PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

PLAN AND SCHEME OF EXAMINATION

B. PHARM. Session 2009-2010

B. Pharm. Semester- I

S. No.	Subject Code	Subject	Teaching H/Week		Sessional marks Internal		Main Exam. Marks (External)	
			T	P	T	P	T	P
01	PHM 1.1.1	Pharmaceutical Analysis-I	3	4	20	20	80	80
02	PHM 1.1.2	Introduction to dosage form	4	-	20	-	80	-
03	PHM 1.1.3	Pharmacognosy-I	3	4	20	20	80	80
04	PHM 1.1.4	Pharmaceutical chemistry-I (Inorganic Pharmaceutical chemistry)	3	4	20	20	80	80
05	PHM 1.1.5	Compute science and application	4	4	20	20	80	80
			17	16	100	80	400	320

B. Pharm. Semester- II

S. No.	Subject Code	Subject	Teaching H/Week		Sessional marks Internal		Main Exam. Marks (External)	
			T	P	T	P	T	P
01	PHM 1.2.1	Pharmaceutics –I (Dispensing and Community Pharmacy)	4	4	20	20	80	80
02	PHM 1.2.2	Pharmacognosy -II	3	4	20	20	80	80
03	PHM 1.2.3	Pharmaceutical chemistry-II (Physical Chemistry)	4	4	20	20	80	80
04	PHM 1.2.4	Pharmaceutical chemistry-III (Organic chemistry-I)	4	4	20	20	80	80
05	PHM 1.2.5	Anatomy Physiology and Health Education -I	3	3	20	20	80	80
			18	19	100	100	400	400

B. Pharm. Semester- III

S No.	Subject Code	Subject	Teaching H/Week		Sessional marks Internal		Main Exam. Marks (External)	
			T	P	T	P	T	P
01	PHM 2.3.1	Pharmaceutics –II (Unit operation-I)	3	4	20	20	80	80
02	PHM 2.3.2	Pharmaceutical chemistry-IV (Organic chemistry-II)	4	4	20	20	80	80
03	PHM 2.3.3	Pharmaceutical Mathematics	4	-	20	-	80	-
04	PHM 2.3.4	Pharmaceutical Microbiology	4	3	20	20	80	80
05	PHM 2.3.5	Anatomy Physiology and Health Education -II	3	4	20	20	80	80
			18	15	100	80	400	320

B. Pharm. Semester- IV

S. No.	Subject Code	Subject	Teaching H/Week		Sessional marks Internal		Main Exam. Marks (External)	
			T	P	T	P	T	P
01	PHM 2.4.1	Pharmaceutics –III (Unit operation-II)	4	4	20	20	80	80
02	PHM 2.4.2	Pharmaceutical Analysis-II	4	4	20	20	80	80
03	PHM 2.4.3	Pharmacognosy-III	4	4	20	20	80	80
04	PHM 2.4.4	Pathophysiology of common diseases	4	-	20	-	80	-
05	PHM 2.4.5	Pharmaceutics –IV (Physical Pharmacy)	4	4	20	20	80	80
			20	16	100	80	400	320

B. Pharm. Semester- V

S. No.	Subject Code	Subject	Teaching H/Week		Sessional marks Internal		Main Exam. Marks (External)	
			T	P	T	P	T	P
01	PHM 3.5.1	Pharmaceutical chemistry-V (Biochemistry)	3	4	20	20	80	80
02	PHM 3.5.2	Pharmaceutics –V (Pharmaceutical Technology –I)	4	4	20	20	80	80
03	PHM 3.5.3	Pharmacology -I	4	4	20	20	80	80
04	PHM 3.5.4	Pharmacognosy-IV	3	3	20	20	80	80
05	PHM 3.5.5	Pharmaceutics –VI (Hospital Pharmacy)	4	3	20	20	80	80
			18	18	100	80	400	400

B. Pharm. Semester- VI

S. No	Subject Code	Subject	Teaching H/Week		Sessional marks Internal		Main Exam. Marks (External)	
			T	P	T	P	T	P
01	PHM 3.6.1	Pharmaceutical chemistry-VI (Medicinal Chemistry-I)	4	4	20	20	80	80
02	PHM 3.6.2	Pharmaceutical Jurisprudence and ethics	3	-	20	-	80	-
03	PHM 3.6.3	Pharmaceutics VII (Biopharmaceutics & Pharmacokinetics)	4	4	20	20	80	80
04	PHM 3.6.4	Pharmacology -II	4	6	20	20	80	80
05	PHM 3.6.5	Pharmacognosy-V	3	4	20	20	80	80
			18	18	100	80	400	320

B. Pharm. Semester- VII

S. No	Subject Code	Subject	Teaching H/Week		Sessional marks Internal		Main Exam. Marks (External)	
			T	P	T	P	T	P
01	PHM 4.7.1	Pharmaceutical Biotechnology	4	-	20	-	80	-
02	PHM 4.7.2	Pharmaceutics –VIII (Pharmaceutical Tech.-II)	4	6	20	20	80	80
03	PHM 4.7.3	Pharmaceutical Industrial Management	4	-	20	-	80	-
04	PHM 4.7.4	Pharmacology –III	4	4	20	20	80	80
05	PHM 4.7.5	Pharmaceutical chemistry-VII (Medicinal Chemistry-II)	4	4	20	20	80	80
06	PHM 4.7.6	List of elective subject (Project work)	-	6				
			20	20	100	60	400	240

B. Pharm. Semester- VIII

S. No	Subject Code	Subject	Teaching H/Week		Sessional marks Internal		Main Exam. Marks (External)	
			T	P	T	P	T	P
01	PHM 4.8.1	Pharmaceutics –IX (Dosage form Design)	4	3	20	20	80	80
02	PHM 4.8.2	Pharmaceutical Analysis-III	4	6	20	20	80	80
03	PHM 4.8.3	Pharmaceutical chemistry-VIII (Medicinal Chemistry-III)	4	3	20	20	80	80
04	PHM 4.8.4	Pharmacognosy-VI	4	3	20	20	80	80
05	PHM 4.8.5	Pharmacology –IV (Clinical Pharmacy and Drug Interaction)	4	-	20	-	80	-
06	PHM 4.8.6	Dissertation on the project	-	6				100
			20	21	100	80	400	420

B. Pharm. I Semester

01. PHM 1.1.1 : Pharmaceutical Analysis-I

Sub. Code	Subject	Theory
PHM 1.1.1	Pharmaceutical Analysis-I	3 hrs/ week

1. Quantitative Analysis and Data Handling: Introduction to concept of Quality Control and Assurance in Pharmaceutical Industry and role of Statistics in pharmaceutical analysis. Significance of quantitative analysis in quality control, different techniques of analysis, preliminaries and definitions, significant figures. Rules for retaining significant figures, Types of errors (Determinate and Indeterminate). Minimization of errors, Propagation of errors in addition and subtraction, multiplication and division, exponents, logarithms, precision and accuracy, selection of sample. **8**

2. Acid Base Titrations: Acid base concept, role of the solvent, Relative strengths of acids and bases; Law of mass action; common ion effect, ionic product of water, pH, Hydrolysis of salts, Handerson – Hasselbach equation; Buffer and buffer capacity: Acid base indicators, Theory of indicators, Choice of indicators; Neutralization curves (Strong acid and strong base, strong acid weak base, weak acid strong base and weak acid weak base) Polyprotic system, dissociation calculations for polyprotic acids, fractions and equilibrium concentrations of dissociating species at a given pH, salts of polyprotic acids, (Amphoteric salts and unprotonated salts), Buffer calculations for polyprotic acids, titrations of polyprotic acid, amino acid system and its titrations. Application in assay of H_3B0_3, HCl, H_3P0_4, NaOH and Na_2B0_3. **10**

3. **Oxidation-Reduction Titrations:** Concepts of oxidation and reduction, redox reactions, equivalent weights of oxidizing and reducing agents, electrochemical cells, reduction potential, standard reduction potential, Nernst equation, cell representations, measurement of electrode potential and its application in determining the equilibrium constant of a reaction, concept of formal potential, oxidation reduction curves, redox indicators, potassium pemanganate titrations, iodimetry and iodimetry, ceric sulphate titrations, potassium iodate titrations, sodium 2, 6- dichlorophenol - indophenol titrations, pharmaceutical applications. **10**

4. Precipitation Titrations

Precipitation reactions, solubility product, effects of common ion, acids, temperature and solvent upon the solubility of a precipitate, conditional solubility product, fractional precipitation, argentiometric titrations, ammonium or potassium thiocyanate titrations, mercuric nitrate titrations, indicators, Gay-Lussac method, Mohr's method, Volhard's method, Fajan's method, Pharmaceutical applications. **12**

5. **Gravimetric Analysis:** Precipitation techniques, the colloidal state, gravimetric factor, supersaturation, co-precipitation and its types, Post precipitation, digestion, washing of the precipitate, filtration, filter papers and crucibles, ignition, thermogravimetric curves of copper sulphate, specific examples like barium as barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants**.** **8**

Sub. Code	Subject	Practical
PHM 1.1.1	Pharmaceutical Analysis-I	4 hrs/ week

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 standardization 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.

Books Recommended:

1. Becket & Stenlake. Practical Pharmaceutical Chemistry. Vol. 1& 2. 4th edition, 2005. CBS Publishers, New Delhi.
2. Jeffery, Bassett & Mendham. Vogel's text book of Quantitative chemical analysis. 5th edition, 1996. Addison Wesley Longman Ltd England.
3. Danzer K, Analytical Chemistry, 2007, Springer
4. Verma. Analytical Chemistry. IIIrd edition, 2007. CBS Publishers, New Delhi.
5. Alexeyev. Qualitative Analysis. 2nd edition, 2005. CBS Publishers, New Delhi.
6. L. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry, Oxford University Press, Delhi (Latest Edition).

02. PHM 1.1.2 : Introduction to Dosage Forms

Sub. Code	Subject	Theory
PHM 1.1.2	Introduction to Dosage Forms	4 hrs/ week

1. Pharmacy Profession : History of Pharmacy, Pharmacy as a career, Pharmaceutical education in India and abroad, Pharmacopoeia of India and other Pharmacopoeias, Other official books. **06**
2. Introduction to different dosage forms, their classification with examples (Official formulation), their relative application. **05**
3. Definitions, general formulation, manufacturing procedures and official products of solutions, aromatic waters, syrups, spirits, elixirs, glycerides, lotions, liniments, gargles, mouth washes, douches, draught preparation. **15**
4. Additive of dosage forms : Introduction, classification and uses of following additives in formulation of different dosage forms : preservatives, antioxidants, surfactants, hydrocolloids, Diluents, binders, lubricants, organoleptic additives, **08**
5. Crude Extracts : Infusion, decoction, tincture, and extracts, methods of preparation of dry, soft and liquid extracts of IP. **06**
6. Allergenic extracts : Types of allergens, preparation of extracts testing and standardization of extracts. **05**
7. Important terms of Pharmaceutics : definition and examples of expectorant, pharmaceutical aid, additives, **05**

Book Recommended

1. Remington's Pharmaceutical Sciences.
2. Pharmacopoeia of India, Govt. of India, Ministry of Health
3. Ansel : Introduction to Pharmaceutical Dosage Forms

03. PHM 1.1.3 : Pharmacognosy -I

Sub. Code	Subject	Theory
PHM 1.1.3	Pharmacognosy -I	3 hrs/ week

1. Definition, history, scope and development of Pharmacognosy. **02**
2. **Sources of drugs:** Biological, marine, mineral and plant tissue cultures as sources of drugs. **03**
3. **Plant Cell:** Its structure and non-living inclusions; mitosis and meiosis; different types of plant tissues and their functions. Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed. Modification of root and stem. **05**

4. **Classification of drugs:** e.g. Alphabetical, morphological, taxonomical, chemical and pharmacological. **02**

5. **Plant taxonomy**: Study of the following families with special reference to medicinally important plants- Apocynacae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae,Liliaceae, Graminae, Libiatae, Cruciferae, Papaveraceae. **12**

6. **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. **06**

7**. Quality control of crude drugs:** Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation. Add."Introduction to crude drug monograph and its importance in registration of herbal products. **08**

8. **An introduction to active constituents of drugs:** Their isolation classification and properties – alkaloid, glycosides, terpines, steroids and flavonoids **06**

9. **Systematic pharmacognostic study of following:**

a) **Carbohydrates and derived products:** Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia and Tragacanth. **04**

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. **04**

Sub. Code	Subject	Practical
PHM 1.1.3	Pharmacognosy -I	4 hrs/ week

1. Preparation, microscopic examination of stem, root and leaf of monocot and dicot plants. Morphological characteristics of plant families mentioned in Theory.
2. Microscopic measurements of cells and cell contents: Starch grains, calcium oxalate crystals and phloem fibres.
3. Determination of leaf constants such as stomatal index, stomatal number, veinislet number, vein-termination number and palisade ratio.
4. Identification of crude drugs belonging to carbohydrates and lipids.
5. Preparation of herbarium sheets.

