	100	50
	Pharmaceutical Chemistry – IV (Organic chemistry – II) (Practical)	80	40	20	-	100	50
2.3.3	Pharmaceutical Analysis – I (Theory)	80	40	20	-	100	50
2.3.4	Pharmaceutical Analysis – II (Theory)	80	40	20	-	100	50
\	Pharmaceutical Analysis – II (Practical)	80	40	20	-	100	50
	Semester – IV						
2.4.1	Pharmaceutics – I (Physical Pharmacy) (Theory)	80	40	20	-	100	50
	Pharmaceutics – I (Physical Pharmacy) (Practical)	80	40	20	-	100	50
2.4.2	Pharmaceutics- III (Unit Operations – II) (Theory)	80	40	20	-	100	50
	Pharmaceutics- III (Unit Operations – II) (Practical)	80	40	20	-	100	50
2.4.3	Pharmaceutical Microbiology (Theory)	80	40	20	-	100	50
	Pharmaceutical Microbiology (Practical)	80	40	20	-	100	50
2.4.4	Pharmacognosy – III (Theory)	80	40	20	-	100	50
	Pharmacognosy – III (Practical)	80	40	20	-	100	50
2.4.5	Pathophysiology of common Diseases (Theory)	80	40	20	-	100	50
	Semester – V						
3.5.1	Pharmaceutical Chemistry –V(Biochemistry) (Theory)	80	40	20	-	100	50
	Pharmaceutical Chemistry –V(Biochemistry) (Practical)	80	40	20	-	100	50
3.5.2	Pharmaceutics – V (Pharmaceutical Technology – I) (Theory)	80	40	20	-	100	50
	Pharmaceutics – V (Pharmaceutical Technology – I) (Practical)	80	40	20	-	100	50
3.5.3	Pharmacology – I (Theory)	80	40	20	-	100	50
	Pharmacology – I (Practical)	80	40	20	-	100	50
3.5.4	Pharmacognosy – IV (Theory)	80	40	20	-	100	50
	Pharmacognosy – IV (Practical)	80	40	20	-	100	50
3.5.5	Pharmaceutics – VI (Hospital Pharmacy) (Theory)	80	40	20	-	100	50
	Pharmaceutics – VI (Hospital Pharmacy) (Practical)	80	40	20	-	100	50

	Semester – VI						
3.6.1	Pharmaceutical Chemistry – VI (Medicinal Chemistry – I) (Theory)	80	40	20	-	100	50
	Pharmaceutical Chemistry – VI (Medicinal Chemistry – I) (Practical)	80	40	20	-	100	50
3.6.2	Pharmaceutics – VII (Biopharmaceutics & Pharmacokinetics) (Theory)	80	40	20	-	100	50
	Pharmaceutics – VII (Biopharmaceutics & Pharmacokinetics) (Practical)	80	40	20	-	100	50
3.6.3	Pharmacology – II (Theory)	80	40	20	-	100	50
	Pharmacology – II (Practical)	80	40	20	-	100	50
3.6.4	Pharmacognosy – V (Chemistry of Natural Products) (Theory)	80	40	20	-	100	50
	Pharmacognosy – V (Chemistry of Natural Products) (Practical)	80	40	20	-	100	50
3.6.5	Computer Applications in Pharmacy (Theory)	80	40	20	-	100	50
	Computer Applications in Pharmacy (Practical)	80	40	20	-	100	50
	Semester – VII						
4.7.1	Pharmaceutical Biotechnology (Theory)	80	40	20	-	100	50
4.7.2	Pharmaceutics – VIII (Pharmaceutical Technology – II) (Theory)	80	40	20	-	100	50
	Pharmaceutics – VIII (Pharmaceutical Technology – II) (Practical)	80	40	20	-	100	50
4.7.3	Pharmaceutical Industrial Management (Theory)	80	40	20	-	100	50
4.7.4	Pharmacology – III (Theory)	80	40	20	-	100	50
	Pharmacology – III (Practical)	80	40	20	-	100	50
4.7.5	Pharmaceutical Chemistry – VII(Medicinal Chemistry – II) (Theory)	80	40	20	-	100	50
	Pharmaceutical Chemistry – VII(Medicinal Chemistry – II) (Practical)	80	40	20	-	100	50
	Semester- VIII	80	40	20	-	100	50
4.8.1	Pharmaceutics – IX (Theory)	80	40	20	-	100	50
	Pharmaceutics – IX (Practical)	80	40	20	-	100	50
4.8.2	Pharmaceutical Analysis – III (Theory)	80	40	20	-	100	50
	Pharmaceutical Analysis – III (Practical)	80	40	20	-	100	50
4.8.3	Pharmaceutical Chemistry – VIII (Medicinal Chemistry – III) (Theory)	80	40	20	-	100	50
	Pharmaceutical Chemistry – VIII (Medicinal Chemistry – III) (Practical)	80	40	20	-	100	50
4.8.4	Pharmacognosy – VI (Theory)	80	40	20	-	100	50
	Pharmacognosy – VI (Practical)	80	40	20	-	100	50
4.8.5	Pharmacology – IV (Clinical Pharmacy & Drug Interactions) (Theory)	80	40	20	-	100	50
4.8.6	Project - Elective	-	-	200	100	200	100

IV.

COURSE OF STUDY

B.PHARM. (LATERAL ENTRY)

(from III Semester to VIII Semester)

SEMESTER –III

MATHEMATICS & BIOSTATISTICS

2.3.1. Theory **4 hrs / week**

1. **Algebra**: Introductions
2. Equations reducible to quadratics,
   Simultaneous equations :
   Linear Quadratic
   Determinants,
   Properties of solution of simultaneous equations by Cramer's rule,
   Matrices,
   Definition of special kinds of matrices,
   Arithmetic operations on matrices,
   Inverse of a matrix,
   Solution of simultaneous equations by matrices,
   Pharmaceutical applications of :
   Determinants
   Matrices.
   Evaluation of:
   En1, En2,En3, mensuration Its pharmaceutical applications.

3. **Calculus:** Introduction
   Differential: Introduction
   Limits and functions,
   Definition of differential coefficient,
   Differentiation of standard functions,
   Including function of a function (Chain rule).
   Differentiation of implicit functions,
   Logarithmic differentiation
   Parametric differentiation,
   Successive differentiation.

   Integral:
   Integration as inverse of differentiation,
   Indefinite integrals of standard forms,
   Integration by parts,
   Substitution
   Partial fractions,
   Formal evaluation of definite integrals.

1. **Biometrics**: Significant digits and rounding of numbers,
   Data collection,
   Random sampling methods
   Non-random sampling methods,
   Sample size,
   Data organization,
   Diagrammatic representation of data:
   1 – Dimensional Diagram
   2 – Dimensional Diagram
   3 – Dimensional Diagram
   Measures of central tendency:
   Introduction
   Mean
   Median
   Mode

Measures of dispersion:
   Introduction
   Types of studying dispersions
   Standard Deviation
   Standard error of means,
   Coefficient of variation,
   Confidence (fiducially) limits,
   Probability and events,
   Bayes' theorem,
   Probability theorems,
   Probability distributions,
   Elements of binomial distribution
   Poisson distribution distribution
   Normal distribution
   Normal curve and properties,
   Fitting of Distribution
   Kurtosis
   Skewness,
   Correlation analysis
   Regression analysis,
   Difference between Correlation and Regression
   Method of least squares,
   Statistical inference,
   Student's t – test
   Student's t- test: Difference of Mean
   Student's t – test for Single Mean
   Paired t-test,
   F-test
   Chi test
   Applications of statistical concepts in Pharmaceutical Sciences

SEMESTER – III

PHARMACEUTICAL CHEMISTRY – III
(Organic Chemistry – I)

2.3.2. Theory: **4 Hours/Week**

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

1. **Structure and Properties**:
   Atomic structure, Atomic orbital,
   Molecular orbital theory,
   Wave equation, Molecular orbital,
   Bonding and Antibonding orbital
   Covalent bond, Hybrid orbital, Intermolecular forces,
   Bond dissociation energy, Polarity of bonds, Polarity of molecules,
   Structure and physical properties,
   Intermolecular forces,
   Acids
   Bases
   Buffers

2. **Stereochemistry:**
   Isomerism
   Nomenclature
   Associated physiochemical properties,
   Optical activity, stereoisomerism,
   Specification of configuration, Reactions involving stereo isomers,
   Chirality, chiral reagents conformations

3. **Structure, Nomenclature, Preparation and Reactions of:**
   Alkanes
   - Nomenclature
   - Physical Properties
   - Chemical Properties

   Alkenes,
   - Nomenclature
   - Physical Properties
   - Chemical Properties

   Cycloalkanes,
   Dienes,
   - Nomenclature
   - Physical Properties
   - Chemical Properties

   Benzene,
   - Nomenclature
   - Physical Properties
   - Chemical Properties

Polynuclear aromatic compounds,
- Nomenclature
- Physical Properties
- Chemical Properties

Arenes,
- Nomenclature
- Physical Properties
- Chemical Properties

Alkyl halides,
- Nomenclature
- Physical & Chemical Properties

Alcohols
- Nomenclature
- Physical Properties
- Chemical Properties

Ethers,
- Nomenclature
- Physical & Chemical Properties

Epoxides,

Amines,
- Nomenclature
- Physical Properties
- Chemical Properties

Phenols,
- Nomenclature
- Physical Properties
- Chemical Properties

Aldehydes and ketones,
- Nomenclature
- Physical Properties
- Chemical Properties

