

B.PHARM. (UGD - FOUR YEAR) COURSE STRUCTURE

(Applicable to those who admitted from 2005-06 Session)

B.PHARM. PART-I: Semester-I

Subjects			Contact Hrs. / Week	Credits
Theory:				
01.	PH-1101	Pharmaceutics	3	3
02.	PH-1102	Pharmaceutical Inorganic Chemistry	3	3
03.	AP-1103	Physics	3	3
04.	AM-1103	Computer Programming and Graphics	4	4
05.	AM-1104	Mathematics & Statistics	4	4
Total of Theory			17	17
Practical:				
06.	PH-1301	Pharmaceutics	3	2
07.	PH-1302	Pharmaceutical Inorganic Chemistry	3	2
08.	AP-1303	Physics	3	2
09.	CL-1301	Computer Lab	3	2
Total of Practical			12	8
Total for First Semester			29	25

B.PHARM. PART-I: Semester-II

Subjects			Contact Hrs. / Week	Credits
Theory:				
01.	PH-1201	Pharmaceutical Organic Chemistry – I	4	4
02.	PH-1202	Pharmaceutical Biology	3	3
03.	PH-1203	Physical Pharmaceutics	3	3
04.	ES-1201	Environmental Studies	4*	4
05.	PC-1201	Professional Communication	3	3
Total of Theory			17	17
Practical:				
06.	PH-1401	Pharmaceutical Organic Chemistry – I	3	2
07.	PH-1402	Pharmaceutical Biology	6	4
08.	PH-1403	Physical Pharmaceutics	3	2
Total of Practical			12	8
Total for Second Semester			29	25
Total for Part-I			58	50

B.PHARM. PART-II: Semester-III

Subjects			Contact Hrs. / Week	Credits
Theory:				
01.	PH-2101	Pharmaceutical Technology	3	3
02.	PH-2102	Pharmaceutical Organic Chemistry – II	4	4
03.	PH-2103	Pharmaceutical Physical Chemistry	3	3
04.	PH-2104	Pharmacology–I (Anatomy & Physiopharmacology)	3	3
05.	PH-2105	Pharmaceutical Microbiology	4	4
Total of Theory			17	17
Practical:				
06.	PH-2301	Pharmaceutical Technology	3	2
07.	PH-2302	Pharmaceutical Organic Chemistry – II	3	2
08.	PH-2303	Pharmaceutical Physical Chemistry	3	2
09.	PH-2304	Pharmacology – I	3	2
Total of Practical			12	8
Total for Third Semester			29	25

B.PHARM. PART-II: Semester-IV

Subjects			Contact Hrs. / Week	Credits
Theory:				
01.	PH-2201	Dispensing and Hospital Pharmacy	3	3
02.	PH-2202	Pharmaceutical Analysis – I	3	3
03.	PH-2203	Pharmacognosy – I	3	3
04.	PH-2204	Pharmacology – II	4	4
05.	CH-2221A	Pharmaceutical Engineering	4	4
Total of Theory			17	17
Practical:				
06.	PH-2401	Dispensing Pharmacy	4	3
07.	PH-2402	Pharmacognosy – I	3	2
08.	CH-2421A	Pharmaceutical Engineering	4	3
Total of Practical			11	8
Total for Fourth Semester			28	25
Total for Part-II			57	50

B.PHARM. PART-III: Semester-V

Subjects			Contact Hrs. / Week	Credits
Theory:				
01.	PH-3101	Pharmaceutical Medicinal Chemistry – I	4	4
02.	PH-3102	Pharmacognosy – II	3	3
03.	PH-3103	Pharmaceutical Biochemistry	4	4
04.	PH-3104	Pharmacology – III	3	3
05.	PH-3105	Pharmaceutical Jurisprudence	3	3
Total of Theory			17	17
Practical:				
06.	PH-3301	Pharmaceutical Medicinal Chemistry – I	3	2
07.	PH-3302	Pharmacognosy – II	3	2
08.	PH-3303	Pharmaceutical Biochemistry	4	3
09.	PH-3304	Pharmacology – II	3	2
Total of Practical			13	9
Total for Fifth Semester			30	26

B.PHARM. PART-III: Semester-VI

Subjects			Contact Hrs. / Week	Credits
Theory:				
01.	PH-3201	Pharmaceutical Analysis – II	3	3
02.	PH-3202	Pharmaceutical Biotechnology	3	3
03.	PH-3203	Pharmacology – IV	3	3
04.	PH-3204	Pharmaceutical Management	3	3
05.	HU-	Open Elective (Humanities)	3	3
Total of Theory			15	15
Open Elective (Humanities) Subjects:				
HU-3201: History of Science & Technology				
HU-3202: Industrial & Organizational Psychology				
HU-3203: Intellectual Property Rights				
HU-3204: Energy Management				
HU-3205: Industrial Psychology				
HU-3206: Ethics, Philosophy & Values				
HU-3207: Entrepreneurship Development				
Practical:				
06.	PH-3401	Pharmaceutical Analysis – I	4	3
07.	PH-3402	Pharmaceutical Microbiology	5	3
08.	PH-3403	Pharmacology – III	5	3
Total of Practical			14	9
Total for Sixth Semester			29	24
Total for Part-III			59	50

B.PHARM. PART-IV: Semester-VII

Subjects			Contact Hrs. / Week	Credits
Theory:				
01.	PH-4101	Pharmaceutical Instrumental Analysis	4	4
02.	PH-4102	Dosage Formulation Design	4	4
03.	PH-4103	Pharmaceutical Medicinal Chemistry – II	3	3
04.	PH-	Elective [PH-4104 / PH-4105]	3	3
Total of Theory			14	14
Seventh Semester Elective Subjects:				
PH-4104: Bioavailability & Therapeutic Drug Monitoring				
PH-4105: Drug Design				
Practical:				
05.	PH-4301	Dosage Formulation Design	3	2
06.	PH-4302	Pharmaceutical Medicinal Chemistry – II	3	2
07.	PH-4303	Project	3	2
08.	PH-4304	Seminar/Group Discussion	3	2
09.	PH-4305	Training/Tour Viva-voce	--	2
Total of Practical			12	10
Total for Seventh Semester			26	24

B.PHARM. PART-IV: Semester-VIII

Subjects			Contact Hrs. / Week	Credits
Theory:				
01.	PH-4201	Clinical Pharmacy	3	3
02.	PH-4202	Pharmaceutical Medicinal Chemistry – III	3	3
03.	PH-4203	Pharmacognosy – III	3	3
04.	PH-	Elective [PH-4204 / PH-4205]	3	3
Total of Theory			12	12
Eighth Semester Elective Subjects:				
PH-4204: Cosmetology				
PH-4205: Quality Assurance				
Practical:				
05.	PH-4401	Pharmaceutical Instrumental Analysis	3	2
06.	PH-4402	Pharmacognosy – III	3	2
07.	PH-4403	Project	9	6
08.	PH-4404	Comprehensive Viva-voce	--	2
Total of Practical			15	12
Total for Eighth Semester			27	24
Total for Part-IV			53	48
GRAND TOTAL FOR B.PHARM. COURSE			228	198

B.PHARM. (FOUR YEAR) COURSES – DETAILED SYLLABI

First Semester

PH-1101: Pharmaceutics

[Credits: 3]

1. History of Pharmacy - Ancient and medieval India and its contemporary systems in other parts of the world.
2. Definition and ramification of Pharmaceutical sciences, their scope and significance.
3. Introduction to Pharmacopoeias and Formularies.
4. Solutions: Official pharmaceutical solutions products for oral and topical use including syrups and glycerines etc.
5. Clarification, filtration, collation and centrifugal separation of pharmaceutical preparations.
6. Drying: Principles, factors affecting and equipments (Tray drier, Spray drier, infrared heating, fluid bed drier, lyophilisation etc.); Theories of drying.
7. Mixing of powders, semi solids, liquids.
8. Important Galenicals and pharmaceutical preparations official in I.P. and other compendia and their storage.