04. PHM 1.1.4 Pharmaceutical Chemistry-I (Inorganic P'ceutical Chemistry-I)

Sub. Code	Subject	Theory
PHM 1.1.4	Pharmaceutical Chemistry-I (Inorganic Pharmaceutical Chemistry-I)	3 hrs/ week

1 Impurities in Pharmaceutical Substances & their Control.Sources and types of impurities, their limits, limit test for chlorides, sulphates, iron, lead and arsenic. **04**

2. **Pharmaceutical Aids & Necessities**

2.1 **Antioxidants:** Theory, the selection of Antioxidants, Official antioxidants (Hypophosphorous Acid, Sodium bisulphite, Sodium thiosulphate,Sodium nitrite **03**

2.2 **Water:** Official water (Water, Purified water, Water for injection, Bacteriostatic water for injection, Sterile water for injection) **03**

3. **Major Intra & Extracellular Electrolytes**

Major Physiological ions (Chloride, Phosphate, Bicarbonate, Sodium, Potassium, Calcium, Magnesium); Electrolytes used in replacement therapy(Sodium chloride), Potassium replacement (potassium chloride), Calcium replacement (Calcium chloride, Calcium gluconate) Parenteral magnesium administration (Magnesium sulphate), Physiological acid base balance, Electorlytes used in acid base therapy (Sodium acetate, Potassium acetate, Sodium bicarbonate, Sodium citrate, Potassium citrate, Sodium lactate, Ammonium chloride), Electrolyte combination therapy. **06**

4. **Essential and Trace Elements**

Iron, Copper, Zinc, Chromium, Manganese, Molybdenum, Selenium, Sulphur and Iodine. Official Iodine Products (Iodine, Potassium iodide, Sodium iodide). **03**

5. **Gastrointestinal Agents**

5.1 **Acidifying agents**, **Antacids:** (Sodium bicarbonate, Aluminium hydroxide, Aluminium phosphate, Dihydroxy Aluminium, Sodium carbonate, Calcium carbonate, Tribasic Calcium phosphate, Magnesium carbonate, Magnesium hydroxide, Magnesium oxide, Magnesium phosphate, Magnesium trisilicate) Combination antacid preparations. **04**

5.2 **Protectives and Adsorbents:** Introduction. Bismuth containing products, Bismuth subnitrate, Bismuth subcarbonate, Kaolin, Activated charcoal. **02**

5.3 **Saline Cathartics:** Introduction, Sodium phosphate, Potassium sodium tartrate, Magnesium hydroxide, Magnesium citrate, Magnesium sulphate, , Potassium phosphate, Potassium bitartrate, Calomel. **04**

6. **Topical Agents**

6.1 **Protective:** Definition, Protective products, Talc, Insoluble Zinc compounds (Zinc oxide, Calamine, Zinc stearate), Titanium dioxide, Aluminium as a protective agent, Silicone polymer. **04**

6.2 **Antimicrobials and Astringents:** Antimicrobial terminology, mechanism of action, control of antimicrobial/ astringent action. **03**

6.3 **Oxidative Antimicrobial Agents:** Hydrogen peroxide, Zinc peroxide, Sodium carbonate, Potassium permanganate, Iodine preparation and compounds**.** **03**

6.4 **Protein Precipitant Antimicrobial Agents:** Silver nitrate, Mild Silver Protein Mercury compounds (Yellow Mercuric oxide, Mercuric chloride), Sulphur and Sulphur compounds(Sublimed sulphur and Precipitated sulphur) Boric acid and Sodium borate, Antimony potassium tartrate, Official compounds of Aluminium and Zinc. **04**

7. **Dental Products:** Anticaries agents: Fluorides, official products (Sodium fluoride, Stannous fluoride), Phosphates, Dentifrices: Dentifrices containing Fluorides, Official products (Pumice). Dentifrices containing desensitizing agents, Official products (Zinc chloride and Zinc-Eugenol cement). **04**

8. **Co-ordination Compounds and Complexation:** Theoretical considerations and official products (Calcium disodium edetate, Disodium edetate, Dimercaprol and Penicillamine) **02**

9. **Miscellaneous Inorganic Pharmaceutical Agents:** Inhalants, respiratory stimulants, expectorants and emetics, antidotes,tableting aids and suspending agents. **02**

Sub. Code	Subject	Theory
PHM 1.1.4	Pharmaceutical Chemistry-I (Inorganic Pharmaceutical Chemistry-I)	3 hrs/ week

The background and systematic qualitative analysis of inorganic mixtures of up to four radicals. Six Mixtures to be analyzed, preferably by semi-micro methods. All indentification tests for pharmacopoeal inorganic pharmaceuticals and qualitative tests for cations & anion should be covered .

Books Recommended:

1. J.H. Block, E. Roche, T.O. Soine and C.O. Wilson, "Inorganic Medicinal and Pharmaceutical Chemistry", Lea & Febiger, Philadelphia, P.A.
2. 2. L.M. Artherden, Bentley and Drivers, "Textbook of Pharmaceutical Chemistry", S& Ed., Oxford University Press, Delhi.
3. Pharmacopoeia of India, Govt. of India, Ministry of Health.
4. Block, Roche, Soine & Wilson. Inorganic Medicinal & Pharmaceutical Chemistry. 1st edition, 1986. Varghese publishing house, Mumbai.
5. Chatwal. Pharmaceutical Chemistry Inorganic. 3rd edition, 2007. Himalaya publishing house, Mumbai.
6. Singh & Kapoor. Practical Pharmaceutical chemistry. 4th edition, 1998. Vallabh prakashan, Delhi.

05. PHM 1.1.4 Computer Science and Applications

Sub. Code	Subject	Theory
PHM 1.1.5	Computer Science and Applications	4 hrs/ week

1. Computer Fundamentals :

1.1 Introduction to computers : Characteristics of computers, Historical perspectives of computers, computer generations, types of computers and uses, Software, Hardware, Basic architecture and functions of CPU and its parts, Important I/O devices like Keyboard, Mouse, Printers, Video Monitors. **04**

1.2 Number System : Decimal, Binary, Basic Binary arithmetic (Conversion to and from decimal numbers, Binary addition and subtraction). **04**

1.3 Memory Storage : Memory Cells, Semiconductor and Magnetic core memory, ROM (its types), RAM, Cache and Virtual memory, Secondary storage devices and their organization (Hard disk, Floppy disk, CD, DVD). **04**

2 Operating Systems : Definitions, Need, Organization, Functions, Types of Operating Systems, DOS, Windows, Handling Drives, Directories and files, Commands (Internal & External), Icons, Clipboard, Folders, Major differences between DOS & Windows. **06**

3. Communication Networks : Hardware and software components, Seven layers of OSI architecture, Network Topologies (Ring, Star, Fully Connected and Bus), LAN and WAN, Bounded and unbounded communication media, Internet, World Wide Web and I.T., Browsers, Important terminology regarding Internet applications, Electronic Mail, Potential uses and abuses of Internet. **07**

4. Computer Programming : Programming languages, Classifications, Low level and high level languages, merits and pitfalls of languages, object oriented languages, Syntax and semantics, Basic steps involved in software development, Flow charts, Compilers and Interpreters. **07**

5 Simple programming using 'C' Data types, Constants, Variables, Arithmetic and relational expressions, Symbolic constants, Input and output assignment statements, If-else, Switch statements, Loops (While, do-while and for), Transfer statements, Arrays, Problem solving using 'C' taking simple algorithms. **08**

6. Computer Applications :

6.1 Word processing : Techniques, File manipulation, Formatting, Printing setups Table handling, Mail merge, etc. using MS-Word. **02**

6.2 Spreadsheet package : Worksheets, Formatting sheets, Calculations and graphing using formulae and functions, Import and export of data using MS-Excel. **02**

6.3 Graphics : Objectives and types of graphics , Presentation packages, Slides designing, Diagrams and graphs, Import & Export data using MS-Power Point. **02**

6.4 Data security against viruses : Definition of computer viruses, Detection, prevention and cure against viruses using anti-virus software packages. **02**

6.5 Pharmaceutical applications : Basics of computer use in various pharmaceutical and clinical applications like drug information services, hospital and community pharmacy, drug design, pharmacokinetics and data analysis. **02**

Sub. Code	Subject	Practical
PHM 1.1.5	Computer Science and Applications	4 hrs/ week

Simple exercises based upon the following need to be dealt :

1. Computer operating systems like MS-DOS, MS-Windows.
2. Word-processing like MS-Word.
3. Spreadsheet calculations using MS- Excel.
4. Graphic applications using MS-Power Point, MS-Excel.
5. Programming using 'C'.Book references (for Theory and Practicals):

Books Recommended:

1. Fundamentals of Computers by Rajaraman, Prentice Hall of India

2. Tiwari, NK, Computer Fundamental with Pharmacy Applications, Ist edition, 2008, Pharm Med Press
3. Learn MS-Office 2000 by Stultz, BPB Publications. 4. Using Microsoft Windows 1998 by Ivens, Prentice Hall of India.
5. Learn DOS in a day by Stultz, BPB Publications.

B. Pharm. Semester- II

01. PHM 1.2.1 : Pharmaceutics –I (Dispensing and Community Pharmacy)

Sub. Code	Subject	Theory
PHM 1.2.1	Pharmaceutics –I (Dispensing and Community Pharmacy)	3 hrs/ week

1. **Introduction :** Definition, Scope and future trends in Dispensing **02**
2. **Prescription :** Definition, various part of prescription, Handling of prescription, source of errors in prescription, General dispensing procedures including labeling of dispensing products. **04**
3. **Pharmaceutical calculations:** Posology, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipes percentage solutions, alligation, alcohol dilution, proof spirit, isotonic solutions and displacement value. **10**
4. **Principles involved and procedures adopted in dispensing of:** Typical prescriptions like mixtures, solutions, emulsions, creams, ointments, powders, capsules, pastes, jellies, suppositories, ophthalmic, pastilles, lozenges, pills, lotions, liniments, inhalations, paints, sprays, tablet triturates etc. **18**
5. **Incompatibilities:** Physical, therapeutic and chemical incompatibilities, inorganic incompatibilities including incompatibilities of metals and their salts, non-metals, acids, alkalis, organic incompatibilities. Purine bases, alkaloids, pyrazolone derivatives, amino acids, quaternary ammonium compounds, carbohydrates, glycosides, anesthetics, dyes, surface active agents, correction of incompatibilities. Therapeutic incompatibilities. **07**
6. **Community Pharmacy :** Organization and structure of retail and wholesale drug store-types of drug store and design, legal requirements for establishment, maintenance and drug store, dispensing of proprietary products, maintenance of records of retail and wholesale,patient counseling, role of pharmacist in community healthcare & education.**07**

Sub. Code	Subject	Practical
PHM 1.2.1	Pharmaceutics –I (Dispensing and Community Pharmacy)	4 hrs/ week

1. **Dispensing of prescription falling under the categories:** Mixtures, solutions, emulsions, creams, ointments, powders, suppositories, ophthalmic, capsules, paste, jellies, pastilles, lozenges, pills, tablet triturates, 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 pharmaceuticals calculations, pricing of prescriptions and dosage calculations for pediatric and geriatric patients.
4. Dispensing of prescriptions involving adjustment of tonicity.
5. Categorization and storage of Pharmaceutical products based on legal requirements of labeling and storage.

6. Project report on Visit to the nearby Community for Counseling on the rational use of drugs and aspects of healthcare.

Books Recommended

1. Carter SJ. "Cooper & Gunn's Tutorial Pharmacy", 6th edition, CBS Publishers & Distributors, New Delhi.
2. Indian Pharmacopoeia 2007, Vol I-III**,** 2008, Indian Pharmacopoeia Commission, Ghaziabad.
3. British Pharmacopoeia 2009, British Pharmacopoeia Commission, UK.
4. Remington's The Science & Practice of Pharmacy Mack Publishing Co. Easton, PA
5. Jain NK & Gupta GD. Modern Dispensing Pharmacy, II edition, 2009, Pharma Book Syndicate, Hyderabad.
6. Gaud RS & Gupta GD. Practical Pharmaceutics, 1st edition, Reprint 2008, , CBS Publishers & Distributors, New Delhi.

02. PHM 1.2.2 : Pharmacognosy-II

Sub. Code	Subject	Theory
PHM 1.2.2	Pharmacognosy-II	3 hrs/ week

1. **Resins**: Study of Drugs Containing Resin and Resin Combination like Colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of peru, benzoin, turmeric, ginger. **06**

2. **Tannins:** Study of tannins and tannin containing drugs like Gambir, black catechu, gall and myrobalan. **05**

3. **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, Palamarosa Gaultheria, Sandal wood. **12**

4. **Phytochemical Screening:**

a) Preparation of extracts, and fractionation into single constituent fractions using column chromatographic methods of isolation. **03**

b) Chemical and chromatographic methods of screening of Screening of alkaloids, saponins, cardenolides and bufradienolides, flavonoids and leucoanthocyanidins, tannins & polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts. **08**

5. **Fibres:** Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos. Pharmaceutical standards of fiber products. **05**

6. **Pharmaceutical aids:** Study of pharmaceutical aids of category dispersing, emulsifying, suspending agents and viscosity builders, e.g., like talc, diatomite, kaolin, bentonite, gelatin and natural colors. **06**

Sub. Code	Subject	Practical
PHM 1.2.2	Pharmacognosy-II	3 hrs/ week

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

Books Recommended

1. Trease, G. E. and Evans, W.C. Pharmacognosy, Published by Elsevier, a Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. Kokate, C.K., Purohit, A.P. and Gokhale, S.B Pharmacognosy, Nirali Prakashan, Pune.
3. Handa, S.S and Kapoor, V.K. Textbook of Pharmacognosy, Vallabh Prashan, New Delhi.
4. Wallis, T.E. Textbook of Pharmacognosy, Fifth Edition, CBS Publishers and Distributors, New Delhi.
5. Tyler, V.C., Brady, L.R. and Robers, J.E. Pharmacognosy. Lea & Febiger, Philadelphia.

03. PHM 1.2.3 : Pharmaceutical Chemistry-II (Physical Chemistry)

Sub. Code	Subject	Theory

PHM 1.2.3	Pharmaceutical Chemistry-II (Physical Chemistry)	4 hrs/ week

1. **Behaviour of Gases:** Kinetic theory of gases, deviation from ideal behaviours and explanation **04**
2. **The Liquid State** : Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents **05**
3. **Solutions:** Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient,conductance and its measurement, Debye Huckel theory. **06**
4. **Thermodynamics:** First, second and third laws, Zeroth law, absolute temperature scale, thermochemical equations, phaseequilibria and phase rule. **09**
5. **Adsorption:** Freudlich and Gibbs adsorption, isotherms, Langmuir theory of adsorption. **04**
6. **Photochemistry:** Consequences of light absorption, Jablenski diagram, Lambert-Beer Law, Quantum efficiency. **05**
7. **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. **10**
8. **Quantum Mechanics:** Postulates of quantum mechanics, operators in quantum mechanics, the Schrodinger wave equation. **05**

Sub. Code	Subject	Practical
PHM 1.2.1	Pharmaceutical Chemistry-II (Physical Chemistry)	4 hrs/ week

1. To determine molar mass by Rast method and cryoscopic method.
2. To determine refractive index of given liquids and find out the contribution of carbon, hydrogen and oxygen in molar refraction of a compound.
3. To determine molar mass of volatile liquids by Victor-Meyer method.
4. To determine the specific rotation of sucrose at various concentrations and determine the intrinsic rotation.
5. To determine the heat of solution, heat of hydration and heat of neutralization.
6. To determine the cell constant, verify Ostwald dilution law and perform conductometric titration.
7. To determine rate constant of simple reaction.