Carboxylic acids, Functional derivatives of carboxylic acids,
- Nomenclature
- Physical Properties
- Chemical Properties

Reactive intermediates:–
- Carbocations,
- Carbanions,
- Carbenes,
- Nitrene and nitrenium ions

SEMESTER – III

PHARMACEUTICAL CHEMISTRY – IV
(Organic Chemistry - II)

2.3.3. Theory: **3 Hours/Week**

1. **Nucleophilic aromatic substitutions**:
   Introduction and chemistry
   Mechanism
   Mechanism and application
   Alpha, Beta – unsaturated carbonyl compounds:
   Introduction and Preparations
   Properties and Uses
   Conservation of orbital symmetry and rules
   Introduction and chemistry
   Types of reactions
   Electrocyclic,
   Cycloaddition
   Sigmatropic reactions;
   Introduction and General accepts
   Examples and reactions
   Neighbouring group effects;
   Catalysis by transition metal complexes,
   Stereoselective and stereospecific reactions;
   Introduction and Mechanism
   Steroselective reactions
   Stereospecific reactions with examples
   New organic reagents used in drug synthesis.
   Reagents and Application
   Synthetic reactions

2. **Heterocyclic Compounds**:
   Chemistry, preparations and properties of some important heterocyclics containing 3, atoms with one or two heteroatoms like O, N, S.:-
   Introduction and nomenclature
   3 membered heterocyclic rings preparation and properties
   Chemistry, preparations and properties of some important heterocyclics containing 4, atoms with one or two heteroatoms like O, N, S.

   Chemistry, preparations and properties of some important heterocyclics containing 5, atoms with one or two heteroatoms like O, N, S.
   Chemistry preparations and properties of Pyrrole and Pyrazola
   Furan and Thiophen
   Imidazoles
   Oxazoles and Thiazoles

Chemistry, preparations and properties of some important heterocyclics containing 6, atoms with one or two heteroatoms like O, N, S.

- Pyridine
- Pyridazine and Pyrimidine
- Thiazine and oxazine
- Pyran and Piperazine and others

Chemistry, preparations and properties of some important heterocyclics containing 7, atoms with one or two heteroatoms like O, N, S.

- Azepines and Indoles
- Benzimidazoles and Purines

3. Chemistry of lipids,
   - Introduction, Properties and Identification test
   - Synthesis of Lipids
   - Other Chemistry of Lipids

   Carbohydrates,
   - Introduction, Classification , Identification
   - Mono sacharides and Di sacharides
   - Poly sacharides
   - Synthesis

   Proteins
   - Introduction, Classification, and Identification
   - Chemistry of Proteins

   Nucleic acids
   - Properties and Chemistry
   - Synthesis

2.3.3 Practicals: 4 hrs / week

At least five exercises in synthesis involving various heterocyclic ring systems
An exercise involving stereoselective synthesis of a compound.
Resolution of racemic DL-alanine or any other example.
Workshop on molecular modeling of primary, secondary and tertiary structures of proteins, molecular modeling on double helical structure of nucleic acid showing hydrogen bonding.

SEMESTER-III

PHARMACEUTICAL ANALYSIS - I

2.3.4. Theory **3 hrs / week**

Introduction

1. **Significance of quantitative analysis in quality control**
   Different techniques of analysis
   Preliminaries and definitions
   Significant figures
   Rules for retaining significant digits
   Types of errors
   Mean deviation, standard deviation statistical treatment of small
   Data sets
   Selection of sample, precision and accuracy,
   Fundamentals of volumetric analysis
   Methods of expressing concentration
   Primary and secondary standards.

2. **Acids Base Titrations**:
   Acid base concepts
   Role of solvent relative strengths of acids and bases
   Ionization, law of mass action, common – ion effect.
   Ionic product of water,
   pH, Hydrolysis of salts,
   Henderson- Hesselbach equation, Buffer solutions,
   Neutralization curves, Acid-base indicators,
   Theory of indicators, choice of indicators,
   Mixed indicators,
   Polyprotic system, polyamine and amino acid systems, amino
   Acid titration, applications in assay of H_3PO_4 , Na OH, $CaC0_3$ etc.

3. **Oxidation Reduction Titrations:**
   Concepts of oxidation and reduction, redox reactions,
   Strengths and equivalent weights of oxidizing and reducing agents,
   Theory of redox titrations
   Redox indicators,
   Cell representations measurement of electrode potential,
   Oxidation- reduction curves, Iodimetry and Iodometry,.
   Titrations involving:
   Ceric sulphate, potassium iodate,
   Potassium bromate potassium permanganate
   Titanous chloride and sodium 2, 6-dichlorophenol indophenols

4. **Precipitation Titrations** :
Precipitation reactions,
Solubility products
Effect of acids, temperature
Solvent upon the solubility of a precipitate,
Argentometric titrations
Titrations involving:
Ammonium or potassium thio cyanate,
Mercuric nitrate, and barium sulphate,
Indicators, Gay-Iussac method Mohr's method,
Volhard's method and Fajan's method.

5. **Gravimetric Analysis:**
Precipitation techniques, solubility products;
The colloidal state,
Super saturation co-precipitation, post –precipitation,
Digestional 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
Magnesium as magnesium pyrophosphate, organic precipitants.

SEMESTER-III

PHARMACEUTICAL ANALYSIS – II

2.3.5. Theory **3 hrs / week**

Theoretical considerations and application in drug analysis and quality control of the following analytical techniques:

1. **Non-aqueous titrations** :
   Theoretical considerations
   Applications in drug analysis
   Quality control

2. **Complexometric titrations**:
   Theoretical considerations
   Applications in drug analysis
   Quality control

3. **Miscellaneous Methods of Analysis**:
   Diazotization titrations:
   Introduction
   Applications
   Kjeldhal method of nitrogen estimation
   Introduction & Theoretical consideration
   Application in drug analysis
   Karl-Fischer titration,
   Introduction & Theoretical consideration
   Application in drug analysis
   Oxygen flask combustion,
   Introduction & Theoretical consideration
   Application in drug analysis
   Gasometry.
   Introduction & Theoretical consideration
   Application in drug analysis

4. **Extraction procedures including separation of drugs from excipien**
   Introduction & Theoretical consideration
   Different extraction procedures
   Separation of drugs from excipients

5. **Chromatography**:
   The following techniques will be discussed
   with relevant examples of Pharmacopoeial products.
   TLC,
   Introduction & Principle
   Instrumentation
   Applications

HPLC,
- Introduction & Principle
- Instrumentation
- Applications

GLC,
- Introduction & Principle
- Instrumentation
- Applications

HPTLC,

Paper Chromatography
- Introduction & Principle
- Instrumentation
- Applications

Column Chromatography
- Introduction & Principle
- Instrumentation
- Applications

6. **Potentiometry.**
   - Introduction & Instrumentation
   - Applications

7. **Conductometry.**
   - Introduction & Instrumentation
   - Applications

8. **Coulometry**.
   - Introduction & Instrumentation
   - Applications

9. **Polarography**.
   - Introduction & Instrumentation
   - Applications

10. **Amperometry**.
    - Introduction & Instrumentation
    - Applications

2.3.5. Practicals: **4 hrs / week**

1. Non-aqueous Titrations: Preparation and standardization of perchloric acid and sodium/potassium/lithium methoxides solutions; Estimations of some pharmacopeial products.
2. Complexometric Titrations: Preparations and standardization of EDTA solution, some exercises related to pharmacopeial assays by complexometric titrations.
3. Miscellaneous Determinations: Exercises involving diazotisation, Kjeldhal, Karl-Fischer, Oxygen flask combustion and gasometry methods. Determination of alcohol content in liquid galenicals, procedure(BPC) shall be covered
4. Experiments involving separation of drugs from excipients.
5. Chromatographic analysis of some pharmaceutical products.
6. Exercises based on acid base titration in aqueous and non-aqueous media, oxidation-reduction titrations using potentiometric technique, Determination of acid-base disassociation constants and plotting of titration curves using pH meter.
7. Exercises involving polarimetry.
8. Exercises involving conductometric and polarographic techniques.

SEMESTER -IV

PHARMACEUTIS – I
(Physical Pharmacy)

2.4.1. Theory **3 hrs / week**

Matter, Properties of Mater:
State of matter, change in the state latent heats and vapour pressure,
Sublimation-critical point,
Eutectic mixture,
Gases, aerosols-inhalers, relative humidity,
Liquid complexes, liquid crystals
Glassy state, solids- crystalline, amorphous and Polymorphism

MICROMERETIC AND POWER RHEOLOGY:
Particle size and distribution, particle Size, number and weight distribution,
Particle number and weight distribution, particle number,
Methods determining particle volume, optical microscopy, sieving,
Sedimentation, measurement, particle shape, specific surface, methods for
Determining surface area,
Permeability, adsorption, derived properties of powers,
Porosity, packing arrangement, densities, bulkiness and flow properties

SURFA CE 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 of interface

Viscosity and rheology :
Newtonian systems, Law of flow, Kintemaetic viscosity,
Effect of temperature,
Non-Newtonian systems,
Pseudo plastic, dilatants,
Plastics, thixotropy, thixotropy in formulation,
Determining of viscosity, capillary, falling ball, rotational viscometers.