Suggested books: Latest editions of-

1. "Remington's Pharmaceutical Sciences", ed. A.R.Gennaro, Mack Publishing co., P.A.
2. Leon Lachmen, H.a.Lieberman and J.L.Kanig, "The Theory and Practice of Industrial Pharmacy", Lea & Febiger, Philadelphia/Varghese Publishing House, Mumbai.
3. Pharmacopoeia of India, Published by the Controller of Publications, Delhi.
4. British Pharmacopoeia, 2003, Her Majesty's Stationary Office, University Press, Cambridge, U.K.

PH-1102: Pharmaceutical Inorganic Chemistry

[Credits: 3]

1. A systematic study of inorganic chemistry with special reference to preparation, properties, tests for identity and purity and pharmaceutical uses of: Sodium, Potassium, Magnesium, Calcium, Barium, Aluminium, Lead, Silver, Zinc, Antimony and Iron compounds official in I.P., B.P., U.S.P., B.P.C. and N.F.
2. Natural and artificial radio-activity, radio-isotopes - their preparation, properties and Pharmaceutical uses.
3. The occurrence of impurities in Pharmaceutical compounds and preparations, their sources and limit tests.
4. Brief introduction of monographs of I.P. and B.P. with reference to their importance in Pharmacy (Sodium bicarbonate, Potassium chloride, Sodium chloride, Calcium gluconate, Magnesium stearate and Boric acid).
5. Physico-chemical concepts of qualitative and quantitative analysis such as electrolytic dissociation, modern concepts of acids and bases, chemical equilibrium, pH and buffer action, solubility product, common ion effect, hydrolysis of salts and amphoteric substances.

Suggested books: Latest editions of-

1. Pharmacopoeia of India, Published by the Controller of Publications, Delhi.
2. J.Bassett, R.C.Denny, G.H.Jeffery, J.Mendham, Vogel's Test book of Quantitative Inorganic Analysis, ELBS/Longman, London.

3. A.H.Beckett and J.B.Stenlake, Practical Pharmaceutical Chemistry, The Athlone Press of the University of London.
4. J.H.Block, E.Roche, T.O.Soine and C.O.Wilson: Inorganic Medicinal and Pharmaceutical Chemistry, Lea and Fabiger, Philadelphia, P.A. (USA).
5. L.M.Atherden: Bentley and Driver's Text Book of Pharmaceutical Chemistry, O.U.P., London.

AP-1103: Physics

[Credits: 3]

1. Measurement, standards, reference, Fram. S, Vectors, Pseudo Forces conservative and Non-conservative Forces System of variable mass, Collision Cross Section, Rotational Dynamics of a Rigid body, Classical, Relativistic and Quantum Mechanism, Combinations of Harmonic Motions, Damped Harmonic motion, Forced Oscillations and Resonance, wave motion Power and Intensity in Wave motion Superposition Principle, Complex Waves.
2. Thermal Equilibrium. First law of Thermodynamics and its applications, Kinetic Theory, Equipartition of Energy, Mean Free Path, Brownian Motion. The van der weals equation, Carnot cycle, Second law of Thermodynamics, Entropy, Reversible and Irreversible Processes.
3. Electric Field, Electric Dipole, Electric Potential energy, Potential Gauss : theorem Dielectrics, E.P. and D. Vectors, Energy density in an electric field, Kirchoff's rules Growth and Deoay of current in R.C. Circuits, Time-varying magnetic fields; Lorentz Force, particle, Accelerators, Inductance, Mutual Inductance, Energy Density in a magnetic field, Alternating current, L.C.R. Circuit, Power factor, Maxwell's equations, Electromagnetic Waves, Poynting vector.
4. Nature and Propagation of light, Interference in thin films, Michelson's interferometer, Fresnel and Fraunhofer Diffraction, Diffraction Grating, Resolving Power, Polarisation of light, Browster's law Double refraction, Nicol Prism and Polaroids, circular and elliptical polarisation, Optical activity.
5. Compton Effect, Matter Waves, Uncertainty Principle Elementary Particles.

AM-1103: Computer Programming and Graphics

[Credits: 4]

Computer Programming:

1. Basic concepts of computer programming; program developing; Algorithm and Flow charts.
2. Introduction to Language C; Basic structure of programs, programming style, executing a C program.
3. C constants, variables and data types, declaring variables, C operators and expressions, Data input and output statements, formatted input and output statements.
4. Control statements: Decision making and branching: simple if, if-else, goto and switch statement.
5. Decision making and looping: while loop, do, while loop and for loop statements.
6. Arrays: Array variables, declaration of array variables, reading and writing arrays, one dimensional and multidimensional arrays, handling of character strings.
7. User defined functions: Introduction to functions, form of functions, categories of functions, local, global, static and automatic variables, calling a function, functions with arrays, void functions, recursion, multifunction programs.
8. Structures and unions.

9. Pointers: Accessing the address of a variable, understanding pointers, scale factor, declaring and initializing pointers, pointer expressions, pointers and arrays, pointers and functions, pointers and structures.
10. Complete programs on typical applications.
11. File management in C.

Computer Graphics:

1. Introduction: Basic concepts of computer graphics, Raster Scan technique, Graphic drivers.
2. Graphic mode, functions for Graphic mode: `initgraph()`, `getgraphmode()`, `restorecrtmode()`, `detectgraph()`
3. Graphic functions: `setpalatte()`, `putpixel()`, `setpixel()`, `setcolor()`, `getpalatte()`, `getx()`, `gety()` etc.
4. Drawing on the screen: Line drawing, curve drawing, filling point.
5. 2D and 3D drawing: Drawing and filling circles, rectangles, ellipses, polygons; Drawing and filling nonregular shapes.
6. Text mode: Text mode functions.
7. Rotating geometric figures.

Suggested books: Latest editions of-

1. Programming in C, E.Balagurusami, Tata McGraw Hills.
2. Programming in C, Byron S. Gottfried, Schoum Series , Tata McGraw Hills.
3. C Graphics Handbook, Roger T. Stevens, Academic Press.
4. Computer Graphics, D.Hearn and P.M.Baker, Pretice Hall.

AM-1104: Mathematics and Statistics

[Credits: 4]

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, complementary function and particular integral, simultaneous linear differential equations, pharmaceutical applications.

1. 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.
2. Statistics: 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, probability and events, Bayes' Theorem, probability theorems, probability distributions, elements of Binomial and Poisson distribution, normal distribution, curve and properties, kurtosis and skewness, correlation and regression analysis, 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.