BOOKS RECOMMENDED

1. Laidler, K.J.Physical Chemistry with Biological Applications. Benjamin. 1980
2. Shoemaker, D.P. and Garland, C.W. Experiments in Physical Chemistry. McGraw Hill Book Co. New York.
3. Puri, B.R., Sharma, L.R. and Pathania, M.S. Principles of Physical Chemistry. Shoban Lal Nagin Chand & Co. 1993
4. Bahl, Bahl & Tuli. Essentials of Physical Chemistry. 14th edition, 2006. S. Chand & company, New Delhi.
5. Khosla, Garg & Gulati. Senior practical physical chemistry. 12th edition, 2006. R. Chand & company, New Delhi.
6. Mahadik & Bhosale. Hand book of practical chemistry. 9th edition, 2006. Nirali prakashan, Pune.

04. PHM 1.2. 4 : Pharmaceutical Chemistry-II (Physical Chemistry)

Sub. Code	Subject	Theory
PHM 1.2.4	Pharmaceutical Chemistry-III (Organic Chemistry-I)	4 hrs/ week

1. Structure and Properties: The structural theory, the chemical bond, quantum mechanics, atomic orbitals, electronic configuration, molecular orbitals, intramolecular forces, bond dissociation energy, polarity of bonds, polarity of molecules, structure and physical properties including melting point, boiling point and solubility, acids and bases, isomerism. **05**

2. Stereochemistry: Introduction, stereoisomerism, enantiomerism, diastereoisomerism, optical activity, chiral center, racemic modification, meso-structures, configuration, reactions involving stereoisomers, stereoselective and stereospecific reactions**. 05**

3. Role of Solvent: Secondary bonding, solubility of non-ionic and ionic solutes, protic and aprotic solvents, ion pairs, role of solvent in substitution reactions, phase-transfer catalysis. **03**

4. Structure, Nomenclature, Preparation & Reactions :

a. Alkanes, alkenes, alkynes and their cyclic analogs. **07**
b. Alkyl halides. **05**
c. Alcohols ethers, **03**
d. Benzene and arenes, **06**
e. Aldehyde and ketones **05**
f. Carboxylic acids and their functional derivatives **04**
g. Amines and diazonium salts **03**
h. Phenol Reactive Intermediate carboncation , carbanions, carbenes, nitrene and nitrenium ions are to be discussed wherever involved. **02**

Sub. Code	Subject	Practical
PHM 1.2.4	Pharmaceutical Chemistry-III (Organic Chemistry-I)	4 hrs/ week

1. The student should be introduced to the various laboratory techniques through demonstrations involving synthesis of selected organic compounds (e.g. aspirin, pbromoacetanilide, anthraquinone from anthracine, reduction of nitrobenzene, etc.)
2. Identification of organic compounds and their derivatisation.
3. Introduction to the use of stereo models.

Books Recommended

1. Roberts, J.D. and Caserio, M.C. Basic Principles of Orgenic Chemistry. W.A. Benjamin,Inc., New York.
2. Vogel, A.I. A Textbook of Practical Organic Chemistry. ELBS/ Longman, London
3. Morrison & Boyd. Organic chemistry. 6th edition, 2007. Dorling Kindersley India, Delhi.
4. Finar. Organic chemistry. Vol. 1& 2. 6th edition, 2007. Dorling Kindersley India, Delhi.
5. Bentley & Drive. Text book of Pharmaceutical Chemistry. 8th edition, 2005. Oxford university, New Delhi.
6. Mann & Saunders. Practical Organic Chemistry. 4th edition, 2004. Orient Longman Ltd, New Delhi.
7. Ferguson, Textbook of Organic Chemistry, 2nd Ed. , EWP
8. Gallego, Organic Reaction Mechanisms, Springer

05. PHM 1.2. 5 : Pharmaceutical Chemistry-II (Physical Chemistry)

Sub. Code	Subject	Theory
PHM 1.2.5	Anatomy, Physiology & Health Education-I	3 hrs/ week

1. **Scope of anatomy and physiology :** scope, basic medical 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. **10**
2. **Osseous System:** Structure, composition and functions of skeleton, Classification of joints, types of movements of joints, Disorders of joints. **07**
3. **Skeletal Muscles:** Gross anatomy; physiology of muscle contraction, physiological properties of skeletal muscles and their disorders. **06**
4. **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. **10**
5. **Lymph and Lymphatic System :** Composition, formulation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen. **05**
6. **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 disorder like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias. **12**

Sub. Code	Subject	Practical
PHM 1.2.5	Anatomy, Physiology & Health Education-I	4 hrs/ week

1. Study of human skeleton.
2. Study of different systems with the help of charts and models.
3. Microscopic study of different tissues.
4. 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.
5. Recording of body temperature, pulse rate and blood pressure, basic understanding of Electrocardiogram-PQRST waves and their significance.

Books Recommended

1. Tortora, G.J. and Grabowski, S.R.Principles of Anatomy and Physiology 9th edt.2000 Collins College Publishers, Luciano, New York
2. Guyton, A.C. & Hall, J.E. W.B. Textbook of Medical Physiology.9thedt.1996Sanders Co.New York
3. Chaurasia, B.DHuman Anatomy, Parts I, II & III.8th edt.1995 Regional and CBS Publishers & Distributors, New Delhi
4. Chatterjee, C.C. Human Physiology, part I&II11th edt.1992Medical Allied Agency, Calcutta
5. Ghai, C.L. A Textbook of Practical Physiology 5th edt. Jaypee brother New Delhi

B. Pharm. Semester- III

01. PHM 2.3.1 : ***Pharmaceutics-II*** **(Unit Operations I)**

Sub. Code	Subject	Theory
PHM 2.3.1	*Pharmaceutics-II* (Unit Operations I)	3 hrs/ week

1. **Unit Operations**: Introduction, basic laws. **02**
2. **Fluid Flow** : Types of flow, Reynold's number, Viscosity, Concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure. **04**
3. **Material Handling Systems**: **06**
   a. Liquid handling- Different types of pumps.
   b. Gas handling- various types of fans, blowers and compressors.
   c. Solid handling- Bins, Bunkers, Conveyers, Air transport.
4. **Filtration and Centrifugation**: Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, and centrifugal sedimenters. **07**
5. **Crystallization:** Characteristics of crystals like-purity, size, shape,geometry, habit, forms size and factors affecting them. Solubility curves and calculation of yields. Supersaturation theory and its limitations, Nucleation mechanisms, Crystal growth. Study of various types of Crystallizers, tanks, Caking of crystals and its prevention. Numerical problems on yields. **07**
6. **Dehumidification and Humidity Control:** Basic concepts and definition, wet bulb and adiabatic saturation temperatures, Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations. **06**
7. **Refrigeration and Air Conditioning :** Principles and applications of refrigeration and air conditioning. **04**
8. **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. Factors affecting the choice. **04**
9. **Industrial hazards and Safety Precautions**: Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, Accident records etc. **03**

Sub. Code	Subject	Practical
PHM 2.3.1	*Pharmaceutics-II* (Unit Operations I)	4 hrs/ week

1. Measurement of flow of fluids and their pressure, determination of Reynold's number and calculation of Frictional losses.
2. Evaluation of filter media, determination of rate of filtration and Study of factors affecting filtration.
3. Experiments to demonstrate applications of centrifugation.
4. Thermometers and Psychrometric charts.
5. Determination of humidity-use of Dry Bulb and Wet Bulb.

Books Recommended

1. Badger, W.L. and Banchero, J.T. Introduction to Chemical Engineering. McGraw Hill International Book Co., London.
2. Brown, C.G. Unit Operations (Indian Ed.) CBS Publishers & Distributors.
3. McCabe , W.L. and Smith, J.C. and Harriolt, P.Unit Operations of Chemical Engineering.5th
4. Edition McGraw Hill International Book Co., London.
5. Bhatt N.D. and Panchal, V.M. Machine Drawing Charocar Publishing House, Opp. Amul Dairy, Anand , 388001 (India) .

02. PHM 2.3.2 : Pharmaceutical Chemistry-IV (Organic Chemistry-II)

Sub. Code	Subject	Theory
PHM 2.3.2	Pharmaceutical Chemistry-IV (Organic Chemistry-II)	3 hrs/ week

1. Heterocyclic Chemistry: Nomenclature, structure, reactions and synthesis of different heterocyclic systems (furan, thiophene, pyridine, imidazole, oxazole, thiazole, quinoline and isoquinoline, phenothiazine**). 10**

2. Carbohydrates: Monosaccharides, detailed structure determination of glucose including cyclic structure, Killiani- Fischer synthesis, Ruff degradation conversion of aldopentose to aldohexose and vice-versa, disaccharides : structure determination of maltose, cellobiose, lactose, sucrose, Polysaccharides: starch, cellulose**. 12**

3. Proteins: Structure, properties, synthesis of. *a* -amino acids, peptides, terminal residual analysis and synthesis**. 05**

4. Nucleic acids: Introduction, structure of nucleic acid bases, structures of nucleosides, structure of nucleotldes, RNA & DNA**. 05**

5. Fats and oils: (phospholipids, glycolipids and lipoprotein),Analysis of Oil and Fat(Acid, Saponification and iodine values determinations) **06**

6. Xanthine derivatives (caffeine, theophylline, theobromine**) 03**

7. **Coumarines :** Introduction and examples. **03**

8. Aryl halides (nucleophilic aromatic substitution reactions), *a*, *ß* -unsaturated Carbonyl compounds (electrophilic addition, Michael addition, Diels-Alder reaction) **04**

Sub. Code	Subject	Practical
PHM 2.3.2	Pharmaceutical Chemistry-IV (Organic Chemistry-II)	4 hrs/ week

At least five exercises in synthesis involving various heterocyclic ring systems. An exercise involving stereoselective synthesis of a compound. Resolution of racemic DL-alanine or any other example. Workshop on molecular modelling of primary, secondary and tertiary structures of proteins, molecular modelling on double helical structure of nucleic acid showing hydrogen bonding. Determination of physico-chemical constants for oils and fats; preparation of organic compounds.

Books Recommended

1. I. L. Finar, Organic Chemistry, Vol. I & II, The English Language Book Society, London and Longman Group Limited, London (Latest Edition).
2. R. T. Morrison and R.N. Boyd, Organic Chemistry, 6th Edition, Prentice Hall of India, Private Limited, New Delhi (Latest Edition).
3. R. N. Acheson, An Introduction to the Chemistry of Heterocyclic Compounds, Inter-sciences Publishers, New York (Latest Edition).

03. PHM 2.3.3 : Pharmaceutical Mathematics

Sub. Code	Subject	Theory
PHM 2.3.2	Pharmaceutical Mathematics	3 hrs/ week

1. **Algebra :** 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. **08**
2. **Trigonometry :** Measurement of angle, T-ratios, addition, subtraction and transformation formulae, T-ratios of multiple, sub-multiple, and certain angles. **05**
3. **Calculus 15**

(a) **Differential :** Limits and functions, definition of differential coefficients, differentiation of standard functions, Differentiation of implicit functions, logarithmic differentiation, parametric differentiation and successive differentiations.

(b) **Integral :** Indefinite integrals of standard forms, integration by parts, substitution and partial fractions.

4. Measures of central value; mean, mode and median measures of central tendency, measures of dispersion. **08**
5. Standard deviation and standard error of means, coefficient of variation. **06**
6. Elements of binomial and Poisson distributions, Normal distribution curve and properties. **08**

Books Recommended

1. A Textbook of Mathematics for XI-XII Students. NCERT Publications. Vol I-IV 1991
2. Seshagiri P. Rao, A Textbook of Remedial Mathematics, Ist edition, 2008, Pharma Med Press
3. Schaum's Differential Equations. Mc Graw Hill,Singapore
4. Bolton's Pharmaceutical Statistics. Practical and Clinical Applications. Marcel Dekker, New York, 1990
5. Gupta, S.P. Statistical Methods. Sultan Chand & Co., New Delhi, 1990.

04. PHM 2.3.4 : Pharmaceutical Microbiology

Sub. Code	Subject	Theory
PHM 2.3.4	Pharmaceutical Microbiology	4 hrs/ week

1. **Introduction** : Historical development and scope of pharmaceutical microbiology, Structure of Bacterial Cell. **03**
2. **Classification of microbes and taxonomy** : Actinomycetes, Bacteria, Rickettsiae, spirochetes and viruses. **05**
3. **Identification of microbes** : Stains and types of staining techniques, electron microscopy. **03**
4. **Nutrition, cultivation and Isolation** : bacteria, Actinomycetes, fungi and virus. **05**
5. **Microbial genetics and variation** : Structure of gene, genetic code, transcription, translation, mutation and regulation of gene expresion, bacterial enzymes. **06**
6. **Control of Microbes** : physical and chemical methods :
   a. **Disinfectants** : Dynamics of disinfection, factors affecting the process of disinfection, Evaluation of liquid disinfectants & methods of measuring growth inhibition (MIC). Types of chemical agents employed for disinfection, antisepsis and preservation with their full description & use. **05**
   b. **Principles and Practice of sterilization methods** : Introduction, sensitivity of microorganisms, typical survival curves for bacterial spores exposed to moist heat or gamma radiations, expression of resistance in therms of D value and Z value & sterility assurance. Sterilization methods (Heat, Gaseours, Radiations & Filtration using different filter devices) with emphasis on sterilization of items used in hospital, thermolabile drugs and injectables. Monitoring of sterilization processes. Laminar aseptic hoods and aseptic processing. **06**
7. Sterlity Testing : Methods and media used with emphasis of the specific details of the sterility testing of parenterals and ophthalmics and other non injectable preparations such as catgut etc. **06**
8. Immunology : Infection, Factors influencing infection, immunity-Natural and acquired, Antigen containing preparations – Diphtheria, tetanus, staphylococcus, plague and BCG vaccine, Antibody containing preparation and Diagnostic preparations. **06**
9. Microbial assays of antibiotics, vitamins and amino acids. **05**

Sub. Code	Subject	Practical
PHM 2.3.4	Pharmaceutical Microbiology	4 hrs/ week

Experiments devised to prepare various types of culture media, subculturing of common aerobic and anaerobic bacteria, fungus and yeast, various staining methods, various methods of isolation and identification of microbes, sterilization techniques and validation of sterilization techniques, evaluation of antiseptics and disinfectants, testing and sterility of pharmaceutical products as per I.P. requirements, microbial assays of antibiotics, vitamins etc.

