SCHEME OF EXAMINATION

&

SYLLABI

OF

BACHELOR OF PHARMACY (B. PHARMA)
(2006-07)

GURU GOBIND SINGH
INDRAPRASTHA UNIVERSITY
KASHEMRE GATE, DELHI-110006

BACHELOR OF PHARMACY

FIRST SEMESTER EXAMINATION

Course Code		Paper	L	T/P	Credits
bph	101	Pharmaceutical Analysis-I	3	-	3
bph	103	Remedial Mathematics	4	-	4
bph	105	Pharmacognosy – I	3	-	3
bph	107	Pharmaceutical Chemistry-I (Inorganic Pharmaceutical Chemistry)	3	-	3
bph	109	Basic Electronics & Computers Applications	3	1	4
PRACTICAL/VIVA VOCE					
bph	151	Pharmaceutical Analysis-I Lab.	-	4	2
bph	153	Pharmacognosy-I Lab.	-	4	2
bph	155	Pharmaceutical Chemistry-I Lab.	-	4	2
bph	157	Basic Electronics & Computer Applications – Lab.	-	4	2
		Total	16	17	25

BACHELOR OF PHARMACY

SECOND SEMESTER EXAMINATION

Course Code		Paper	L	T/P	Credits
bph	102	Pharmaceutics-I (Pharmaceutical Technology-I)	3	-	3
bph	104	Advanced Mathematics	4	-	4
bph	106	Pharmaceutical Chemistry-II (Physical Chemistry)	3	1	4
bph	108	Pharmaceutical Chemistry-III (Organic Chemistry-I)	4	1	5
bph	110	Anatomy, Physiology and Health Education (APHE-I)-I	3	-	3
PRACTICAL/VIVA VOCE					
bph	152	Pharmaceutics-I Lab (Pharmaceutical Technology-I)	-	4	2
bph	154	Pharmaceutical Chemistry-II Lab. (Physical Chemistry)	-	4	2
bph	156	Pharmaceutical Chemistry-III Lab.	-	6	3
bph	158	Anatomy, Physiology-I Lab and Health Education (APHE)	-	4	2
		Total	17	20	28

BACHELOR OF PHARMACY

THIRD SEMESTER EXAMINATION

Course Code		Paper	L	T/P	Credits
bph	203	Pharmaceutical Chemistry - IV (Organic Chemistry-II)	3	1	4
bph	201	Pharmaceutics-II (Unit Operations-I)	3	1	4
bph	205	Pharmacognosy-II	3	-	3
bph	207	Pharmaceutical Analysis - II	3	-	3
bph	209	APHE-II	3	-	3
PRACTICAL/VIVA VOCE					
bph	251	Pharmaceutics-II (Unit Operations-I)	-	4	2
bph	253	Pharmaceutical Chemistry – IV (Organic Chemistry-II)	-	4	2
bph	255	Pharmacognosy-II	-	4	2
bph	257	Pharmaceutical Analysis - II	-	4	2
bph	259	APHE-II	-	4	2
		Total	15	22	27

BACHELOR OF PHARMACY

FOURTH SEMESTER EXAMINATION

Course Code	Paper	L	T/P	Credits
bph 202	Pharmaceutics-III (Unit Operations II)	3	1	4
bph 204	Pharmaceutical Microbiology	3	-	3
bph 206	Pharmacognosy – III	3	-	3
bph 208	Pathophysiology of Common Diseases	4	-	4
bph 210	Pharmaceutics-IV (Dispensing & Community Pharmacy)	3	1	4
	Practicals			
bph 252	Pharmaceutics-III (Unit Operations II)	-	4	2
bph 254	Pharmaceutical Microbiology	-	4	2
bph 256	Pharmacognosy – III	-	4	2
bph 258	Pharmaceutics-IV (Dispensing & Community Pharmacy)	-	4	2
	Total	16	18	26

BACHELOR OF PHARMACY

FIFTH SEMESTER EXAMINATION

Course Code		Paper	L	T/P	Credits
bph	301	Pharmaceutical Chemistry-V (Biochemistry)	3	-	3
bph	303	Pharmaceutics-V (Physical Pharmacy)	3	1	4
bph	305	Pharmacology-I	3	-	3
bph	307	Pharmacognosy – IV	3	-	3
bph	309	Pharmaceutics-VI (Hospital Pharmacy)	3	-	3
		Practicals			
bph	351	Pharmaceutical Chemistry-V (Biochemistry)	-	4	2
bph	353	Pharmaceutics-V (Physical Pharmacy)	-	4	2
bph	355	Pharmacology-I	-	4	2
bph	357	Pharmacognosy – IV*	-	4	2
bph	359	Pharmaceutics-VI (Hospital Pharmacy)	-	4	2
		Total	15	21	26

- Pharmacognosy- IV (bph-357) Practical Examination will include Pharmacognosy Tour report assessment also.

BACHELOR OF PHARMACY

SIXTH SEMESTER EXAMINATION

Course Code		Paper	L	T/P	Credits
bph	302	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	3	1	4
bph	304	Pharmaceutical Jurisprudence & Ethics	4	-	4
bph	306	Pharmaceutics-VII (Biopharmaceutics & Pharmacokinetics)	3	-	3
bph	308	Pharmacology – II	4	-	4
bph	310	Pharmacognosy-V (Chemistry of Natural Products)	3	-	3
		Practicals			
bph	352	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	-	4	2
bph	356	Pharmaceutics-VII (Biopharmaceutics & Pharmacokinetics)	-	4	2
bph	358	Pharmacology – II	-	6	3
bph	360	Pharmacognosy-V (Chemistry of Natural Products)	-	4	2
		Total	17	19	27

BACHELOR OF PHARMACY

SEVENTH SEMESTER EXAMINATION

Course Code		Paper	L	T/P	Credits
bph	401	Pharmaceutical Biotechnology	4	-	4
bph	403	Pharmaceutics VIII (Pharmaceutical Technology II)	4	-	4
bph	405	Pharmaceutical Industrial Management	4	-	4
bph	407	Pharmacology III	3	-	3
bph	409	Pharmaceutical Chemistry VIII (Medicinal Chemistry-II)	3	1	4
		Elective (Theory) Any one of the following			
bph	411	Packaging Technology	4	-	4
bph	413	Quality Assurance	4	-	4
bph	415	Industrial Pharmacognosy	4	-	4
bph	417	Drug design	4	-	4
Bph	419	Pharmaceutical Marketing	4	-	4
		Practicals			
bph	451	Pharmaceutics VIII (Pharmaceutical Technology II)*	-	4	2
bph	453	Pharmacology III	-	4	2
bph	455	Pharmaceutical Chemistry VIII (Medicinal Chemistry-II)	-	4	2
		Total	22	13	29

* Pharmaceutics-VIII (Pharmaceutical Technology-II) bph-451 Practical Examination will include industrial tour report assessment also.

BACHELOR OF PHARMACY

EIGHTH SEMESTER EXAMINATION

Course Code		Paper	L	T/P	Credits
bph	402	Pharmaceutics IX	3	-	3
bph	404	Pharmaceutical Analysis III	3	-	3
bph	406	Pharmaceutical Chemistry VIII(Medicinal Chemistry-III)	3	1	4
bph	408	Pharmacology IV (Clinical Pharmacy & Drug Interactions)	4	-	4
		Practicals			
bph	452	Pharmaceutics IX	-	3	2
bph	454	Pharmaceutical Analysis III	-	4	2
bph	456	Pharmaceutical Chemistry VIII(Medicinal Chemistry-III)	-	3	2
bph	460	Project Work*	-	-	8
		Total	13	11	28

- *The subject of the Project will relate to elective subject chosen by the candidate. The Project Work will carry 100 marks and shall be evaluated by a Board of Examiners comprising of one internal examiner and one external examiner to be appointed by the Vice-Chancellor on the recommendation of the coordinator of the programme.

Note: Total credits for B.Pharmacy programme : 216
Minimum credits to be earned for the award of B.Pharmacy degree: 210

BACHELOR OF PHARMACY

FIRST SEMESTER

PHARMACEUTICAL ANALYSIS-I

Course Code: bph-101 **L-3** **Credits-3**

Unit-I [10]

- 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.
- Precipitation Techniques, solubility product, effect of acids, temperature and solvent upon the solubility of a precipitate, the colloidal state.

Unit-II [10]

- **Acid 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, NaOH, $CaCO_3$ etc.

Unit-III [10]

- **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 ammonium sulphate, potassium iodate, potassium bromate, potassium permanganate, titanous chloride and sodium 2, 6-dichlorophenol indophenol.

Unit-IV [10]

- **A. Precipitation Titrations:** Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, Indicators, Gay-lussac method, Mohr's method, Volhard's method and Fajan's method.
- **B. Gravimetric Analysis:** Supersaturation, Co-precipitation, Post-precipitation, Digestional washing of the precipitate, Filtration, Filter papers and crucibles, Ignition, Thermogravimetric curves, Specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic precipitants.

BOOKS RECOMMENDED:

1. Mendhanm J, Denny R.C., Barnes J.D., Thomas M, Jeffery G.H., "Vogel's Text Book of Quantitative Chemical Analysis", Pearson Education Asia.
2. Conners K.A., "Text Book of Pharmaceutical Analysis", Wiley Inter-science.
3. Beckett A.H., and Stenlake J.B., Practical Pharmaceutical Chemistry, Vol. I & II. The Atherdon Press of the University of London.
4. British Pharmacopoeia, Her Majesty's Stationery Office, University Press, Cambridge, latest edition
5. Alexeyev V." Quantitative Analysis". CBS Publishers & Distributors.
6. Indian pharmacopoeia, Ministry of Health, Govt. of India, latest edition.

BACHELOR OF PHARMACY

FIRST SEMESTER

REMEDIAL MATHEMATICS

Course Code: bph 103 **L-4 T-0 Credits-4**

Unit I

[10]

- **Algebra:** Equations reducible to quadratics, simultaneous equations (linear and 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 and matrices.

Unit II

[10]

- **Measures of Central Value:** Objectives and pre-requisites of an ideal, measure, mean, mode and median, Geometric Mean and Harmonic Mean; Partition Values; Measure of dispersion: Range, Quartile Deviation, Mean Deviation and Standard Deviation.

Unit III

[10]

- **Analytical Plane Geometry:** Certain co-ordinates, distance between two points, area of triangle, a locus of point, straight line; slope and intercept from, double-intercept form, normal (perpendicular form), slope-point and two point form, general equation of first degree.

Unit IV

[10]

- **Calculus:**
  Differential: 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 and partial fractions, formal evaluation of definite integrals.

BOOKS RECOMMENDED:

References:

Frank Mathematics for B.Pharm. by G.D. Dhall, S.N. Chhibber, Hari Om Trivedi and Subodh Chandra.
Introductory Mathematics for Business and Economics by V.K.Kapoor.
Gupta S.P., Statistical Methods, Sultan Chand & Sons, latest edition

Suggested readings:

1. Narayan S., Differential Calculus, Sultan Chand & Sons, Latest Edition
2. Narayan S., Integral Calculus, Sultan Chand & Sons, Latest Edition
3. Salhotra K.K., A Text Book of Applied Mathematics, Katson Publishing House, Latest Edition

BACHELOR OF PHARMACY

FIRST SEMESTER

PHARMACOGNOSY-I

Course Code: bph-105 **L-3** **Credits-3**

Unit-I

[10]

Definition, history, scope and development of Pharmacognosy.

Sources of drugs: Biological, marine, mineral and plant tissue cultures as sources of drugs.

Classification of drugs: e.g. Alphabetical, morphological, taxonomical, chemical and pharmacological.

Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation.

Unit-II

[10]

Plant taxonomy: Study of the following families with special reference to medicinally important plants – Apocynacae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, Papaveraceae

An introduction to active constituents of drugs: Their isolation, classification and properties.

Unit-III

[10]

- **Cultivation, collection, processing and storage of crude drugs:** Factors influencing cultivation of medicinal plants. Types of soils and fertilizers of common use. Pest management and natural pest control agents. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants.

Unit-IV

[10]

- **Systematic pharmacognostic study of following:**

(a)Carbohydrates and derived products: Agar, Guar gum, acacia, Honey, Isabgol, Pectin, Starch, Sterculia and Tragacanth.

(b)Lipids: Bees wax, Castor oil, Cocoa butter, Cod-liver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice-bran oil, Shark liver oil and Wool fat.

BOOKS RECOMMENDED:

1. Kokate, C.K."Practical Pharmacognosy" Vallabh Prakashan Delhi.
2. Wallis T.E., Analytical Microscopy, J&A Churchill Limited, London.
3. Brain K.R. and Turner T.D. "The Practical Evaluation of Phyto Pharmaceutical", Wright, Scientechnica- Bristol.
4. Kokate, C.K.Pharmacognosy, Nirali Prakashan, Pune.
5. Trease, G.E. & Evans, W.C., "Pharmacognosy" Bailleire tindall East bourne, U.K.
6. Wallis, T.E., Textbook of Pharmacognosy, J.A. Churchill, Ltd.
7. Schewer P.J., "Marine Natural Products", Academic press, London.

BACHELOR OF PHARMACY

FIRST SEMESTER

PHARMACEUTICAL CHEMISTRY-I
(INORGANIC PHARMACEUTICAL CHEMISTRY)

Course Code: bph-107 **L-3** **Credits-3**

An outline of methods of preparation, uses, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any, of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia:

Unit-I

[10]

- **Gases & Vapours :** Oxygen, Anaesthetics.
- **Dental Products:** Dentifrices, anti-caries agents.
- Complexing and Chelating agents used in therapy.

Unit-II

[10]

- **Gastrointestinal Agents:** Acidifying agents, Antacids, Protectives and Adsorbents, Cathartics.
- **Pharmaceutical Aids & Necessities:** Acids and Bases, Buffers, Anti-oxidants, Water.

Unit-III

[10]

- **Major Intra- and Extra-cellular Electrolytes:** Major Physiological ions. Electrolytes used for replacement therapy, Acid-base balance and Combination therapy.
- **Essential and Trace Elements:** Transition elements and their compounds of pharmaceutical importance : Iron and haematinics, mineral supplements (Cu, Zn, Cr, Mn, Sb, S, I).

Unit-IV

[10]

- **Inorganic Radio pharmaceuticals**: Nuclear radio pharmaceuticals, Reactions, Nomenclature, Methods of obtaining their standards and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions.
- **Topical Agents:** Protectives, Astringents and Anti-infectives.
- **Miscellaneous Agents**: Inhalants, respiratory stimulants, sclerosing agents, expectorants, emetics, poisons and antidotes, sedatives.

BOOKS RECOMMENDED:

1. Block J.H. Roche E,. Soine T. and Wilson C; "Inorganic Medicinal and Pharmaceutical Chemistry". Lea & Febiger.
2. Indian Pharmacopoeia, Ministry of Health, Govt. of India, latest edition.
3. Atherden L.M., Bentley and Drivers,"Text Book of Pharmaceutical Chemistry", Oxford University Press, London.