Dispersion systems:
Colloidal dispersions: Definition, types, properties of colloids,
Protective colloids, applications of colloids in pharmacy;
Suspensions and emulsions: Interfacial properties of suspended particles,
Settling suspensions,
Theory of sedimentation, effect of Brownian movement,
Sedimentation of flocculated particles, Sedimentation parameters,
Wetting of particles,
Controlled flocculation, flocculation in structured vehicles,
Rheological considerations;
Emulsions-types, theories, physical stability

Complexation:
Classification of complexes,
Methods of preparation
Analysis,
Applications

Kinetics and drug stability:
General considerations and concepts,
Half-life determination,
Influence of temperature, light, solvent,
Catalytic species and other factors,
Accelerated stability study, expiration dating.

Buffer:
Buffer equations and buffer capacity in general,
Buffers in pharmaceutical systems,
Preparation, stability, buffered isotonic solutions,
Measurements of tonicity,
Calculations and methods of adjusting isotonicity

2.4.1. Practicals **4 hrs / week**

Determination of latent heat, vapour pressure, critical point.
Studies on polymorphs, their identification and properties.
Determining of particle size, particle size distrinbution and surface area using various methods of particle size analysis.
Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
Determination of surface interfacial tension, HLB value and critical micellar concentration of surfactants.
Study of rheolodgival properties of various types of systems using different viscometers.
Studies of different types of colloids and their properties.
Preparation of various types of suspensions and determination of their sedimentation parameters.
Preparation and stability studies of emulsions.
Studies on different types of complexes and determination of their stability constants.

Determination of half-life, rate constant and order of reaction.
To study the influence of various factors on the rate of reaction.

Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.

Preparation of pharmaceutical buffers and determination of buffer capacity.

Experiments involving tonicity adjustments.

SEMESTER -IV

PHARMACEUTICS – III
(Unit Operations – II)

2.4.2. Theory **3 hrs / week**

Stoichiometry:
Unit processes material and energy balances, molecular units
mole fraction, tie substance
Gas laws, mole volume, primary and secondary quantities
Equilibrium state, rate process, steady and unsteady states
Dimensionless equations, dimensionless formulae, dimensionless groups
Different types of graphic representation, mathematical problems

Heat transfer:
Source of heat, heart transfer
Steam and electricity as heating media
Determination of requirement of amount of steam electrical energy
Steam pressure
Boiler capacity
Mathematical problems on heat transfer

Evaporation:
Basic concept of phase equilibria
Factor affecting evaporation
Evaporators, film evaporators
Single effect and multiple effect evaporators
Mathematical problems on evaporation

Distillation:
Rault,s law, phase diagrams, volatility
Simple steam
Flash distillations.
Principles of rectification
Mc. Cabe thiele method for calculations of number of theoretical plates
Azeotropic and extractive distillation
Mathemathical problems on drying

Drying:
Moisture content and mechanism of drying, rate of drying
Time of drying calculations
Classification and types of dryers
Dryers used in pharmaceutical industries and special drying methods
Mathematical problems on drying

Size reduction and size separation:
Definition, objectives of size reduction,
Factors affecting size reduction,

Laws governing energy and power requirements of mills
Including ball mill, hammer mill,
Fluid energy mill etc

Mixing:
Theory of mixing,
Solid-solid,
Solid-liquid
Liquid-liquid mixing equipments

Automated process control systems:
Process variables, temperature, pressure, flow, and level
Vacuum and their measurements
Elements of automatic process control
Introduction to automatic process control systems
Elements of computer aided manufacturing (CAM)

Reactors:
Fundamentals of reactors
Design for chemical reactions.

2.4.2. Practicals **4 hrs / week**

Determination of overall heat transfer coefficient.

Determination of rate of evaporation.

Experiments based on stema, extractive and azeotropic distillations.

Determination of rate of drying, free moisture content and bound

moisture content.

Experiments to illustrate the influence of various parameters

on the rate of drying.

Experiments to illustrate priniciples of size reduction, laws governing energy and

power requirements of size reduction.

Experiments to illustrate solid-solid mixing, determination of mixing

efficiency using different types of mixers.

SEMESTER –IV

PHARMACEUTICAL MICROBIOLOGY

2.4.3. Theory **3 hrs / week**

1. Introduction to the scope of microbiology.
   a). Historical aspects Common terms and measurements used in Microbiology
   b). Scope of Microbiology – significance of microbiology in pharmaceutical studies

2. Structure of bacterial cell.

3. Classification of microbes and their taxonomy
   Classification of Bacteria
   Classification of Viruses
   Classification of Fungi
   Classification of Parasites

4. Identification of microbes :
   Microscopy
   Staining techniques – Types , Gram's stain
   Staining techniques – Z,N stain, Albert's stain
   LPCB mount, Leishman stain etc
   Morphology, Biochemical characters, serological characters etc

5. Nutrition and growth pattern of bacteria , Cultivation of Bacteria and culture media, Isolation of Bacteria, Nutrition and cultivation of Aerobic and Anaerobic bacteria.
   Nutrition and cultivation of Fungi
   Nutrition and cultivation of Virus

6. Microbial genetics and variation.
   Basic principles and characters of microbial genome
   Genetic variations and mechanisms transmission of genetic material
   Genetic mechanisms of drug resistance and genetic Engineering

7. Control of microbes by physical and chemical methods.
   a. Disinfection, factors influencing disinfectants, dynamics of disinfection,
   Agents used for disinfectants and antiseptics
   Evaluation of disinfectants and antiseptics

b. Sterilization-different methods, a) Dry heat sterilization
b) Moist heat sterilization
Validation of sterilization methods
Sterilization equipments
Importance and application of sterilization principles in pharmacy

8. Sterility testing as per IP requirement
Sterility testing of antisera, vaccines, IV fluids, etc
Sterility testing of oral and topical medicines
Sterility testing of other invasive and non invasive pharmacy products
Pyrogen testing

9. Infection, sources of infection, methods of transmission
Acquired Immunity definition and classification
Immune response, primary, secondary
Defense mechanisms of body - inmate acquired immunity, interferon
Microbial resistance and pathogenicity

10. Antibiotic sensitivity tests and their importance
Dilution and diffusion tests for antibiogram
Antibiotic assays of body fluids
Microbial assays of vitamins
Microbial assays of amino acids

2.4.3. Practicals **4 hrs / week**

Experiments devised to prepare various types of culture Media
Sub-culturing of common aerobic and anaerobic bacteria, fungi.
Various staining methods,
Various methods of isolation and identification of microbes,
Sterilization techniques and their validation of sterilizing techniques,
Evaluation of antiseptics and disinfectants, testing the sterility of
Pharmaceutical products as per I.P. requirements,
Microbial assay of antibiotics and vitamins etc.

SEMESTER-IV

PHARMACOGNOSY- III

2.4.4. Theory **3 hrs / week**

1. Study of the biological sources, cultivation, and collection, commercial varieties, chemical constituents , substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides:

Introduction

i). **Saponins :**
Liquorice,
Ginseng, dioscorea,
Sarsaparilla, and senega

ii). **Cardioactive sterols**:
Digitalis,
Squill,
Strophanthus and Thevetia

iii). **Anthraquinone cathartics** :
Aloe,
Senna,
Rhubarb and Cascara

iv). **Others**:
Psoralea, Ammi majus,
Ammi visnaga, Gentian,
Saffron
Chirata, Quassia

2. Studies of traditional drugs, common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs:

Introduction:

Amla	Shankhapushpi	Guggal
Kanthkari	Brahmi	Gymnema
Satavari and Tylophora	Adusa	Shilajit
Bhilawa and kalijiri	Arjuna	Nagarmotha
Bach and Rasna	Ashoka	Neem
Punarnava	Methi	
Chitrack and Apamarg	Lahsun and palash	
Gokhru		

3. The Holistic concept of drug administration in traditional systems of medicine
Introduction to Ayurvedic preparations
like,
Arishtas
Asvas
Gutikas
Tailas
Churnas
Lehyas
Bhasmas

Preparation
Evaluation

2.4.4. Practicals **4 hrs / week**

1. Identification of crude drugs listed in theory

2. Microscopic study of some important glycoside containing crude drugs as outlined above. Study of powdered drugs

3. Standardization of some traditional drug formulations

SEMESTER –IV

PATHOPHYSIOLOGY OF COMMON DISEASES

2.4.5. Theory **4 hrs / week**

1**. Basic principles of cell injury and adaptation**:

- Causes of cellular injury
  - Reversible
  - Irreversible
- Pathogenesis
- Morphology of cell injury
- Intercellular alterations in lipids
- Proteins and carbohydrates
- Cellular adaptation
- Atrophy, hypertrophy

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

- Alterations in vascular permeability
- Blood flow,
- Migration of WBC'S
- Acute inflammation
- Chronic inflammation
- Mediators of inflammation
- Brief outline of the process of repair
  - Cell cycle
  - Vascularisation
  - New growth

3. Pathophysiology of common diseases:

- Rheumatoid arthritis, gout
- Epilepsy
- Psychosis
- Depression
- Mania
- Hypertension
- Angina
- Congestive heart failure
- Atherosclerosis
- Myocardial infarction
- Diabetes
- Peptic ulcer
- Asthma
- Ulcerative colitis
- Hepatic disorders
- Acute/Chronic renal failure
- Tuberculosis
- Urinary tract infections
- Sexually transmitted diseases
- Anemias
- Common types of neoplasms

SEMESTER – V

PHARMACEUTICAL CHEMISTRY – V
(Biochemistry)

3.5.1. Theory: **3 Hours/Week**

1. Biochemical organization of the cell and transport processes across cell membrane.

2. The concept of free energy, determination of change in free energy from equilibrium constant
   Reduction potential, bioenergetics, Production of ATP and its biological significance.