Suggested books: Latest editions of-

1. Sanford Bolton: Pharmaceutical Statistics, Marcel Dekker Inc., New York.

Practical:

PH-1301: Pharmaceutics	[Credits: 2]
PH-1302: Pharmaceutical Inorganic Chemistry	[Credits: 2]
AP-1303: Physics	[Credits: 2]
CL-1301: Computer Lab	[Credits: 2]

Second Semester

PH-1201: Pharmaceutical Organic Chemistry - I **[Credits: 4]**

1. Nomenclature and classification of organic compounds and introduction of modern concepts of organic molecules, hybridization of carbon atom, and bonding (sigma and pi bonds).
2. Introduction to organic reactions: classification and reactive intermediates; SN1 and SN2 reactions.
3. Organometallic compounds: Grignard Reagents and Organic zinc compounds.
4. Polyhydric alcohols; Glycol and Glycerol (preparation, physical and chemical properties and their pharmaceutical importance). Preparation and synthetic application of compounds containing reactive methylene group: Malonic ester, Acetoacetic ester and cyano ester.
5. Carboxylic acids: linear dicarboxylic acids and tricarboxylic acids, hydroxy acids and unsaturated acids (Preparation, properties and their Pharmaceutical importance).
6. Aliphatic nitrogen compounds: Amines, Amides, Nitriles and nitro paraffins.
7. Carbonic acid derivatives; Aliphatic sulphur compounds.
8. Benzene and homologues of benzene, aromatic substitution directive influence, orientation in aromatic rings. Resonance.
9. Study of dienes, alicyclic hydrocarbons and conformational analysis of cyclohexane, drawing of some stereo-models.
10. Unsaturated alcohols, unsaturated acids, unsaturated carbonyl-compounds-chemistry and Pharmaceutical importance.
11. Structural, optical and geometrical, isomerism, stereo-chemistry and R.S. configuration and their importance in pharmaceutical chemistry.

Suggested books: Latest editions of-

1. T.R.Morrison and R.Boyd, Organic Chemistry, Prentice Hall of India Private Limited, New Delhi.
2. I.L.Finar, Organic Chemistry, The Fundamental Principles, ELBS/Longman.
3. F.C.Mann and B.C.Saunders, Practical Organic Chemistry, The English Language Book Society and Longman Group Limited, London.

PH-1202: Pharmaceutical Biology **[Credits 3]**

1. Structure of cell, its components and their functions.
2. A general idea of macro- and microscopical characters. Identification of plant drugs (roots, stems, leaves, flowers, fruits and seed).
3. General morphology and life history of following internal parasites:
(a) Trypanosoma (b) Schistosoma
(c) Taenia (d) Ascaris
(e) Ancylostoma (f) Plasmodium
4. Elementary tissues of the human body: Types (epithelial, connective, muscular and nervous tissues) and characteristics and physiological functions.

5. Structure, composition and functions of skeleton. Classification of joints, types of movements at joints.
6. Composition and functions of blood and its elements, blood groups and their significance. Mechanism of coagulation.
7. Composition, formation and circulation of lymph, functions of spleen.
8. Basic structure of heart. Physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation. Brief outline of cardiovascular disorders like hypertension, hypotension, atherosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.
9. Structure and life history with special reference to medicinal importance of Mushrooms, Lycopodium, Kelp & racks, Carrageen and Cetraria.

Suggested books: Latest editions of-

1. Trease, G.E. and Evans, W.C., Pharmacognosy, Bailliere Tindall, Eastbourne, U.K.
2. "Human Physiology", C.C.Chatterjee, Medical Allied Agency, Calcutta.
3. Best and Taylor's Physiological Basis of Medical Practice, Williams & Wilkins, Baltimore.

PH-1203: Physical Pharmaceutics

[Credits: 3]

1. An introduction to Rheology - Newtonian and non-Newtonian systems, measurement of thixotropy, types of viscometers, application of rheology in dosage form development.
2. Kinetics-rate and order of reactions, half life, determination of order, influence of temperature and other factors on reaction rate, stabilization, accelerated stability study, prediction of shelf life.
3. Complexation and protein binding, types; pharmaceutical and medicinal applications.
4. Solubility and Distribution Phenomena; Polymorphism and its effect on solubility.
5. Micromeritics: Methods of sub-division of drugs/pharmaceuticals, Sieves, Standards of sieves, Grading of powders, determination of particle size; importance of particle size distribution.

Suggested books: Latest editions of-

1. J.A.Kitckener, Findley's Physical Chemistry, Green & Co., London.
2. D.P.Shoemaker, C.W.Garland, Experiments in Physical Chemistry, McGraw Hill Book Co., New York.
3. A.N.Martin: Physical Pharmacy, Lippincott Williams and Wilkins, Baltimore, USA.

ES-1201: Environmental Studies

[Credits 4]

(Syllabi will be provided at Institute Level)

PC-1201: Professional Communication

[Credits 3]

1. Reference to context and a general question based on Chapters 2, 10 and the Epilogue of the Tao of Physics by Fritjof Capra [Bantam Books, (Shambala) 1976].
2. General Topics: The sentence. Precis Writing. Technical Vocabulary. Report Writing. Letter Writing.

Suggested books: Latest editions of-

1. The Tao of Physics by Fritjof Capra, Bantam Books, 1976.
2. Technical Writing by R.S.Sharma, Radha Publications, New Delhi, rpt.1999.
3. Technical Writing by R.A.Kelly, ELBS, 1971.

4. Communication Skills for Engineers, Sunita Mishra, C.Muralikrishna, Pearson Education, Singapore, 482 R.I.E., Patparganj, Delhi, 2004.

Practical:

PH-1401: Pharmaceutical Organic Chemistry - I [Credits: 2]

PH-1402: Pharmaceutical Biology [Credits: 4]

PH-1403: Physical Pharmaceutics [Credits: 2]

Third Semester

PH-2101: Pharmaceutical Technology [Credits: 3]

1. Disperse Systems including Interfacial Phenomena:
Suspension – Objective, Theory, Properties of ideal suspension, Interfacial properties, Electrical properties at the interfaces, Electrical double layer, Zeta Potential, Nernst Potential, Application and Formulation consideration.
Emulsion-General considerations, Definition. Formulation of emulsions, Emulsification processes. Stability and Preservation of Emulsion. Evaluation of emulsions and official emulsion products.
Colloids and gels: Types, solute permeation to and through colloids and gels – theories affecting solute permeation; preparations and evaluation.
2. Suppository – Dosage form characteristics, Therapeutic uses, Factors affecting drug absorption from rectal suppositories, Types of suppository bases, Manufacture of suppositories, Evaluation and Packaging.
3. Capsules-Materials for capsules, Method of production, Soft gelatin capsules, Manufacture, Processing control, Stability and Packaging.

Suggested books: Latest editions of-

1. Cooper and Gunns' "Tutorial Pharmacy" ed. S.J.Carter, CBS Publishers, Delhi.
2. "Bentley's Textbook of Pharmaceutics", EA Rawlins, ELBS Bacilliere Tindall.
3. "Modern Pharmaceutics:", G.S.Banker and C.T.Rhodes, Marcel Dekker Inc., NY.

PH-2102: Pharmaceutical Organic Chemistry – II [Credit: 4]

1. Fats, oils, waxes and wool fat, chemistry analysis and Pharmaceutical importance.
2. Preparation, properties and Pharmaceutical importance of the following aromatic compounds - halides, sulphonic acids, phenols, amino and nitrophenols, nitrocompounds, amines, diazonium compounds, aldehyds, hydroxy aldehydes, ketone, acids, hydroxy acids, amino acids, acyl derivatives.
3. Chemistry of polynuclear hydrocarbons and their derivatives-naphthalene, anthracene and phenanthrene.
4. Chemistry of five and six-membered heterocyclic compounds containing one heteroatom and their medicinal uses (furan, thiophene, pyrrole and pyridine).
5. Study of carbohydrates, structure and ring-size of glucose and fructose, synthesis of aldohexoses from glyceraldehyde, acetylation, methylation and osazone formation and the pharmaceutical importance of the carbohydrates.
6. Terpenes: Isolation from natural sources, structure elucidation and properties of compounds, e.g. Terpeneol, Carvone, Menthol, Citral.
7. Molecular re-arrangement and synthetic applications associated with the following reactions:

Cannizzaro, Perkin, Reimer-Tieman, Meerwein-Ponndorf-Verley, Reformatsky, Mannich, Michael, Witting, Wagner-Meerwein, Fries, Diels-Alder, Wohle-Ziegler, Fischer, Sandmeyer, Beckmann, Claisen, Cyano-addition, Dieckmann, Knoevenagel, Hydroboration-Metal Hydride reduction, Oxidation with Cr and Mn compounds, peracids.