BACHELOR OF PHARMACY
FIRST SEMESTER

BASIC ELECTRONICS AND COMPUTER APPLICATIONS

Course Code: bph-109 **L-3 T-1 Credits-4**

Unit I

[10]

Basic Electronics:

- Semiconductors, p-n junction diode
- Rectifiers (half wave, full wave/with filters)
- Transistor configurations, Transistor amplifiers
- Introduction to Integrated circuits, photocells and photo multiplier tubes.

Computers:

- Introduction to Computers.
- Need to use Computer
- Over view of Computer Oraganization.

Unit II

[10]

Computer Classification:

- Mainframe, Mini and Micro Computers,
- Comparison of Analog & Digital Computers.
- Hardware and Soft ware.

Operating Systems:

- Introduction to types of operating systems.
- MS-DOS
- RAM, ROM, Virtual Memory
- Architecture of Seven layers of Communications.
- Flow chart

Unit-III

[10]

C Programming:

- C data types
- C expressions, arithmetic operation, relational and logic operations
- C assignment statements, c primitive input output using getchar and putchas, exposure to scan f and print f functions.

C statements- Conditional executing using if else, switch and break statements.
Concept of loops, examples of loops in C using for, while ,do while ,continue statement.

Unit IV

[10]

C Programming:

- One dimensional arrays, ID arrays. Use in matrix computations
- Function- Argument passing mainly for simple variables.
- Strings
- Structures.

BOOKS RECOMMENDED:

1. Thakur P.S., Manchanda R. Nand P; Computers in Pharmacy; Birla Publication Pvt Ltd.
2. Raja Raman V, Fundamentals of Computers, Prentice Hall of India
3. Sinha P.K., Sinha P; Foundations of Computing; BPB Publications

BACHELOR OF PHARMACY

FIRST SEMESTER

PHARMACEUTICAL ANALYSIS-I LAB.

Course Code: bph 151 **L-0 P-4 Credits- 2**

The students should be introduced to the main analytical tools through demonstrations. They should have a clear understanding of a typical analytical balance, the requirements of a good balance, weights, care and use of balance, methods of weighing and errors in weighing. The students should also be acquainted with the general apparatus required in various analytical procedures.

1. Standardization of analytical weights and calibration of volumetric apparatus.

2. **Acid Base Titrations:** Preparation and standardization of acids and bases, some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures e.g. boric acid should also be covered.

3. **Oxidation Reduction Titrations:** Preparation and standardiztaion of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2, 6-dichlorophenol indophenol, and ceric ammonium sulphate.

4. **Precipitation titrations:** Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, Titrations according to Mohr's, Volhard's and Fajan's methods.

5. **Gravimetric Analysis:** Preparation of gooch crucible for filtration and use of sintered glass crucible, Determination of water of hydration, Some exercises related to gravimetric analysis should be covered.

BACHELOR OF PHARMACY

FIRST SEMESTER

PHARMACOGNOSY-I LAB.

Course Code: bph 153 L-0 P-4 Credits-2

- Morphological characteristics of plant families mentioned in theory.
- Microscopic measurements of cells and cell contents: Starch grains, calcium oxalate crystals and phloem fibres.
- Determination of leaf constants such as stomatal index, stomatal number, vein-islet number, vein-termination number and palisade ratio.
- Identification of crude drugs belonging to carbohydrates and lipids.
- Preparation of herbarium sheets.

SUGGESTED PRACTICALS:

- Study of plants belonging to family Solanacae.
- Study of plants belonging to family Rutacae.
- Study of plants belonging to family Apocynaceae
- Study of plants belonging to family Umbelliferae.
- Microscopical measurements of starch grains (Wheat, maize).
- Microscopical measurements of starch grains (Rice, Potato).
- Various types of calcium oxalate crystals, their study and microscopical measurements (Rhubarb, Senna, Liquorice, etc.).
- Study of various types of phloem fibres.
- Determination of stomatal number with the help of camera lucida along with the working of instrument.
- Determination of stomatal index.
- Determination of vein- islet and vein termination number.
- Determination of palisade ratio.
- Chemical test of Agar, Acacia, Sterulia and Tragacanth.
  (a)Chemical test of Pectin, starch and Honey.
  (b) Swelling factor of Isapaghula husk.
  (c) Average weight of Isapaghula husk.
- Physical Characteristics of Caster oil, Cod-liver oil, Shark-liver oil and Linseed oil.

PROJECT WORK:

- Preparation of Herbarium sheets

BACHELOR OF PHARMACY

FIRST SEMESTER

PHARMACEUTICAL CHEMISTRY-I LAB.

Course Code: bph-155 **L-0 P-4 Credits-2**

List of Experiments:

- To perform limit test of chloride, sulphate, iron, heavy metal and arsenic in the given sample.
- Salt analysis of inorganic mixtures of upto four radicals; six mixtures to be analysed.
- Indentification tests for Pharmacopoeial inorganic pharmaceuticals.

BACHELOR OF PHARMACY

FIRST SEMESTER

BASIC ELECTRONICS & COMPUTER APPLICATIONS-LAB.

Course Code: bph-157 **L-0** **P-4** **Credits-2**

Exercises based on the following are to be dealt:

1. DOS Commands
2. MS-Word, MS-Excel, MS-Powerpoint
3. C-Programming.

BACHELOR OF PHARMACY

SECOND SEMESTER

PHARMACEUTICS – I
(PHARMACEUTICAL TECHNOLOGY I)

Course Code: bph-102 **L-3** **Credits-3**

Unit-I [10]

- **Liquid Dosage Forms:** Introduction, types of additives used in formulations: Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavours; manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.

- **Pharmaceutical Aerosols:** Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications.

Unit-II

[10]

- **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.

Unit-III

[10]

- **Blood Products and Plasma Substitutes:** Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, fibrin foam, plasma substitutes: ideal requirements, PVP, dextran.
- **Ophthalmic Preparations:** Requirements, formulation, methods of preparation, containers, evaluation.

Unit-IV

[10]

- **Cosmeticology and Cosmetic Preparations:** Structure of skin and hair, formulation of cold cream, vanishing cream, cleansing cream, antiperspirants, deodorants, face powder. shampoos, conditioners, shaving and after shaving products, dentifrices, lipsticks and nail lacquer.

BOOKS RECOMMENDED:

1. Remington's Pharmaceutical Sciences Vol-I & Vol-II, Mack Publishing Co.USA., latest edition.
2. Cooper J.W.& Gunn G., Tutorial Pharmacy, Petman Books Ltd. London, latest edition.
3. Lachman L., Liberman H.A., and Kanig J.L., Theory and Practice of Industrial Pharmacy Lea & Febiger, USA., latest edition.
4. Ansel H.C., Introduction to Pharmaceutical Dosage form, Lea Febiger, USA., latest edition.
5. Juliarco R.L., Drug Delivery System, Oxford University Press, Oxford., latest edition.
6. Harrys Cosmeticology, latest edition.
7. Balsam and sargarin, Cosmetics, Science and Technology, latest edition.
8. Mittal B.M. and Saha R.N.-A Handbook of Cosmetics, Vallabh Prakashan,Delhi, latest edition.
9. Aulton, M.E., Textbook of Pharmaceutics, Vol.I & II Churchill Livingstone, latest edition.

BACHELOR OF PHARMACY

SECOND SEMESTER

ADVANCED MATHEMATICS

Course Code: bph-104 L-4 Credits-4

Unit I

[10]

- **Differential equations:** Revision of integral calculus, definition and formation of differential equations, equations of first order and first degree, variable separable, homogeneous and linear differential equations and equations reducible to such types, linear differential equations of order greater than one with constant coefficients, simultaneous linear differential equations, pharmaceutical applications.

Unit II

[10]

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

Unit III

[10]

- **Biometrics:** Significant digits and rounding of numbers, data collection, random and non-random sampling methods, sample size, data organization, diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams, measures of central tendency, measures of dispersion, Standard Deviation and standard error of means, coefficient of variation, confidence (fiducial) limits, correlation and regression analysis

Unit IV

[10]

- Probability and events, Bayes' theorem, probability theorems, probability distributions, elements of binomial and Poisson distribution, normal distribution curve & properties, kurtosis and skewness, method of least squares, statistical inference, Student's and paired t-test, F-test and elements of ANOVA, applications of statistical concepts in Pharmaceutical Sciences.

BOOKS RECOMMENDED:

References:

1. Gupta S.P., Kapoor V.K.; Fundamentals of Mathematical Statistics.
2. Gupta S.P., Statistical Methods, Sultan Chand & Sons, latest edition
3. Piskunov N., Differential & Integral Calculus, CBS Publishers and Distributors, Latest Edition

Suggested Readings:

4. Prasad C., Mathematics for Engineers, Prasad Mudranalaya Latest Edition
5. Kreyszig E., Advanced Engineer Mathematics, John Wiley & Sons, Latest Edition
6. Sanchiti D.C and Kapoor V.K., Statistics (Theory, Methods & Application), Sultanchand & Sons

BACHELOR OF PHARMACY

SECOND SEMESTER

PHARMACEUTICAL CHEMISTRY-II
(PHYSICAL CHEMISTRY)

Course Code: bph-106 **L-3 T-1 Credits-4**

Unit-I

[10]

- **Behaviour of Gases:** Kinetic theory of gases, deviation from ideal behaviour and explanation.
- **The Liquid State:** Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moment) and chemical constitution.
- **Solutions:** Ideal and real solutions, solutions of gases in liquids, colligative properties.

Unit-II

[10]

- **Thermodynamics:** Fundamentals, first, second, third and zeroth law, Joule-Thompson's effect, Thermochemical equations.
- **Phase equillibria:** Phase**,** component, degree of freedom, phase rule (excluding derivation). Cooling curves& Phase diagrams for one & two component system (example-Sulphur, H_2O, KI-H_2O, NaCl-H_2O system)

Unit-III

[10]

- **Chemical Kinetics:** Zero, first and second order reactions, complex reactions, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid base and enzyme catalysis.
- **Electro chemistry:** Faraday's law of electrolysis, Electrolytic conductance and its measurements, molar and equivalent conductivity, its variation with dilution. Kohlrausch law, Arrhenius theory, Degree of ionization and Ostwald's dilution law. Theory of strong electrolytes (Debye Huckle theory)

Unit-IV

[10]

- **Photochemistry:** Consequences of light absorption, Jablonski diagram, Lambert-Beer law, Quantum efficiency.
- **Partition Coefficient**
- **Adsorption**: Freudlich and Gibbs adsorption isotherms (excluding derivation), Langmuir theory of adsorption.

BOOKS RECOMMENDED:

1. Bahl B.S., Tuli G.D. & Bahl Arun, Essentials of Physical Chemistry, S.Chand & Co Delhi
2. Shoemaker D.P., Garland C.W., Experiments of Physical Chemistry, Mc Graw Hill Book Co.
3. Pali S.R., and Prabartak S.K.D.E., Practical Physical Chemistry, Halton Limited, Calcutta.
4. Negi A.S. & Anand S.C."Text Book of Physical Chemistry" Wiley Eastern Ltd.
5. Glasstone S. & Lewis D, Elements of Physical Chemistry, Macmillan Education.

BACHELOR OF PHARMACY

SECOND SEMESTER

PHARMACEUTICAL CHEMISTRY-III
(ORGANIC CHEMISTRY-I)

Course Code: bph-108 **L-4 T-1 Credits-5**

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

Unit-I

[10]

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

Unit-II

[10]

- **Stereochemistry:** Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations.

Unit-III

[10]

- **Structure, Nomenclature, Preparation and Reactions of:** Alkanes, Alkenes, Alkynes, Cycloalkanes, Dienes, Alkyl halides, Alcohols, Ethers, Epoxides, Reactive intermediates – carbocations, carbanions, carbenes, nitrene and nitrenium ions.

Unit-IV

[10]

- **Structure, Nomenclature, Preparation and Reactions of:** Amines, Phenols, Aldehydes and Ketones, Carboxylic acids, Functional derivatives of carboxylic acids, Benzene, Polynuclear aromatic compounds, Arenes.

BOOKS RECOMMENDED:

1. Morrison T.R. and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt.Ltd. New Delhi.
2. Finar I.L., Organic Chemistry Vol.I & II ELBS/ Longman.
3. Bahl B.S. & Bahl Arun, Advance Organic Chemistry, S Chand & Co. Ltd., Ram Nagar, New Delhi.

BACHELOR OF PHARMACY

SECOND SEMESTER

ANATOMY, PHYSIOLOGY & HEALTH EDUCATION (APHE-I)

Course Code: bph-110 **L-3** **Credits-3**

Unit-I

[10]

- Scope of anatomy and physiology and basic terminology used in these subjects. Structure of cell, its components and their functions.
- **Elementary Tissues of the Human Body:** Epithelial, connective, muscular and nervous tissues, their sub-types and their characteristics.

Unit-II

[10]

- **Osseous System:** Structure, composition and functions of skeleton, Classification of joints, types of movements of joints, Disorders of joints.
- **Skeletal Muscles:** Gross anatomy, physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.

Unit-III

[10]

- **Haemopoietic System:** Composition and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.
- **Lymph and Lymphatic System:** Composition, formulation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.

Unit-IV

[10]

- **Cardiovascular System:** Basic anatomy of the heart, Physiology of heart, blood vessels and circulation. Basic understanding of Cardiac cycle, Heart sounds and understanding of Cardiac cycle, Heart sounds and Electrocardiogram. Blood pressure and its regulation. Brief outline of cardiovascular disorders like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

BOOKS RECOMMENDED:

1. Ranade VG, "Text book of Practical Physiology", Pune Vidyarthi Griha Prakashan, Pune.
2. Difore S.H. "Atlas of Normal Histology"- Lea & Febiger Philadelphia.
3. Chaurasia B.D., Human Anatomy, Regional & Applied Part-I, II & III, CBS Publisher & Distributors, New Delhi.
4. Guyton AC, Hall JE, "Text book of Medical Physiology", WB Saunders Company.
5. Chatterjee C.C., "Human Physiology", Medical Allied Agency Calcutta.
6. Ross & Wilson, "Anatomy & Physiology in Health & Illness", Churchill Livingstone.
7. Tortora GJ & Grabowski SR, "Principles of Anatomy & Physiology", Harper & Row Publisher, New Delhi.
8. Parmar N.S. "Health Education & Community Pharmacy" CBS Publishers, Delhi.
9. Shalya Subhash " Human Physiology" CBS Publishers & Distributors.
10. Keele, C.A. Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.

BACHELOR OF PHARMACY

SECOND SEMESTER

PHARMACEUTICS – I LAB.

(PHARMACEUTICAL TECHNOLOGY-I LAB.)

Course Code: bph 152 **L-0 P-4 Credits-2**

- Preparation, evaluation and packaging of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, eye drops, eye ointments. Preparation of extracts and galenical products utilizing various methods of extraction. Formulation of various types of cosmetics for skin, hair, dentifrices and manicure preparations.