3. **Enzymes**:
   Nomenclature, 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

5. **Carbohydrate Metabolism**:
   Conversion of polysaccharide to glucose –1- phosphate,
   Glycolysis and fermentation and their regulation
   Gluconeogenesis and glycogenolysis,
   Metabolism of galactose and galactosemia,
   Role of sugar nucleotides in biosynthesis,
   and Pentosephosphate pathway.

6. **The Citric Acid Cycle**:
   Significance, reactions and energetic of the cycle,
   Amphibolic role of the cycle, and Glyoxalic acid cycle

7. **Lipids Metabolism**:
   Oxidation of fatty acids, Beta oxidation and its energetics
   Alpha oxidation, Omega oxidation
   Biosynthesis of ketone bodies and their utilization,
   Biosynthesis of saturated and unsaturated fatty acids,
   Control of lipid metabolism,
   Essential fatty acids and eicosanoids prostaglandins
   Thromboxanes and leukotrienes
   Phospholipids and sphingolipids

8. **Biological Oxidation**:
   Redox-Potential, enzymes and co-enzymes involved in
   Oxidation reduction and its control
   The respiratory chain, its role in energy capture and its control,

Energetics of oxidative phosphorylation,
Inhibitors of respiratory chain and oxidative phosphorylation,
Mechanism of oxidative phosphorylation

9. **Nitrogen and Sulphur Cycle**:
   Nitrogen fixation, ammonia assimilation, nitrification and
   Nitrate assimilation
   Sulphate activation, sulphate reduction. Incorporation of
   sulphur in organic compounds, Release of sulphur from
   Organic compounds

10. **Metabolism of Ammonia and Nitrogen Containing Monomers**:
    Nitrogen balance, Biosynthesis of amino acids,
    Catabolism of amino acids, Conversion of amino acids to
    specialized products,
    Assimilation of ammonia, Urea cycle,
    Metabolic disorders of urea cycle,
    Metabolism of sulphur containing amino acids
    Porphyrin biosynthesis
    Purine nucleotide interconversion
    Pyrimidine biosynthesis
    Formation of deoxyribonucleotides

    Biosynthesis of Nucleic Acids:
    Brief introduction of genetic organization of the mammalian genome
    Alteration and rearrangements of genetic material,
    Biosynthesis of DNA and Replication of DNA
    Mutation, Physical and Chemical mutagenesis
    Carcinogenesis,
    DNA repair mechanism,
    Biosynthesis of RNA.

11. **Genetic Code and Protein Synthesis**:
    Genetic code,
    Components of protein synthesis
    Inhibition of Protein synthesis
    Brief account of genetic engineering
    Polymerase chain reaction.

12. Regulation of gene expression.

3.5.1 Practicals: 4 hrs / week

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
3. Separation of amino acids by two dimensional paper chromatography and gel electrophoresis.
4. The separation of lipids by TLC.
5. Separation of serum proteins by electrophoresis on cellulose acetate.
6. Quantitative estimation of aminoacids.
7. Quantitative estimation of proteins.
8. The identification of c-terminal amino acids of a protein.
9. The identification of glucose by means of the enzyme glucose oxidase.
10. The isolation and assay of glycogen from the liver and skeletal muscle of rats.
11. Enzymatic hydrolysis of glycogen by alpha and beta amylases.
12. The isolation and determination of RNA and DNA.
13. Effect of temperature on the activity of alpha – amylase.
14. Estimation of SGOT, SGPT, ALP and BRN in the serum.

SEMESTER -V

PHARMACEUTIS – V
(PHARMACEUTICAL TECHOLOGY – I)

3.5.2. Theory **3 hrs / week**

Liquid dosages forms:
Introduction, types of additives used in formulations
Vehicles, stabilizers, preservatives
Suspending agents, emulsifying agents
Solubilizers, colors, flavours and others
Manufacturing packaging and evaluation of clear liquids
Suspensions and emulsions official in pharmacopoeia

Semisolid dosage forms:
Definitions, types, mechanisms of drug penetration factors influencing penetration
Semisolid bases and their selection
General formulation of semisolids
Clear gels manufacturing procedure
Evaluation and packaging

Suppositories:
Ideal requirements, bases
Manufacturing procedure
Packaging and
Evaluation

Extraction and galenical products:
Principle and
Method of extraction
Preparation of infusion
Tinctures, dry and soft liquid extracts

Blood products and plasma substitutes:
Collection, processing and storage of whole human blood
Concentrated human RBC'S
Dried human plasma
Human fibrinogen
Human thrombin
Human normal immunoglobulin
Human fibrin
Foam plasma substitutes
Ideal requirements, PVP, dextran etc. for control of blood pressure as per I.P.

Pharmaceutical aerosols:
Definition, propellants
General formulation
Manufacturing and
Packaging methods
Pharmaceutical applications

Ophthalmic preparations:
Requirements
Formulation
Methods of preparation
Containers
Evaluation

Cosmeticology and cosmetic preparations:
Fundamentals of cosmetic science,
Structure and functions of skin and hair
Formulation, preparation and packaging of cosmetics for skin, hair
Dentifrice and
Manicure preparations like nail polish,
Lipsticks,
Eye lashes, baby care products etc.

3.5.2. Practical **4 hrs / week**

Preparation, evaluation and packaging of liquid orals like lotions, suspensions and emulsions, ointments , suppositories, aerosols, eye drops, eye ointments etc.

Preparation of pharmacopoeial extracts and galenical products utilizing various methods of extraction.

Collection, processing, storage and fractionation of blood.

Formulation of various types of cosmetics for skin, hair, dentifrices and manicure preparations.

SEMESTER – V

PHARMACOLOGY – I

3.5.3 Theory: **3 hrs/ week**

1. **General Pharmacology**:
   Introduction to Pharmacology, Sources of drugs,
   Dosage forms and routes of administration
   Mechanism of action
   Combined effect of drugs
   Factors modifying Drug action
   Tolerance and dependence
   Pharmacogenetics
   Absorption
   Distribution
   Metabolism
   Excretion of drugs, Principles of Basic and Clinical pharmacokinetics
   Adverse Drug Reactions
   Treatment of poisoning
   ADME drug interactions,
   Bioassay of Drugs
   Biological Standardization
   Discovery of drugs
   Development of new drugs

2. **Pharmacology of Peripheral Nervous System:**
   a. Neurohumoral transmission (Autonomic and Somatic)
   b. Parasympathomimetics
      Parasympatholytics
      Sympathomimetics
      Adrenergic Receptor and neuron blocking agents
      Ganglionic stimulants and blocking agents
   c. Neuromuscular blocking agents
   d. Local anesthetic agents

3. **Pharmacology of Central Nervous System:**
   a. Neurohumoral transmission in the C.N.S.
   b. General Anesthetics.
      Stages
      Drugs
   c. Alcohols and disulfiram.
   d. Sedatives, hypnotics,
      Anti-anxiety agents
      Centrally acting muscle relaxants.
   e. Psychopharmacological agents anti-psychotics
      anti-depressants, anti-maniacs and hallucinogens.
   f. Anti-epileptics drugs.
      Types
      Drugs

g. Anti-Parkinsonism Drugs.
h. Analgesics, Antipyretics, Anti-inflammatory Anti-gout drugs.
i. Narcotic analgesics Antagonists.
j. C.N.S. stimulants.
k. Drug Addiction and Drug abuse.

3.5.3 Practicals: 4 hrs / week

1. **Introduction to Experimental Pharmacology:**
   Preparation of different solutions for experiments. Drug dilutions, use of molar and w/v solutions in experimental pharmacology.

   Common laboratory animals and anesthetics used in animal studies. Commonly used instruments in experimental pharmacology.

   Some common and standard techniques.
   Bleeding and intravenous injection, intragastric administration.

   Procedures for rendering animals unconscious – stunning of rodents, pithing of frogs, chemical euthanasia.

2. **Experiments on intact preparations:**
   Study of different routes of administration of drugs in mice/rats.

   To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone sleeping time in mice.

3. **Experiments on Central Nervous System:**
   Recording of spontaneous motor activity, stereotypy, analgesia, anticonvulsant activity, anti-inflammatory activity, and muscle relaxant activity of drugs using simple experiments.
4. Effects of autonomic drugs on rabbit's eye.
5. Effects of various agonists and antagonists and their characterization
6. using isolated preparations like frog's rectus abdominal muscle and
7. Isolated ileum preparations of rat, guinea pig and rabbit.