8. Stereochemistry, conformational and configurational analysis: (i) Acyclic compounds upto Butane (ii) Cyclic systems upto decalin.

Suggested books: Latest editions of-

1. I.L.Finar, Organic Chemistry, ELBS/Longman, London.
2. I.L.Finar, Organic Chemistry, The Fundamental Principles, ELBS/Longman.

PH-2103: Pharmaceutical Physical Chemistry

[Credits: 3]

1. Chemical kinetics-rate and order of reaction, molecularity, specific rate constants, mathematical treatment of rate, zero and first order reactions, thermodynamics vs. kinetics control, influence, of temperature of and other factors on reaction rate, classical collision theory of reaction rates, transition state theory, effect of solvents dielectric constant and catalysis, decomposition of medical agents, oxidation and stability analysis.
2. Application of Thermodynamic principles in Pharmacy.
3. Physical properties of drug molecules - dielectric constant induced. Polarization of non-polar molecules, refractive index, molar refraction, optical rotation, optical rotatory dispersion.
4. Partition coefficient. Hansch equation and Hansch analysis, and the importance in the field of pharmacy.
5. Inter-facial phenomena-adsorption, various types of adsorption, isotherm, and their medicinal importance.
6. Conductivity and transport number, strong and weak electrolytes, voltaic cell, reversibility, polarization, single electrode potential, concentration cell, oxidation-reduction potentials, standard electrodes, determination of hydrogen ion concentration and solubility.

Suggested books: Latest editions of-

1. J.A.Kitchener, Findley's Physical Chemistry, Green & Co., London.
2. A.N.Martin: Physical Pharmacy, Lippincott Williams and Wilkins, Baltimore, USA.

PH-2104: Pharmacology – I (Anatomy & Physiopharmacology)

[Credits: 3]

1. General principles of pharmacology: Mechanisms, of drug action, combined effect of drugs, factors modifying drug action, tolerance and dependence.
2. Structure 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 digestion and absorption of food. An introduction to disorders of digestive system with reference to drugs acting on gastrointestinal tract.
3. Structure of respiratory organs, functions of respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity. An introduction to respiratory disorders with reference to drugs acting on the respiratory system.
4. 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.

5. Autonomic Nervous System: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in ANS.
6. Urinary System: Various parts, structure and functions of the kidney and urinary tract. Physiology of urine formation and acid base balance. Diseases of the urinary system with reference to drugs used.
7. Sense Organs: Structure and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors). Drugs acting on ocular and aural disorders.

Suggested books: Latest editions of-

1. Crossland, J. and Thomson, J.H., "Essentials of Pharmacology" Harper and Row.

PH-2105: Pharmaceutical Microbiology [Credits: 4]

1. General techniques of microbiology, morphology, life history, habit, variation, reproduction, mode of nutrition and cultivation of bacteria, yeasts, moulds and common protozoa.
2. Principles of isolation and identification of pure culture, different staining methods, preparation of staining solutions and culture media.
3. Principles of sterilization, efficiency of various methods of sterilization with special reference to thermo labile medicaments, cleaning and sterilization of glasswares, medicaments, surgical dressings.
4. Ligatures and sutures, manufacturing units and their manufacture and standardization.
5. Effects of physical and chemical agents on bacteria, disinfectants and antiseptics, mode of action and standardization of disinfectants.
6. Aseptic methods, mode of contamination and determination of degree of contamination. Aseptic handling of sterile materials and medicaments and test for sterility of medicaments, culture media, ligatures and sutures.
7. Reaction of micro-organism to disease, common infections and communicable diseases, their causative organism, mode and route of infection. Methods of control and diagnostic test of organisms of special interest to India.

Suggested books: Latest editions of-

1. Prescott and Dunn, "Industrial Microbiology", McGraw Hill Book Company Inc.
2. A.J.Salle, "Fundamental Principles of Bacteriology".
3. G.Sykes, "Disinfection and Sterilization".

Practical:

PH-2301: Pharmaceutical Technology [Credits: 2]

PH-2302: Pharmaceutical Organic Chemistry – II [Credits: 2]

PH-2303: Pharmaceutical Physical Chemistry [Credits: 2]

PH-2304: Pharmacology – I [Credits: 2]

Fourth Semester

PH-2201: Dispensing and Hospital Pharmacy [Credits: 3]

1. The prescription-form of the prescription order, handling of prescription, prescription containers, legal considerations.
2. Labeling, weights & measures; calculations, and working knowledge of Latin in prescription handling.

3. Principles and procedures of dispensed products - Solutions, suspensions, emulsions, powders and oral unit dosage forms, pills, ointments, creams, pastes, jellies, suppositories and pessaries.
4. Poisoning control-toxic agents, causes, preventive and emergency treatment of accidental poisoning.
5. Hospital Pharmacy - education and training, hospital development and expansion, organization and administration, financing, standards of practice and administration; in patient drug distribution, prescription errors.

Suggested books: Latest editions of-

1. "Textbook of Hospital Pharmacy", M.C.Allwood and J.T. Fell, Blackwell Scientific Publications, Oxford.
2. Cooper and Gunn's, "Dispensing for Pharmaceutical Students", S.J.Carter, CBS Publishers, Delhi.

PH-2202: Pharmaceutical Analysis – I

[Credits: 3]

1. Computation of analytical results, rejection of doubtful values with special reference to volumetric and gravimetric analysis.
2. Sources of errors in volumetric and gravimetric analysis and their avoidance, standard or the Gaussian error distribution curve.
3. Fundamentals of volumetric analysis, methods of expressing concentration, standardization, primary and secondary standards.
4. General principles of acidimetry, alkalimetry, oxidation-reduction and precipitation methods as exemplified by standard reagents such as Potassium hydrogen phthalate, carbonate, permanganate, dichromate, thiosulphate, silver nitrate etc.
5. Ionic equation and solution of stoichiometric and analytical problems.
6. Non-aqueous titrations.
7. Complexation - metal complexes, chelates, molecular organic complexes of pharmaceutical importance, complexometric titrations.

Suggested books: Latest editions of-

1. J.Bassett, R.C.Denny, G.H.Jeffery, J.Mendham, Vogel's Test book of Quantitative Inorganic Analysis, ELBS/Longman, London.
2. A.H.Beckett and J.B.Stenlake, Practical Pharmaceutical Chemistry, The Athlone Press of the University of London.
3. Pharmaceutical Analysis by T.Higuchi, CBS Publishers, New Delhi.