Books Recommended

1. Hugo and Russel. "Pharmaceutical Microbiology", 6th edition, 1998, Balckwell Scientific Publication, Oxford.
2. Prescott LM, Harley GP, Klein DA." Microbiology". 5th Edition, V.C.Brown Publishers, Oxford.
3. Pelczar MJ, Chan ECS, Krieg NR. " Microbiology", 5th edition, 1993, Tata McGraw Hill Publishing company Ltd., New Delhi.
4. Ananthanarayan R, Panikar CKJ. "Textbook of Microbiology", 5tg edition, 1999, Orient Longmann Ltd, Chennnai.
5. Gupte S." The short textbook of Medical Microbiology", 9th edition, 2006, Jaypee Brothers Medical Publishers Ltd, New Delhi.
6. Gaud and Gupta, Practical Microbiology, 3rd edition reprint 2008, Nirali Prakashan, Pune.

05. PHM 2.3.5 : Anatomy, Physiology & Health Education-II

Sub. Code	Subject	Theory
PHM 2.3.5	Anatomy, Physiology & Health Education-II	4 hrs/ week

1. **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. **06**
2. **Respiratory System:** Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity **05**
3. **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. **08**
4. **Autonomic Nervous System:** Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S. **03**
5. **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. **04**
6. **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. **05**
7. **Endocrine System:** Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and Ovary, their hormones and functions.**06**
8. **Sense Organs :** Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors). **04**
9. **Concepts of health and disease:** Disease causing agents and prevention of disease. **02**
10. **Classification of food requirements:** Balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water. **02**
11. **Demography and family planning:** Medical termination of pregnancy. **01**
12 **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). **05**
13. **First Aid:** Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods. **02**

Sub. Code	Subject	Practical
PHM 2.3.5	**Anatomy, Physiology & Health Education-II**	3 hrs/ week

1. Microscopic studies of different tissues.
2. Simple experiments involved in the analysis of normal and abnormal urine
3. Collection of specimen, appearance, determination of PH of urine by Ph meter. quantitative determination of Sugars, proteins, urea, lipidprofile, uric acid & creatinine.
4. Physiological experiments on nerve-muscle preparations.
5. Determination of vital capacity, experiments of spirometry.

Books Recommended

1. Tortora, G.J. and Grabowski, S.R.Principles of Anatomy and Physiology 9th edt.2000 Collins College Publishers, Luciano, New York
2. Guyton, A.C. & Hall, J.E. W.B. Textbook of Medical Physiology.9thedt.1996Sanders Co.New York
3. Chaurasia, B.DHuman Anatomy, Parts I, II & III.8th edt.1995 Regional and CBS Publishers & Distributors, New Delhi
4. Chatterjee, C.C. Human Physiology, part I&II11th edt.1992Medical Allied Agency, Calcutta
5. Parmar, N.S. Health Education and Community Pharmacy,.1st edt.1998CBS Publishers & Distributors New Delhi

B. Pharm. IV Semester

01. PHM 2.4.1 : ***Pharmaceutics – III (Unit Operations II)***

Sub. Code	Subject	Theory
PHM 2.4.1	*Pharmaceutics – III (Unit Operations II)*	4 hrs/ week

1. **Stoichiometry :** Unit processes material and energy balances, molecular units, mole fraction, 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. **07**
2. **Heat Transfer :** Source of heat, heat transfer, steam and electricity as heating media, determination of requirement of amount of steam/electrical energy, steam pressure, Boiler capacity, Mathematical problems on heat transfer. **08**
3. **Evaporation :** Basic concept of phase equilibria, factor affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators, Mathematical problems on evaporation. **07**
4. **Distillation :** Raoult's law, phase diagrams, volatility; simple steam and flash distillations, principles of rectification, Calculation of number of theoretical plates, Azeotropic and extractive distillation. Mathematical problems on distillation. **07**
5. **Drying:** Moisture content and mechanism of drying, rate of drying and time of drying calculations; classification and types of freeze drying dryers behaviour of solids during drying, MC,EMC,CMC and LOD dryers used in pharmaceutical industries and special drying methods. Mathematical problems on drying. **08**
6. **Size Reduction and Size Separation:** Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of mills including ball mill, hammer mill, fluid energy mill etc. **08**
7. **Mixing:** Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments. **05**

Sub. Code	Subject	Practical
PHM 2.4.1	*Pharmaceutics – III (Unit Operations II)*	4 hrs/ week

1. Determination of overall heat transfer coefficient.
2. Determination of rate of evaporation.
3. Experiments based of steam, extractive and azeotropic distillations.

4. Determination of rate of drying, free moisture content and bound moisture content.
5. Experiments of illustrate the influence of various parameters on the rate of drying.
6. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of size Reduction.
7. Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers.

Books Recommended

1. Carter SJ. "Cooper & Gunn's Tutorial Pharmacy", 6th edition, CBS Publishers & Distributors, New Delhi.
2. Badger WL, Banchero JT. "Introduction to Chemical Engineering". McGraw Hill International Book Co., London.
3. Perry RH, Green DW. "Chemical Engineers Handbook", 7th edition, 1998, McGraw Hill, International Editors Ltd, London.
4. Subramanyam CVS, Setty JT, Suresh S, Devi VK." Pharmaceutical Engineering- Principles & practices", 1st edition,2002, Vallabh Prakashan , Delhi.
5. Subramanyam CVS, Setty JT, Suresh S, Devi VK." Practical Pharmaceutical Engineering", 1st edition,2002, Vallabh Prakashan , Delhi.
6. Sudakar Reddy, Pharmaceutical Engineering : Practical Manual (Unit Operations), PharmaMed Press

02. PHM 2.4.2 : Pharmaceutical Analysis-II

Sub. Code	Subject	Theory
PHM 2.4.2	Pharmaceutical Analysis-II	3 hrs/ week

1. Non- aqueous Titrations: Theoretical consideration, scope and limitations, acid base equilibria in non-aqueous media, titration of weak bases, titration of weak acids, indicators, pharmaceutical products should be selected for illustration. **05**

2. Complexometric Titrations: Concept of complexation and chelation, Werner's Coordination number and electronic structure of c]mplexions, stability constants, titration curves, masking and demasking agents, types of Complexometric titrations, metal ion indicators, factors influencing the stability of complexes, applications. **05**

3. Miscellaneous Methods of Analysis : Diazotisation titration, Kjeldahl nitrogen determination, Karl-Fischer titration, Oxygen flask combustion**.** **04**

4. Extractions Procedures: Separation of drugs from excipients, The Craige method of multiple extraction, continuous counter - current extraction, effect of temperature, pH, Inert solute, association, ion-pair formation, the emulsion problems in extractions. **03**

5. Nuclear Chemistry and Radioactivity as an Analytical Tool: Nuclear composition, forces and stability, isotopes, radioactive emission, measurement of radioactivity, modes of decay, half life period, artificial radioactivity, applications in pharmacy. Radiopharmaceutical and contrast media: Radio-pharmaceuticals, radiopharmaceutical preparations and radiopaque contrast media, counting statistical errors and corrections, safety. **06**

6. Chromatography: Gas chromatography: Introduction; Principles of gas chromatography, basic GLC apparatus, carrier gases; sample introduction, column, column efficiency, solid support, liquid phases, branches of gas chromatography; Detectors, temperature effect; Applications of GLC in Pharmaceutical analysis. HPLC **:**Introduction, Theory & nomenclature, instrumentation, liquid-solid chromatography; Liquid- liquid chromatography, exclusion chromatography; HPLC columns; Solvent selection in HPLC; Data handling in HPLC, Applications of HPLC. TLC Quantitative Estimation. Ion-Exchange and Molecular Sieve Processes. Theory of ion-exchange, types of exchangers, ion exchange equilibria, ion-exchange capacity, ion-exchange separation, applications in pharmaceutical analysis, molecular sieve separation and applications. **12**

7. Electrochemistry The electric cell, electrode potential, half cells, types of half cells, sign convention, Nemst equation, the salt bridge, activity series, standard potential, standard hydrogen electrode, measuring the relative voltage of half cells, calculations of standard potential, reference electrodes, indicator electrodes.

a. Potentiometry Theoretical consideration, ion-selective electrodes, measurement of potential, location of the end point, equipment, analytical applications, direct measurement of a metal concentration, differential curves, determination of Ksp, pH measurements, dead-stop titrations; pH meter, pH definition, relation of pH to potential, equipment, applications. 10

b. Conductometric and High Frequency Titrations and their Applications.
c. Coulometric Titrations : Its basic principles and Applications.
d. Polarography and Its Applications: Theory, mass transport processes, current processes, current potential relationship, polarization, choice of eletrodes, effect of oxygen, instrumentation, calculation of concentration, laboratory design and safety.
e. Amperometric Titrations and Its Applications

8. Phase Solubility Analysis: Theory, experimental procedures, applications in Pharmaceutical analysis. **03**

Sub. Code	Subject	Practical
PHM 2.4.2	Pharmaceutical Analysis-II	4 hrs/ week

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

Books Recommended

1. A.H. Beckett and J.B. Stenlake, Practical Pharmaceutical Chemistry, Vol. I & II, The Athlone Press of the University of London (Latest Edition).
2. J. Bassett, R.C. Denney, G.H. Jeffery & J. Medhan, Vogel's Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis. The English Language Book Society and Longman (Latest Edition).
3. H. H. Willard, L.L. Merritt; Jr., and J.A. Dean, Instrumental Mehtods of Analysis, Van Nostrand Reinhold, New York (Latest Edition).
4. L. G. Chatten, Pharmaceutical Chemistry, Vols. I and II, Marcel Dekker, New York (Latest Edition).
5. Braun, Introduction to Instrumental Analysis, I edition, PharmaMed Press
6. Danzer, K., Analytical Chemistry Theoretical and Metrological Fundamentals, Springer

03. PHM 2.4.3 : Pharmacognosy – III

Sub. Code	Subject	Theory
PHM 2.4.3	Pharmacognosy – III	4 hrs/ week

1. Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, **04**
2. uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides: **10**
   a. **Saponins :** Liquorice, ginseng, dioscorea, sarsaparilla, and senega.
   b. **Cardiocative sterols:** Digitalis, squill, strophanthus and thevetia.
   c. **Anthraquinone cathartics:** Aloe, senna, rhubarb and cascara.
   d. **Others :** Psoralea, Ammi majus, Ammi visnaga, gentian, saffron, chirata, quassia.
3. Studies of traditional drugs used in Indian system of medicine, common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacological, categories and common uses and marketed formulations of following indigenous drugs : Amla, Kantkari, Stavari, Gilo (Guruch), Bhilawa, Kalijiri, Bach, Rasna, Punarnava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi , Adusa, Arjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gyumnema, Shilajit, Nagarmotha, kalmegh and Neem. **25**
4. The holistic concept of drug administration in traditional systems of medicine. Introduction to ayurvedic system and ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas. **06**
5. Standardisation of ayurvedic and herbal products and scope of clinical validation of these products. **05**

Sub. Code	Subject	Practical
PHM 2.4.3	Pharmacognosy – III	4 hrs/ week

1. Identification of crude drugs listed in theory.
2. Diagnostic macroscopic and Microscopic study of some important glycoside containing crude drugs as outlined above. Study of powdered drugs
3. Standardization of some traditional drug formulations.
4. Marker standardization of herbal products.

Books Recommended

1. Trease, G. E. and Evans, W.C. Pharmacognosy, Published by Elsevier, a Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. Kokate, C.K., Purohit, A.P. and Gokhale, S.B Pharmacognosy, Nirali Prakashan, Pune.
3. Harborne, J.B. Phytochemical Methods. Chapman & Hall, International Edition, London.
4. Handa, S.S and Kapoor, V.K. Textbook of Pharmacognosy, Vallabh Prashan, New Delhi.
5. Wallis, T.E. Textbook of Pharmacognosy, Fifth Edition, CBS Publishers and Distributors, New Delhi.
6. Tyler, V.C., Brady, L.R. and Robers, J.E. Pharmacognosy. Lea & Febiger, Philadelphia.
7. Ansari, S.H. Essentials of Pharmacognosy. Third Edition 2009, Birla Publication Pvt. Ltd., Delhi.

04. PHM 2.4.4 : Pathophysiology of Common Diseases

Sub. Code	Subject	Theory
PHM 2.4.4	Pathophysiology of Common Diseases	4 hrs/ week

1. **Basic Principles of Cell Injury and Adaptation:** Causes of Cellular injury, pathogenesis, morphology of cell injury. Intercellular alterations in lipids, proteins and carbohydrates, Cellular adaptation, atrophy, hypertrophy. **07**
2. **Basic Mechanisms 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. **08**

3. **Physiology of Inflammatory Diseases** : Rheumatoid arthritis, gout, ulcerative colitis, peptic ulcer, asthma **06**
4. **Pathophysiology of cardiac Disorder** : hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, arrhytimia **06**
5. **Pathophysiology of diseases of Microbes :** various types of Hepatitis, tuberculosis, urinary tract infections, sexually transmitted diseases, AIDS **07**
6. **Pathophysiology of renal diseases :** acute and chronic renal failure **03**
7. **Pathophysiology of CNS Disorders :** epilepsy, psychosis,depression, mania, Alzheimer disease, Parkinson diseases **07**
8. **Pathophysiology of common diseases** : liver cirrhosis, diabetes, anemia, Iatrogenic diseases, and common types of neoplasm. **06**

Books Recommended

1. Cotran, R.S., Kumar, V., Collins, T. Robbins Pathological Basis of Disease. 7th edt.2003 W.B. Saunders Co.New York
2. Dipiro, J.T. etal Pharmacotherapy: A Pathological Approach.6th edt2005 The Mc Graw Hill Companies.