SEMESTER-V

PHARMACOGNOSY- IV

3.5.4. Theory **3 hrs / week**

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid containing drugs:

a). **Pyridine – piperidine:**
- Tobacco,
- Areca and lobelia

b). **Tropane:**
- Belladonna
- Hyoscyamus
- Datura
- Duboisia
- Coca
- Withania

c). **Quinoline and isoquinoline**:
- Cinchona
- Ipecac
- Opium

d). **Indole:**
- Ergot
- Rauwolfia
- Catharanthus
- Nux-vomica and physostigma

e). **Imidazole:** Pilocarpus

f). **Steroidal**: Veratrum and Kurchi

g). **Alkaloidal amine**:
- Ephedra
- Colchicum

h). **Glycoalkaloid** : Solanum

i). **Purines :**
- Coffee
- Tea and cola

2. **Role of**
   - Medicinal plants in national economy
   - Aromatic plants in national economy

3. **Biological sources, preparation, identification tests and uses of the following enzymes :**
   - Diastase
   - Papain
   - Pepsin
   - Trypsin
   - Pancreatin

4. General techniques of biosynthetic studies
   Basic metabolic pathways
   Shikimic acid pathways
   Brief introduction to biogenesis of secondary metabolites of Pharmaceutical importance
   Biosynthesis of Glycosides
   Biosynthesis of Alkaloids
   Biosynthesis of isoprenoid compounds

5. Plant bitters
   Sweeteners

6. Introduction and classification
   Study of different chromatographic methods:
   - Paper
   - TLC
   - HPLC
   - GC, HPTLC
   - Electrophoresis
   - Applications in evaluation of herbal drugs

3.5.4. Practicals **4 hrs / week**

1. Identification of crude drugs listed above

2. Microscopic study of characters of eight- selected drugs given in theory in entire and powdered form.

3. Chemical Evaluation of powdered drugs, and enzymes

4. Chromatographic studies of some herbal constituents

SEMESTER -V

PHARMACEUTIS – VI
(HOSPITAL PHARMACY)

3.5.5. Theory **3 hrs / week**

1. Organization and structure:

Organization of a hospital and hospital pharmacy
Responsibilities of a hospital pharmacist
Pharmacy and therapeutic committee
Budget preparation and Implementation

2. Hospital formulary:

Contents,
Preparation
Revision of hospital formulary

3. Drug store management and inventory control:

a. Organization of drug store,
Types of materials stocked, and Storage conditions

b. Purchase and inventory control principles
Purchase procedures
Purchase order
Procurement and stocking

4. Drug distribution systems in hospitals:

a. Out- patient dispensing, methods adopted.
b. Dispensing of drugs :
Inpatients
Types of drug distribution systems
Charging policy, labeling.
c. Dispensing of drugs to ambulatory patients.
d. Dispensing of controlled drugs.

5. Central sterile supply unit and their management:

Types of materials for sterilization,
Packing of materials prior to sterilization,
Sterilization equipments,
Supply of sterile materials

6. Manufacture of sterile and non sterile products:

Policy making of manufacturability items
Demand and costing
Personnel requirements
Manufacturing practice
Master formula card
Production control, manufacturing records

7. Drug information services:

Sources of information on drugs, Disease, treatment schedules,
Procurement of information,
Computerized services (e.g.,MEDLINE) ,
Retrieval of information,
Medication error

8. Records and reports:

Prescription filling, drug profile,
Patient medication profile,
Cases on drug interaction
Adverse reactions, idiosyncratic cases etc.

9. Nuclear Pharmacy:

Introduction to Radio Pharmaceuticals,
Radio-active half life, Units of radio-activity
Production of radio-pharmaceuticals,
Methods of isotopic tagging,
Preparation of radio-isotopes in the laboratory using radiation dosimeter, radio-isotope generators, Permissible radiation dose level.
Radiation hazards and their prevention,
Specifications for radio-active laboratory.

3.5.5. Practicals **4 hrs / week**

1. Experiments based on Sterilization of various types of materials used in Hospitals.

2. Practicals designed on the use of computers in Drug Information Centre, prescription filling, documentation of information on drug interaction.

3. Experiments to illustrate handling of radiopharmaceutical products, measurement of radioactivity.

SEMESTER – VI

PHARMACEUTICAL CHEMISTRY – VI
(Medicinal Chemistry – I)

3.6.1. Theory: **3 Hours/Week**

1. Basic Principles of Medicinal Chemistry:

Physio-chemical aspects (Optical, geometric and bioisosterism) ofDrug molecules and Biological action, Optical

Geometrical
Bio isosterism
Protein Binding

Solubility and Partition coefficient
Ionisation
Hydrogen
bonding and Biological action

Chelation
Oxidation reduction potential and surface activity
Ferguson principles

Drug – receptor interaction including transduction mechanisms.

Introduction and Isosterism
Forces involved in drug receptor inter reactions

2. Principles of Drug Design (Theoretical Aspects):
   Traditional analog (QSAR) and mechanism based approaches
   Introduction to graph theory:

Introduction,
Factors governing drug design
Rational approach to drug design
Mechanism

Applications of quantum mechanics, Computer aided

Drug designing (CADD) Molecular modeling.
Mechanical approach and molecular orbital indices
Examples of molecular orbital SAR studies
Molecular orbital approach
Theoretical methods based upon model systems
Quantum mechanism

Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including physiochemical properties of the following classes of drugs:

Drugs acting at Synaptic and neuro-effector junction sites:

i. Cholinergics and Anticholinesterases
Introdcution , classification ,mode of action,
Physiochemical properties
Synthesis of Cholinergics
SAR and synthesis of Anticholinesterases

ii. Adrenergic drugs
Adrenaline and non adrenaline and others
Alpha Blockers
Beta Blockers

iii. Antispasmodic and anti ulcer drugs
Introduction, classification , Properties , mode of action
SAR
Synthesis

iv. Neuromuscular blocking agents.
Non depolarizing drugs
Depolarizing

B. Autocoids

i. Antihistamines
Classification, mode of action , properties and chemistry
SAR and synthesis
Synthesis

ii. Eicosanoids
Introduction chemistry
SAR mode of action and synthesis

iii. Analgesic- antipyretics, anti-inflammatory (non-steroidal) aagents.
Introduction , mode of action
SAR
Synthesis
Synthesis

C. Drugs affecting uterine motility:

Oxytocics (including oxytocin, ergot alkaloids and prostaglandins). Biochemical approaches in drug designing wherever applicable should be discussed.

Oxytocin
Ergot alkaloids
Prostaglandins

3.6.1. Practicals **4 Hours/Week**

1. Exercises based on QSAR: Hansch and Free-Wilson methods.
2. Synthesiss of selected drugs from the course content.
3. Spectral analysis of the drugs synthesized.
4. Establishing the pharmacopoeial standards of the drug synthesized. Determination of partititon coefficient, dissociation constant and molar refractivity of compounds for QSAR analysis.

SEMESTER -VI

PHARMACEUTIS – VII
(BIOPHARMACEUTICS & PHARMACOKINETICS)

3.6.2. Theory **3 hrs / week**

1. Introduction to biopharmaceutics
   Pharmacokinetics
   Role in formulation development and clinical setting

2. Biopharmaceutics:
   a. Passage of drugs across biological barrier
   Passive diffusion
   Active transport
   Facilitated diffusion
   pinocytosis).

   b. Factors influencing absorption
   Physicochemical,
   Physiological
   Pharmaceutical

   c. Drug distribution in the body,
   Plasma protein binding

3. Pharmacokinetics:
   a. Significance of plasma drug concentration measurement.
   b. Compartment model- definition and scope.
   c. Pharmacokinetics of drug absorption – zero order first order absorption rate constant using Wagner – Nelson and Loo- Reigelman method
   d. Volume of distribution and distribution coefficient.
   Compartment kinetics – one compartment and two Compartment models

Determination of pharmacokinetic parameters from plasma and
Urine data after drug administration by intravascular and oral route
Curve fitting (method of Residuals), regression procedures.

   e. Clearance concept,
   Mechanism of renal clearance,
   Clearance ratio,
   Determination of renal clearance
   f. Extraction ratio,
   Hepatic clearance,
   Biliary excretion
   Extrahepatic circulation

g. Non- linear pharmacokinetics with special reference to one Compartment model after I.V. drug administration, Michael Menten Equation
Detection of non- linearity (Saturation mechanism)

4. Clinical pharmacokinetics:
   a. Definition and scope
   b. Dosage adjustment in patients with renal failure
      Without renal failure
      With Hepatic failure
   c. Design of single dose bio- equivalence study
      Relevant statistics
   d. Pharmacokinetic drug interactions &
      their significance combination therapy

5. Bioavailability and bioequivalence:
   a. Measures of bioavailability, c_{max}, t_{max}, and area under the curve (AUC)
   b. Design of single dose bioequivalence study
      Relevant statistics
   c. Review of regulatory requirements for conduction of bioequivalent studies

3.6.2 Practicals **4 hrs/week**

Experiments designed for the estimation of various pharmacokinetics parameters with given data. - 12 hrs

1. Analysis of biological specifications for drug content and estimation of the pharmacokinetic parameters.
   In vcitro evaluation of different dosage forms for drug release
   Absorption studies – in vitro and in situ.
2. Statistical treatment of pharmaceutical data.

SEMESTER – VI

PHARMACOLOGY – II

3.6.3 Theory: **4 hrs/ week**

1. Pharmacology of Cardiovascular System:
   Introduction
   a. Digitalis
      Cardiac glycosides
   b. Antihypertensive drugs:
      Classification
      Mechanism
      Adverse effect
   c. Antianginal
      Vasodilator drugs
      Calcium channel blockers
      Beta adrenergic antagonist
   d. Antiarrythmic drugs:
      Classification
      Mechanism
      Adverse effect
   e. Antihyperlipidemic drugs.
      Classification
      Mechanism
      Adverse effect
   f. Drugs used in the therapy of shock.