PH-2203: Pharmacognosy - I

[Credits 3]

1. History of Pharmacognosy - Crude vegetable and animal drugs, official and non-official drugs and Classification of crude drugs.
2. A brief survey of different systems of medicine existing in India, their basic principles and their relation to pharmacognosy.
3. General account of Cultivation and Collection of plants.
4. Salient features of preparation of crude drugs for market.
5. Deterioration of drugs due to insects and pests.
6. Study of earths used in pharmacy: Talc, Diatomite, Asbestos, Kaolin, Fuller's earth, Chalk, Bentonite.

7. Study of the following fibres used in the manufacture of surgical dressing and/or filtering aids: Vegetable fibres - cotton, oxidised cellulose. Animal fibres-silk and wool. Synthetic fibres-rayon, nylon.
8. Study of the diagnostic characters of the following families with emphasis on plants of medicinal and economic value: Ranunculaceae, Leguminosae, Papaveraceae, Umbelliferae, Compositae, Apocynaceae, Solanaceae, Rubiaceae, Scrophulariaceae, Nyctaginaceae, Loganiaceae, Euphorbiaceae, Asclepiadaceae & Acanthaceae.
9. Preparation and preservation of herbarium sheets of medicinal plants and their importance in identification work.
10. Study of photosynthesis with special reference to its role in biosynthesis of natural products.
11. Study of the following: Starch, Honeybee, Cantharides & Cochineal.

Suggested books: Latest editions of-

1. Kokate, C.K., "Practical Pharmacognosy", Vallabh Prakashan, Delhi.
2. Medicinal Plants of India, Indian Council of Medical Research, New Delhi.

PH-2204: Pharmacology - II

[Credits: 4]

1. Drug ADME, Pharmacogenetics.
2. Pharmacology of Peripheral Nervous System:
 - (a) Parasympathomimetics, Parasympatholytics, Sympathomimetics, Adrenergic Receptor and Neuron blocking agents, ganglionic stimulants and blocking agents.
 - (b) Neuromuscular blocking agents.
3. Pharmacology of Central Nervous System:
 - (a) General anesthetics and Local anesthetics.
 - (b) Alcohols and disulfiram.
 - (c) Sedatives, hypnotics, anti-anxiety agents and centrally acting muscle relaxants.
 - (d) Narcotic and non-narcotic analgesics.
 - (e) C.N.S. stimulants.
 - (f) Antidepressants
 - (g) Psychopharmacological
 - (h) Anti-epileptic drugs.
 - (i) Anti-Parkinsonian drugs.
 - (j) Drug addiction and drug abuse.
4. Male and female reproductive organs and their hormones. Menstruation, coitus and fertilization physiology. Contraception.

Suggested books: Latest editions of-

1. Goodman and Gilman's "The Pharmacological basis of Therapeutics", Editors: A Goodman Gilman, T.W.Rall, A.S.Nies, P.Taylor, Pergamon Press.
2. Best and Taylor's Physiological Basis of Medical Practice, Williams & Wilkins, Baltimore.

CH-2221A: Pharmaceutical Engineering

[Credits: 4]

1. Units and dimensions.
2. Fluid Flow: Properties of fluids, Types of fluids, Newtonian and non Newtonian fluids, Basic equations of fluid flow, Pipes and pipe fittings, Pressure and flow measurements.

3. Mechanical operations: Crushing and grinding, Laws of crushing and grinding, Sieving and particle classification, Mixing of powders, Dispersion of fine particles; Granulation in tablet making.
4. Heat Transfer: Introduction, principles and applications. Mathematical problems on heat transfer, conduction and convection, insulation, Convective heat transfer, Individual and overall heat transfer coefficients, Types of heat exchangers. Evaporation, basic concepts, factors affecting evaporation, evaporators, types of evaporators, single and multiple effect evaporators.
5. Mass transfer: Humidification and dehumidification: Basic concepts and definition, wet bulb and adiabatic saturation temperatures, psychometric chart and measurement of humidity, equipment for dehumidification operations.
6. Distillation: Raoult's law, phase equilibria, volatility; batch and continuous distillation, steam and flash distillations, azeotropic and extractive distillations.
7. Extraction: Principles and operation of solid – liquid and liquid-liquid extractions.

Practical:

PH-2401: Dispensing Pharmacy	[Credits: 3]
PH-2402: Pharmacognosy – I	[Credits: 2]
CH-2421A: Pharmaceutical Engineering	[Credits: 3]

Fifth Semester

PH-3101: Pharmaceutical Medicinal Chemistry – I **[Credits: 4]**

1. Heterocyclic Chemistry:
 - (a) Synthesis, reaction and pharmaceutical importance of the following:
 - (i) Two hetero atoms in five and six membered ring. Pyrazole, Imidazole, Thiazole, Oxazole, Pyrimidines.
 - (ii) Five or six membered hetero cycles fused to one Benzene ring : Benzofuran, Indole, Benzimidazole, Benzoxazole, Benzthiazole Coumarins, Quinoline and Isoquinoline
 - (iii) Benzodiazepine, phenothiazines, thioxanthenes, acridines, Dibenzazepins.
 - (b) Purine and Pyrimidines derivatives: Xanthenes, guanine, nucleic acid. Uric and methylated xanthenes, their structural elucidation and pharmaceutical importance.
2. Alkaloids: Methods of extraction and structure determination, classification and synthesis of the following alkaloids: Ephedrine, Nicotine, Atropine, Cocaine, Papaverine, Pilocarpine, Physostigmine.
3. Chemistry of Essential amino acids, peptides (Insulin), simple proteins.
4. SAR and synthesis and mechanism of action of compounds leading to the following classes of drugs.
5. Local Anaesthetics, Sedatives and Hypnotics (Barbiturates), Anti-convulsants, Non-opiate analgesics, Anti-tussives, Antispasmodics, Antihistaminics (ethylenediamines, aminoalkylesters, and tricyclic systems), Tranquillizers (Phenothiazines).

Suggested books: Latest editions of-

1. W.C.Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
2. J.N.Delagado and W.A.R.Remers, Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, J.Lipponcott Co., Philadelphia.

PH-3102: Pharmacognosy – II **[Credits: 3]**

1. A study of source, geographical distribution, cultivation (only those in italics), collection, preparation for market, macroscopical characters/description, commercial varieties, substitutes, adulterants, chemical constituents and tests, uses and pharmacopoeial standards of the following:
2. *Acacia*, *Agar*, *Tragacanth*, *Gelatin*, *Ispaghul*, *Sterculia*, *Benzoin*, *Balsam Tolu*, *Storax*, *Colophony*, *Asafoetida*, *Turpentine oil*, *Arachis oil*, *Castor oil*, *Shark liver oil*, *Bees wax*, *Catechu*, *Cannabis*, *Valerian*, *Chirata*, *Kalmegh*, *Picorrhiza*, *Punarnava*, *Aloe*, *Opium*, *Lemongrass*, *Brahmi*, *Taxus*.
3. Biological Source, preparation, description, identification tests and uses of the following enzymes: *Diastase*, *Hyaluronidase*, *Penicillinase*, *Papain*, *Pepsin*, *Trypsin*, *Pancreatin* and *Streptokinase*.
4. Introduction to tissue culture with reference to phytopharmaceuticals.
5. Commercial aspects of drug production, preservation and storage of crude drugs. Changes occurring in drying and comminution. Enzyme action in vegetable drugs.
6. Adulteration and evaluation of crude drugs.
7. Types and significance of standards of crude drugs included in I.P. and B.P.

Suggested books: Latest editions of-

1. Medicinal Plants of India, Zafar, R., CBS Publications, New Delhi.
2. Reinert, J. and Bajaj, Y.P.S., Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture, CRC Press, Florida, USA.
3. The Wealth of India: Raw Materials, CSIR, New Delhi.