05. PHM 2.4.5 : Pharmaceutics IV (Physical Pharmacy)

Sub. Code	Subject	Theory
PHM 2.4.5	Pharmaceutics IV (Physical Pharmacy)	4 hrs/ week

1. Matter and Properties of Matter : State of matter, change in the state of matter, latent heats and vapor pressure, sublimation-critical point, Eutectic mixtures, gases, aerosols - inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solidscrystalline, amorphous and polymorphism. **05**

2. 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 of determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties. **08**

3. Surface and Interfacial Phenomena: Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid- gas and solid-liquid interfaces, complex films, electrical properties of interface. **08**

4. 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. **05**

5. Dispersion Systems: Colloidal Dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions and Emulsions: Interfacial properties of suspended particles, settling 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; Emulsions-types, theories, physical stability. **10**

6. Complexation: Classification of complexes, methods of preparation and analysis, applications. **04**

7. 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. **05**

8. **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. **05**

Sub. Code	Subject	Theory
PHM 2.4.5	Pharmaceutics IV (Physical Pharmacy)	4 hrs/ week

1. Determination of particle size, particle size distribution and surface area using various methods of Particle size analysis.
2. Determination of derived properties of powders like densities, porosities, compressibility, angle of repose
3. Determination of surface/interfacial tension, spreading coefficient HLB value, and critical micellar concentration of surfactants.
4. Study of rheological properties of various types of systems using different Viscometers.
5. Preparation of various types of suspensions and determination of their sedimentation parameters.
6. Preparation and stability studies of emulsions.
7. Studies on different types of complexes and determination of their stability constants.
8. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals
9. Preparation of pharmaceutical buffers and determination of buffer capacity.
10. Experiments involving tonicity adjustments.

Books Recommended

1. Sinko PJ."Martin's Physical pharmacy & Pharmaceutical sciences", 5th edition, 2006, B.I. Publications Pvt Ltd, New Delhi.
2. Carter SJ. "Cooper & Gunn's Tutorial Pharmacy", 6th edition, 200, CBS Publishers & Distributors, New Delhi.
3. Remington's The Science & Practice of Pharmacy Mack Publishing Co. Easton, PA
4. Gaud and Gupta " Practical Physical Pharmacy", I edition, reprint 2008, CBS Publisher and Distributor, New Delhi
5. Subhramanyam CVS. "Textbook of Physical Pharmaceutics", 2nd edition , 2007, Vallabh Prakashan, New Delhi.

B. Pharm. V Semester

01. PHM 3.5.1 : Pharmaceutical Chemistry-V *(Biochemistry)*

Sub. Code	Subject	Theory
PHM 3.5.1	Pharmaceutical Chemistry-V (Biochemistry)	3 hrs/ week

1. Biochemical organization of the cell and transport process across cell membrane. **02**
2. The concept of free energy, bioenergetics, production of ATP and its biologicalsignificance. **03**
3. Enzymes: Nomenclature, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis. **04**
4. Co-enzymes: Co-enzymes and their significance. Metals as co-enzymes and their significance. **03**
5. Carbohydrate Metabolism: Conversion of polysaccharide to glucose-1- phosphate, Glycolysis and fermentation and their regulation, gluconeogenesis and glycogenolysis, Metabolism of galactose and galactosemia, role of sugar nucleotides in biosynthesis, and Pentosephosphate pathway. **05**
6. The Citric Acid Cycle: Significance, reactions and energetic of the cycle, Amphibolic role of the cycle, and Glyoxalic acid cycle. **03**
7. Lipids Metabolism: Oxidation of fatty acids, □-oxidation & energetic, □-oxidation, □-oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids & eicosanoids (prostaglandins, thromboxanes and leukotrienes), phospholipids,and sphingolipids. **05**
8. Biological Oxidation: Enzymes and co-enzymes involved in oxidation reduction & its control, respiratory chain its role in energy capture and its control, Inhibitors of respiratory chain and oxidative phosphorylation, Mechanism of oxidative phosphorylation. **04**

9. Nitrogen & Sulphur Cycle: Ammonia assimilation, Incorporation of sulphur in organic compounds, Release of sulphur from organic compounds. **04**
10. Metabolism of Ammonia and Nitrogen Containing Monomers: Nitrogen balance , Biosynthesis of amino acids,Catabolism of amino acids, Conversion of amino acids to specialized products, Assimilation of ammonia, Urea cycle, metabolic disorders of urea cycle, Metabolism of sulphur containing amino acids, Porphyrin biosynthesis, formation of bile pigments, hyperbilirubinemia, Purine biosynthesis, Purine nucleotide interconversion, Pyrimidine biosynthesis and Formation of deoxyribonucleotides. **05**
11. Biosynthesis of Nucleic Acids: Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Biosynthesis of DNA and RNA. **04**
12. Genetic Code and Protein Synthesis: Genetic code, Components of protein synthesis, and Inhibition of protein synthesis. Brief account of genetic engineering and polymerase chain reactions. Regulation of gene expression. **06**

Sub. Code	Subject	Practical
PHM 3.5.1	Pharmaceutical Chemistry-V (Biochemistry)	4 hrs/ week

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
3. Separation of amino acids by two dimensional paper chromatography and gel electrophoresis.
4. Separation of lipids by TLC.
5. Separation of serum proteins by electrophoresis on cellulose acetate.
6. Quantitative estimation of amino acids.
7. Quantitative estimation of proteins.
8. Determination of glucose by means of the enzyme glucose oxidase.
9. Enzymatic hydrolysis of glycogen by alpha- and beta- amylases.
10. Isolation and determination of RNA and DNA.
11. Effect of temperature on the activity of alpha-amylase.
12. Estimation of SGOT, SGPT, Alkaline phosphotase and Bilirubinu in the serum.

Books Recommended

1. Conn, E.E. and Stump, P.K. Outlines of Biochemistry. John Wiley & Sons, New York.
2. Jayaraman, J. Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi
3. Lehninger, A.L. Biochemistry, Worth Publisher, Inc.
4. Plumer, D.T. An Intoduction to Practical Biochemistry. Tata McGraw Hill, New Delhi.
5. Harper's Biochemistry, Lange Publishing Group.

02. PHM 3.5.2 : Pharmaceutical Chemistry-V *(Biochemistry)*

Sub. Code	Subject	Theory
PHM 3.5.2	Pharmaceutics-V (Pharmaceutical Technology I)	3 hrs/ week

1. **Liquid Dosages Forms:** Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavours and others, manufacturing packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia. **07**
2. **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. **08**
3. **Suppositories:** Classification, Ideal requirements, bases, manufacturing procedure, packaging and evaluation. **05**
4. **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 foam, plasma substitutes, ideal requirements, PVP, dextran etc. for control of blood pressure as per I.P. **05**

5. **Pharmaceutical Aerosols**: Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications. **07**
6. **Opthalmic Preparations**: Requirements, formulation, methods of preparation, containers, evaluation. **05**
7. **Cosmeticology and Cosmetic Preparations:** Fundamentals of cosmetic science, structure and functions of skin and hair. Formulation, preparation and packaging of cosmetics – deodorants and antiperspirants, shampoo, face powder, dentifrice, nail polish, Lipsticks, eye lashes and baby care products. **08**

Sub. Code	Subject	Theory
PHM 3.5.2	Pharmaceutics-V (Pharmaceutical Technology I)	3 hrs/ week

1. Preparation, evaluation and packaging of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, aerosols, eye drops, eye ointments etc.
2. Preparation of pharmacopoeial extracts and galenical products utilizing various methods of Extraction.
3. Collection, processing, storage and fractionation of blood.
4. Formulation of various types of cosmetics for skin, hair, dentifrices and manicure preparations.

Books Recommended

1. Aulton ME. "Pharmaceutics- The Science of Dosage Form Design", 1st edition, 1998, ELBS/Churchill Livingstone, New York.
2. Lachman L, Lieberman HA, Kanig JL." The Theory & Practice of Industrial Pharmacy", 3rd edition, 1991, Varghese Publishing House, Bombay.
3. Banker GS, Rhode CT. "Modern Pharmaceutics", 4th edition, Informa Healthcare, New York.
4. Allen LV, Popovich NG, Ansel HC", Ansel's pharmaceutical Dosage Forms & Drug Delivery Systems", 8th edition, 2005.
5. Sagarin, Balsam MS." Cosmetic Science & Technology", Vol. 1-3 2nd ed. John Wiley.
6. Balsam SM AND Edward, Cosmetics : Science and Technology, 2nd edition, 2008, Willey.
7. Butter H., Poucher's Perfumes Cosmetics and Soaps, 10th edition, 2007, Springer.

03. PHM 3.5.3 : Pharmacology I

Sub. Code	Subject	Theory
PHM 3.5.3	Pharmacology I	**3 hrs/week**

1. **General Pharmacology :** Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying Drug action, tolerance and dependence, Pharmacogenetics. Principles of Basic and Clinical pharmacokinetics, Adverse Drug Reactions and treatment of poisoning, ADME drug interactions, Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs. **20**
2. **Pharmacology of Peripheral Nervous System :**
   a. Neurohumoral **02**
   b. Parasympathomimetics, Parasympatholytics, Sympathomimetics, Adrenergic transmission (autonomic and Somatic Receptor and neuron blocking agents, Ganglionic, stimulants and blocking agents. **04**
   c. Neuromuscular blocking Agents. **02**
   d. Local anesthetic Agents **02**
3. **Pharmacology of Central Nervous System:**
   a. Neurohumoral transmission in the C.N.S. **02**
   b. General Anesthetics. **01**
   c. Aliphatic Alcohols and disulfiram. **01**
   d. Sedatives, hypnotics, Anti-anxiety agents and Centrally acting muscle relaxants. **02**

e. Psychopharmacological agents (anti psychotics) antidepressants, anti maniacs and halllucinogens) **03**
f. Anti-epileptics drugs. **01**
g. Anti-Parkinsonian Drugs. **01**
h. Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs **03**
i. Narcotic analgesics and antagonists **02**
j. CNS stimulants **02**
k. Drug Addiction and Drug Abuse **02**

Sub. Code	Subject	Practical
PHM 3.5.3	Pharmacology I	4 hrs/ week

1. Introduction of Experimental Pharmacology: Preparation of different solutions for experiments. Drug dilutions, use of molar and w/v solutions in experimental Pharmacology. Common laboratory animals and anesthetics used in animal studies. Commonly used instruments in experimental pharmacology. Some common and standard techniques. Bleeding and intravenous injection, intragastric administration. Procedures for rendering animals unconscious- stunning of rodents, various methods of euthanasia.
2. Experiments of intact preparations: Study of different routes of administration of drugs in mice/rats.
3. To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone sleeping time in mice.
4. 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.
5. Effects of autonomic drugs on rabbit's eye.
6. Effect of various agonists and antagonists and their characterization using Isolated isolated ileum and fundus preparations of rat.

Books Recommended

1. Gilman, A.G., Goodman, L.S.,Goodman and Gilman's The Pharmacological Basis of Therapeutics. 11th edt.2006 Editors J.G.Hardmanetal. Pergamon Press, New York
2. Tripathi K.D. Essential of Medical Pharmacology.6th edt. 2008. Jaypee brother medical publisher. New Delhi
3. Harvey AR,Champ CP Pharmacology 3rd Edt 2006 Lippincott Willams &Wilkins Philadelphia
4. Ghosh, M.N Fundamentals of Experimental Pharmacology. 4th edt. 2008**,** Scientific Book Agency, Kolkatta.
5. Kulkarni, S.K. Handbook of Experimental Pharmacology. 2nd edt.1997 Vallabh Prakashan, Delhi

04. PHM 3.5.4 : Pharmacognosy-IV

Sub. Code	Subject	Theory
PHM 3.5.4	Pharmacognosy-IV	3 hrs/ week

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, and specific chemical tests of following alkaloid containing drugs : **22**
   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.
   e. Imidazole: Pilocarpus
   f. Steroidal: Veratrum and kurchi
   g. Alkaloidal amine: Ephedra and colchicun
   h. Glycoalkaloid: Solanum.
   i. Purines: Coffee, tea and cola.
2. Role of medicinal and aromatic plants in national economy. **02**
3. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin. **05**
4. General biosynthetic pathways of natural products like alkaloids, glycosides, terpenoids, lignans, quassinoids, carotenoids and flavonoids. **05**
5. Plant bitters and sweeteners. **03**
6. Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs. **03**

Sub. Code	Subject	Practical
PHM 3.5.4	Pharmacognosy-IV	4 hrs/ week

1. Identification of crude drugs listed above.
2. Diagnostic macroscopic and microscopic study of characters of eight- selected drugs given in theory in entire and powdered form.
3. Chemical Evaluation of powdered drugs, and enzymes.
4. Chromatographic studies of some herbal constituents.

Books Recommended

1. Trease, G. E. and Evans, W.C. Pharmacognosy, Published by Elsevier, a Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. Kokate, C.K., Purohit, A.P. and Gokhale, S.B Pharmacognosy, Nirali Prakashan, Pune.
3. Handa, S.S and Kapoor, V.K. Textbook of Pharmacognosy, Vallabh Prashan, New Delhi.
4. Medicinal Plants of India. ICMR, New Delhi.
5. Wallis, T.E. Textbook of Pharmacognosy, Fifth Edition, CBS Publishers and Distributors, New Delhi.
6. Tyler, V.C., Brady, L.R. and Robers, J.E. Pharmacognosy. Lea & Febiger, Philadelphia.