SUGGESTED PRACTICALS:

1. Preparation, evaluation and packaging of :

I. Solution e.g. Salts for Reconstituted solutions	(a)	ORS Citrate
	(b)	ORS-A etc.
II. Emulsion	(a)	Liquid Paraffin Emulsion
	(b)	Castor oil Emulsion etc.
III. Suspension	(a)	Antacid preparations
IV. Ointment	(a)	Simple Ointment
	(b)	Zinc Oxide Ointment etc.
V. Eyedrops	(a)	Sulphacetamide Eye Ointment
	(b)	Zinc Sulphate Eye Drops
VI.Suppositories	(a)	Zinc Oxide Suppositories
	(b)	Iodoform Suppositories

2. Preparation of Pharmaceutical Extracts:
   I. Compound Cardamon Tincture I.P.
   II. Capsicum Tincture I.P.
   III.Liquorice Liquid Extract I.P. etc.

3. Formulation of various cosmetics for:

I. Skin	(a)	Cleansing cream
	(b)	Cold cream
	(c)	After shave lotion etc.
II. Hair	(a)	Hair dressing cream
	(b)	Hair dressing lotion
	(c)	Liquid shampoo etc.
III. Dentifrices	(a)	Tooth powder
	(b)	Tooth paste
	(c)	Mouth wash etc.
IV. Manicure	(a)	Hand cream
	(b)	Liquid Bleach etc.

BACHELOR OF PHARMACY

SECOND SEMESTER

PHARMACEUTICAL CHEMISTRY-II LAB.

Course Code: bph 154 **L-0 P-4 Credits-2**

- Determination of molar mass by Rast cryoscopic method.
- Determination of refractive index of given liquids.
- Determination of specific rotation of sucrose at various concentrations and determination of intrinsic rotation.
- Determination of rate constant of simple reaction.
- Determination of cell constant, verify Ostwald's dilution law and perform conductometric titration.
- Determination of surface tension.
- Determination of partition co-efficient.
- Determination of viscosity.
- Determination of solubility.
- Determination of heat of solution, heat of hydration and heat of neutralization.

BACHELOR OF PHARMACY

SECOND SEMESTER

PHARMACEUTICAL CHEMISTRY-III LAB.

Course Code: bph 156 **L-0 P-6 Credits-3**

- The student should be introduced to the various laboratory techniques through demonstrations involving synthesis of selected organic compounds (e.g. aspirin, p-bromoacetanilide, anthraquinone from anthracene, reduction of nitrobenzene etc.)

  [04]

- Identification of organic compounds and their derivatisation.
  [09]

- Introduction to the use of stereomodels.
  [02]

BACHELOR OF PHARMACY

SECOND SEMESTER

ANATOMY, PHYSIOLOGY & HEALTH EDUCATION (APHE) – I LAB.

Course Code: bph 158 **L-0 P-4 Credits-2**

Study of human skeleton.

Study of different systems with the help of charts and models.

Microscopic study of different tissues.

Estimation of hemoglobin in blood. Determination of bleeding time, clotting time, R.B.C. Count, Total leucocyte count, D.L.C. and E.S.R.

Recording of body temperature, pulse rate and blood pressure, basic understanding of Electrocardiogram-PQRST waves and their significance.

BACHELOR OF PHARMACY

THIRD SEMESTER

PHARMACEUTICS-II
(UNIT OPERATIONS I)

Course Code: bph-201 **L-3 T-1** **Credits-4**

Unit-I

[10]

- **Unit Operations:** Introduction to Pharmaceutical Engineering. Unit Operations, Concept and Requirement, Material and Energy Balances.

- **Fluid flow:** Types of flow, Reynold's number, Concept of boundary layer, basic equations of fluid flow and derivation of Bernoulli's Theorem, manometers and measurement of flow and pressure, flow meters (Principles and Construction of Venturimeter, Orificementer, Pitot Tube, Weirs Rotameter, Positive Displacement Meter – Current Meter and Discmeter), Valves (plugcock, globe, gate valves, water hammer, unidirectional valves and automatic regulatory valves).
- **Material Handling Systems:**

  Liquid handling – Different types of pumps – reciprocating pumps, positive displacement pumps, rotary pumps – volute and centrifugal pump, peristaltic pump, Air Binding and self-priming pumps.

Unit-II

[10]

- **Material Handling Systems:**
  1. **Gas handling –** Blowers and Compressors.
  2. **Solid handling** – Bins, Bunkers, Conveyors (Screw, Belt, Pneumatic and Chain conveyors).
  3. **Filtration and Centrifugation:** Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration. Principles of centrifugation, industrial centrifugal filters, and centrifugal sedimenters.
  4. **Crystallization:** Characteristics of crystals like-purity, size, shape, geometry, habit, forms, size and factors affecting them, Solubility curves and calculation of yields.

Unit-III

[10]

- **Crystallization:** Material and heat balances around Swenson Walker Crystallizer, Supersaturation theory and its limitations, Nucleation mechanisms, crystal growth. Study of various types of Crystallizer, tanks, agitated batch, Swenson Walker, Single vacuum, circulating magma and Crystal Crystallizer, Caking of crystals and its prevention.
- **Dehumidification and Humidity Control:** Basic concepts and definition, wet bulb and adiabatic saturation temperatures, Psychrometric chart and measurement of humidity.

Unit-IV

[10]

- **Dehumidification and Humidity Control:** Application of humidity measurement in pharmacy, equpments for dehumidification operations.
- **Refrigeration and Air Conditioning:** Principles and applications of refrigeration and air conditioning.
- **Material of Construction:** General study of composition, corrosion, resistance, properties and applications of the materials of construction with special reference to stainless steel and glass.
- **Industrial Hazards and Safety Precautions:** Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, Accident records etc.

BOOKS RECOMMENDED:

1. Badger W.L. and Banchero J.T. Introduction to Chemical Engineering Mc Graw Hill International Book London, latest edition.
2. Perry R.H.& Clinton C.H. Chemical Engineers Handbook, Mc Graw Kogakush Ltd., latest edition
3. McCabe W.L. and Smith J.C. Unit Operation of Chemical Engineering Mc Graw Hill International Book London, latest edition.
4. Sambhamurthy, Pharmaceutical Engineering, New Age Publishers, latest edition.
5. Gavhane, K.A. "Unit Operation-I", Nirali Prakashan, latest edition

BACHELOR OF PHARMACY

THIRD SEMESTER

PHARMACEUTICAL CHEMISTRY-IV
(ORGANIC CHEMISTRY – II)

Course Code: bph 203 **L-3 T-1 Credits-4**

Unit-I

[10]

- **Conservation of orbital symmetry and rules:** Electrocyclic, cyloaddition and sigmatropic reactions;
- **Neighbouring Group Effects:** Catalysis by Transition Metal Complexes.
- Chemistry of Fats, Oils & Waxes, analytical constants of fats & oils & their significance in the analysis, Drying, semi drying & non-drying oils.

Unit-II

[10]

- Nucleophillic aromatic substitutions;
- Classification, identification, general methods of preparation and reactions of amino acids and proteins, Structure of Nucleic acids.

Unit-III

[10]

- **Heterocyclic Compounds:** General classification of heterocyclic compounds & nomenclature, Chemistry, synthesis & properties of the following heterocyclic systems.
  (a) Pyrrole, Furan and thiophene.
  (b) Pyridine, pyrimidine, pyrazine, pyridazine.
  (c) Pyrazole, Imidazole, Oxazole, Isoxazole.
  (d) Indole, Quinoline.

Unit-IV

[10]

- **Carbohydrates**
  Classification, structure, chemistry, identification of:
  (a) Monosaccharides- Glucose and fructose.
  (b) Disaccharides- Sucrose, Lactose and maltose.
  (c) Ploysaccharides- starch.
- ά β- unsaturated carbonyl compounds.

BOOKS RECOMMENDED:

1. Morrison T.R. and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt.Ltd., New Delhi.
2. Finar I.L., Organic Chemistry Vol.I & II ELBS/ Longman.
3. Agarwal O.P., Chemistry of organic Natural Products Vol I & II, Goel Publishing House, Meerut, India.
4. Peter S., A Guide book to Mechanism in Organic Chemistry, Pearson Education Ltd., India.
5. Atherden L.M., Bentley and Drivers, "Text Book of Pharmaceutical Chemistry", Oxford University Press, London.

BACHELOR OF PHARMACY

THIRD SEMESTER

PHARMACOGNOSY-II

Course Code: bph 205 **L-3** **Credits-3**

Unit-I

[10]

- **Resins:** Study of Drugs Containing Resins and Resin Combination like colophony, podophyllum, jalap, cannabis, capscium, myrrh, asafoetida, balsam of tolu, balsam of peru, benzoin, turmeric, ginger.

- **Tannins:** Study of Tannins and Tannin containing durgs like Gambir, Black Catechu, Call and Myrobalan.

Unit-II

[10]

- **Volatile Oils:** General methods of obtaining volatile oils from plants, study of volatile oils of Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood.

Unit-III

- **Phytochemical Screening:** [10]
  (a) Preparation of extracts.
  (b) Screening of alkaloids, saponins, cardenolides and bufadinolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthraquinonens, cynogenetic glycosides, amino acids in plant extracts.

- **Chemotaxonomy of medicinal Plants.**

Unit-IV

[10]

- **Fibres:** Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.
- **Pharmaceutical aids:** Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors.
- Hellucinogens, Narcotics and Common Poisonous Plants of India
- **Marine Pharmacognsy:** Novel medicinal Agents from marine sources.

BOOKS RECOMMENDED:

1. Kokate C.K. "Pharmacognosy" Nirali Prakashan, Pune.
2. Trease G.E. & Evans W.C., "Pharmacognosy" Balliere Tindall East Bourne U.K.
3. Tyler V.E. "Pharmacognosy " Leas & Febiger, Philadelphia.
4. Wallis, T.E. "Text Book of Pharmacognosy" J&A Churchill Ltd. London.
5. Atal C.K. & Kapur BM, "Cultivation & Utilization of Medicinal Plant, RRI, Jammu.
6. Harborne JB, Phytochemical method, Chapman & Hall International Edition, London.

BACHELOR OF PHARMACY

THIRD SEMESTER

PHARMACEUTICAL ANALYSIS - II

Course Code: bph 207 **L-3** **Credits-3**

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

Unit-I

[10]

- **Non-aqueous titrations**
- **Complexometric titrations**

Unit-II

[10]

- **Miscellaneous Methods of Analysis:** Diazotisation titrations, Kjeldahl method of nitrogen estimation, Karl-Fischer titration, Oxygen flask combustion, gasometry.
- **Extraction procedures including separation of drugs from excipients**

Unit-III

[10]

- **Chromatography:** The following techniques will be discussed with relevant examples of Pharmacopoeial products.
- TLC, HPLC, GLC, HPTLC, Paper Chromatography and Column Chromatography.

Unit-IV

[10]

- **Electrochemistry:** Introduction, Dielectric cell, electrode potential, Nernst equation, Salt bridge, Standard potential, Reference & Indicator electrodes, measuring the relative voltage of cell.
- **Potentiometry:** General principles, instrumentation & applications.
- **Conductometry:** General principles, instrumentation & applications.
- **Coulometry:** General principles, instrumentation & applications.
- **Polarography:** General principles, instrumentation & applications.
- **Amperometry:**General principles, instrumentation & applications.

BOOKS RECOMMENDED:

1. Willard H.H., Merritt L.L. & Dean J.A., Instrumental Methods of Analysis, Van Nostrand, Reinhold, New York
2. Beckett A.H. & Stenlake J.B., Practical Pharmaceutical Chemistry, Vol. I & II, The Athlone Press of the University of London.
3. Connors K.A., A Text Book of Pharmaceutical Analysis, Wiley – Interscience, New York
4. Jeffery G.H., Bassett J., Mendham J, Denney R.C., Vogel's Text Book of Quantitative Chemical Analysis, Addison Wesley Longman, Indian Branch Delhi
5. Ewing Gale W., Instrumental Methods of Chemical Analysis, Mc Graw Hill, USA

BACHELOR OF PHARMACY

THIRD SEMESTER

ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION (APHE-II)

Course Code: bph 209 **L-3** **Credits-3**

Unit-I [10]

- **Digestive System:** Gross anatomy of the gastro-intestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food. Disorders of digestive system.
- **Respiratory System:** Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity.
- **Urinary System:** Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base balance. Diseases of the urinary system.

Unit-II [10]

- **Central Nervous System:** Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain, cranial nerves and their functions.
- **Automatic Nervous System:** Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.

Unit-III

[10]

- **Reproductive System:** Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis & oogenesis. Pregnancy, its maintenance and parturition.
- **Endocrine System:** Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and Ovary, their hormones and functions.
- **Sense Organs:** Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

Unit-IV

[10]

- **Concepts of health and disease:** Disease causing agents and prevention of disease.
- **Classification of food requirements:** Balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water.
- **Demography and family planning:** Medical termination of pregnancy.
- **Communicable diseases:** Brief outline, their causative agents, modes of transmission and prevention (chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea, and AIDS).
- **First Aid:** Emergency treatment of shock, snake bites, burns, poisoning fractures and resuscitation methods.

BOOKS RECOMMENDED:

1. Ranade V.G., "Text book of Practical Physiology", Pune Vidyarthi Griha Prakashan, Pune.
2. Difore S.H., "Atlas of Normal Histology"- Lea & Febiger Philadelphia.
3. Chaurasia B.D., Human Anatomy, Reasonal & Applied Part-I, II & III, CBS Publisher & Distributors, New Delhi.
4. Guyton A.C., Hall JE, "Text book of Medical Physiology", WB Saunders Company.
5. Chatterjee C.C., "Human Physiology", Medical Allied Agency Calcutta.
6. Ross & Wilson, "Anatomy & Physiology in Health & Illness", Churchill Livingstone.
7. Tortora G.J. & Anagnodokos N.P., "Principles of Anatomy & Physiology", Harper & Row Publisher, New Delhi.
8. Parmar N.S., "Health Education & Community Pharmacy" CBS Publishers, Delhi.
9. Shalya Subhash " Human Physiology" CBS Publishers & Distributors.
10. Keele, C.A. Niel, E and Joels, N, Samson Wright's Applied Physiology, Oxford University Press.
11. Chaudhuri S.K.; Concise Medical Physiology.
12. Goyal R.K., Patel Natvar M. and Shah S.A., Practical Anatomy, Physiology and Biochemistry.
13. Dacie J.V., Lewis S.M.; Practical Haematology.

BACHELOR OF PHARMACY

THIRD SEMESTER

PHARMACEUTICS-II LAB.
(UNIT OPERATIONS I)

Course Code: bph 251 **L-0 P-4 Credits-2**

Unit Operation Practicals:

Measurement of flow of fluids and their pressure, determination of Reynold's number and calculation of frictional losses.

Evaluation of filter media, determination of rate of filtration and study of various factors affecting filtration.

Experiments to demonstrate applications of centrifugation.

Thermometers and Psychrometric charts for humidity measurements.

Determination of humidity – use of dry bulb and wet bulb thermometers.