2. Drugs Acting on the Hemopoietic System:
   a. Hematinics.
   b. Anticoagulants, Vitamin K
      Hemostatic agents
   c. Fibrinolytic
      Anti-platelet drugs
   d. Blood and plasma volume expanders.
      Introduction
      Advantage and Disadvantage

3. Drugs acting on urinary system:
   Fluid and electrolyte balance
   a. Diuretics:
      Loop diuretics
      Thiazide diuretics
4. Autocoids:
   a. Histamine
      5-HT antagonists
      Histamine antagonists

b. Prostaglandins
   Thromboxanes
   Leukotrienes.
c. Pentagastrin,
   Cholecystokinin
   Angiotensin
   Bradykinin
   Substance P

5. Drugs Acting on the Respiratory System:

   a. Anti-asthmatic drugs
      Bronchodilators
   b. Anti-tussives
      Expectorants
   c. Respiratory stimulants.
      Cortical
      Medullary

3.6.3. Practicals: 4 hrs / week

1. **Experiments on Isolated Preparations:**

a. To record the concentration response curve (CRC) acetylcholine using rectus abdominis muscle preparation of frog.
b. To study the effects of physostigmine and d-tubocurarine on the CRC of acetylcholineusing rectus abdominis muscle preparation of the frog.
c. To record the CRC of 5-HT on rat fundus preparation.
d. To record the CRC of histamine on guinea pig ileum preparation.
e. To record the CRC of noradrenaline on rat anococcygeus muscle preparation.
f. To record the CRC of oxytocin using rat uterus preparation.

2. Pharmacology of Cardiovascular System:

   a. To study the ionotropic and chronotropic effects of drugs on isolated frog heart.
   b. To study the effects of drugs on normal and hypodynamic frog heart.

3. **Blood Pressure of anaesthetized Dog/Cat/Rat:**

a. To demonstrate the effects of various drugs on the B.P. and respiration including the Vasomotor Reversal of Dale and nicotinic action of acetylcholine.

SEMESTER-VI

PHARMACOGNOSY- V
(Chemistry of Natural Products)

3.6.4. Theory **3 hrs / week**

1. Chemical approaches to simple molecules of natural origin.
   Spectral approaches to simple molecules of natural origin
   UV – Visible
   IR
   NMR
   Mass and X-ray diffraction
   Others

2. Concept of stereoisomerism
   Geometrical Isomerism
   Optical Isomerism
   Examples of Isomerism from natural products

3. Chemistry, biogenesis and pharmacological activity of medicinal important:
   Nomenclature of Terpenes
   Monoterpenes,
   Sesquiterpenes,
   Diterpenes,
   Triterpenoids.

4. Carotenoids :
   Introduction, Characteristic and Functions
   α - carotenoids
   β - carotenes
   Vitamin A
   Xanthophylls of medicinal importance

5. **Glycosides:** Chemistry and biosynthesis of
   Digitoxin,
   Digoxin
   Hecogenin
   Sennosides
   Diosgenin
   Sarasapogenin

6. Alkaloids:
   Chemistry and Biogenesis
   Atropine and related compounds
   Quinine
   Reserpine

Morphine and Papaverine
Ephedrine
Ergot
Vinca alkaloids

Pharmacological activity of
Atropine and related compounds ,Quinine, Reserpine
Morphine and Papaverine ,Ephedrine, Ergot, Vinca alkaloids

7. Chemistry and biogenesis of medicinally important
lignans
Quassanoids
Flavonoids

8. Chemistry of
Penicillin
Streptomycin
Tetracyclines

Therapeutic activity of
Penicillin
Streptomycin
Tetracyclines

3.6.4. Practicals **4 hrs/week**

1. Laboratory experiments on isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.

2. Exercises on paper and thin layer chromatographic evaluations of herbal drug constituents

SEMESTER- VI

COMPUTER APPLICATIONS IN PHARMACY

3.6.5. Theory **3 hrs / week**

1. **Introduction to Computers.**
2. **Computer applications in pharmaceutical and clinical studies**
3. **Computer Classification**
   Mainframe, Mini and Micro Computers,
   Comparison of Analog and Digital Computers
   Hardware and Software, Calculator and Computer
4. **Operating Systems**
   Introduction, Types of operating systems, MS – DOS, LYNX and WINDOWS XP
5. **Introduction to Data Structure**
   Like Queues, List, trees, Binary trees algorithms, Flow Chart, Structured Systems, Analysis, Development, Ingress-SQL, Statistics and Methodologies
6. **Type of Languages**
   Conventional languages, their advantages, limitations
   C, Visual Basic and Programming of these languages
7. **Computer Graphics**
8. **Introduction to Computer Networks**
   Architecture of seven layers of communications
9. **Introduction to Internet**
10. **Basic Electronics**
    Semiconductors, p-n function diode, LED, photodiode and its uses. Rectifiers (half wave, full wave / with filters), Transistors configurations, Transistor amplifiers. Introduction to Integrated circuits, photocells and photomultiplier tubes

3.6.5. Practicals **4 Hours/week**

Exercises based on the following are to be dealt:

1. Computer operating systems like MS-DOS, WINDOWS XP and LYNX
2. Simple programs in C and VISUAL BASIC
3. Study of soft-ware packages like Chem Draw, Tinker and WinMopac
4. Microsoft Package (Document, Spreadsheet, Presentations and Storage)

SEMESTER –VII

PHARMACEUTICAL BIOTECHNOLOGY

4.7.1. Theory **4 hrs / week**

1. **Immunology and Immunological preparations:**
   Principles,
   Antigens and haptens,
   Immune system
   Cellular humoral immunity,
   Immunological tolerance,
   Antigen- antibody reactions
   Applications
   Hypersensitivity,
   Active
   Passive immunization;
   Vaccines- their preparation,
   Standardization and storage

2. **Genetic recombination**:
   Transformation,
   Conjugation,
   Transduction,
   Protoplast fusion
   Gene cloning
   Application
   Development of hybridoma for monoclonal antibodies
   Study of drugs produced by biotechnology such as Activase,
   Humulin
   Humatrope
   HB etc

3. **Antibiotics:**
   Historical development of antibiotics
   Antimicrobial spectrum and methods used for their standardization
   Screening of soil for organisms producing antibiotics fermenter,
   Its design, control of different parameter
   Isolation of mutants
   Factors influencing rate of mutation
   Design of fermentation process
   Isolation of fermentation products with special reference to penicilins
   Streptomycins,
   Tetracyclines
   Vitamin B12

4. **Microbial transformation:**
   Introduction
   Types of reactions mediated by microorganisms
   Design of biotransformation processes
   Selection of organisms
   Biotransformation process
   Its improvements with special reference
   Steroids

5. **Enzyme Immobilization**:
   Techniques of immobilization of enzymes
   Factors affecting enzyme kinetics
   Study of enzymes such as hyaluronidase
   Penicillinase,
   Streptokinase
   Streptodornase,
   Amylases
   Proteases etc
   Immobilization of bacteria
   Plant cells

SEMESTER -VII

PHARMACEUTICS – VIII
(PHARMACEUTICAL TECHNOLOGY II)

4.7.2. Theory **4 hrs / week**

1. **Capsules**:

Advantages and disadvantages of capsule dosage form,
Material for production of hard gelatin capsules, size of capsules
Method of capsule filling, soft gelatin
Capsule shell and capsule content
Importance of base absorption and minimum /gm factors in Soft capsules
Quality control, stability testing
Storage of capsule dosage forms.

2. **Micro- encapsulation**:

Types of microcapsules, importance of micro encapsulation in pharmacy
Micro encapsulation by phase separation, co-acervation,
Multi orifice, spray drying,
Spray congealing,
Polymerization complex emulsion,
Air suspension technique, coating pan and other techniques,
Evaluation of micro capsules.

3. **Tablets:**
   a. Formulation of different types of tablets, granulation technology on large- scale by various techniques
      Physics of tablets making
      Different types of tablet compression machinery
      Equipments employed evaluation of tablets

   b. Coating of tablets :
      Types of coating, film forming materials
      Formulation of coating solution
      Equipments for coating, coating process
      Evaluation of coated tablets
   c. Stability kinetics
      Quality assurance

4. **Parenteral Products:**
   a. Pre formulation factors, routes of administration, water for injection
      Pyrogenicity, non aqueous vehicles, isotonicity and Methods of its adjustment
   b. Formulation details, containers and closures and selection.

   c. Pre filling treatment, washing of containers and closures,

Preparation of solution and suspensions,
Filing and closing of ampoules, vials, infusion fluids, lyophillization
Preparation of sterile powders, equipment for large scale manufacture
Evaluation of parenteral products

d. Aseptic techniques –sources of contamination and methods of prevention
Design of aseptic area, laminar flow bench services and maintenance
e. Sterility testing of pharmaceuticals.

5. **Sterility products**:
Definition, primary wound dressing,
Absorbents, surgical cotton, surgical gauzes etc.,
Bandages, adhesive tape, protective cellulosic hemostastics, official dressings,
Absorbable and non absorbable sutures, ligatures and catguts.
Medical prosthetics
Organ replacement materials

6. **Packaging of pharmaceutical products**:
Packaging components,
Types, specifications and methods of evaluation, stability aspects of packaging.
Packaging equipments,
Factors influencing choice of containers,
Legal and other official requirements for containers,
package testing.

4.7.2 . Practicals **4 hrs / week**

1. Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like powders, capsules, tablets, parenterals, microcapsules, surgical dressing etc.