05. PHM 3.5.5 : Pharmaceutics VI (Hospital Pharmacy)

Sub. Code	Subject	Theory
PHM 3.5.5	Pharmaceutics VI (Hospital Pharmacy)	3 hrs/ week

1. Organization & Structure: Organization of a hospital and hospital Pharmacy, Responsibilities of hospital pharmacist, Pharmacy and therapeutic committee, Budget preparation and Implementation. **05**
2. Hospital Formulary: Contents, preparation and revision of hospital formulary. **02**
3. Drug Store Management and Inventory Control: **05**
   a. Organization of drug store, Types of materials stocked, storage conditions.
   b. Purchase and Inventory Control-principles, purchase procedures, Purchase order, Procurement and stocking.
4. Drug distribution System in Hospitals: **05**

a. Outpatient 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.

5. Central Sterile Supply Unit and their Management: Types of materials for sterilization, Packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials. **05**
6. Manufacture of Sterile and Non-sterile Products: Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, Master formula Card, production control, Manufacturing records. **07**
7. Drug Information Services: Sources of Information on drugs, disease, treatment schedules, procurement of information, computerized services (e.g., MEDLINE), Retrieval of information, Medication error. **04**
8. Records and Reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc. 04
9. Nuclear Pharmacy: Introduction to Radio pharmaceuticals, radio-active half life, Units of radio-activity Production of radio-pharmaceuticals, Permissible radiation dose level, Radiation hazards and their prevention, specifications for radio-active laboratory. **08**

Sub. Code	Subject	Practical
PHM 3.5.5	Pharmaceutics VI (Hospital Pharmacy)	4 hrs/ week

1. Experiments based on Sterilization of various types of materials used in Hospitals.
2. Practical designed on the use of computers in Drug Information Center, prescription filling, documentation of information on drug interaction.
3. Preparation and quality control of i.v. fluids and i.v. admixtures Experiments to illustrate handling of radio pharmaceutical products, measurement of radioactivity.
4. Case studies of prescriptions regarding drug interactions, drug dosage corrections, suggesting antidotes for poisoning cases, managing ADR, etc.

Books Recommended

1. Owunwonne Handbook of Radio pharmaceuticals. Narosa Publishing House, New Delhi.
2. Hassan, William E. Hospital Pharmacy. Lea & Febiger, Philadelphia.
3. Remington's The Science & Practice of Pharmacy Mack Publishing Co. Easton, PA
4. Turco. S, and King, R.E. Sterile Dosage Forms. Lea & Febiger, Philadelphia.

B. Pharm. VI Semester

01. PHM 3.6.1 : Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)

Sub. Code	Subject	Theory
PHM 3.6.1	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	3 hrs/ week

1. Physicochemical and Stereochemmical aspects of drugs including bioisosterism in relation to biological activity, Drug-Receptor interaction. **04**
2. Conventional methods of drug design, Lead,Discovery of Lead, lead optimization **04**
3. Vitamins: Water soluble and fat soluble vitamins **07**
4. Introduction, Structure, Stereochemistry, Nomenclature, Synthesis of specified drugs (given in parenthesis), mode of action, Structure Activity Relationships (if any) uses and Physicochemical properties of the following classes of drugs:
   a. Adrenergic hormones and drugs including biosynthesis, storage, release and metabolism of Catecholamine (Isoprenaline, Adrenaline, Salbutanol). **04**
   b. Cholinergic and Anticholinestarases including biosynthesis, storage, release and metabolism of acetylcholine (Neostigmine bromide,Pyridostigmine Bromide) **04**
   c. Antispasmodic and Antiulcer drugs (Propantheline bromide,Dicyclomine hydrochloride) **04**

d. Antiparkinsonism drugs (Apomorphine). **04**
e. Neuromuscular blocking agents (Succinylcholine chloride,Gallamine triethiodide). **04**
f. Antihistamines including Sodium Cromoglycate (Chloropheniramine). **05**
g. Prostaglandins and other Eicosanoids: Nomenclature, biosynthesis and biological activity. **05**
h. Analgesic-antipyretics and Non-steroidal Anti-inflammatory agents: (Indomethacin, and Phenylbutazone). **05**

Sub. Code	Subject	Practical
PHM 3.6.1	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	3 hrs/ week

1. Exercises based on QSAR:
2. Synthesis of selected drugs from the course content.
3. Spectral analysis of the drugs synthesized.
4. Establishing the pharmacopoeial standards of the drugs synthesized.
5. Determination of partition coefficient, dissociation constant and molar
6. Activity of compounds of QSAR analysis.

Books Recommended.

1. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Eleventh Edition, edited by J. H. Block and J. M. Beale Jr., Lippincott Williams & Wilkins, Philadelphia, 2004.
2. Pharmaceutical Chemicals in Perspective, B.G. Reuben and H.A. Wittcoff, John Wiley & Sons, New York, 1989.
3. Foye's, Principles of Medicinal Chemistry, Sixth Edition, Wolters Kluwer (India), Lea & Febiger, Philadelphia, USA, 2008.
4. Hansch, C. Comprehensive medicinal Chemistry Vol.IV, Quantitative Drug Design. Pergamom Press, Oxford.
5. Singh, H. and Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, Second Edition Vallabh Prakashan, Delhi,2005.
6. Povl Krogsgaard, Tommy, Textbook of Drug Design & Discovery, 3rd edition , 2004,

02. PHM 3.6.2 : Pharmaceutical Jurisprudence & Ethics

Sub. Code	Subject	Theory
PHM 3.6.2	*Pharmaceutical Jurisprudence & Ethics*	3 hrs/ week

1. Introduction **08**
   a. Pharmaceutical Legislations- A brief review.
   b. Drugs & Pharmaceutical Industry- A brief review.
   c. Pharmaceutical Education- A brief review.

2. An elaborate (practical oriented) study of the following **12**
   a. Code of Pharmaceutical Ethics
   b. Pharmacy Act 1948.
   c. Drugs and Cosmetics Act 1940 and Rules 1945.
   d. Medicinal & Toilet Preparations (Excise Duties) Act 1955.
   e. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
   f. Drugs Price Control Order.

3. A brief study of the following with special reference to the main provisions. **20**
   a. Poisons Act 1919
   b. Drugs and Magic Remedies (Objectionable Advertisements) Act 1954.
   c. Medical Termination of Pregnancy Act 1970 & Rules 1975.
   d. Prevention of Cruelty to Animals Act 1960.
   e. States Shops & Establishments Act & Rules.
   f. Insecticides Act 1968.
   g. AICTE Act 1987.
   h. Factories Act 1948.

i. Minimum Wages Act 1948.
j. Patents Act 1970.

4. A brief study of the Various Prescription/Non-prescription Products, Medical / Surgical accessories, Diagnostic aids, appliances available in the market. **05**

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

Books Recommended

1. Jain, N.K.A Textbook of Forensic Pharmacy. Vallabh Prakashan, New Delhi.
2. Mithal, B.M. A Textbook of Forensic Pharmacy. National Book Depot, Kolkatta.
3. Kokate and Gokhale, Textbook of Forensic Pharmacy, 2006, Pharma Book Syndicate, Hyderabad

03. PHM 3.6.3 : P'ceutics VII(Biopharmaceutics and P'cokinetics)

Sub. Code	Subject	Theory
PHM 3.6.3	P'ceutics VII(Biopharmaceutics and P'cokinetics)	4 hrs/ week

1. Introduction : Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting. **03**
2. Biopharmaceutics : **07**
   a. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis)
   b. Factors influencing absorption- Physicochemical, physiological and pharmaceutical.
   c. Drug distribution in the body, plasma protein binding.
3. Pharmacokinetics: **30**
   a. Significance of plasma drug concentration measurement
   b. Compartment and model-Definition and Scope.
   c. Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant using Wagner – Nelson and Loo- Reigelman method.
   d. Volume of distribution and distribution coefficient.
   e. 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.
   f. Curve fitting (method of Residuals), regression procedures.
   g. Clearance concept, Mechanism of renal clearance, clearance ratio, Determination of renal clearance.
   h. Extraction ratio, hepatic clearance, biliary excretion, Extrahepatic circulation.
   i. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menten Equation, detection of non-linearity (Saturation mechanism).
   j. Non-Compartmental concept of mean residence time (MRT)
4. Bioavailability and bioequivalence: **10**
   a. Measures of bioavailability, Cmax, tmax and area under the curve (AUC).
   b. Design of single dose bioequivalence study and relevant statistics.
   c. Review of regulatory requirements for conduct of bioequivalent studies.

Sub. Code	Subject	Practical
PHM 3.6.3	P'ceutics VII(Biopharmaceutics and P'cokinetics)	4 hrs/ week

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.

Books Recommended

1. Notari, R.E. Biopharmaceutics & Pharmacokinetics- An Introduction. Marcel Dekker.
2. Rowland, M. and Tozer, T.N. Clinical Pharmacokinetics. Lea & Febiger, N.Y.
3. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics. 4th edition, 2008, PharmMed Press.

4. Shargel, L. and Yu, A. Applied Biopharmaceutics and Pharmacokinetics. Appleton & large,Norwalk.
5. Wagner, J.G. Fundamentals of Clinical Pharmacokinetics. Drug Intelligence Publications,Hamilton.
6. Stephen H. Curry, Drug Disposition and Pharmacokinetics, 3rd edition 2008, PharmMed Press

04. PHM 3.6.4 : Pharmacology II

Sub. Code	Subject	Theory
PHM 3.6.4	Pharmacology II	4 hrs/week

1. Pharmacology of Cardiovascular System : **18**

a. Digitalis and cardiac glycosides.
b. Antihypertensive drugs.
c. Antianginal and Vasodilator drugs, including calcium channel blockers and beta adrenergic antagonists.
d. Antiarrhythmic drugs.
e. Antihyperlipedimic drugs
f. Drugs used in the therapy of shock

2. **Drugs Acting on the Hemopoietic System :** **07**

a. Hematinics
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 b. Diuretics **07**

4. **Autacoids :** **10**

a. Histamine, 5- HT and their antagonists.
b. Prostaglandins, thromboxanes and leukotrienes.
c. Pentagastrin , Cholecystokinin, Angiotensin, Bradykinin and Substance P.

5. **Drugs Acting on the Respiratory System:** **08**

a. Anti-asthmatic drugs including bronchodilators.
b. Anti-tussives and expectorants.
c. Respiratory stimulants.

Sub. Code	Subject	Theory
PHM 3.6.4	Pharmacology II	4 hrs/week

1. **Experiments on Isolated Preparations:**

a. To record the CRC of 5- HT on rat fundus preparation.
b. To record the CRC of histamine on guinea pig ileum preparation.
c. To record the CRC of oxytocin using rat uterus preparation.

2. **Pharmacology of Cardiovascular System:**

a. To study the ionotropic and chronotropic effects of drugs on isolated rat heart.
b. To study the effects of drugs on normal and hypodynamic frog heart.
3. Blood Pressure of anaesthetized Rat : To demonstrate the effects of various drugs on the B.P. and respiration including the Vasomotor Reversal of Dale and nicotinic action of acetylcholine.

Books Recommended

1. Gilman, A.G., Goodman, L.S.,Goodman and Gilman's The Pharmacological Basis of Therapeutics. 11th edt.2006 Editors J.G.Hardmanetal. Pergamon Press, New York
2. Tripathi K.D. Essential of Medical Pharmacology.6th edt. 2008. Jaypee brother medical publisher. New Delhi
3. Katzung B.G. Basic & Clinical Pharmacology 4th edt. 2008 Churchill Livingstone New York
4. Rang M.P., Dale M.M. and Riter, J.M. Pharmacology. 6th edt.2007Churchill Livingstone.London.

5. Harvey AR,Champ CP Pharmacology 3rd Edt 2006 Lippincott Willams & Wilkins Philadelphia

05. PHM 3.6.5 : Pharmacognosy – V (Chemistry of Natural Products)

Sub. Code	Subject	Theory
PHM 3.6.5	Pharmacognosy – V (Chemistry of Natural Products)	4 hrs/week

1. Chemical and spectral approaches to simple molecules of natural origin. **03**
2. Concept of stereoisomerism taking examples of natural products. **04**
3. Chemistry, and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes, and triterpenoids. **06**
4. **Carotenoids :** a- carotenoids, b- carotenes, vitamin A, Xanthophylls of medicinal importance. **05**
5. **Glycosides:** Chemistry, pharmacological activity of digitoxin, digoxin, hecogenin, sennosides, diogenin and sarasapogenin. **08**
6. **Alkaloids :** Chemistry, and pharmacological activity of atropine and related compounds; quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids. **15**
7. Chemistry and pharmacological activity of medicinally important lignans and quassinoids, flavonoids. **05**
8. Chemistry and therapeutic activity of penicillin, streptomycin and tetracycline **04**

Sub. Code	Subject	Practical
PHM 3.6.5	Pharmacognosy – V (Chemistry of Natural Products)	4 hrs/week

1. Laboratory experiments on isolation, separation, and purification of various groups of chemical constituents of pharmaceutical significance.
2. Exercises on paper and thin layer chromatographic evaluations of herbal drug constituents.

Books Recommended

1. Trease, G. E. and Evans, W.C. Pharmacognosy, Published by Elsevier, a Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. Beckett, A.H. and Stenlake, J.B.Practical Pharmaceutical Chemistry, Fourth Edition- Part Two, CBS Publishers and Distributors, New Delhi.
3. Chatwal, G.R. and Anand, S.K. Instrumental Methods of Chemical Analysis, Himalaya Publishing House, New Delhi.
4. Wallis, T.E. Textbook of Pharmacognosy, Fifth Edition, CBS Publishers and Distributors, New Delhi.
5. Jackson, B.P. and Snowdon, D.w. Atlas of Microscopy of Medicinal Plants Culinerbs and Spices, CBS Publishers & Distributors (P) Ltd., New delhi.