BACHELOR OF PHARMACY

THIRD SEMESTER

PHARMACEUTICAL CHEMISTRY-IV LAB.
(ORGANIC CHEMISTRY – II)

Course Code: bph 253 **L-0 P-4 Credits-2**

1. Analysis of Oils and fats.
   (a) Acid Value
   (b) Saponification value
   (c) Iodine value

2. Synthesis of organic compounds preferably having heterocyclic ring system or involving two steps.(at least five)

3. Workshop on modeling of primary, secondary & tertiary structures of proteins.

BACHELOR OF PHARMACY

THIRD SEMESTER

PHARMACOGNOSY-II LAB.

Course Code: bph 255 **L-0 P-4 Credits-2**

1. Identification of crude drugs mentioned in theory.
2. Study of fibres and pharmaceutical aids.
3. Microscopic studies of seven selected crude drugs and their powders mentioned under the category of volatile oils in theory and their chemical tests.
4. General chemical tests for alkaloids, glycosides, steroids, flavonoids and tannins.

Suggested Practicals:

1. Morphology of Nutmeg, Cardamom, Valerian
2. Morphology of Turmeric, Ginger, Cannabis
3. Morphology of Cotton, Silk and Wool alongwith Chemical Tests
4. Morphology and microscopy of Clove
5. Morphology and microscopy of Fennel
6. Morphology and microscopy of Coriander
7. Morphology and microscopy of Cinnamon Bark
8. Morphology and microscopy of Dill
9. Morphology and microscopy of Eucalyptus
10. Test for identification of Glycosides (anthraquinone and saponins)
11. Test for identifications of Tannins.
12. Preparation of reagents for Alkaloids and perform chemical test on any alkaloid containing drug.
13. Chemical test of Balsam (Tolu and Peru) and Asafoetida
14. Test for identification of Steroids and Flavanoids.

BACHELOR OF PHARMACY

THIRD SEMESTER

PHARMACEUTICAL ANALYSIS – II

Course Code: bph 257 **L-0 P-4 Credits-2**

1. **Non-aqueous Titrations:** Preparation and standardization of perchloric acid and sodium/potassium/lithium methoxides solutions, Estimations of some pharmacopoeial products.
2. **Complexometric Titrations:** Preparation and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titrations.
3. Exercises involving Diazotisation, Kjeldahl & Karl-Fischer moisture determination 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, oxidaton-reduction titrations using potentiometric technique, Determination of acid-base dissolution constants and ploting of titration curves using pH meter.
7. Exercises involving polarimetry.
8. Exercises involving conductometric and polarographic techniques.

BACHELOR OF PHARMACY

THIRD SEMESTER

ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION (APHE-II)-LAB.

Course Code: bph 259 **L-0 P-4 Credits-2**

1. Study of different systems with the help of charts and models.
2. Microscopic studies of different tissues.
3. Simple experiments involved in the analysis of normal and abnormal urine: Collection of specimen, appearance, determination of pH, sugars, proteins, urea and creatinine.
4. Determination of blood groups and Rh factors.
5. Determination of vital capacity, experiments on spirometry.

BACHELOR OF PHARMACY

FOURTH SEMESTER

PHARMACEUTICS-III
(UNIT OPERATIONS II)

Course Code: bph 202 **L-3 T-1 Credits-4**

Unit-I

[10]

- **Stoichiometry:** Unit processes, material and energy balances, molecular units, mole fraction, tie lines, 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:** Sources of heat, heat transfer, steam as heating media, steam pressure.

Unit-II

[10]

- **Evaporation:** Basic concept of phase equilibria, factors affecting evaporation, evaporators; tube evaporators, film evaporators, single effect and multiple effect evaporators. Mathematical problems on evaporation.
- **Drying:** (a) Moisture content and mechanism of drying, rate of drying and time of drying calculations.

Unit-III

[10]

- **Drying:** (b) Classification and types of dryers, dryers used in pharmaceutical industries: Tray Dryer, Spray Dryer, Fluidised Bed Dryer, Vacuum Dryer, Freeze Dryer, Mathematical problems on drying.
- **Distillation:** Raoult's law, phase diagrams, volatility, simple, steam and flash distillation, principles of rectification, Mc. Cabe Thiele method for calculations of number of theoretical plates, Azeotropic and extractive distillation. Mathematical problems on distillation.

Unit-IV

[10]

- **Size Reduction:** Definition, objective of size reduction, factors affecting size reduction, laws governing energy and power requirement of a mill including ball mill, hammer mill, fluid energy mill, bhurstone mill.
- **Mixing – T**heory of mixing; Solid-Solid, Solid-Liquid and Liquid-Liquid mixing, equipments.

BOOKS RECOMMENDED:

1. Badger W.L. and Banchero J.T; Introduction to Chemical Engineering, Mc Graw Hill, International Book Co.,London, latest edition.
2. Perry R.H. & Clinton C.H. Chemical Engineers Handbook, Mc Graw Kogakusha Ltd., latest edition.
3. McCabe W.L. and Smith J.C; Unit Operation of Chemical Engineering Mc Graw Hill International Book Co., London, latest edition.
4. Gavhane, K.A. "Unit Operation-II", Nirali Prakashan, Pune, latest edition.
5. Sambhamurthi, Pharmaceutical Engineering, New Age Publishers, Delhi, latest edition.
6. C.V.S. Subramanyam, Thimma Shetty, Suresh, Kusum Devi; Pharmaceutical Engineering Principles and Practices; Vallabh Prakashan, Delhi.

BACHELOR OF PHARMACY

FOURTH SEMESTER

PHARMACEUTICAL MICROBIOLOGY

Course Code: bph 204 **L-3** **Credits-3**

Unit-I

[10]

- Introduction and the scope of microbiology.
- Structure of bacterial cell.
- Classification of microbes and their taxonomy, Bacteria and Viruses.

Unit-II

(10)

- Identification of Microbes: stains and types of staining techniques, electron microscopy.
- Nutrition, cultivation, isolation of bacteria and viruses.
- Microbial genetics and variation.

Unit-III

[10]

- Control of microbes by physical and chemical methods.

a. Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
b. Sterilization, different methods, validation of sterilization methods & equipments.

Unit-IV

[10]

- Sterility testing of Pharmaceutical products as per Indian Pharmacopoeia.
- Microbial assays of Antibiotics & Vitamins.
- Immunity, primary and secondary, defensive mechanisms of body, microbial resistance, interferon.

BOOKS RECOMMENDED:

1. Pelczar & Reid, Microbiology, Tata McGraw Hill, Delhi, latest edition.
2. Ananthanarayan R & Panikeer CKJ, Textbook of Microbiology, Orient Longman, latest edition.
3. Hugo and Russel, Pharmaceutical Microbiology, Black Well Scientific Publication, Oxford
4. Prescott L.M., Harley J.P. & Klien D.A.Microbiology, Mc Graw Hill, latest edition.
5. Satiner R.Y., Ingraham, J.L., Wheelis M.L. & Painter P.R. General Microbiology, Macmillan Press Limiteed
6. Gunasekaran P, Laboratories Mannual of Microbiology, New Age Publishers
7. Aneja K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom Cultivation, Vishwa Prakashan.
8. Virella G. Microbiology and Infectious Diseases, William & Wilkins, latest edition.

BACHELOR OF PHARMACY

FOURTH SEMESTER

PHARMACOGNOSY-III

Course Code: bph 206 **L-3** **Credits-3**

Unit-I

[10]

- Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substituents, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides:
  (i) **Saponins:** Liquorice, ginseng, dioscorea, sarsaparilla and senega.
  (ii) **Cardioactive sterols:** Digitalis, squill, strophanthus and thevetia.
  Anthraquinone cathartics: Aloe, senna, rhubarb and cascara.
  (iii) **Others:** Psoralea, Ammi majus, Ammi visnaga, gentian, saffron, chirata, quassia.

Unit-II

[10]

- 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:
- Amla, Kantkari, Satavari, Tylophora, Bhilawa, Kalijiri, Bach, Rasna, Punarnava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi, Adusa, Arjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gyumnema, Shilajit, Nagarmotha, Neem, Tulsi.

Unit-III

[10]

- The holistic concept of drug administration in traditional systems of medicine. Introduction to ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas.
- Herbs as health foods.
- Herbal cosmetics.

Unit-IV

- Standardisation of Herbal Drugs [10]
- Utilization and Production of Phytoconstituents such as Calcium, Sennosides, Diosgenin, Solasodine & Podophyllotoxin 1`

BOOKS RECOMMENDED:

1. Kokate, C.K."Practical Pharmacognosy" Vallabh Prakashan Delhi.
2. Wallis T.E., Analytical Microscopy, J&A Churchill Limited, London.
3. Trease, G.E. & Evans, W.C., Evans, W.C., "Pharmacognosy" Bailleire Tindall East Boarne, U.K.
4. Tyler V.E.: "Pharmacognosy" Lea & Febiger, Philadelphia.
5. Wallis, T.E., "Text book of Pharmacognosy", J&A Churchill Ltd. London.
6. Kokate, C.K.Pharmacognosy, Nirali Prakashan, Pune., J.A. Churchill, Ltd.
7. Medicinal Plants of India I & II, Indian council of Medical Research, New Delhi.
8. Nadkarni A.K. Indian Materia Medica 1-2, Popular Prakashan (P) Ltd. Mumbai
9. Atal C.K. & Kapur BM, "Cultivation & Utilization of Medicinal Plant, RRL, Jammu.
10. Indian Herbal Pharmacopoeia, Vol.I & II, ICMR & RRL, Jammu.
11. The Wealth of India, Raw Materials(All Volumes) Council of Scientific & Industrial Research, New Delhi.
12. Rastogi & Malhotra, Compendium of Indian Medicinal Plants I-IV
13. Indian Ayurvedic Pharmacopoeia, Govt.of India.
14. Kokate C.K.,Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Publication.

BACHELOR OF PHARMACY

FOURTH SEMESTER

PATHOPHYSIOLOGY OF COMMON DISEASES

Course Code: bph 208 **L-4 T-0 Credits -4**

Unit-I

[10]

- **Basic Principles of Cell Injury and Adaptation:** Causes of Cellular injury, pathogenesis, morphology of cell injury. Intercellular alterations in lipids, proteins and carbohydrates, cellular adaptation, atrophy, hypertrophy.

Unit-II

[10]

- **Basic Mechanicms involved in the process of inflammation and repair:** Alterations 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

[10]

- **Pathophysiology of Common Diseases:** Rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania, hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction

Unit-IV

[10]

- **Pathophysiology of Common Diseases:** Diabetes, peptic ulcer, asthma, ulcerative colitis, hepatic disorders, acute and chronic renal failure.

- Tuberculosis, urinary tract infections, sexually transmitted diseases, anemias and common types of neoplasms. Wherever applicable the molecular basis should be discussed.

BOOKS RECOMMENDED:

1. Dipiro JL, Pharmacotherapy – A Pathophysiological Approach, Elsevier.
2. Robbins SL, Kumar V, Basic Pathology, WB Saunders.
3. Mohan H. ; Text Book of Pathology
4. Mentz H.E.A; Pathophysiology in Medical Science.
5. Miller M.J.; Pathophysiology – Principle of Disease

BACHELOR OF PHARMACY

FOURTH SEMESTER
PHARMACEUTICS-IV
(DISPENSING & COMMUNITY PHARMACY)

Course Code: 210 **L-3 T-1** **Credits-4**

Unit-I

[10]

- **Definition and Scope**
- **Prescription:** Handling of prescription, source of errors in prescription, care required in dispensing procedures.
- General dispensing procedures including labeling of dispensed products.
- Pharmaceutical Calculations: Posology, calculation of dosage for infants, adults and elderly patients; Enlarging and reducing recipes percentage solutions, allegation, alcohol dilution, proof spirit, isotonic solution, displacement value etc.

Unit-II

[10]

- **Principles involved and procedures adopted in dispensing of:** typical prescriptions like mixtures, solutions, emulsions, creams, ointments, powders, capsules, pastes, jellies, suppositories, ophthalmics, pastilles, lozenges.

Unit-III

[10]

- **Principles involved and procedures adopted in dispensing of:** Pills, Lotion Liniments, Inhalations, Paints, Sprays, Tablet Triturates.
- **Incompatibilities:** Physical, chemical and therapeutic incompatibilities occurrence and methods of correction. (along with examples)

Unit-IV

[10]

- **Community Pharmacy:** Organization and structure of retail and whole sale drug sale, types of drug store and design, legal requirements for establishment, maintenance and drug store-dispensing proprietary products, maintenance of records of retail and whole sale , patient counseling, role of pharmacist in community health care and education .

BOOKS RECOMMENDED:

1. Carter, S.J.Cooper and Gunn's Dispensing for Pharmaceutical students, CBS Publishers, Delhi, latest edition
2. Stoklosa, M.J. Pharmaceutical Calculations, Lea & febiger, Philadelphia, latest edition
3. Zafar & Zafar, Health Education & Community Pharmacy, latest edition

BACHELOR OF PHARMACY

FOURTH SEMESTER

PHARMACEUTICS-III LAB.
(UNIT OPERATIONS II)

Course Code: bph 252 **L-0 P-4 Credits-2**

1. Determination of overall heat transfer coefficient.
2. Experiments to illustrate the influence of parameters like surface area, temperature on evaporation, etc.
3. Experiments based on steam distillation, simple distillation, etc.
4. Determination of rate of drying, free moisture content, bound moisture content and equilibrium moisture content, etc.
5. Experiments to illustrate the influence of various parameters on the rate of drying like surface area temperature, etc.
6. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of size reduction, etc.
7. Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers, etc.
8. And other related experiments.

BACHELOR OF PHARMACY

FOURTH SEMESTER

PHARMACEUTICAL MICROBIOLOGY LAB.

Course Code: bph 254 **L-0 P-4 Credits-2**

- Experiments devised to prepare various types of culture media, sub-culturing of common aerobic and anaerobic bacteria, fungus and yeast, 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 IP requirements, microbial assay of antibiotics and vitamins etc.

SUGGESTED PRACTICALS:

1. Preparation of various types of culture media.
2. Subculturing of common bacteria, fungi & yeast.
3. Isolation of bacteria.
4. Identification and staining of bacteria.
   - Simple staining
   - Gram Staining
   - Acid fast staining
   - Negative staining
   - Hanging drop preparation
5. To study the effect of pH and temperature on the growth of bacteria.
6. To investigate ability of given culture to ferment carbohydrates (glucose, lactose) and to hydrolyse starch.
7. Evaluation of disinfectants and antiseptics.
   - Phenol Coefficient test, minimum inhibitory concentration.
8. Study of sterilization methods & equipments
   - Dry heat
   - Moist heat
9. Test for sterility of Pharmaceutical products as per IP.
10. Microbial assay of antibiotics. As per IP.

BACHELOR OF PHARMACY

FOURTH SEMESTER

PHARMACOGNOSY-III LAB.

Course Code: bph 256 L-0 P-4 Credits-2

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.