2. Evaluation of materials used in pharmaceutical packaging.

SEMESTER –VII

PHARMACEUTICAL INDUSTRIAL MANAGEMENT

4.7.3. Theory **4 hrs / week**

1. **Concept of Management**:
   Administrative Management
   Planning
   Organizing
   Staffing, Directing
   Controlling
   Entrepreneurship development

   Operative Management
   Personnel, Materials
   Production, Financial
   Marketing, Time/Space, Margin/Morale
   Principles of Management
   Co-ordination, Communication, Motivation, Decision-making
   Leadership
   Innovation, Creativity
   Delegation of Authority
   Responsibility, Record Keeping
   Identification of key points to give maximum thrust for development and perfection.

2. **Accountancy:**
   Principles of Accountancy,
   Ledger posting and book entries,
   Preparation of trial balance,
   Columns of a cash book,
   Bank reconciliation statement,
   Rectification of errors,
   Profits and loss account,
   Balance sheet, purchase,
   Pricing of stocks, Cheques ,
   Bills of exchange,
   Promissory notes hundies,
   Documentary bills.

3. **Economics:**
   Principles of economics with special laws of
   Demand and supply,
   Demand schedule, demand curves,
   Labor welfare,
   General Principles of insurance inland and foreign trade,
   Procedure of exporting
   Procedure of Importing goods.

4. **Pharmaceutical Marketing**:
   Functions, buying, selling, transportation, storage,
   Finance, feedback, information
   Channels of distribution,
   Wholesale, retail, departmental store,
   Multiple shop and mail order business.

5. **Salesmanship**:
   Principles of sales promotion
   Advertising,
   Ethics of sales, merchandising,
   literature, detailing.
   Recruitment, training,
   evaluation, compensation to the pharmacist.

6. **Market Research**:
   a. Measuring & Forecasting Market Demands
   b. Major concept in demand measurement,
   c. Estimating current demand, Geo-demographic analysis,
   d. Estimating industry sales, Market share & Future demand.
   e. Market Segmentation
   f. Market Targeting.

7. **Materials Management**:
   A brief exposure or basic principles of materials management
   Major areas, scope, purchase,
   stores, inventory control
   Evaluation of materials management.

8. **Production Management**:
   A brief exposure of the different aspects of
   Production Management
   Visible and Invisible inputs,
   Methodology of Activities,
   Performance Evaluation Technique
   Process-Flow, Process Know-how Maintenance Management.

SEMESTER –VII

PHARMACOLOGY- III

4.7.4. Theory **3 hrs / week**

1. Drugs Acting on the Gastrointestinal Tract :

a). Antacids, Anti Secretory and Anti- ulcer drugs.
b). Lacatives and antidiarrhoeal drugs.
c). Appetite Stimulants and Suppressants.
d). Emetics and anti-emetics.
e). Miscellaneous – Carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.

2. Pharmacology of Endocrine System:

a). Hypothalamic and pituitary hormones
b). Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and Vitamin D.
c). Insulin, oral hypoglycaemic agents & glucagons.
d). ACTH and corticosteroids.
e). Androgens and anabolic steroids.
f). Estrogens, progesterone and oral contraceptives.
g). Drugs acting on the uterus.

3. Chemotherapy :

a). General Principles of Chemotherapy.
b). Sulfonamides and cotrimoxazole.
c). Antibiotics–Penicillins, Cephalosporins, Chloramphenicol Erythromycin, Quinolones and Miscellaneous Antibiotics.
d). Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.
e). Chemotherapy of malignancy and Immunosuppressive Agents.

4. Principles of Toxicology :

a). Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning.

b). Heavy metals and heavy metal antagonists.

4.7.4. Practicals **4 hrs / week**

1. Experiments on Isolated Preparations:

a). To calculate the pA_2 Value of atropine using acetylcholine as an agonist on rat ileum preparation.
b). To calculate the pA_2 Value of mepyramine or chlorpheniramine using histamine as agonist on guinea pig ileum.
c). To estimate the strength of the test sample of agonist / drug (e.g. Acetylcholine, Histamine, 5 – HT, Oxytocin, etc) using a suitable isolated muscle preparation employing matching bioassay, Bracketing assay, Three point assay and four point bioassay.

2. Pharmacology of the Gastrointestinal Tract :

To study the Anti-secretary and anti – ulcer activity using pylorus ligated rats.

3. Clinical pharmacology :

To determine the effects of certain clinically useful drugs on human volunteers like :

a). Antihistaminics
b). Anti – anxiety and sedative drugs
c). Analgesics
d). Beta blockers.

SEMESTER – VII

PHARMACEUTICAL CHEMISTRY – VII
(Medicinal Chemistry – II)

4.7.5. Theory: **3 Hours/Week**

Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physio-Chcemical properties of the following classes of drugs:

1. **Steroids and related drugs**:
   Steroidal nomenclature
   Stereochemistry,
      Introduction stereochemistry of Androgens and Anabolic agents
      Stereochemistry of Estrogens, Progesterones and adrenocorticoids
   Synthesis Androgens and Anabolic agents,
   Synthesis and SAR Estrogens
   Synthesis and SAR progestational agents
   Synthesis and SAR of adrenocorticoids.

2. **Drugs acting on the Central Nervous System**:
      General Anesthetics,
         Introduction, Classification, mode of action and Properties
         Chemistry and Synthesis
      Local Anesthetics,
         Introduction, Classification, mode of action and Properties
         SAR
         Chemistry and Synthesis
   Hypnotics and Sedatives,
      Classification, mode of action , properties
      SAR
      Synthesis

   Opioid analgesics,
      Introduction, Classification, mode of action and Properties
      SAR
      Chemistry and Synthesis
      Synthesis
   Antitussives,
      Chemistry and SAR
      Synthesis
   Anti convulsants,
      Chemistry and SAR
      Synthesis

Antiparkinsonism drugs,
CNS stimulants,
Chemistry and SAR
Synthesis
Psychopharmacological agents
(neuroleptics, antidepressants, anxiolytics).
Introduction, mode of action, properties
SAR and chemistry
SAR
Synthesis

3. Diuretics,
   Classification , mode of action, properties and other chemistry
   SAR
   Synthesis
   Cardiovascular drugs,
   Introduction, mode of action, properties chemistry
   SAR
   Anti anginan drugs and Vasodilators
   Anti arrhythmic drugs
   Anti hypertension and Anti hyper lipidemic agents
   Anticoagulant
   Chemistry and SAR
   Synthesis
   Antiplatelet drugs.
   Chemistry and SAR
   Synthesis

   Biochemical approaches in drug designing wherever applicable should be discussed.

4.7.5. Practicals **4 hrs / week**

1. Workshop on stereomodel use of some selected drugs.

2. Synthesis of selected drugs from the course content involving two or more steps and their spectral analysis.

3. Establishing the Pharmacopoeial standards of the drugs synthesized.

SEMESTER -VIII

PHARMACEUTICS – IX

(Dosage Form Design)

4.8.1. Theory **3 hrs / week**

1. Preformulation studies:

a. Study of physical properties of drug like physical form
   Particle size, shape, density,
   Wetting dielectric constant.
   Solubility, dissolution
   Organoleptic property
   Stability and bioavailability.

b. Study of chemical properties of drugs like
   Hydrolysis,
   Oxidation,
   Reduction,
   Racemization,
   Polymerization
   Formulation
   Stability of products.

c. Study of pro-drugs in solving problems related to
   Stability,
   Bioavailability
   Elegancy of formulations.

2. Design,
   Development
   Process validation methods
   Pharmaceutical operations involved in the production
   Pharmaceutical products with special reference to Tablets,
   Suspensions.

3. Stabilization and stability testing protocol for various
   Pharmaceutical products.
   Liquid Oral Preparations
   Solid Dosage forms
   Parental Preparations
   Cosmetic Preparations
   Biological Products

4. Performance evaluation methods:

a. In vitro dissolution studies for solid dosage forms
Tablets , Capsules , Powders
Sustained release dosage forms
Interpretation of dissolution data.
Tablets, Capsules , Powders
Sustained release dosage forms

b. Bioavailability studies
Bioavailability testing protocol
Bioavailability testing procedures.

c. In vivo methods of
Evaluation
Statistical treatment.

5. GMP Quality assurance, Quality- audit.

6. Controlled released formulations.
Design,
Development,
Production
Evaluation

4.8.1. Practicals **3 hrs / week**

1. Preformulation studies including drug-excipient compatibility studies, effect of stabilizers, preservatives etc. in dosage form design.