B. Pharm. VII Semester

01. PHM 4.7.1 : Pharmaceutical Biotechnology

Sub. Code	Subject	Theory

PHM 4.7.1	Pharmaceutical Biotechnology	4 hrs/week

1. **Introduction :** Definition and application of biotechnology in pharmaceutical sciences. **02**
2. **Immunology :** Principles, antigens and haptens, immune system, cellular humoral immunity, immunological tolerance. **04**
3. **Culturing Microorganisms :** Batch culture, continous culture, Fed-batch culture and use of culture system for the production of microbial products. **04**
4. **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,Streptokinase Humatrope, Hepatitis B vaccine etc. **08**
5. **Fermentation Technique :** Introduction of fermentation, fermenter technoilogy, control of different parameters. Isolation of mutants, factors influencing rate of mutation. Design of fermentation process. Isolation of fermentation products - penicillins, streptomycins, tetracyclines, vitamin B_{12} & ethanol. **12**
6. **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. **10**
7. **Enzyme immobilization :** Techniques of immobilization of enzymes, factors affecting enzyme kinetics. Study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylases and proteases etc. immobilization of bacteria and plant cells. **10**

Books recommended

1. Trevan, Boffey, Goulding and Stanbury, Biotechnology the Biological Prianciples, Tata McGraw Hill.
2. Hugo and Russel. "Pharmaceutical Microbiology", 6th edition, 1998, Balckwell Scientific Publication, Oxford.
3. Trevan MD, Boffey S, Goulding KH, Stanbury P." Biotechnology- The Biological Principles ", 1st edition, 1998, Tata McGraw Hill , New Delhi.
4. Crueger W, Crueger A." Biotechnology", 2nd edition, 20000, Panima Publishing Corporation, New Delhi.
5. Vyas SP, Dixit VK."Pharmaceutical Biotechnology", 1st edition ,2007, CBS Publishers & Distributors, New Delhi
6. Ward, O.P. "Fermentation Technology, Principles, Processes & products" Open University press, Milton Keynes, U.K.
7. Gaud, Gupta and Gokhale, Practical Biotechnology, 3rd edition, 2008, Nirali Prakashan, Pune

02. PHM 4.7.2 : Pharmaceutics- VIII (P'ceutical Technology- II)

Sub. Code	Subject	Theory
PHM 4.7.2	Pharmaceutics- VIII (P'ceutical Technology- II)	4 hrs/week

1. **Capsules :** Introduction, types, advantages and disadvantages, material and method of preparation hard gelatin capsules, size of capsules, method of capsule filling, soft gelatin, capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsules, evaluation, quality control, stability testing and storage of capsule dosage forms. **06**
2. **Microenapsulation :** Types of microcapsules, importance on microencapsulation in pharmacy, microencapsulation by phase separation, coacervation, multi orifice, spray drying, spray congealing,

polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules. **08**

3. **Tablets : 08**
   a. Formulation of different types of tablets, granulation technology or large scale by various techniques, physics of tablets making, different types of tablet compression machinery and the equipment employed, evaluation of tablets.
   b. Coating of Tablets:- Types of coating, film forming materials, formulation of coating solution, equipments for coating, coating process evaluation of coated tablets.
   c. Stability kinetics and quality assurance.
4. **Parenteral Products**: **10**
   a. Preformulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.
   b. Formulation details, containers and closures and selection.
   c. Prefilling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products.
   d. Aseptic Techniques:- source of contamination and methods of prevention, design of aseptic area, laminar flow bench services and maintenance.
   e. Sterility testing of Pharmaceuticals.
5. **Surgical products**:- Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc. bandages, adhesive tape, protective cellulosic hemostastics, official dressings, absorbable and non absorbable sutures, ligatures and catguts. Medical prosthetics and organ replacement materials. **06**
6. **Packaging of Pharmaceutical Products**: Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing. **05**
7. **Controlled release (CR) delivery systems** : Principle, Advantages and Disadvantages, Classification and types of oral drug delivery system, transdermal and parenteral CR drug delivery agents. **07**

Sub. Code	Subject	Practical
PHM 4.7.2	Pharmaceutics- VIII (P'ceutical Technology- II)	6 hrs/week

1. Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like powders, capsules, tablets, parenterals, micro-capsules, surgical dressing etc.
2. Evaluation of materials used in pharmaceutical packaging.

Books Recommended

1. Aulton ME. "Pharmaceutics- The Science of Dosage Form Design", 1st edition, 1998, ELBS/Churchill Livingstone, New York.
2. Lachman L, Lieberman HA, Kanig JL." The Theory & Practice of Industrial Pharmacy", 3rd edition, 1991, Varghese Publishing House, Bombay.
3. Banker GS, Rhode CT. "Modern Pharmaceutics", 4th edition, Informa Healthcare, New York.
4. Allen LV, Popovich NG, Ansel HC", Ansel's pharmaceutical Dosage Forms & Drug Delivery Systems", 8th edition, 2005.
5. Lieberman HA, Lachman L, Sachwartz JB." Pharmaceutical Dosage Forms: Tablets", 2nd edition , 2005, Vols 1-3 Marcel Dekker, N.Y.
6. Bentia Simson, Microencapsulation, 2nd edition, 2007, Tylor's and Fransis

03. PHM 4.7.3 : Pharmaceutical Biotechnology

Sub. Code	Subject	Theory
PHM 4.7.3	Pharmaceutical Industrial Management	4 hrs/week

1. 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). Identification of key points to give maximum thrust for development and perfection. **08**
2. Accountancy: Principles of Accountancy, Ledger posting and book entries, preparation of trial balance, columns of a cash book, Bank reconciliation statement, rectification of errors, profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques, bills of exchange, promissory notes of hundies, documentary bills. **07**
3. Economics: Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labor welfare, general principles of insurance & inland, foreign trade, procedure of exporting and importing goods. **05**
4. Pharmaceutical Marketing: Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business. **06**
5. Salesmanship: Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing. Recruitment, training, evaluation, compensation to the pharmacist. **07**
6. Market Research: **06**
   a) Measuring & Forecasting Market Demands- Major concept in demand measurement, estimating current demand, Geodemographic analysis, estimating industry sales, market share & future demand.
   b) Market Segmentation & Market Targeting.
7. Material Management: A brief exposure of basic principles of materials management major areas, scope, purchase, stores, inventory control and evaluation of materials management. **06**
8. Production Management: A brief exposure of the different aspects of Production Management- Visible & Invisible inputs, methodology of activities, performance evaluation techniques, process flow, process know how, maintenance management. **05**

Books Recommended

1. Mohan S, Jai D." Drug Store and Business Management ", 1st edition, 1995,S.V Kar & Co, Jalandhar .
2. Singh S, Singh P." Drug Store and Business Management", 1st edition, 1995, S.Dinesh & Co.Circular Road Jalandhar.
3. Koontz & O'Donnel Principles of Management Tata Mc Graw Hill, Delhi.
4. G. Vidya Sagar, Pharamceutical Industrial Management, 2nd edition, 2005, Pharma Book Syndicate

04. PHM 4.7.4 : Pharmaceutical Chemistry-VII (Medicinal Chemistry-II)

Sub. Code	Subject	Theory
PHM 4.7.4	Pharmaceutical Chemistry-VII (Medicinal Chemistry-II)	4 hrs/week

1. Drugs Acting on the Gastrointestinal Tract: 10

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, Astrigents, digestants, enzymes and mucolytics.

2. Pharmacology of Endocrine System: 15

a. Hypothalamic and pituitary hormones.
b. Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and Vitamin D.

c. Insulin, oral hypoglycaemic agents and Glucagon.
d. ACTH and corticosteroids
e. Androgens and anabolic steroids
f. Estrogens, progesterone and oral contraceptives
g. Drugs acting on the uterus.

3. Chemotherapy **18**

a. General Principles of Chemotherapy
b. Sulfonamides and cotrimoxazole
c. Antibiotics- penicillins, cephalosporins, chloramphenicol,erythromycin, Quinolones and miscellaneous antibiotics.
d. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.
e. Chemotherapy of malignancy and immunosuppressive agents.

4. Principles of Toxicology **12**

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.
c. Organ cystem toxicology of CNS, Liver, reproductive, respiratory and the formed elements of the bloods

Sub. Code	Subject	Practical
PHM 4.7.4	Pharmacology III	6 hrs/week

1. **Experiments on Isolated Preparations**:

a. To calculate the pA2 value of atropine using acetylcholine as an against on rat ileum preparation.
b. To calculate the pA2 value of mepyramine or chlorpheniramine using histamine as against on guinea pig ileum.
c. To estimate the strength of the test sample of against/ drug (e.g. Acetylcholine, Histamine, 5HT, Oxytocin etc.) using a suitable isolated muscle preparation employing matching bioassay, bracketing assay, three point assay and four point bioassay.

2. Pharmacology of the Gastrointestinal Tract:

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

3. **Clinical pharmacology**:

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

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

Books Recommended

1. Gilman, A.G., Goodman, L.S.,Goodman and Gilman's The Pharmacological Basis of Therapeutics. 11th edt.2006 Editors J.G.Hardmanetal. Pergamon Press, New York
2. Tripathi K.D. Essential of Medical Pharmacology.6th edt. 2008. Jaypee brother medical publisher. New Delhi
3. Katzung B.G. Basic & Clinical Pharmacology 4th edt. 2008 Churchill Livingstone New York
4. Rang M.P., Dale M.M. and Riter, J.M. Pharmacology. 6th edt.2007Churchill Livingstone.London.
5. Harvey AR,Champ CP Pharmacology 3rd Edt 2006 Lippincott Willams & Wilkins Philadelphia
6. Kulkarni, S.K. Handbook of Experimental Pharmacology. 2nd edt.1997 Vallabh Prakashan, Delhi

05. PHM 4.7.5 : Pharmaceutical Chemistry-VII (Medicinal Chemistry-II)

Sub. Code	Subject	Theory
PHM 4.7.5	Pharmaceutical Chemistry-VII (Medicinal Chemistry-II)	3 hrs/week

Introduction, Structure, Stereochemistry, Nomenclature, Synthesis of specified drugs (given in parenthesis), mode of action, Structure Activity Relationships (if any) uses and Physicochemical properties of the following classes of drugs:

1. **Steroids:** Biosynthesis of Cholesterol; Estrogens (Oestradiol), Nonsteroidal estrogens (Stilboesterol), Antiestrogens, Progestogens, (progesterone from stigmasterol),Synthetic Progesterone (norethisterone),

antiprogestogens, oral contraceptives, androgens (biosynthesis of testosterone and its synthesis from diosgenin), anabolic agents and adrenocorticoids (pathway for steroidogenesis),SAR of glucocorticoids. **10**

2. **General Anaesthetics**: Inhalational anaesthetics, Intravenous anaesthetics. **10**
3. **Local Anaesthetics**: Esters (Benzocaine), Amides (Lignocaine). **10**
4. **Hypnotics and Sedatives**: Barbiturates (Phenobarbitone);benzodiazepines (Nitrazepam) **03**
5. **Anticonvulsants**: Barbiturates; Hydantoin (Phenytoin); Oxazolidinediones (Troxidone); Benzodiazepines and Carbamazepine. **02**
6. **Opioid Analgesics**: Morphine and related drugs; Synthetic modifications of Morphine, totally synthetic analgesics; 6, 7-Benzomorphinan (Pentazocine), 4-phenylpiperidines (pethidine), Methadone and related derivatives; endogenous opioid peptides and opioid antagonists (Nalorphine). **05**
7. **Antitussives:** Centrally acting Antitussives, Opium alkaloids and related agents and Synthetic Antitussives, Peripherally acting antitussives and Expectorants. **02**
8. **Central Nervous System Stimulants**: Natural and Synthetic (Nikethamide); methylxanthines (Theophyllines) and Modified methylxanthines. **02**
9. **Psychopharmacological Agents: Antipsychotic agents**: Phenothiazines (chlorpromazine); butyrophenones and miscellaneous; **Antidepressants:** Tricyclic antidepressants (Amitryptyline), Atypical antidepressants; Monoamine oxidase inhibitors; **Anxiolytics:** Meprobamate and related drugs (Meprobamate); benzodiazepines (Diazepam). **07**
10. **Diuretics**: Carbonic anhydrase inhibitors (Acetazolamide); Thiazides and related drugs (Bendrofluazide); High ceiling diuretics (Frusemide), Aldosterone antagonists (spironolactone); other potassium sparing diuretics and osmotic diuretics. **04**
11. **Cardiovascular agents:** Cardiac glycosides; Antihypertensive agents; Antianginals and vasodilators; Antiarrhythmic drugs; Antihyperlipidemic drugs; Anticoagulant and platelet aggregation inhibitors (methyldopa, propranolol, procainamide, nitroglycerin). **09**

Sub. Code	Subject	Practical
PHM 4.7.5	Pharmaceutical Chemistry-VII (Medicinal Chemistry-II)	4 hrs/week

1. Workshop on stereomodel use of some selected drugs.
2. Synthesis of selected drugs from the course content involving two or more steps and their spectral analysis.
3. Establishing the Pharmacopoeial standards of the drugs synthesized.

Books Recommended:

1. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Eleventh Edition, edited by J. H. Block and J. M. Beale Jr., Lippincott Williams & Wilkins, Philadelphia, 2004.
2. Pharmaceutical Chemicals in Perspective, B.G. Reuben and H.A. Wittcoff, John Wiley & Sons, New York, 1989.
3. Foye's, Principles of Medicinal Chemistry, Sixth Edition, Wolters Kluwer (India), Lea & Febiger, Philadelphia, USA, 2008.
4. Singh, H. and Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, Second Edition Vallabh Prakashan, Delhi, 2005.