SUGGESTED PRACTICALS:

1. Morphology and microscopy (powder) of Liquorice along with its chemical tests.
2. Morphology of Aloe and chemical tests of Aloe-extracts.
3. Morphology, microscopy (powder and T.S.) of Senna Leaf.
4. Morphology, microscopy (powder) of Rhubarb.
5. Morphology of Psoralia, Amimajus, saffron, and Chirata
6. Morphology of Amla, Kantkari, Shatavari and Bach.
7. Morphology of Punarnava, Apamarg, Gokhru and Shankh-pushpi.
8. Morphology of Brahmi, Methi, Lehsun and Palash.
9. (a) Morphology of Nagarmotha and Neem.
   (b) Identification Tests for Guggal liquids.
10. To study the following standards-
    (a) Loss of drying (b) Extractive values (c) Ash values
    (d)P_H of 1% solution, in water and alcohol of any Ayurvedic formulation (solid) available in the market.
11. To perform above studies (exp.10) in any liquid Ayurvedic formulation.
12. Preparation of medicated oil.

PROJECT WORK:

A report on marketed preparations based on traditional drugs mentioned in theory.

BACHELOR OF PHARMACY

FOURTH SEMESTER

PHARMACEUTICS-IV LAB.
(DISPENSING & COMMUNITY PHARMACY)

Course Code: bph 258 **L-0 P-4 Credits-2**

1. **Dispensing of prescriptions falling under the categories:**
   Mixtures, solutions, emulsions, creams, ointments, powders, suppositories, ophthalmics, capsules, pastes, jellies, lotions, liniments, inhalations, paints, etc.
2. Identification of various types of incompatibilities in prescription, correction thereof and dispensing of such prescriptions.
3. Dispensing procedures involving pharmaceutical calculations, pricing of prescriptions.
4. Dispensing of prescriptions involving adjustment of tonicity.

BACHELOR OF PHARMACY

FIFTH SEMESTER

PHARMACEUTICAL CHEMISTRY-V

(BIOCHEMISTRY)

Course Code: bph 301 **L-3** **Credits-3**

Unit-I

[10]

- Biochemical organization of the cell and transport processes across cell membrane.
- 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.
- **Carbohydrate Metabolism:** Conversion of polysaccharide to glucose phosphate, Glycolysis, Gluconeogenesis Glyconeogenesis, Metabolism of galactose and galactosemia, Role of sugar nucleotides in biosynthesis and Pentosephosphate pathway.

Unit-II

[10]

- **Enzymes:** Nomenclature, enzyme kinetics and its mechanism of action, mechanism of inhibition of enzymes and iso-enzymes in clinical diagnosis.
- **Co-enzymes:** Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance.
- **Biological Oxidation:** The respiratory chain, its role in energy capture and its control, Energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation.

Unit-III

[10]

- **Lipids Metabolism:** Oxidation of fatty acids, oxidation & energetic, α-oxidation, β-oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids.
- Biosynthesis of amino acids, Catabolism of amino acids, Conversion of amino acids to specialized products, biosynthesis of purines and Pyrimidine, formation of deoxyribonculeotides.

Unit-IV

[10]

Biosynthesis of Nucleic Acids,Biosynthesis of DNA and its replication, Mutation, Physical & chemical mutagenesis, carcinogenesis, DNA repair mechanism, Biosynthesis of RNA.

- Genetic code and Protein Synthesis, Components of protein synthesis, and Inhibition of protein synthesis.

- Regulation of gene expression.

BOOKS RECOMMENDED:

1. Jayaraman J., Laboratory manual in Biochemistry, Wiley Eastern limited.
2. Plummer, David J., An Introduction to practical Biochemistry, Mc Graw Hill, New Delhi.
3. Singh S.P., Practical manual to Biochemistry, CBS Publisher, New Delhi.
4. Martin D.W., Mays P.A. & Redwell V.M., "Harper's review of Biochemistry" Lange Medical Publication.
5. Conn E.E. & Stumph P.K., Outline of Biochemistry, Macmillan Worth Publishers.
6. Nelson D.L. & Cox MM, Lehninger Principles of Biochemistry, Mcmillan Worth Publishers.
7. Stryer L., Biochemistry, WH, Freeman & Company, San Francisco.
8. Harrow B. & Mazur A., Text Book of Biochemistry, W.B. Saundeers Co., Philadelphia.

BACHELOR OF PHARMACY

FIFTH SEMESTER
PHARMACEUTICS-V
(PHYSICAL PHARMACY)

Course Code: bph 303 **L-3 T-1 Credits-4**

Unit-I

[10]

- **Matter: properties of matter**: states of matter, change in the state of matter, latent heat and vapor pressure, sublimation, critical point, Eutectic mixture, gases, aerosoles-inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solids-crystalline, amorphous and polymorphism.
- **Micromeretics and Powder Rheology:** Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangements, densities, bulkiness & flow properties.

Unit-II

[10]

- **Surface and Interfacial Phenomenon:** Liquid interface, suface and interfacial tensions, surface free energy, measurement of surface and interfacial tension, 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, kinematic viscosity, effect of temperature, non-newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers.

Unit-III

[10]

- **Dispersion Systems:** Colloidal Dispersions: Definition, types, properties of colloids, protective colloids, application of colloids in Pharmacy; suspension and emulsions; Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations; emulsion-types, theories, physical stability.

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

Unit-IV

[10]

- **Kinetics and Drug Stability**: General considerations & concepts, half-life determination, influence of temperature, light, solvent, catalytic species and other factors, accelerated stability study, expiration dating, climatic zones & ICH guidelines.
- **Buffers**: 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.

BOOKS RECOMMENDED:

1. Martin A, Bustamante P.& Chun A.H.C., Physical Pharmacy, Lea & Febiger, Philadelphia, latest edition.
2. Shotten E & Ridgaway K; Physical Pharmaceutics, Oxford University Press, London, latest edition.
3. Conores, K.A., Amiden, G.L. and Stella, V.J. Chemical Stability of Pharmaceuticals John Wiley and Sons, New York, latest edition.
4. Genaro, A.R; Remington's Pharmaceutical Science. 19th Ed. Mack Publishing Co. , latest edition.
5. Subhramanyam, C.V.S. Text Book of Physical Pharmaceutics. Vallabh Prakashan, New Delhi, latest edition.
6. Martin A., A., Bustamante, P., A.H.C. Physical Pharmacy. 4th Edition. B.I.Waverly (P) Ltd., New Delhi, latest edition.
7. Agarwal S.P., Khanna Rajesh; Physical Pharmacy, CBS Publisher, New Delhi, latest edition.

BACHELOR OF PHARMACY

FIFTH SEMESTER

PHARMACOLOGY- I

Course Code: bph 305 **L-3** **Credits-3**

Unit-I

[10]

- **General Pharmacology:** Introduction to Pharmacology, sources of drugs. dosage forms and routes of administration, mechanism of action, factors modifying drug action, tolerance and dependence, pharmacogenetics.
- Absorption, Distribution, Metabolism and Excretion of drugs, Principles of basic and clinical pharmacokinetics, adverse drug reactions and treatment of poisoning, ADME drug interactions. Drug addition and drug abuse.
- Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs.

Unit-II

[10]

- **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 anaesthetic Agents.

Unit-III

[10]

- **Pharmacology of Central Nervous System:**
  a. Neurohumoral transmission in the C.N.S.
  b. General Anaesthetics.
  c. Alcohols and Disulfiram.
  d. Sedatives, hypnotics, anti-anxiety agents and centrally acting muscle relaxants.
  e. Psychopharmacological agents anti psychotics antidepressants, anti maniacs and hallucinogens.

Unit-IV

[10]

- Anti-Epileptics drugs.
- Anti-Parkinsonian Drugs.
- Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs.
- Narcotic analgesics and antagonists.
- C.N.S. stimulants

BOOKS RECOMMENDED:

1.Grover J.K., Experiments in Pharmacy & Pharmacology, CBS, New Delhi.
2.Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
3.Barar F.S.K.,Text Book of Pharmacology, Interpoint, New Delhi.
4.Goodman & Gilman, The Pharmacological basis of Therapeutics, Editors: J.G. Hardman, L.E. Limbird, P.B. Molions, R.W.Ruddon and A.G. Gil, Pergamon press.
5.Katzung, B.G.,Basic & Clinic Pharmacology, Prentice Hall, international.
6.Laurence, D.R. & Bennet P. N., Clinical Pharmacology, Churchill Livingstone.
7.Rang MP, Dale MM, Riter JM., Pharmacology Churchill Livingstone.
8.Tripathi K.D., Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
9.Satoskar & Bhandarkar, Pharmacology & Pharmacotheropeutics, Popular Prakashan Pvt.Ltd. Mumbai.
10. Lewis's Pharmacology, revised by James Crossland.
11. Ghosh, M.N.; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
12. Ian Kitchen, "Text Book of in vitro pharmacology.".

BACHELOR OF PHARMACY

FIFTH SEMESTER

PHARMACOGNOSY-IV

Course Code: bph 307 **L-3** **Credits-3**

Unit-I

[10]

- Systematic study of sources, 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 and Withania.
  c) **Quinoline and isoquinoline:** Cinchona, Ipecac, Opium.
  d) **Indole:** Ergot, Rauwolfia, Catharanthus, Nux-vomica and Physostigma.
- Role of medicinal and aromatic plants in national economy.

Unit-II [10]

(a) **Imidazole:** Pilocarpus.
(b) **Steroidal:** Veratrum and Kurchi.
(c) **Alkaloidal amine:** Ephedra and Colchicum.
(d) **Glycoalkaloid:** Solanum.
(e) **Purines:** Coffee, Tea and Cola.

- **Biological sources, preparation, identification tests and uses of the following enzymes:** Diastase, Papain, Pepsin, Trypsin, Pancreatin.
- **Natural allergens and photosensitizing agents & fungal toxins**

Unit-III

[10]

- General techniques of biosynthetic studies and basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance.
- Plant bitters and sweeteners

Unit-IV

[10]

- Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.

- Historical developments of plant tissue culture, types of cultures, nutritional requirements, growth & maintaince Application of plant tissue culture in Pharmacognosy

BOOKS RECOMMENDED:

1. Kokate, C.K."Practical Pharmacognosy" Vallabh Prakashan Delhi.
2. Wallis T.E., Analytical Microscopy, J&A Churchill Limited, London.
3. Ganborg & Weltor, Plant Tissue Culture Methods, National Research Council of Canada, Saskatchewan.
4. Clarke ECG, Isolation & Identification of Drugs, The Pharmaceutical Press, London.
5. Trease, G.E. & Evans, W.C., "Pharmacognosy" Bailleire Tindall East Boarne, U.K.
6. Tyler V.E.: "Pharmacognosy" Lea & Febiger, Philadelphia.
7. Wallis, T.E., "Text book of Pharmacognosy", J&A Churchill Ltd. London.
8. Kokate, C.K.etal Pharmacognosy, Nirali Prakashan, Pune.,
9. Atal C.K. & Kapur BM, "Cultivation & Utilization of Medicinal Plant, RRL, Jammu.
10. Stahl .E, Thin Layer Chromatography, A Laboratory Handbook, Springer Verlog, Berlin.
11. Henry TA. The Plant Alkaloids, Mc Graw Hill, New York.
12. Dixit, V.K.,Vyas S.P.Pharmaceutical Biotechnology, CBS Publication, New Delhi.
13. Street H.E. Tissue Culture & Plant Science, Academic Press, London.
14. Kokate C.K.,Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Publication.

BACHELOR OF PHARMACY

FIFTH SEMESTER

PHARMACEUTICS VI
(HOSPITAL PHARMACY)

Course Code: bph 309 **L-3** **Credits-3**

Unit-I

[10]

- **Organization and structure:** Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist, Pharmacy and therapeutic committee, Budget preparation and implementation.
- **Hospital Formulary:** Contents, preparation and revision of hospital formulary.

Unit-II

[10]

- **Drugs Store Management and Inventory Control:**
  (a) Organization of drug store, types of materials stocked, storage conditions.
  (b) Purchase and Inventory control – principles, purchase procedures, purchase order, procurement and stocking.
- **Central Sterile Supply Unit and their Management:** Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, supply of sterile materials.

Unit-III

[10]

- **Drug Information Services:** Sources of information on drugs, disease, treatment schedules, procurement of information, computerized services (e.g., MEDLINE), retrieval of information, medication error.
- **Records and Reports:** Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc.

Unit-IV

[10]

- **Drug distribution Systems in Hospitals:**
  (a) Out-patient dispensing, methods adopted.
  (b) Dispensing of drugs to in-patients. Types of drug distribution systems, charging policy, labeling.
  (c) Dispensing of drugs to ambulatory patients.
  (d) Dispensing of controlled drugs.
- **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 laboratory using radiation dosmetry, radio-isotope generators, permissible radiation dose level, radiation hazards and their prevention, specifications for radio-active laboratory.

BOOKS RECOMMENDED:

1. Hasan, Hospital Pharmacy, Lea & Febiger , Philadelphia.
2. Merchant H.S. and Qadry J.S. Text Book of Hospital Pharmacy, B.S. Shah Prakashan, Ahmedabad.
3. Heifindal *et al*: Clinical Pharmacy & Therapeutics.
4. Allwood & Fell , Hospital Pharmacy.
5. Dandiya P.C., Khar R.K. & Gurbani; Pharmacist year Book, CBS Publishers.
6. Ramington's Pharmaceutical Sciences, Vol. I & Vol. II, Mack Publishing C., USA, latest edition.
7. Text book of Hospital & Clinical Pharmacy, Pratibha Nand & Dr. R.K Khar,.Birla Publication, Delhi-32.

BACHELOR OF PHARMACY

FIFTH SEMESTER

PHARMACEUTICAL CHEMISTRY-V LAB.
(BIOCHEMISTRY)

Course Code: bph 351 **L-0 P-4 Credits-2**

1. Estimation of glucose in Blood.
2. Estimation of liver glycogen.
3. Estimation of protein in serum.
4. Determination of Creatinine and Creatine in blood & urine.
5. Estimation of chloride in serum & urine.
6. Estimation of free fatty acids in serum.
7. Estimation of uric acid in serum & urine.
8. Determination of acid and alkaline phosphate.
9. Determination of SGOT & SGPT.
10. Determination of Blood Cholestrol.
11. Determination of serum bilirubin.
12. Estimation of RNA & DNA.
13. Electrophoretic separation of serum proteins.
14. Fat determination in milk.

BACHELOR OF PHARMACY

FIFTH SEMESTER

PHARMACEUTICS-V LAB.

(PHYSICAL PHARMACY)

Course Code: bph 353 **L-0 P-4 Credits-2**

- Determination of particle size distribution, using various methods.
- Determination of true density, bulk density, percentage porosity and angle of repose.
- Determination of surface tension, HLB and CMC of surfactant.
- Determination of relative viscosity, absolute viscosity, using Oswald viscometer.
- To study the effect of different concentration of polymeric substances on viscosity.
- Determination of shelf life, using accelerated stability studies.
- Determination of reaction rate constant and half-life.
- Preparation of emulsion and identification test for emulsion.
- Preparation of pharmaceutical buffers and determination of buffer capacity,

BACHELOR OF PHARMACY

FIFTH SEMESTER

PHARMACOLOGY-I LAB.

Course Code: bph 355 **L-0 P-4 Credits-2**

PRACTICAL:

Use of computer simulated CDs or Video cassettes for Pharmacology practical whenever possible.