PH-3103: Pharmaceutical Biochemistry

[Credits: 4]

1. Introduction: Scope of Biochemistry
2. Carbohydrates: Gluco- and glycogenolysis, glycogenesis, gluconeogenesis, alcoholic fermentation, Krebs cycle, HMP Shunt, ATP Synthesis, regulation of carbohydrate metabolism.
3. Amino Acids: Metabolism, urea cycle, Zwitterions.
4. Proteins: Primary, secondary, tertiary and quaternary structures, types and functions, biosynthesis, purification, isoenzymes.
5. Lipids: Metabolism of fatty acids, phospholipids, cholesterol biosynthesis, regulation of fatty acid metabolism.
6. Nucleic acids: Functions, genetic code.
7. Enzymes: Classification, assay, kinetic derivation of Michaelis – Menten's equation, mechanism of action, regulation (allosteric and feed back).
8. Vitamins: Structure, physiological & biochemical functions, coenzymes.
9. Hormones: Molecular mechanism of actions (epinephrine/glucagons and insulin and estradiol or testosterone), Cyclic AMP.
10. Energetic and cellular metabolism: Energetics of cellular reactions, biological oxidation and reduction and ATP synthesis, free energy changes.
11. Memory and consciousness: Biochemical, physiological and molecular basis, short term, intermediate term and long term memory, consolidation of short term memory.

Suggested books: Latest editions of-

1. B.Harrow and A.Mazur, Text Book of Biochemistry, W.B.Saunders Co., Philadelphia.
2. D.T.Plumer, An Introduction to Practical Biochemistry, Tata McGraw Hill, New Delhi.

PH-3104: Pharmacology – III

[Credits: 3]

1. Pharmacology of cardiovascular system:
 - (a) Digitalis and cardiac glycosides
 - (b) Antiarrhythmic drugs
 - (c) Coronary dilators
 - (d) Anti-hypertensive drugs
 - (e) Drugs used in atherosclerosis
2. Drugs acting on the Hemopoietic system:
 - (a) Hematinics and growth hormones
 - (b) Anticoagulants, Vitamin K and Hemostatic agents
 - (c) Fibrinolytic and anti-platelet drugs
 - (d) Blood and plasma volume expanders
3. Drugs acting on urinary system:
 - (a) Fluid and electrolyte balance restorers
 - (b) Diuretics and antidiuretics
5. Autacoids:
 - (a) Histamine, 5-HT and their antagonists.
 - (b) Prostaglandins, thromboxones and leukotrienes and kinins.
6. Drugs acting on the respiratory system:
 - (a) Anti-asthmatic drugs including bronchodilators and mucolytics.
 - (b) Anti-tussive and expectorants.
 - (c) Respiratory stimulants.

Suggested books: Latest editions of-

1. Goodman and Gilman's "The Pharmacological basis of Therapeutics", Editors: A Goodman Gilman, T.W.Rall, A.S.Nies, P.Taylor, Pergamon Press.
2. Crossland, J. and Thomson, J.H., "Essentials of Pharmacology" Harper and Row.

PH-3105: Pharmaceutical Jurisprudence

[Credits: 3]

1. Historical introduction to pharmaceutical legislations, Drugs and Cosmetics act and rules and amendments thereto, Pharmacy Act, Dangerous drugs act and rules. Medicinal and toilet preparations act and rules, Drugs and magic remedies act. Industries act. Medicinal termination of Pregnancy Act. Code of Pharmaceutical Ethics, Poison Act.
2. Controls on labels and labeling, packaging and storage. Patent Law, Law regulating the introduction of new drugs. Price control act.

Suggested books: Latest editions of-

1. Pharmaceutical Jurisprudence by N.K.Jain, CBS Publishers, New Delhi.

Practical:

PH-3301: Pharmaceutical Medicinal Chemistry - I

[Credits: 2]

PH-3302: Pharmacognosy - II

[Credits: 2]

PH-3303: Pharmaceutical Biochemistry

[Credits: 3]

PH-3304: Pharmacology – II

[Credits: 2]

Sixth Semester

PH-3201: Pharmaceutical Analysis – II

[Credits: 3]

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

1. Diazotization titrations, Kjeldahl method of nitrogen estimation, Karl-Fischer titration, Oxygen flask combustion.
2. Extraction procedures of separation of drugs from excipients.
3. Construction, theory and application of modern analytical- and electro-chemical instruments used in pharmaceutical analysis, such as necessary of the following:
Electrode assemblies, Electrical potential, pH measurement, Potentiometry, Conductometry, Polarography and Amperometry

Suggested books: Latest editions of-

1. Instrumental Methods of Analysis: Willard, N., CBS Publishers, New Delhi.
2. Quantitative Analysis, V. Alexey, CBS Publishers, New Delhi.

PH-3202: Pharmaceutical Biotechnology

[Credits: 3]

1. Immunology and Immunological Preparations. Principles, antigens and haptens, immune system, cellular humoral immunity, immunological tolerance, antigen – antibody reactions and their applications. Active and passive immunization, vaccines, their preparations, standardization and storage.
2. 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 insulin, GH, Hbs Ag, streptokinase etc.
3. Antibiotics, Historical development of antibiotics, Screening of soil for organisms producing antibiotics, fermenter, its design, control of different parameters; isolation of mutants, factors affecting rate of mutation; Design of fermentation process; Isolation of fermentation products with special reference to penicillin or vitamin B12.
4. Enzyme immobilization, techniques of enzyme immobilization, factors affecting enzyme kinetics; Study of some of the immobilized enzymes; Immobilization of bacteria and plant cells.
5. Tissue culture (Elementary knowledge) – Animal and plant tissue culture techniques.

Suggested books: Latest editions of-

1. Pharmaceutical Biotechnology by S.P.Vyas and V.K.Dixit, CBS Publishers, New Delhi.

PH-3203: Pharmacology – IV

[Credits: 3]

1. Principles of bioassay of Ach, d-tubocurarine, Histamine, Elementary biostatistics.
2. Drugs acting on gastrointestinal disorders:
 - (a) Antacids, anti-secretory and anti-ulcer drugs
 - (b) Laxatives and antidiarrhoeal drugs
 - (c) Appetite stimulants and suppressants
 - (d) Emetics and anti-emetics
3. Pharmacology of endocrine system:
 - (a) Hypothalamic and pituitary hormones
 - (b) Thyroid and anti-thyroid drugs
 - (c) Antidiabetics
 - (d) Adrenals and hormones
 - (e) Drugs acting on the uterus
4. Chemotherapy:
 - (a) General principles of chemotherapy

- (b) Sulphonamides and co-trimoxazole
- (c) Antibiotics: Pencillins, cephalosporins, chloramphenicol, erythromycin, quinolones and miscellaneous antibiotics.
- (d) Chemotherapy of malaria, tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.
- (e) Chemotherapy of malignancy and immunosuppressing agents
- (f) Anthelmintics and Anti-amoebics

Suggested books: Latest editions of-

1. Goodman and Gilman's "The Pharmacological basis of Therapeutics", Editors: A Goodman Gilman, T.W.Rall, A.S.Nies, P.Taylor, Pergamon Press.
2. Crossland, J. and Thomson, J.H., "Essentials of Pharmacology" Harper and Row.