2. Experiments demonstrating improvement in bioavailability through prodrug concept.

3. Stability evaluation of various dosage forms and their expiration dating.

4. Dissolution testing and data evaluation for oral solid dosage forms.

5. Evaluation of Bioequivalence of some marketed products.

6. In vivo bioavailability evaluation from plasma drug concentration and urinary excretion curves.

7. Design, development and evaluation of controlled release formulations.

SEMESTER-VIII

PHARMACEUTICAL ANALYSIS - III

4.8.3. Theory **3 hrs / week**

Introduction

A. Quality Assurance:

1. GLP
   ISO 9000
   TQM
   Quality Review & Quality Documentation

2. Regulatory control
   Introduction
   Regulatory drug analysis
   Interpretation of analytical data

3. Validation, quality audit:
   Quality of equipment
   Validation of equipment
   Validation of analytical procedures

B. The theoretical aspects, basic instrumentation, elements of Interpretation of spectra, and applications of the following Analytical techniques should be discussed:

1. Ultraviolet and visible spectrophotometry
   - Theoretical aspects
   - Instrumentations
   - Interpretation of spectra
   - Applications

2. Fluorimetry
   - Theoretical aspects
   - Instrumentations
   - Interpretation & Applications

3. Infrared spectrophotometry
   - Theoretical aspects
   - Instrumentations
   - Interpretation & Applications

4. Nuclear Magnetic resonance spectroscopy including 13c NMR
   - Theoretical aspects
   - Instrumentations
   - Interpretation of spectra & Applications

5. Mass Spectrometry
   - Theoretical aspects
   - Instrumentations
   - Interpretation of spectra
   - Applications

6. Flame Photometry
   - Theoretical aspects
   - Instrumentations
   - Interpretation & Applications

7. Emission Spectroscopy
   - Theoretical aspects
   - Instrumentations
   - Interpretation & Applications

8. Atomic Absorption Spectroscopy
   - Theoretical aspects
   - Instrumentations
   - Interpretation & Applications

9. X- ray Diffraction
   - Theoretical aspects
   - Instrumentations
   - Interpretation & Applications

10. Radio immunoassay
    - Theoretical aspects
    - Instrumentations
    - Interpretation & Applications

4.8.2. Practicals **4 hrs/ week**

1. Quantitative estimation of at least ten formulations containing single drug or more than one drug, using instrumental techniques

2. Estimation of Na, K, Ca ions using flame photometry

3. IR of samples with different functional groups (- COOH , -COOR, -CONHR; -NH2 , -NHR, -OH , etc

4. Workshop to interpret the structure of simple organic compounds using UR, IR, NMR and MS

SEMESTER –VIII

PHARMACEUTICAL CHEMISTRY – VIII

(Medicinal Chemistry – III)

4.8.3. Theory **3 hrs / week**

1. Drug metabolism and Concepts of Pro drugs.
   Pathways of metabolism, Microsomal reactions
   Non microsomal oxidation
   Drug conjugation
   Stereochemical aspects of drug metabolism, Pro drug

2. Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship (including physiochemical aspects) of the following classes of drugs. (Biochemical approaches in drug designing wherever applicable should be discussed).

   a. Antimetabolites (including sulfonamides).
      Antifolates
      Amino acids Antagonists, phenyl Alanine metabolites
      Glutamic acids Antimetabolites Vitamin Antagonists
      Gaba transaminase inhibitor and Beta lactamasa, ACEI

   b. Chemotherapeutic agents used in Protozoal, Parasitic and other infection.
      Introduction, classification, physiochemical Properties,
      Mode of action of Protozoal drugs
      SAR
      Synthesis
      Anti amoebic drugs
      Leishmaniasis drugs
      Drugs used in Trichomoniasis
      Anti malarials

   c. Antineoplastic agents.
      Introduction, classification, properties and mode of action
      SAR
      Synthesis

   d. Anti-viral including anti-HIV agents.
      Introduction, classification, properties and mode of action
      SAR
      Synthesis
      Synthesis

e. Immunosuppressive and immuno stimulants.
   Introduction, classification, properties and mode of action
   SAR
   Synthesis
   Synthesis

3. Amino acids, peptide, nucleotides and related drugs.

i) Thyroid and Anti thyroid drugs.
   Introduction, classification, properties and mode of action
   SAR
   Synthesis
   Synthesis

ii) Insulin and oral hypoglycemic agents.
   Introduction, classification, properties and mode of action
   SAR
   Synthesis
   Synthesis

iii) Peptidomimetics and mucleotidomimetics
   Introduction, classification, properties and mode of action
   SAR
   Synthesis

f. Diagnostic agents.
   Introduction, classification, properties and mode of action
   SAR
   Synthesis

g. Pharmaceutical Aids.
   Anti – Oxidants
   Preservatives
   Coloring agents
   Filtering aids , diluents , expients
   Suspending agents , adsorbents and others

4.8.3. Practicals **3 hrs / week**

1. Experiments designed on drug metabolism:

    a. Preparation of S9 and microsomes from tissue homogenates and standardization of protein.

    b. Effect of Phenobarbital pretreatment on microsomal cytochrome p-450, cytochrome b5, and NADPH-Cytochrome C-reductase and comparison of microsomes from control.

    c. Determination of microsomal aminopyrine demethylase and p-nitroanisole o-demethylase activities.

    d. Determination of microsomal azo- and nitroreductase activities.

2. Synthesis of selected drugs.

3. Establishing the pharmacopoeal standards and spectral studies.

SEMESTER-VIII

PHARMACOGNOSY- VI

4.8.4. Theory **3 hrs / week**

1. World – wide trade in medicinal plants
Derived products with special reference to diosgenin
(disocorea) , taxol (Taxus sps) digitalis
Tropane alkaloid containing plants
Papain , Cinchona , Ipecac, Liquorice, Ginseng, Aloe, Valerian, Rauwolfia
Plants containing laxatives

2. A brief account of plant based industries
Institutions involved in work on medicinal and aromatic Plants in India
Utilization and production of phytoconstituents such as quinine, Calcium sennosides
Podophyllotoxin, diosgenin
Solasodine and tropane alkaloids

3. Utilization of aromatic plants
Derived products
Special reference to sandalwood oil, mentha oil
Lemon grass oil, vetiver oil
Geranium oil and eucalyptus oil

4. Historical development of plant tissue culture
Types of cultures
Nutritional requirements
Growth and their maintenance
Applications of plant tissue culture in pharmacognosy

5. Chemotaxonomy of medicinal plants
    - Introduction
    - Characters studied in chemotaxonomy
    - Application of chemotaxonomy

6. Marine Pharmacognosy
    - Introduction
    - Cardiovascular active substance
    - Cytotoxic compounds
    - Antimicrobial compounds
    - Antibiotic compounds
    - Anti-Inflammatory and Antispasmodic Agents
    - Marine toxins
    - Miscellaneous compounds

Novel medicinal agents from marine sources

7. Natural allergens
   Photosensitizing agents
   Fungal toxins

8. Herbs as health foods
   Nutraceuticals
   Antioxidants , PUFA , Probiotics, Prebiotics
   Dietary fibres, Omega- 3 Fatty acids
   Spirulina , Royal jelly , Soya, Garlic

9. Herbal cosmetics
   Cosmeceuticals
   Phyto-Cosmeuticals
   Sources, Chemical constituents and Therapeutic benefit
   Retinoic acid, Alpha-hydroxy acids, Boswellic acids
   Vitamin C and Vitamin E, Co-enzyme and Miscellaneous

4.8.4. Practicals **3 hrs / week**

1. Isolation of some selected phytoconstituents studied in theory
2. Extraction of volatile oils and their chromatographic profiles
3. Some experiments in plant tissue culture

SEMESTER – VIII

PHARMACOLOGY – IV
(Clinical Pharmacy and Drug Interactions)

4.8.5 Theory: **4 hrs/ week**

1. Introduction to Clinical Pharmacy.
   Concept of Clinical Pharmacy

2. **Basic Concepts of Pharmacotherapy.**
   a. Clinical Pharmacokinetics
      Individualization of Drug Therapy
   b. Drug Delivery Systems
      Biopharmaceutic
      Therapeutic Considerations
   c. Drug Use during :
      Infancy
      Elderly
   d. Drug use during pregnancy.
      First trimester
      Second trimester
      Third trimester
   e. Drug induced diseases.
   f. The Basics of Drug Interactions.
      Pharmacokinetics
      Pharmacodynamic
      Protein Binding
      Displacement
   g. General Principles of Clinical Toxicology.
      Introduction
      Types of toxic reaction
   h. Interpretation of Clinical Laboratory Tests.
      Medical Statistics
      Students t-test

3. **Important Disorders of Organ Systems and their Management:**

   a. Cardiovascsular Disorders:
      Hypertension,
      Congestive Heart Failure,
      Angina,
      Acute Myocardial Infarction,
      Cardiac arrhythmias

b. CNS Disorders:
   Epilepsy,
   Parkinsonism,
   Schizophrenia,
   Depression
c. Respiratory Disease:
   Asthma
d. Gastrointestinal Disorders:
   Peptic ulcer,
   Ulcerative colitis,
   Hepatitis, Cirrhosis
e. Endocrine Disorders:
   Diabetes mellitus
   Thyroid Disorders
f. Infectious Diseases:
   Tuberculosis,
   Urinary Tract Infection,
   Enteric Infections,
   Upper Respiratory Infections
g. Hematopoietic Disorders:
   Anemias
   Drugs used
h. Joint and Connective Tissue Disorders:
   Rheumatic diseases,
   Gout
   Hyperuricemia.
i. Neoplastic Diseases:
   Acute Leukaemias,
   Hodgkin's disease

4. Therapeutic Drug Monitoring.
   Removal of samples
   Estimation
   Validation

5. Concepts of Essential Drugs and Rational Drug use.
   Prophylactic
   Therapeutic
   Emergency

SEMESTER – VIII **PROJECT - ELECTIVE**

4.8.6. List of Elective Subjects

1. Pharmaceutical Marketing
2. Medicinal Plant biotechnology.
3. Quality assurance.
4. Drug design and lead identification.
5. Bioavailability and therapeutic drug monitoring.
6. Cosmeticology.
7. Packaging technology.
8. Any other emerging area availing the local expertise.

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