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 anaesthetics used in animal studies.
   - Commonly used instruments in experimental pharmacology.
   - Some common and standard techniques.
   - Bleeding and Intravenous injection.
   - 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.

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** using isolated preparations like rat ileum, guinea pig.

BACHELOR OF PHARMACY

FIFTH SEMESTER

PHARMACOGNOSY-IV LAB.

Course Code: bph 357 **L-0 P-4 Credits-2**

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 constitutuents.
5. Some experiments in plant tissue culture.

SUGGESTED PRACTICALS:

1. To study the morphology and microscopy of Datura and Withania.
2. To study the morphology and microscopy of Ipecae and Rauwolfia.
3. To study the morphology and microscopy of Catharanthus and Nux-vomica.
4. To study the morphology and microscopy of Ephedra and Kurchi.
5. To study the morphology and microscopy of Solanum and Vasaca.
6. a) Morphology of Areca, Colchicum.
   b) Transverse section of Catharanthus leaf and Kurchi bark.
7. To study the TLC profile of Catharanthus leaf.
8. To study the TLC profile of Withania root.
9. Chemical test of Tea, Tobacco, Datura and Withania.
10. Chemical test of Nux-vomica, Ephedra and Kurchi.

BACHELOR OF PHARMACY

FIFTH SEMESTER

PHARMACEUTICS VI LAB.
(HOSPITAL PHARMACY)

Course Code: bph 359 **L-0 P-4 Credits-2**

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. Preparation & evaluation of sterile dosage form.
4. Evaluation of surgical dressing.

BACHELOR OF PHARMACY

SIXTH SEMESTER

PHARMACEUTICAL CHEMISTRY-IV
(MEDICINAL CHEMISTRY-I)

Course Code: bph 302 **L-3 T-1 Credits-4**

Unit-I

[10]

- **Basic Principles of Medicinal Chemistry :** Physico-chemical aspects (optical, geometric and bioisosterism) of drug molecules and biological action, Drug-receptor interaction including transduction mechanisms.

- **Principles of Drug Design (Theoretical Aspects) :** Traditional analog (QSAR) and mechanism based approaches (Introduction to graph theory, applications of quantum mechanics, Computer aided drug designing (CADD) and molecular modeling.

Unit-II

[10]

- **Drugs acting at Synaptic and neuro-effector junction sites:**
  i. Cholinergics and Anticholinesterases .
  ii. Adrenergic drugs.
  iii. Antispasmodic and anti ulcer drugs.
  iv. Neuromuscular blocking agents.

Unit-III

[10]

- **Autocoids**
  i. Antihistamines
  ii. Eicosanoids
  iii. Analgesics-antipyretics, anti-inflammatory (non-steroidal) agents.

Unit-IV

[10]

- **Drugs affecting uterine motility:**
  Oxytocics (including oxytocin, ergot alkaloids and prostaglandins) Biochemical approaches in drug designing wherever applicable should be discussed.

BOOKS RECOMMENDED:

1. Mann P. G. & Saunders B. C., Practical Organic Chemistry, ELBS/Longman, London.
2. Furnis B. A., Hannaford A. J., Smith P. W. G. and Tatehell A. R., Vogels's Text Book of Practical Organic Chemistry, The ELBS/Longman, London.
3. Indian Pharmacopoeia, Ministry of Health, Govt. of India.
4. Abraham, Burger's Medicinal Chemistry and Drug Discovery, John Wiley and sons, New York.
5. Dagado J.N. and Remers W A R, 10^{th} eds., Wilson and Giswold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
6. Foye W. C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh H. and Kapoor, V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
8. Nogrady; T, Medicinal Chemistry- A Biochemical Approach, Oxford University Press, New York, Oxford.
9. Finar I.L. Organic Chemistry Vol.I & II ELBS/ Longman, London.

BACHELOR OF PHARMACY

SIXTH SEMESTER

PHARMACEUTICAL JURISPRUDENCE & ETHICS

Course Code: bph 304 **L-4** **Credits-4**

Unit-I

[10]

- **Introduction**
  a. Pharmaceutical Legislations – A brief review.
  b. Drugs & Pharmaceutical Industry – A brief review.
  c. Pharmaceutical Education – A brief review.
  d. Pharmaceutical Ethics
- An elaborate (practical oriented) study of Pharmacy Act 1948.

Unit-II

[10]

- An elaborate (Practical oriented) study of Drugs and Cosmetics Act 1940 and Rules 1945.

Unit-III

[10]

An elaborate study of:

- Medicinal & Toilet Preparations (Excise Duties) Act 1955.
- Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
- Drugs Price Control Order.

A brief study of the following with special reference to the main provisions.

- Poisons Act 1919
- Drugs and Magic Remedies (Objectionable Advertisements) Act 1954.
- Medical Termination of Pregnancy Act 1970 & Rules 1975.

Unit-IV

[10]

A brief study of:

a) Prevention of Cruelty to Animals Act 1960.(Provisions related to experimentation on animals only)
b) States Shops & Establishments Act & Rules.
c) AICTE Act 1987
d) Patents Act 1970.
e) Factories Act 1948.

BOOKS RECOMMENDED:

1. Mittal B.M., Text Book of Forensic Pharmacy, National Book Centre, Dr.Sundari Mohan Avenue, Calcutta, latest edition.
2. Relevant Acts & Rules Published by the Govt. of India, latest edition.
3. Jain N.K., A Text Book of Forensic Pharmacy, Vallabh Prakashan, New Delhi, latest edition.
4. Singh Harkrishan, "History of Pharmacy in India, Vol-I, II & III" Vallabh Prakashan, Delhi, latest edition.

Note: The teaching of all the above Acts should cover the latest amendments.

BACHELOR OF PHARMACY

SIXTH SEMESTER

PHARMACEUTICS VII
(BIOPHARMACEUTICS & PHARMACOKINETICS)

Course Code: bph 306 **L-3** **Credits-3**

Unit-I

[10]

- Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting.
- **Biopharmaceutics:**
  a. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
  b. Factors influencing absorption – Physicochemical, physiological and pharmaceutial.
  c. Drug distribution in the body, plasma protein binding.

Unit-II

[10]

- **Phamacokinetics:**
  a. Significance of plasma drug concentration measurement.
  b. Compartment model – Definition and scope.
  c. Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant using Wagner – Nelson and Loo-Riegelman method.
  d. Volume of distribution and distribution coefficient.

Unit-III

` [10]

- 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.

Unit-IV

[10]

- **Clinical Pharmacokinetics:**
  a. Definition and scope
  a. Dosage adjustment in patients with and without renal and hepatic failure.
  b. Pharmacokinetic drug interactions and their significance in combination therapy.
- **Bioavailability and bioequivalence:**
  a. Measures of bioavailability, Cmax, tmax, and area under the curve (AUC).
  b. Review of regulatory requirements for conduction of bio-equivalent studies.

BOOKS RECOMMENDED:

1. Notari, R.E., Biopharmacutics and Pharmacokinetics – An Introduction Marcel Dekker Inc. New York, latest edition.
2. Rowland M, and Tozer T.N. Clinical Pharmacokinetics, Lea & Febriger, New York, latest edition.
3. Wagner J.G. Fundamentals of Clinical Pharmacokinetics, Drug Intelligence Publishers, Hamilton, latest edition.
4. Wagner J.G. Pharmacokinetics, for the Pharmaceutical Scientist, Technomic publishing A.G. Basel, Switzerland, latest edition.

BACHELOR OF PHARMACY

SIXTH SEMESTER

PHARMACOLOGY-II

Course Code: bph 308 **L-4** **Credits-4**

Unit-I

[10]

- **Pharmacology of Cardiovascular System:**
  a) Digitals and cardiac glycosides.
  b) Antihypertensive drugs.
  c) Antianginal and Vasodilator drugs, including calcium channel blockers and beta adrenergic antagonists.
  d) Antiarrhythmic drugs

Unit-II

[10]

- **Drugs Acting on the Hemopoietic System:**
  a. Hematinics.
  b. Antihyperlipedemic drugs.
  c. Drugs used in the therapy of shock.
  d. Anticoagulants, Vitamin K and hemostatic agents.

Unit-III

[10]

- **Drugs acting on Urinary System:**
  a. Fibrinolytic and anti-platelet drugs.
  a) Blood and plasma volume expanders.
  b) Fluid and electrolyte balance.
  c) Diuretics.

Unit-IV

[10]

- **Autocoids:**
  a) Histamine, 5-HT and their antagonists.
  b) Prostaglandins, Thromboxanes and Leukotrienes.
  c) Pentagastrin, Cholecystokinin, Angiotension, Bradykinin and Susbtance P.

- **Drugs Acting on the Respiratory System:**
  a) Anti-asthmatic drugs including bronchodilators.
  b) Anti-tussives and expectorants.
  c) Respiratory stimulants.

BOOKS RECOMMENDED:

1. Ghosh MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
2. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS, New Delhi.
3. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
4. Barar F.S.K.; Text Book of Pharmacology, Interprint, New Delhi.
5. Goodman & Gilman, The Pharmacological basis of Therapeutics, Editors: J.G. Hardman, L.E. Limbird, P.B. Molinoss, R.W.Ruddon and A.G. Gil, Pergamon press.
6. Katzung, B.G.; Basic & Clinic Pharmacology, Prentice Hall, international.
7. Laurence, D.R. & Bannet P.N.; Clinical Pharmacology, Churchill Livingstone.
8. Rang MP, Dale MM, Riter JM, Pharmacology Churchill Livingstone.
9. Tripathi, K.D., Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
10. Satoskar & Bhandarkar; Pharmacology & Pharmacotheropeutics, Popular Prakashan Pvt.Ltd. Mumbai.
11. Craig, C.R. and Stitzel, R.R.; Modern Pharmacology, Little Brown and Co.1994.

BACHELOR OF PHARMACY

SIXTH SEMESTER

PHARMACOGNOSY-V
(CHEMISTRY OF NATURAL PRODUCTS)

Course Code: bph 310 **L-3** **Credits-3**

Unit-I

[10]

- Chemical and spectral approaches to simple molecules of natural origin.
- Concept of stereoisomerism taking examples of natural products.

Unit-II

[10]

- Chemistry, biogenesis and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes, and triterpenoids.
- **Carotenoids:** β-carotenoids, α-carotenes, vitamin A, Xanthophylls of medicinal importance.

Unit-III

[10]

- **Glycosides:** Chemistry and biosynthesis of digitoxin, digoxin, hecogenin, sennosides, diosgenin and sarasapogenin.
- **Alkaloids:** Chemistry, biogenesis and pharmacological activity of atropine and related compounds; quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids.

Unit-IV

[10]

- Chemistry and biogenesis of medicinally important lignans and quassanoids, flavonoids.
- Chemistry and therapeutic activity of penicillin, streptomycin and tetracyclines.

BOOKS RECOMMENDED:

1. Brain, K.R. & Turner T.D., "The Practical Evaluation of Phytopharmaceuticals", Wright, Bristol.
2. Stahl.E. "Thin Layer Chromatography" A Laboratory Hand Book" Springer Verlag, Berlin.
3. Pharmacopoeia of India.
4. Finar, I.L. "Organic Chemistry" Vol.I & II ELBS, London.
5. Aggarwal, O.P.,"Chemistry of Organic Natural Products", Vol.I & II, Goel Publ.House, Meerut.
6. Trease G.E. & Evan W.C., "Pharmacognosy" Baillaire Tindall East bourne, U.K.
7. Tyler V.E. "Pharmacognosy" Lea & Febiger, Philadelphia.
8. Pridham J.B. & Swain T. "Biosynthetic Pathway Higher Plants" Academic Press, New York.

BACHELOR OF PHARMACY

SIXTH SEMESTER

PHARMACEUTICAL CHEMISTRY-IV LAB.
(MEDICINAL CHEMISTRY-I)

Course Code: bph 352 **L-0 P-4 Credits-2**

1. Synthesis of selected drugs from the course content.
2. Establishing the pharmacopoeial standards of the drugs synthesized.
3. Exercises based on QSAR : Hansch & Free-Wilson methods.
4. Determination of partition coefficient, dissociation constant and molar refractivity of compounds.

BACHELOR OF PHARMACY
SIXTH SEMESTER

PHARMACEUTICS VII LAB.

(BIOPHARMACEUTICS & PHARMACOKINETICS)

Course Code: bph 356 **L-0 P-4 Credits-2**

1. Experiments designed for the estimation of various pharmacokinetic parameters with given data.
2. Analysis of biological specifications for drug content and estimation of the pharmacokinetic parameters.
3. *In vitro* evaluation of different dosage forms for drug release.
4. Absorption studies – *in vitro* and *in situ*.
5. Statistical treatment of pharmaceutical data.

SUGGESTED PRACTICALS:

1. Calculation of AUC for the data given by using:
   (i) Counting square method (ii) Weighing method (iii) Trapezoidal rule method.
2. (i) Comparison and calculation of absolute bioavailability of drug from the given solution.
3. (ii) Comparison and calculation of relative bioavailability of drug from the given solution.
4. Preparation of standard curve of Salicylic acid by calorimetric method.
5. Study of the influence of excipients on the rate of release of drug *in vitro*.
6. Study of the influence of excipients on the rate of release of drug in vitro by coating method.
7. Determination and comparison of the effects of excipients on the rate of release of a drug (salicylic acid) from various type of ointment by semipermeable membrane method.
8. Determination of the effect of experiments upon the rate of release of drug (salicylic acid) from capsule dosage form.
9. Calculation of K, V_d, $t_{½}$, C_o from a given problem.
10. Calculation of K_e and $t_{½}$ when 100 gm of dose administered by IV and cumulative amount of drug obtained in urine.
11. Determination of K_a, K, V_d when 100 mg of tablet dosage form is given by oral route.
12. Determination of K, $t_{½}$, when 10 mg of drug dissolved in 100 ml of water was assayed after keeping it at room temperature and removing the sample periodically.
13. Determination of V_d, K, $t_{½}$, duration of activity and increase in duration of activity.
14. Determination of K_a, $t_{½}$, t_{max} and V_d.
15. Determination of rate constant, half life by plotting a graph between time versus drug concentration.
16. Study of the rate of release of dispersible tablet .
17. Preparation and evaluation of paracetamol tablet.
18. Study of the rate of release of the rate of paracetamol tablet.
19. Study of the influence of experiments on the rate of release of a drug *in vitro* by coating method.

BACHELOR OF PHARMACY

SIXTH SEMESTER

PHARMACOLOGY-II LAB

Course Code: bph 358 **L-0 P-6 Credits-3**

SUGGESTED PRACTICAL:

a) To record the dose response curve (DRC) of Acetylcholine using ileum of rat.
b) To study the parallel shift of DRC in presence of competitive antagonist on DRC of Ach using rat ileum.
c) To study the CRC of histamine on guinea pig ileum preparation and study the effect of antihistamines.
d) To record the CRC of oxytocin using rat uterus preparation.
e) To study the dose response curve (DRC) of physostigmine using rat ileum.