PH-3204: Pharmaceutical Management

[Credits: 3]

1. Establishing a Pharmaceutical Factory:
 - (a) Law governing the establishment of a pharmaceutical factory and how to abide by it in starting such factory.
 - (b) Choice of site,
 - (c) Placement of the building/buildings within the site.
 - (d) Area and other requirements of each department such as maintenance, manufacturing, packing, warehousing services etc.
 - (e) Nature of building-single vs. multi-storied.
 - (f) Juxtaposition of each department
 - (g) Expansion possibilities in relation to projected future demand on the factory
 - (h) Layout of each department from the point of view of efficiency as well as from the drug legislation, Excise and factory act angle.
 - (i) Safety, Industrial pollutants, types, prevention.
 - (j) Materials handling of Pharmaceuticals
2. Organization of a pharmaceutical house, Types of Organization, Capital requirement, its relation between sales, laboratories and Production units.
3. Procedural matter of factory administration particularly production in relation to: quality control, GMP & ISO, in-process quality control, costing, warehousing, development of new products.
4. Main equipments necessary in the industry, their cost, cost control, availability and efficiency of performance.
5. Methods of communication within various departments of the factory.
6. Personnel requirements of the pharmaceutical factory and the Labour law; selection and training of personnel; Motivation, importance in industry, types and hierarchy.
7. Certain practices of commerce in pharmaceutical industry:
 - (a) Collection of statistics for import and export of raw materials and pharmaceuticals and application.
 - (b) Matters related to trade mark and patent laws in relation to pharmaceuticals.
 - (c) Inventory control.
 - (d) Market Research for pharmaceuticals; Production, Planning & Material management.

Suggested books: Latest editions of-

1. Principles of Industrial Management by L.P.Alford and H.R.Beatty, The Ronald Press Company, New York.

HU- : Open Elective (Humanities) [Credits: 3]
(Syllabi will be provided at Institute Level)

Practical:

PH-3401: Pharmaceutical Analysis – I [Credits: 3]

PH-3402: Pharmaceutical Microbiology [Credits: 3]

PH-3403: Pharmacology - III [Credits: 3]

Seventh Semester

PH-4101: Pharmaceutical Instrumental Analysis [Credits: 4]

1. Elementary knowledge of the Principles and Applications of U.V. and I.R. Spectroscopy in the structural elucidation of Organic compounds.
2. General treatment of the construction theory and application of modern optical and analytical instruments used in Pharmaceutical Analysis, such as necessary for working of the following:
 - (a) Colorimetry, fluorimetry, nephelometry and turbidometry
 - (b) Spectrophotometry - visible, ultra violet and infrared.
 - (c) Raman Spectra and Emission Spectroscopy
 - (d) Optical Rotation
 - (e) Radiochemical Analysis and use of Geiger Muller and Scintillation counters
 - (f) Elementary idea of X Ray Diffraction
3. Chromatography: Adsorption, partition, vapour phase, Ion exchange chromatography, Paper Electrophoresis (Elementary concepts), Counter current separation and Centrifugation.

Suggested books: Latest editions of-

1. Instrumental Methods of Analysis: Willard, N., CBS Publishers, N.Delhi.

PH-4102: Dosage Formulation Design [Credits: 4]

1. Pre-formulations studies of dosage forms; Pharmaceutical aids; their classification, nature, properties and uses in formulations.
2. Manufacturing of tablets: different forms, selection of adjuvants, technique of granulation, compression and coating, Fundamentals of physics of tablet making and Evaluation of Tablets.
3. Coating – Principles and Procedures.
4. Prolonged action and controlled release Drug Delivery Systems: Principles, methods of prolongation and control of Drug Release and their evaluation.
5. Parenteral medications: types of injections, clinical administration, product components and manufacturing process, design and working of clean room.
6. Dermatological preparations and Cosmetology: Their formulation, bases used, stability and their evaluation.
7. Aerosols: principles, different systems, propellants, containers and valve systems.

8. Pharmaceutical packaging – Materials and Technical Aspects.
9. Drug Regulatory Affairs – New Drug Application (NDA), Investigational New Drug (IND), Methods of filing Application and data to be submitted.

Suggested books: Latest editions of-

1. Leon Lachmen, H.A.Lieberman and J.L.Kanig, "The Theory and Practice of Industrial Pharmacy", Lea & Febiger, Philadelphia/Varghese Publishing House, Mumbai.
2. Martindale's Extra Pharmacopoeia (Ed. JEF Reynolos), The Pharmaceutical Press, London.
3. S.H.Willing: Good Manufacturing Practices for Pharmaceuticals, Marcel Dekker Inc., NY.
4. United States Pharmacopoeia, U.S.P. Convention Inc., Rockville, Madison (USA).
5. British Pharmacopoeia, 2003, Her Majesty's Stationary Office, University Press, Cambridge, U.K.

PH-4103: Pharmaceutical Medicinal Chemistry – II

[Credits: 3]

1. Elementary principles of Drug designing: SAR, PAR and QSAR; Hansch approach, Bioisosters.
2. Reactions of drug detoxification with representative examples.
3. Study of the development and synthesis of the compounds belonging to the following classes of drugs:
General and Basal Anaesthetics, Antipyretics, Antihypertensives, Analeptics, Antituberculars, Antileprotics, Anti-helminthics, Antiamoebics, Antimalarials, Anticoagulants (Heparin and Oval), Antithyroids, Oral Hypoglycemics, Diuretics and Sulphonamides.
4. A short account of the following classes of drugs:
Antineoplastics (Alkylating Agents and Antimetabolites), Antiseptics, Antifungal, Antiviral, Antiarrhythmics, NSAIDs, Diagnostics, Medicinal Dyes and Expectorants.

Suggested books: Latest editions of-

1. P.Sykes, A Guidebook to mechanism in Organic Chemistry, Orient Longman, New Delhi.
2. W.C.Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
3. C.Hanch, Comprehensive Medicinal Chemistry, Vol. IV, Quantitative Drug Design, Pergamon Press, Oxford, U.K.

Seventh Semester Elective Subjects:

PH-4104: Bioavailability & Therapeutic Drug Monitoring

[Credits: 3]

1. Principles of Drug Dissolution Related to Bioavailability; Dissolution Rate; Elementary idea of *in vitro* and *in vivo* correlation and its significance.
2. Explanation of terms: Bioavailability (Absolute and Relative), Bioequivalence, chemical and clinical and therapeutic equivalence, pharmaceutical alternative; Purpose and methods of bioavailability studies using blood level and urinary excretion data, Federal Requirements.
3. Definition of Pharmacokinetics and introduction to different pharmacokinetic parameters, such as rate constants for absorption and elimination, half-life, apparent volume of distribution, clearance, steady state plasma drug concentrations and factors affecting it. Calculation of Dosage regimen.

4. Therapeutic Drug Monitoring – Individualization of need based Dose requirement. Design of Dosage regimen; Pharmacokinetic evaluation of drug levels in body, readjustment of dosage regimen, clinical examples.

Suggested books: Latest editions of-

1. "Modern Pharmaceutics"; G.S.Banker and C.T.Rhodes, Marcel Dekker Inc., NY.
2. J.G.Wagner – Fundamentals of Clinical Pharmacokinetics, Drug Intelligence Publications, Hamilton, PA, USA.

PH-4105: Drug Design

[Credits: 3]

2. Principles of Drug Design (Theoretical Aspect), Traditional analog (QSAR) and mechanism based approaches:
 - (a) Objectives and Limitation of Quantitative Structure-activity relationship.
 - (b) QSAR Parameters
 - (c) QSAR Methods
 - (d) Substituent constants
 - (e) Linear relationship between Log P and Biological activity
 - (f) Non-Linear relationship between Log P and Biological activity
 - (g) Steric substituent constants
 - (h) Methods used in QSAR studies.
3. Introduction to Graph theory, Application and Quantum mechanics, Computer Aided Drug Designing and Molecular Modeling.
4. Preliminary idea of Quantitative Structure Pharmacokinetic relationship (QSPR) in Drug Design.