06. PHM 4.7.6 : Elective Subject

Sub. Code	Subject	Theory
PHM 4.7.5	Elective Subject	4 hrs/week

B. Pharm. VIII Semester

01. PHM 4.8.1 : Pharmaceutics-IX (Dosage Form Design)

Sub. Code	Subject	Theory
PHM 4.8.1	Pharmaceutics-IX (Dosage Form Design)	4 hrs/week

1. Preformulation studies : **14**
   a. Study of physical properties of drugs 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 formulation.
2. Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions. **10**
3. Stabilization and stability testing protocol for various pharmaceutical products. **05**
4. Performance evaluation methods : **12**
   a. In vitro dissolution studies for solid oral dosage forms, Federal perspectives on Immediate Release (IR) and Extended Release (ER) products.
   b. Brief Concepts of Biopharmaceutics Classification Scheme (BCS), in-vitro in-vitro correlation and bio-waiver.
   c. Important federal considerations for bio-availability and bio-equivalence studies for oral products; Statistical considerations including Crossover ANOVA.
5. GMP and quality assurance, Quality audit. **04**
6. Design, development, production and evaluation of controlled released formulations. **05**

Sub. Code	Subject	Practical
PHM 4.8.1	Pharmaceutics-IX (Dosage Form Design)	4 hrs/week

1. Preformulation studies including drug-excipient compatibility studies, effect of stabilizers, preservatives etc. in dosage form design.
2. Experiments demonstrating improvement in bioavailability through prodrug concept.
3. Stability evaluation of various dosage forms and their expiration dating.
4. Dissolution testing and data evaluation for oral solid dosage forms.
5. Evaluation of Bioequivalence of some marketed products.
6. In vivo bioavailability evaluation from plasma drug concentration and urinary excretion curves.
7. Design, development and evaluation of controlled release formulations.

Books Recommended

1. Aulton ME. “Pharmaceutics- The Science of Dosage Form Design”, 1st edition, 1998, ELBS/Churchill Livingstone, New York.
2. Lachman L, Lieberman HA, Kanig JL.” The Theory & Practice of Industrial Pharmacy”, 3rd edition, 1991, Varghese Publishing House, Bombay.
3. Banker GS, Rhode CT. “Modern Pharmaceutics”, 4th edition, Informa Healthcare, New York.
4. Lieberman HA, Lachman L, Sachwartz JB.” Pharmaceutical Dosage Forms: Tablets”, 2nd edition , 2005, Vols 1-3 Marcel Dekker, N.Y.
5. Jain NK. “Controlled and novel drug delivery”, 3rd edition,2004, CBS Publishers & Distributors, New Delhi.

02. PHM 4.8.2 : Pharmaceutical Analysis-III

Sub. Code	Subject	Theory
PHM 4.8.2	Pharmaceutical Analysis-III	4 hrs/week

1. Electromagnetic Radiations: Nature of Electromagnetic Radiations,the interaction between energy and matter. **02**
2. Ultraviolet and Visible Spectrophotometry: Electronic excitation, quantitative laws, deviations from Beer's law, graphical presentation of data, chromophores, photometric error, instrumentation (light sources, prism

and grating monochromators, photoemissive and photomultiplier tubes), single and double beam instruments, spectrophotometric measurements, concentration and optimum absorbance value, applications. **06**

3. Fluorometric Analysis: Theory, quantitative description, experimental factors affecting fluorescence intensity, factors affecting Io and F directly, relationship of fluorescence to molecular structure, instrumentation (cells, light sources, wavelength selection, detectors), correction of spectra, pharmaceutical applications. **04**
4. Infrared Spectrophotometry: Theory, characteristic absorption bands of organic functional groups, interpretation of infrared absorption Spectra; Frequency range, bandwidth and scan speed, concentration range and absorbance value, preparation of sample, sample cell, IR instrumentation, (light sources, monochromator detectors), qualitative and quantitative applications in pharmaceutical analysis, analytical shortcomings. **06**
5. X-Ray Spectroscopy: An introduction to the theory of x-ray spectroscopy (Miller indices, Space lattice and unit cell, Bravais lattices). Interplanar spacing in crystal system. Diffraction of x-ray by crystals, Bragg's equation, powder method, x-ray diffraction pattern of cubic system (NaCl),applications in pharmaceutical analysis.**05**
6. Nuclear Magnetic Resonance Spectroscopy: An introduction to the theory of NMR, magnetic properties of the nuclei, nuclear magnetic moments, absorption of energy, chemical shift, shielding and deshielding, spin-spin coupling, NMR instrumentation, typical spectra, analytical application in pharmaceutical analysis. **07**
7. Mass Spectrometry: Instrumentation, Basic principle determination of the molecular formula, recognition of the molecular ion peak, fragmentation and analytical application in pharmaceutical analysis. **07**
8. Flame Photometry : Origin of spectra, atomization and ionization, instrumentation (nebuliser, mirrors, burners, slits, monochromator, detector, background emission, interferences, qualitative & quantitative applications in pharmaceutical analysis). **04**
9. Atomic Absorption Spectroscopy: Theory of absorption of radiant energy by atoms, equipment, analytical applications. **04**
10. Polarimetry, its Principles and Applications **03**

02. PHM 4.8.2 : Pharmaceutical Analysis-III

Sub. Code	Subject	Practical
PHM 4.8.2	Pharmaceutical Analysis-III	4 hrs/week

1. Quantitative estimation of at least ten formulations containing single drug or more than one drug, using instrumental techniques.
2. Estimation of Na+,K+, Ca++ ions using flame photometry.
3. IR of samples with different functional groups (-COOH, -COOR,- CONHR;-NH2-OH, etc)
4. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS

Books Recommended

1. L.G. Chatten, Pharmaceutical Chemistry, V 01. 1 and 2, Marcel Dekker, NY (Latest Edition).
2. A. H. Beckett and J. B. Stenlake, Practical Pharmaceutical Chemistry,Vol. 1 and 2, Athlone Press of the University of London (Latest Edition).
3. H. Willard, L.L., Marriott; Jr., J. A. Dean, Instrumental Methods of Analysis, Van Nostrand Reinhold, N.Y. (Latest Edition).

4. J. W. Robinson, Undergraduate Instrumental Analysis, Marcel and Dekker Inc., NY, 1970 (Latest Edition).
5. V. M. Parikh, Absorption Spectroscopy of Organic Molecules, Addison-Wesley Publishing Co., London, 1974 (Latest Edition).
6. D. A. Skoog, E. 1. Holler and T. A. Nieman, Principles of Instrumental Analysis, Saunders Golden Sunburst Series, Saunders College Publishing Harcourt Brace College Philadelphia, Fort Worth, Chicago (Latest Edition)

03. PHM 4.8.3 : Pharmaceutical Chemistry-VIII (Medicinal Chemistry-III)

Sub. Code	Subject	Theory
PHM 4.8.3	Pharmaceutical Chemistry-VIII (Medicinal Chemistry-III)	4 hrs/week

1. Drug Metabolism: Introduction, General pathways of drug metabolism: Phase I (Functionalization) and Phase II (Conjugation) **05**
   Phase I: Oxidative reactions, Reductive reactions and Hydrolytic Reactions
   Phase II: Glucuronic acid conjugation, Sulphate conjugation, Amino acid conjugation, Glutathione conjugation, Acetyl conjugation and Methyl conjugation.
2. Introduction, Structure, Stereochemistry, Nomenclature, Synthesis of specified drugs (given in parenthesis), mode of action, Structure Activity Relationships (if any) uses and Physicochemical properties of the following classes of drugs:
   a. Antibacterials: Penicillins, Cephalosporins, Tetracyclines, Aminoglycosides, Polypeptides antibiotics, Chloramphenicol, Quinolones, Sulphonamides. Antimycobacterials: (p-Aminosalicyclic acid, Thiacetazone, Isoniazid, Dapsone) **14**
   b. Antimalarials: Quinoline and analogues, 4-Aminoquinolines, 8-Aminoquinolines, 9-Aminoacridines, Biguanides (Chloroquine, Primaquine), Artemisinin & its derivatives **05**
   c. Antiviral agents: Introduction to DNA, RNA and retroviruses. **03**
   b. 2.4 Antiamoebic and antiprotozoal drugs: Emetine hydrochloride, quinoline derivatives, organometallic compounds, Metronidazole (Metronidazole, Diloxanide furoate). **03**
   c. 2.5Anthelmintics: Drugs used in cestode infection, antifilarial agents (Thiabendazole, Niclosamide, Hexylresorcinol) **02**
   d. Antifungal drugs: (Clotrimazole ,Ketoconazole) **02**
   e. Antineoplastic agents: Alkylating agents, Antimetaboilities, Antitumor alkaloids, Hormones agonist and antagonists (Tamoxifen, Thiotepa, Chlorambucil),Antibiotics,Vinca Alkaloids and Paclitaxel. **07**
3. Hormones: Thyroid and Antithyroid Drugs; Insulin & Oral hypoglycemic agents **04**
4. Diagnostic Agents and Organic Pharmaceutical Aids **03**

Sub. Code	Subject	Practical
PHM 4.8.3	Pharmaceutical Chemistry-VIII (Medicinal Chemistry-III)	4 hrs/week

1. Experiments designed on drug metabolism :
   a. Preparation of S9 and microsomes from tissue homogenates and standardization of protein.
   b. Effect of Phenobarbital pretreatment on microsomal cytochrome p-450, cytochrome b5, and NADPH-Cytochrome C-reductase and comparison of microsomes from control.
   c. Determination of microsomal aminopyrine demethylase and p-nitroanisole odemethylase activities.
   d. Determination of microsomal azo- and nitroreducatase activities.
2. Synthesis of selected drugs.
3. Establishing the pharmacopoeal standards and spectral studies.

Books Recommended:

1. Singh & Kapoor. Medicinal & Pharmaceutical chemistry. 1st edition, 2001. Vallabh publications, Delhi.

2. Wilson & Gisvolds. Text book of Organic Medicinal & Pharmaceutical Chemistry. 11th edition, 1998. Lippincott Willians & Wilkins, London.
3. Lemke, Willians, Roche & Zito. Foye's Principles of Medicinal Chemistry. 6th edition, 2008. Lippincott Willians & Wilkins, London.
4. Nogrady & Weaver. Medicinal Chemistry. 3rd edition, 2005. Oxford university, Newyork.
5. Wermuth. The Practice of Medicinal Chemistry. 2nd edition, 2004. Elsevier India Pvt Ltd, New Delhi.

04. PHM 4.8.4 : Pharmacognosy-VI

Sub. Code	Subject	Theory
PHM 4.8.4	Pharmacognosy-VI	4 hrs/week

1. World-wide trade in medicinal plants and derived products with special reference to diosgenin (diascorea) taxol (Taxus sps) digitalis, tropane alkaloid containing plants, papain, Cinchona, Ipeacac, Liquorice, Ginseng, Aloe, Valerian, Rauwolfia and plants containing laxatives. **10**
2. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Utilization and production of phytoconstituents such as quinine, calcium sennosides, podophyllotoxin, diosgenin, olasodine, and tropane alkaoids. **07**
3. Utilization of aromatic plants and derived products with special reference to sandalwood oil, mentha oil, lemon grass oil, vetiver oil, geranium oil and eucalyptus oil. **06**
4. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. **04**
5. Chemotaxonomy of medicinal plants. **02**
6. Marine pharmacognosy, novel medicinal agents from marine sources. **05**
7. Natural allergens and photosensitizing agents and fungal toxins. **04**
8. Herbs and health foods and neutraceuticals and introduction to registration aspects of herbal products for marketing. Agencies controlling regulatory aspects for herbal products at national and international level (WHO, EMEA etc). **07**
9. Herbal cosmetics. **05**

Sub. Code	Subject	Practical
PHM 4.8.4	Pharmacognosy-VI	3 hrs/week

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

Books Recommended

1. Atal, C.K. and Kapur, B.M. Cultivation & Utilization of Medicinal Plants, RRL Jammu.
2. Kalia, A.N. Textbook of Industrial Pharmacognosy, CBS Publishers & Distributors, New Delhi.
3. Ansari, S.H. Essentials of Pharmacognosy. Third Edition 2009, Birla Publication Pvt. Ltd., Delhi.
4. Remington. The Science and Practice of Pharmacy, Vol. I & II, Mack Publishing Company, Pennsylvania.
5. Wagner, H. and Bladt, S. Plant Drug Analysis- A Thin Layer Chromatography Atlas, Second Edition, Springer India Pvt. Ltd., New Delhi.

05. PHM 4.8.5: Pharmacology-IV (Clinical Pharm.& Drug Interactions)

Sub. Code	Subject	Theory
PHM 4.8.5	Pharmacology-IV (Clinical Pharm.& Drug Interactions)	4 hrs/week

1. Introduction to Clinical Pharmacy **02**
2. Basic Concepts of Pharmacotherapy. **16**
   a. Clinical Pharmacokinetics and individualization of Drug Therapy.
   b. Drug Delivery systems and their Biopharmaceutic and Therapeutic Considerations.
   c. Drug use during Infancy and in the Elderly (Pediatrics and 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.
3. Important Disorders of Organ Systems and their Management : **28**
   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, obesity, .
   e. Endocrine Disorders-Diabetes mellitus and Thyroid Disorders, erectile dysfunction
   f. Infectious Diseases-Tuberculosis, Urinary Tract Infection, Enteric Infections, Upper Respiratory Infections – malaria, amebiosis, HIV
   g. Hematopoietic Disorders-Anemias.
   h. Joint and Connective Tissue Disorders- rheumatic disorder such as rheumatoid arthritis, Juvenile rheumatoid arthritis, ankylosing, spondylitis Gout and Hyperuricemia,
   i. Neoplastic Diseases-Acute Leukemia, Hodgkin's disease.
4. Therapeutic Drug Monitoring. **02**
5. Concept of Essential Drugs and Rational Drug use. **03**

Books Recommended

1. Laurence, D.R. & Bennet, P.N. Clinical Pharmacology, 9th edt. 2006Churchil Livingstone New York
2. Grahm smith D G. Aronson J K Oxford text book of clinical pharmacology and drug therepy.1984 Oxford University press USA
3. Remington's The Science and Practice of Pharmacy, Mach Publishing Co. Pennsylvania.
4. Rowland, M. and Tozer, T.N. Clinical Pharmacokinetics Lea and Febiger, N.Y.
5. Winter, M.E. Basic Clinical Pharmacokinetics, Applied Therapeutics Inc., San Fransisco.

06. PHM 4.8.6: Dissertation on the Project

Sub. Code	Subject	Theory
PHM 4.8.6	Dissertation on the Project	4 hrs/week