BACHELOR OF PHARMACY

SIXTH SEMESTER

PHARMACOGNOSY-V LAB.
(CHEMISTRY OF NATURAL PRODUCTS)

Course Code: bph 360 **L-0 P-4 Credits-2**

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.

3.Extraction of volatile oils and their chromatographic profiles**.**

SUGGESTED PRACTICALS:

1. Isolation of caffeine from Tea leaves.
2. Isolation of Hesperidin from Orange Peel.
3. Isolation of caraway oil from Caraway.
4. Isolation of coriander oil from coriander.
5. Isolation of piperine from Black Pepper.
6. Isolation of Sennosides from Senna leaves.
7. To study TLC profile of extracted oils.
8. To perform column chromatography of any herbal drug.
9. To study paper chromatographic profile for glycone portion seoarated from senna.
10. Quantitative determination of Ascorbic acid present in Amla (Fresh /dry).
11. To isolate the active constituent of any available drug with the help of preparative TLC.

BACHELOR OF PHARMACY

SEVENTH SEMESTER

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: bph 401 **L-4** **Credits-4**

Unit-I

[10]

- **Immunology and Immunological Preparations:** Principles, antigens and haptens, immune system, cellular humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, standardization and storage of BCG.

Unit-II

[10]

- **Genetic Recombination:** Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as Activase, Humulin, Humatrope.

Unit-III

[10]

- **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 parameters. Isolation of mutants, factors influencing rate of mutation.

- **Microbial Transformation:** Introduction, types of reactions mediated by microorganisms, design of biotransformation processes, selection of organisms, biotransformation process and its improvements with special reference to steroids.

Unit-IV

[10]

- **Enzyme immobilization:** Techniques of immobilization of enzymes, factors affecting enzyme kinetics. Study of enzymes such as hyaluronidase, penicillinase, streptokinase, amylases and proteases etc. immobilization of bacteria and plant cells.

BOOKS RECOMMENDED:

1. Vyas S.P. and Dixit V.K., Pharmaceutical Biotechnology, CBS Publication, New Delhi.
2. Prescott and Dunn's Industrial Microbiology, CBS Publishers and Distributors, Delhi, latest edition.
3. P.F.Stanbury & A.Ahhitar, Principles of Fermentation Technology, latest edition.
4. K.Kieslich, Biotechnology, Vol. 69, Verleg Chernie Switzerland, 1984.
5. Stanbury,P.F., Whitaker A. & Hall S.J., Principles of Fermentation, Aditya Book Pvt.Ltd., New Delhi.
6. Crueger W. & Crueger A, Biotechnology-A Text Book of Industrial Microbiology, Panima Publishing Corporation, Delhi, Latest edition.

BACHELOR OF PHARMACY

SEVENTH SEMESTER

PHARMACEUTICS – VIII

(PHARMACEUTICAL TECHNOLOGY II)

Course Code: bph 403 **L-4** **Credits-4**

Unit-I

[10]

- **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, quality control.
- **Micro-encapsulation:** Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, co-acervation, multi orifice, spray drying, spray congealing, polymerization, complex emulsion, air suspension technique, coating pan and other techniques

Unit-II

[10]

- **Tablets:**
  a) Formulation of different types of tablets, granulation technology on large-scale by various techniques, different types of tablet compression machinery and the equipments employed.
  b) Physics of tablets making: strain gauze, measurement of applied and transmitted pressure distribution of forces during compression, effect of applied pressure on related volume and factors affecting strength of tablets.
  c) Coating of Tablets : Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of tablets, stability kinetics and quality assurance.

Unit-III

[10]

- **Controlled release dosage forms;** Design**,** development, production and evaluation of controlled release preparation.

BOOKS RECOMMENDED:

1. Remington: The Science and Practice of Pharmacy Pharmaceutical Science, Mack Publishing Company, USA, latest edition.
2. Avis,R.E., Pharmaceutical Dosage Forms: Practical Medication, Vol-I, Marcel Dekker-Inc, New York, latest edition.
3. Ansel, H.C., Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, USA, latest edition.
4. Juliano, R.C., Drug Delivery Systems, Oxford University Press, Oxford, latest edition.

BACHELOR OF PHARMACY

SEVENTH SEMESTER

PHARMACEUTICAL INDUSTRIAL MANAGEMENT

Course Code: bph 405 **L-4** **Credits-4**

Unit-I

[10]

- **Concept of Management:** Administrative Management (Planning, Organizing, Staffing, Directing and 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).
- **Accountancy:** Principles of accountancy, ledger posting and book entries,

Unit-II

[10]

- **Accountancy:** Preparation of trial balance, columns of a cash book, Bank reconciliation statement, rectification of errors, Profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques, bills of exchange, promissory notes and hundies, documentary bills.
- **Economics:** Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labor welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.
- **Pharmaceutical Marketing:** Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.

Unit-III

[10]

- **Salesmanship:** Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing. Recruitment, training, evaluation, compensation to the pharmacist.
- **Market Research:**
  (a) Measuring & Forecasting Market Demands – Major concept in demand measurement, estimating current demand, geo-demographic analysis, estimating industry sales, market share & future demand.
  (b) Market Segmentation & Market Targeting.
- **Materials Management:** A brief exposure or basic principles of materials management – major areas, scope, purchase, stores.

Unit-IV

[10]

- **Materials Management:** Inventory control and techniques and its significance.
- **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.

BOOKS RECOMMENDED:

1. Davar, R.S. , Personnel management and Industrial Relations.
2. Gupta D.R. and Rajput R.K., Purchaing and Store Keeping., latest edition.
3. Gopal Krishan, M.Sundarsan, Materials Management, latest edition.
4. Borbon, Managing Drug Supply: Management Sciences for Health., latest edition.
5. Hotter Philip, Principles of Marketing, latest edition.
6. Srivastava U.K, Sharma S.C., Qunatitative Techniques for Managerial Decision-making, latest edition.
7. Smith, Pharmaceutical Marketing, latest edition.
8. Aganil S.P., Establishment of Pharmaceutical Factory.

BACHELOR OF PHARMACY

SEVENTH SEMESTER
PHARMACOLOGY-III

Course Code: bph 407 **L-3** **Credits-3**

Unit-I

[10]

- **Drugs Acting on the Gastrointestinal Tract:**
  (a) Antacids, Anti Secretory and Anti-Ulcer drugs.
  (b) Laxatives and Antidiarrhoeal drugs.
  (c) Appetite Stimulants and Suppressants.
  (d) Emetics and Anti-Emetics.
  (e) Miscellaneous – Carminatives, Demulcents, Protectives, Adsorbents, Astringents, Digestants, Enzymes and Mucolytics.

Unit-II

[10]

- **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 & Glucagon.
  (d) ACTH and Corticosteroids.
  (e) Androgens and Anabolic steroids.
  (f) Estrogens, Progesterone and Oral Contraceptives.
  (g) Drugs acting on the uterus.

Unit-III

[10]

- **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.

Unit-IV

[10]

- Urinary tract infections and sexually transmitted diseases.
- Chemotherapy of malignancy and Immunosuppressive Agents.
- **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.

BOOKS RECOMMENDED:

1. Ghosh MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
2. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS, New Delhi.
3. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
4. Barar F.S.K.; Essentials of Pharmacotherapeutics, Interprint, New Delhi.
5. Goodman & Gilmans: The Pharmacological basis of Therapeutics, edited by Alfred Goodman, Gilman, Theodore W.Rall, Alan S.Nies and Palmer Taylor.
6. Katzung, B.G.Basic & Clinical Pharmacology, Prentice Hall, international.
7. Laurence, D.R. & Bennet P.N.; Clinical Pharmacology, Churchill Livingstone.
8. Rang H.P., Dale M.M., Riter J.M., Pharmacology Churchill Livingstone.
9. Tripathi, K.D.; Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
10. Satoskar & Bhandarkar; Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt.Ltd. Mumbai.
11. Paul L., Principles of Pharmacology, Chapman and Hall.
12. Robert A. Turner and Peter Hebborn Vol-I; "Screening methods in Pharmacology.

BACHELOR OF PHARMACY
SEVENTH SEMESTER
PHARMACEUTICAL CHEMISTRY – VII
(MEDICINAL CHEMISTRY-II)

Course Code: bph 409 **L-3 T-1 Credits-4**

Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: (Biochemical approaches in drug designing wherever applicable should be discussed)

Unit-I

[10]

- **Steroids and related drugs:** Steroidal nomenclature and stereochemistry, androgens and anabolic agents, estrogens and progestational agents, adrenocorticoids.

Unit-II

[10]

- **Drugs acting on the Central Nervous System:** General Anaesthetics, Local Anaesthetics, Hypnotics and Sedatives, Opioid analgesics, Antitussives.

Unit-III

[10]

- **Drugs acting on the Central Nervous System (cont.):** Anti-convulsants, Antiparkinsonism drugs, CNS stimulants, Psychopharmacological agents (neuroleptics, antidepressants, anxiolytics).

Unit-IV

[10]

- Diuretics, Cardiovascular drugs, Antiocoagulant and anti platelet drugs.

BOOKS RECOMMENDED:

1. Mann P. G. & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
2. Furnis B. A., Hannaford A J, Smith P W G and Tatehell A R, Vogels's Text Book of Practical Organic Chemistry, The ELBS/Longman, London.
3. Indian Pharmacopoeia, Ministry of Health, Govt. of India, India, Latest edition.
4. Abraham, Burger's Medicinal Chemistry and Drug Discovery, John Wiley & sons, New York.
5. Delagado J.N. and Remers W A R, 10^{th} eds., Wilson and Giswold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
6. Foye W. C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
8. Nogrady T., Medicinal Chemistry- A Biochemical Approach, Oxford University Press, New York, Oxford.
9. Finar I.L. Organic Chemistry Vol.I & II ELBS/ Longman, London

BACHELOR OF PHARMACY
SEVENTH SEMESTER

PACKAGING TECHNOLOGY

(ELECTIVE)

Course Code-411 **L-4 Credits- 4**

Unit – I **(10)**

Introduction: Definition, life history of a package, qualities of the package; purpose of packaging, choosing the form of package, hazards encountered by the package, various types of inner and outer packages, selection of a suitable package and child resistant package.

- **Packing materials:** Detailed study with regard to composition packaging characteristics, advantages, economics and limitation of various packaging materials with special emphasis on glass, plastics, metal & rubbers. Evaluation of packaging materials.

Unit – II **(10)**

- **Strip Packing** : Significance of Strip Packing, advantages, economics and limitations of Strip Packing, films employed in Strip Packing, (including composites and laminates) and evaluation of films and strips packs.
- **Blister Packaging**: Blister Packing materials, significance of Blister packing, advantages, economics and limitations of blister packing, various types of blister packages, evaluation of blister package.

Unit-III **(10)**

- **Liquid Formulation Packaging:** Various containers/ closures employed for liquid formulations. Evaluation of liquid formulation packages**.**
- **Semi-Solid Packaging:** Various types of containers / packages used for semi-solid products. Merits and limitations of various packages, evaluation of semi-solid product package.
- **Pouch Packing :** Materials used, advantages, economics and limitations of pouch packing, spectrum of applications, evaluation of pouch packing

Unit-IV **(10)**

- **Sterile Product Packaging**: General principles of packaging of sterile products. Various types of containers used for sterile products including small volume and large volume parenterals. Types of closures used for the sterile products. Limitations and merits of various packages. Evaluation of the sterile product packages.
- **Labelling** : Labelling requirements, packaging inserts and machinery employed for labeling.

BACHELOR OF PHARMACY

SEVENTH SEMESTER

QUALITY ASSURANCE
(ELECTIVE)

Course Code- bph-413 **L-4 Credits- 4**

Unit – I **(10)**

- Concept of Total quality management philosophy and GMPs, GLPs, ISO 9000. Introduction to ICH process, organization and personnel, responsibilities, training, hygiene, personnel, records.
- Manufacturing Premises: Location, Design, plant layout, construction maintenance and sanitation, environmental control, utility services like gas, water, maintenance of sterile areas & control of contamination.

Unit-II

(10)

- Equipment, selection, purchase specifications, maintenance, clean-in place and sterilize- in place methods (TP and STP). Raw materials; purchase, specifications, stores, selection of venders & control of raw materials.
- Manufacture and quality control of dosage forms; manufacturing documents, master formula, batch formula records, standard operating procedure. Quality audits of manufacturing processes and facilities. In process quality controls on various dosage forms; sterile and non-sterile standard operating procedure for various operations like cleaning, disinfection, fumigation, sterilization, membrane filtration etc.

Unit-III **(10)**

- Quality control in laboratory, responsibilities, good laboratory practice, routine controls, instruments, reagents, sampling plans, standard test procedure, protocols, non-clinical testing, control on animal house.
- Validation of Analytical Methods, calibration of Instruments and equipment. Regulatory considerations in validation. Introduction to validation of manufacturing facilities I.Q./O.Q and certification, preparation of validation protocols. Validation of purified water system, distilled water and water for injection. Validation of air handling system; sterile and non sterile areas.

Unit-IV

(10)

- WHO Certification, Globalization of drug industry, Introduction to export and import policy of drugs. Intellectual property rights, patents, trade marks, copy rights, Indian patent act.
- Drug Approval, schedule-Y; introduction to U.S, F.D. A., N.D. A. / A.N.D. A

BACHELOR OF PHARMACY
SEVENTH SEMESTER

INDUSTRIAL PHARMACOGNOSY

(ELECTIVE)

Course Code-415 **L-1** **Credits- 4**

Unit – I **(10)**

Isolation Techniques:
General methods used for the isolation and characterization of alkaloids, lipids, glycosides, proteins, volatile oils, bioflavonoids, steroids, terpenoids and resins. Application of column, paper and thin layer chromatographic techniques for the isolation of phytopharmaceuticals.

Unit –II **(10)**

Phytopharmaceuticals:
Isolation, characterization and estimation of:
Caffeine, Eugenol, Rutin, Solanine, Piperine, Tannic acid, Diosgenin, Hesperidine, Berberine, Calcium sennosides, Rutin, Glycyrrhizin, Menthol, Ephedrine, Quinine, Andrographolides, Guggul lipids and Katha industry in India.

Unit –III **(10)**

Plant Biotechnology
Tissue culture; Nutritional requirements, callus and suspension culture, production of secondary metabolites, viz. Shikonin and Taxol. Biotransformation, immobilization of cells and enzymes. Gene transfer in plants, application of plant biotechnology.
Worldwide trade of crude drugs and volatile oils:
Plants based industries and research institutes, Intellectual Property Rights with special reference to phytoconstituents. Regulation pertaining to trade drugs.