Suggested books: Latest editions of-

1. C.Hanch, Comprehensive Medicinal Chemistry, Vol. IV, Quantitative Drug Design, Pergamon Press, Oxford, U.K.

Practical:

PH-4301: Dosage Formulation Design

[Credits: 2]

PH-4302: Pharmaceutical Medicinal Chemistry – II

[Credits: 2]

PH-4303: Project

[Credits: 2]

PH-4304: Seminar/Group Discussion

[Credits: 2]

PH-4305: Training/Tour Viva-voce

[Credits: 2]

Eighth Semester

PH-4201: Clinical Pharmacy

[Credits: 3]

1. Introduction: History, Scope and Status of Clinical Pharmacy in India.
2. Drug Information.
3. Introduction to different pharmacokinetic parameters and Clinical Pharmacokinetics, Therapeutic drug monitoring. Important disorders and their management.
4. Concept of essential drugs and rational drug use.
5. Adverse drug reactions and pharmacovigilance.
6. Drug interactions.
7. General principles and management of clinical toxicity, essential drug use and rational drug combinations.
8. Drug use during infancy and in the elderly (Pediatrics & Geriatrics).
9. Drug Use during pregnancy.

10. Interpretation of Clinical Laboratory Tests.

Suggested books: Latest editions of-

1. J.G.Wagner – Fundamentals of Clinical Pharmacokinetics, Drug Intelligence Publications, Hamilton, PA, USA.

PH-4202: Pharmaceutical Medicinal Chemistry – III

[Credits: 3]

1. Principles and applications of ^1H NMR & ^{13}C NMR and Mass Spectra in structure elucidation of simple organic molecules.
2. Structure, synthesis, stereo-chemistry and physiological significance of:
 - (a) Cardiac glycosides and cardiac aglycones
 - (b) Vitamins A, B1, C and E
 - (c) Alkaloids - Gnoscapine (Isoquinoline), Yohimbine (Indole), Conessine (Steroidal) and Vasicine (Quinazole)
 - (d) Natural colouring matters - Rutin (flavonoid), Cyanin (Anthocyanin)
3. Steroids: General chemistry and configuration of steroids with special reference to Cholesterol, Ergosterol, Vitamin D and Bile acids.
4. Chemistry of Steroidal hormones - Sex hormones (testosterone, progesterone and estrogens) and corticoids (Cortisone).
5. Antibiotics - Structure, synthesis and assay of penicillin; and chloramphenicol, Semi-synthetic penicillin; Chemistry of streptomycin and tetracyclines.

Suggested books: Latest editions of-

1. W.C.Foye, Principles of Medicinal Chemistry, Lea & Fabiger, Philadelphia.
2. J.N.Delagado and W.A.R.Remers, Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, J.Lipponcott Co., Philadelphia.

PH-4203: Pharmacognosy - III

[Credits: 3]

1. The study of biological source, geographical distribution, cultivation (only those bracketted), collection, preparation for market, microscopical characters, commercial varieties, substitutes adulterants, detailed microscopical characters (only those underlined), chemical constituents and pharmacopoeial standards of the following (Dill), Fennel, (Coriander), (Senna), (Cardamom), (Nutmeg), (Nux-vomica), (Clove), Aconite, (Liquorice), (Ipecac), (Rauwolfia), Rhubarb, (Ginger), (Scilla), (Ephedra), (Ergot), Vasaka, (Belladonna), (Digitalis), Hyoscyamus, (Cinchona), (Cinnamon), Kurchi, (Quassia), Mentha, (Pyrethrum), Ginseng.
2. Principles and methods of Quantitative microscopical analysis:-
Stomatal index, Stomatal number, Palisade ratio, Vein islet number and vein termination number; Lycopodium Spore method for the evaluation of starches.
3. General principles of plant genetics dealing with pharmaceutical examples and applications.
4. General methods of investigations of biosynthetic pathways in vegetable drugs.
5. An elementary treatment of biosynthetic pathways of alkaloids, isoprenoids, coumarins, flavones and glycosides.
6. Separation techniques as applied to isolation of plant constituents.
7. Steroids from natural sources of commercial use.
8. Microbial Transformation of steroids.

Suggested books: Latest editions of-

1. Trease, G.E. and Evans, W.C., Pharmacognosy, Bailliere Tindall, Eastbourne, U.K.
2. Wallis, T.E., "Analytical Microscopy", J & A Churchil Limited, London.
3. Medicinal Plants of India, Indian Council of Medical Research, New Delhi.

Eighth Semester Elective Subjects:

PH-4204: Cosmetology

[Credits: 3]

1. Perfumes: Basic principles of perfumery and fragrance; perfumery raw materials (natural as well as synthetic), fixatives (animal secretions, resinous fixatives, essential oil fixatives, synthetic fixatives), improvers. Formulation of perfumes.
2. Cosmetics:
 - (a) Principles of formulation and manufacture of cosmetics.
 - (b) Emulsification in cosmetics, preparation, preservation and stability of cosmetic products creams.
 - (c) Formulation of following classes of cosmetic preparations:
 - i. Face products: Vanishing creams, cold creams, emollient creams, cleansing creams, moisturizing creams, face powder, lipstick.
 - ii. Hand Products: Protective creams, hand creams and lotions, liquid creams, hand cleaners, nail lacquers.
 - iii. Body Cosmetics: Antiperspirants and deodorants. Depilatories. Talcum and dusting powders, perfumes.
 - iv. Preparations for Oral hygiene: Mouthwash, dentifrices.
 - v. Hair Products: Shampoos, hair grooming & conditioning products, hair waving and setting products.
 - vi. Shaving Products: Pre-shave and after-shave lotions, shaving preparations.
 - vii. Baby specialities: Lotions.
3. Colours: Natural and Synthetics; Characteristics.
4. Preservatives and Antioxidants: Classification, effective concentration, incompatibility.
5. Packaging and labeling of cosmetics.
6. Safety and Toxicity Testing of various types of Cosmetics.

Suggested books: Latest editions of-

1. "Cosmetic Science and Technology", Sagarin and M.S.Balsam, John Wiley & sons, NY.
2. S.G.Thomssen, "Modern Cosmetics", Universal Publishing Corporation, Mumbai.

PH-4205: Quality Assurance

[Credits: 3]

1. Introduction and scope of: cGMP, cGLP, ISO, TQM with reference to pharmaceutical products.
2. Control of quality variation: raw materials control, in-process items control, quality assurance during packaging.
3. Control and assurance of manufacturing process.
4. Regulatory drug analysis and interpretation of data.
5. Validation of equipment, analytical instruments and manufacturing environment.

Suggested books: Latest editions of-

1. A.N.Martin: Physical Pharmacy, Lippincott Williams and Wilkins, Baltimore, USA.
2. S.H.Willing: Good Manufacturing Practices for Pharmaceuticals, Marcel Dekker Inc., NY.

Practical:

PH-4401: Pharmaceutical Instrumental Analysis

[Credits: 2]

PH-4402: Pharmacognosy - III

[Credits: 2]

PH-4403: Project

[Credits: 6]

PH-4404: Comprehensive Viva-voce

[Credits: 2]