Unit-IV **(10)**

Quality control and Standardization of herbal drugs.
Extractive values, ash values, chromatographic techniques (TLC, HPTLC and HPLC) for determination of chromatographic markers, spectroscopic techniques and assay methods. Determination of heavy metals In herbal preparation and alcohol contents in Aristas and bhasams. Quality control and rational use of herbal drugs as per WHO guidelines.
Herbal formulations:
Principles involved in Ayurveda, Sidha, Unani, Chinese and Homeopathic system of medicines. Preparation of Ayurvedic formulations like Aristas, Asava, Ghutika, Tailia, Churna, Avaleha, Ghrita and Bhasms; Unani formulations like Majoons, Safoofs.
Herbal cosmetics:
Shampoos (Soapnut), conditioners (Amla, Henna, Hibiscus, Tea), hair darkeners (Amla, Henna), skin care (Aloe, turmeric)

BACHELOR OF PHARMACY
SEVENTH SEMESTER

DRUG DESIGN

(ELECTIVE)

Course Code: bph-417 **L-1 Credits-4**

UNIT-1

(10)

- **INTRODUCTION:** Drug Discovery, Lead discovery, Lead modification, Bioisosterism, QSAR, 3-D QSAR.

UNIT – II

(10)

- **RECEPTORS**: Drug Receptor interactions, Theories for Drug Receptor interactions
- **ENZYMES**: Enzymes as catalysts, Mechanisms of Enzyme catalysis, Co enzyme catalysis, Enzyme therapy, Enzyme inhibition**.**

UNIT-III

(10)

- **DRUG METABOLISM:** Introduction, methods in Drug Metabolism, Drug Deactivation & Elimination.

- **D N A INTERACTIVE AGENTS:** Introduction, DNA structure & properties, classes of drugs that interact with DNA structure & properties, Classes of drugs that interact with D.N.A.

Unit-IV

(10)

- **PRODRUGS AND DRUG DELIVERY SYSTEM:** Concepts, types of prodrugs, Utility of prodrugs, Mechanism of drug activation**.**

BACHELOR OF PHARMACY
SEVENTH SEMESTER

PHARMACEUTICAL MARKETING

(ELECTIVE)

Course Code: bph-419 **L-4** **Credits-4**

(10)

Unit –I

Managing product lines, advertising and brands in Pharmaceutical market: Introduction to Product and Product lines, Product positioning and punchline ,Role of Product Manager in an organization , Brand and brand decisions, Concept of brand equity, Brand strategy, Brand USPs,Packing and labeling as marketing tool, Setting advertising objectives, Deciding on advertising budget, Selecting advertising media and Advertising evaluation.

Unit-II **(10)**

Pharmaceutical Market and Competition: Introduction to concept of competition in Pharmaceutical market, Identifying competitors and competitors' strategies, Determining competitors' objectives, Assessing competitors' strengths and weaknesses, Estimating competitors' reaction patterns, Selecting competitors to attack and avoid, Balancing customer and competitor orientation.

Unit-III **(10)**

Analyzing Consumer Pharmaceutical Markets and Buying behavior: Buying behavior of customers in Pharmaceutical market, Major factors influencing buying behavior, Stages of buying decision process, Purchase decision, Post purchase behavior.

Unit-IV **(10)**

Introduction to Marketing Planning in Pharmaceutical Industry and building customer satisfaction through quality, service and value: Planning marketing programs, SWOT Analysis (Opportunities/ Threats/ Strengths/ Weakness analysis), Defining customer satisfaction, Attracting and retaining customers , Customer relationship marketing, Pricing and pricing methods.

Books recommended:

1. Philips Kotler, " Marketing Management", latest edition.
2. Harry Smith, " Principles and Methods of Pharmacy management" latest edition.
3. Mickey Smith, "Principles of Pharmaceutical Marketing" latest edition.
4. VS Ramaswamy, S.Namakumari,"Marketing Management Global perspective & Indian context 3rd edition, 2002.
5. YLR Moorthi, " Brand Management- The Indian Context", 2003.
6. Kazmi and Batra, " Advertising and Sales promotion", First edition, 2001.

BACHELOR OF PHARMACY

SEVENTH SEMESTER

PHARMACEUTICS – VIII LAB.

(PHARMACEUTICAL TECHNOLOGY II)

Course Code: bph 451 **L-0 P-4 Credits-2**

- Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like powders, capsules, tablets, parenterals, microen capsules, surgical dressings, etc.
- Evaluation of materials used in pharmaceutical packaging.
- Evaluation of packages- containers & closures.

BACHELOR OF PHARMACY

SEVENTH SEMESTER

PHARMACOLOGY-III LAB.

Course Code: bph 453 L-0 P-4 Credits-2

Unit-I

1) Experiments on Isolated Preparations:

a) To estimate the strength of the test sample agonist/ drug (eg. Ach, Histamine, 5-HT, Oxytocin etc) using suitable isolated muscle preparation employing matching bioassay
b) To estimate the strength of the test sample agonist/ drug (eg. Ach, Histamine, 5-HT, Oxytocin etc) using suitable isolated muscle preparation employing Bracketting assay
c) To estimate the strength of the test sample agonist/ drug (eg. Ach, Histamine, 5-HT, Oxytocin etc) using suitable isolated muscle preparation employing three point assay
d) To estimate the strength of the test sample agonist/ drug (eg. Ach, Histamine, 5-HT, Oxytocin etc) using suitable isolated muscle preparation employing four point bioassay

Unit-II

2) Clinical Pharmacology:
To determine the effect of certain clinically useful drugs on human volunteers like:

a) Antihistamines
b) Anti-anxiety and sedative drugs
c) Analgesics
d) Beta blockers

BACHELOR OF PHARMACY

SEVENTH SEMESTER

PHARMACEUTICAL CHEMISTRY – VII LAB.
(MEDICINAL CHEMISTRY-II)

Course Code: bph 455 **L-0** **P-4** **Credits-2**

Unit-I [10]

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.

BACHELOR OF PHARMACY

EIGHTH SEMESTER

PHARMACEUTICS IX
(DOSAGE FORM DESIGN)

Course Code: bph 402 **L-3** **Credits-3**

Unit-I

[10]

- **Preformulation studies:**
  a) Study of physical properties of drug like physical form, particle size, shape, density, wetting dielectric constant. solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability.
  b) Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc., and their influence on formulation and stability of products.
  c) Study of pro-drugs in solving problems related to stability, bioavailability and elegancy of formulations.

Unit-II

[10]

- Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets and suspensions.
- Stabilization and stability testing protocol for various pharmaceutical products.

Unit-III

[10]

- **Performance evaluation methods:**
  a) *In vitro* dissolution studies for solid dosage forms, methods and interpretation of dissolution data.
  b) Bioavailability studies and bioavailability testing protocol and procedures.
  c) *In vivo* methods of evaluation and statistical treatment.

Unit-IV

[10]

- GMP and Quality assurance, Quality audit.
- Design, development, production and evaluation of controlled release formulations.

BOOKS RECOMMENDED:

1. Ansel, H.C. "Introduction to Pharmaceutical Dosage Forms", K M Varghese & Co., Mumbai, latest edition.
2. Lachman L, Liberman H.A. & Kanig J.L., "The Theory & Practice of Industrial Pharmacy", Lea & Febiger, Philadelphia.
3. "Cosmetic Science & Technology", John Witey & Sons, New York, latest edition.
4. Jollinek, "Formulation & Function of Cosmetics", John Witey & Sons, New York.
5. Thompsons S.G., "Modern Cosmetics", Universal Publishing Corporation, Mumbai.
6. Beans, H.S., Beckett A.H. & Carless, "Advances in Pharmaceutical Science" Academic press.

BACHELOR OF PHARMACY

EIGHTH SEMESTER

PHARMACEUTICAL ANALYSIS-III

Course Code: bph 404 **L-3** **Credits-3**

Unit-I

[10]

- **Quality assurance:**
  1. GLP, ISO 9000, TQM, Quality Review and Quality Documentation.
  2. Regulatory control, Regulatory drug analysis, Interpretation of analytical data.
  3. Validation, Quality audit: Quality of equipment, Validation of equipment and Validation of analytical procedures.

Unit-II

[10]

- Nuclear magnetic resonance spectroscopy including ^{13}C NMR.
- X-ray
- Diffraction.
- Radio immunoassay.

Unit-III

[10]

- Mass spectrometry
- Fluorimetry.
- Flame photometry.

Unit-IV

[10]

- Atomic absorption spectroscopy.
- Emission spectroscopy.
- Ultraviolet and visible spectrophotometry
- Infrared spectrophotometry.

BOOKS RECOMMENDED:

1. Indian Pharmacopoeia, Ministry of Health, Govt. of India, 1996 edition.
2. Becket A.H. and Stenlake J.B. Practical Pharmaceutical Chemistry Vol.I and II, the Athlon press of the University of London.
3. Chatten L.G. A Text Book of Pharmaceutical Chemistry Vol.I & II, Marcel Dekker , New York.
4. Willard H.H. and Merrit L.Jr. and Dean J.A., Instrumental Methods of Analysis Van Nostrand Renhold, New York.
5. Obonson J.W.R. Undergraduate Instrumental Analysis, Marcel Dekker Inc, New York, 1970.
6. Parikh V.H. Absorption Spectroscopy of Organic Molecules, Addison- Wesley Publishing Co., London 1974.
7. Silverstein R. M. & Webster FX, Spectrometric Identification of Organic Compounds, John Wiley & Sons.
8. Skoog V; Principles of Instrumental Analysis, Holler- Neiman.
9. John & Dyer "Application of Absorption Spectroscopy of Organic compounds.
10. Mohan J., Organic Spectroscopy Principles & Applications, Narosa Publishing House, India.
11. Ewing Galen W. Instrumental methods of Chemical Analysis, Mc Graw-Hil, USA.

BACHELOR OF PHARMACY

EIGHTH SEMESTER

PHARMACEUTICAL CHEMISTRY – VIII
(MEDICINAL CHEMISTRY III)

Course Code: bph 406 **L-3** **T-1** **Credits-4**

Unit-I

[10]

- Drug metabolism and Concepts of Prodrugs.
- Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs. (Biochemical approaches in drug designing wherever applicable should be discussed).
- Antimetabolites (including sulfonamides).

Unit-II

[10]

- Chemotherapeutic agents used in Protozoal, Parasitic and other infection.
- Pharmaceutical Aids.
- Antineoplastic agents

Unit-III

[10]

- Anti-viral including anti-HIV agents.
- Immunosuppressives and immunostimulants.
- Diagnostic agents.

Unit-IV

[10]

- Amino acids, peptide, nucleotides and related drugs.
  a. Thyroid and Anti thyroid drugs.
  b. Insulin and oral hypoglycaemic agents.
  c. Peptidomimetics and nucleotidomimetics.

BOOKS RECOMMENDED:

1. Mann P. G. & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
2. Furnis B. A., Hannaford A. J., Smith P W G and Tatehell A R, Vogels's Text Book of Practical Organic Chemistry, The ELBS/Longman, London.
3. Indian Pharmacopoeia, Ministry of Health, Govt. of India.
4. Abraham, Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons, New York.
5. Dagado J.N. and Remers W A R, 10^{th} edn., Wilson and Giswold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
6. Foye W. C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
8. Nogrady T; Medicinal Chemistry- A Biochemical Approach, Oxford University Press, New York, Oxford.
9. Finar I.L. Organic Chemistry Vol.I & II ELBS/ Longman, London.

BACHELOR OF PHARMACY

EIGHTH SEMESTER

PHARMACOLOGY-IV
(CLINICAL PHARMACY AND DRUG INTERACTIONS)

Course Code: bph 408 **L-4** **Credits-4**

Unit-I

[10]

- Introduction to Clinical Pharmacy.
- **Basic Concepts of Pharmacotherapy:**
  a) Clinical Pharmacokinetics and Individualization of Drug Therapy.
  b) Drug Delivery Systems and their Biopharmaceutic & Therapeutic Considerations.
  c) Drug use during Infancy and in the Elderly (Pediatrics & Geriatrics).
  d) Drug use during Pregnancy.
  e) Drug induced Diseases.
  f) The basics of Drug Interactions.
  g) General Principles of Clinical Toxicology.
  h) Interpretation of Clinical Laboratory Tests.

Unit-II

[10]

- **Important Disorders of Organ Systems and their Management:**
  a) Cardiovascular 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.

Unit-III

[10]

a) Endocrine Disorders – Diabetes mellitus and Thyroid disorders.
b) Infectious Diseases – Tuberculosis, Urinary Tract Infection, Enteric Infections, Upper Respiratory Infections.
c) ematopoietic Disorders – Anemias.
d) Joint and Connective Tissue Disorders – Rheumatic Diseases, Gout and Hyperuricemia.

Unit-IV

[10]

- Neoplastic Diseases – Acute Leukaemias, Hodgkin's disease.
- Therapeutic Drug Monitoring.
- Concept of Essential Drugs and Rational Drug use.

BOOKS RECOMMENDED:

1. T.M. Speight, N.H.G. Holford, Aveery's Drug Treatment, 4th Edition, Adis International
2. R.Walker and C.Edwards, "Clinical Pharmacy and Therapeutics", Churchill Livingstone, London, 1999.
3. D.G. Grahaems Smith and J.K. Aronson, Oxford Text book of Clinical Pharmacology and Drug Therapy, Oxford University Press, 1984.
4. B.G.Katzung, Basic and Clinical Pharmacology, Lange Medical Publications, 1995.
5. E.Braunwald, K.J. Isselbucher, J.B.Martin A.S.Faue, J.D. Wilson Harrisons, D.L.Kasper, Principles of Internal Medicine, 13th Edition, Mc Graw Hill International Book Co., 1994.
6. Drug, Facts and Comparisons, St.Louis, USA, 1995.
7. D.R.Laurence; Clinical Pharmacology, 5th Edition, Churchill Livingstone, 1985.
8. P.K.Gupta; Modern Toxicity, Vol.1-3, Metropolitan, New Delhi, 1985.
9. J.Doull, C.D.Klaasgen and M.A.Amdur, Casarett and Doul's Toxicology, 2nd edition, McMillan Publishing Co., Inc 1980.
10. B.Ballantyne, T.Marrs, P.Turner, General and Applied Toxicology, McMillan Press Ltd., 1995.

BACHELOR OF PHARMACY

EIGHTH SEMESTER

PHARMACEUTICS IX LAB.

Course Code: bph 452 **L-0 P-3 Credits-2**

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. *In vivo* bioavailability evaluation from plasma drug concentration and urinary excretion curves.
6. Design, development and evaluation of controlled release formulations.

BACHELOR OF PHARMACY

EIGHTH SEMESTER

PHARMACEUTICAL ANALYSIS-III LAB.

Course Code: bph 454 **L-0 P-4 Credits-2**

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

BACHELOR OF PHARMACY

EIGHTH SEMESTER

PHARMACEUTICAL CHEMISTRY – VIII LAB
(MEDICINAL CHEMISTRY III)

Course Code: bph 456 **L-0 P-3 Credits-2**

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 pharmacopoeial standards and spectral studies.**

BACHELOR OF PHARMACY

EIGHTH SEMESTER

PROJECT WORK

Course Code: bph 460 **L-0 P-0 Credits-8**

The subject of the Project will relate to elective subject chosen by the candidate. The Project Work will carry 100 marks and shall be evaluated by a Board of Examiners comprising of one internal examiner and one external examiner to be appointed by the Vice-Chancellor on the recommendation of the coordinator of the programme.

Proposed List of Elective Subjects in Semester – VII

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.