JODHPUR NATIONAL UNIVERSITY
JODHPUR

Faculty of Pharmaceutical Sciences

B.Pharm.

Session 2009-2010

Plan and scheme of Examination for B. Pharm. Semester - I

Sub. Code	Subject	Hrs/ week		Hrs/sem		Semester Exam.		Sessional Exam.		Total
		L	P	L	P	Th.	Prac.	Th.	Prac.	
101	Pharmaceutical Chemistry-I (Inorganic medicinal chemistry)	3	3	45	45	80	80	20	20	200
102	Pharmaceutical Chemistry-II (Organic Chemistry-I)	3	3	45	45	80	80	20	20	200
103	Pharmaceutics-I (Dispensing Pharmacy)	3	3	45	45	80	80	20	20	200
104	Human Anatomy & Physiology & Health education-I	3	3	45	45	80	80	20	20	200
105	Computer Application	3	3	45	45	80	80	20	20	200
106	Mathematics	3	-	45	-	80	-	20	-	100
Total		**18**	**15**	**270**	**225**					**1100**

Plan and scheme of Examination for B. Pharm. Semester - II

Sub. Code	Subject	Hrs/ week		Hrs/sem		Semester Exam.		Sessional Exam.		Total
		L	P	L	P	Th.	Prac.	Th.	Prac.	
201	Pharmaceutical Analysis-I	3	3	45	45	80	80	20	20	200
202	Pharmaceutical Chemistry-III (Organic Chemistry-II)	3	3	45	45	80	80	20	20	200
203	Pharmaceutics-II (Pharm. Tech.)	3	3	45	45	80	80	20	20	200
204	Human Anatomy & Physiology & Health education-II	3	3	45	45	80	80	20	20	200
205	BIOSTATISTICS	3	3	45	45	80	80	20	20	200
206	Communication Skills	3	-	45	-	80	-	20	-	100
Total		**18**	**15**	**270**	**225**					**1100**

Plan and scheme of Examination for B. Pharm. Semester - III

Sub. Code	Subject	Hrs/ week		Hrs/sem		Semester Exam.		Sessional Exam.		Total
		L	P	L	P	Th.	Prac.	Th.	Prac.	
301	Pharmaceutical Chemistry-IV (Chemistry of Natural Product)	3	3	45	45	80	80	20	20	200
302	Pharmaceutical Chemistry-V (Biochemistry-I)	3	3	45	45	80	80	20	20	200
303	Pharmaceutics-III (Pharmaceutical Microbiology)	3	3	45	45	80	80	20	20	200

304	Pharmaceutics IV (Physical Pharmacy– I)	3	3	45	45	80	80	20	20	200
305	Pharmacognosy -I	3	3	45	45	80	80	20	20	200
306	Pharmaceutics-V (Pharm. Engineering – I)	3	-	45	-	80	-	20	-	100
Total		**18**	**15**	**270**	**225**					**1100**

Plan and scheme of Examination for B. Pharm. Semester - IV

Sub. Code	**Subject**	**Hrs/ week**		**Hrs/sem**		**Semester Exam.**		**Sessional Exam.**		**Total**
		L	**P**	**L**	**P**	Th.	Prac.	Th.	Prac.	
401	Pharmaceutical Chemistry-VI (Biochemistry-II)	3	3	45	45	80	80	20	20	200
402	Pharmaceutics-VI (Biological Pharmacy)	3	3	45	45	80	80	20	20	200
403	Pharmaceutics-VII (Pharm. Engineering – II)	3	3	45	45	80	80	20	20	200
404	Pharmacognosy - II	3	3	45	45	80	80	20	20	200
405	Pharmaceutics VIII (Physical Pharmacy– II)	3	3	45	45	80	80	20	20	200
406	Drug Store & Business Management - I	3	-	45	-	80	-	20	-	100
Total		**18**	**15**	**270**	**225**					**1100**

Plan and scheme of Examination for B. Pharm. Semester - V

Sub. Code	**Subject**	**Hrs/ week**		**Hrs/sem**		**Semester Exam.**		**Sessional Exam.**		**Total**
		L	**P**	**L**	**P**	Th.	Prac.	Th.	Prac.	
501	Pharmaceutical Chemistry-VII (Medicinal Chemistry– I)	3	3	45	45	80	80	20	20	200
502	Pharmaceutics- IX (Pharm. Engineering-III)	3	3	45	45	80	80	20	20	200
503	Pharmaceutics -X (Dosage form design –I)	3	3	45	45	80	80	20	20	200
504	Pharmacology - I	3	3	45	45	80	80	20	20	200
505	Pharmacognosy - III	3	3	45	45	80	80	20	20	200
506	Drug Store & Business Management-II	3	-	45	-	80	-	20	-	100
Total		**18**	**15**	**270**	**225**					**1100**

Plan and scheme of Examination for B. Pharm. Semester - VI

Sub. Code	**Subject**	**Hrs/ week**		**Hrs/sem**		**Semester Exam.**		**Sessional Exam.**		**Total**
		L	**P**	**L**	**P**	Th.	Prac.	Th.	Prac.	
601	Pharmaceutical Chemistry-VIII	3	3	45	45	80	80	20	20	200

	(Medicinal Chemistry–II)									
602	Pharmaceutical Analysis - II	3	3	45	45	80	80	20	20	200
603	Pharmaceutics -XI (Dosage form design –II)	3	3	45	45	80	80	20	20	200
604	Pharmacology - II	3	3	45	45	80	80	20	20	200
605	Pharmaceutics -XII (Hospital & Community Pharmacy)	3	3	45	45	80	80	20	20	200
606	Forensic Pharmacy	3	-	45	-	80	-	20	-	100
Total		**18**	**15**	**270**	**225**					**1100**

Plan and scheme of Examination for B. Pharm. Semester - VII

Sub. Code	**Subject**	**Hrs/ week**		**Hrs/sem**		**Semester Exam.**		**Sessional Exam.**		**Total**
		L	**P**	**L**	**P**	Th.	Prac.	Th.	Prac.	
701	Pharmaceutical Analysis–III	3	3	45	45	80	80	20	20	200
702	Pharmaceutical Chemistry-IX (Medicinal Chemistry–III)	4	3	60	45	80	80	20	20	200
703	Pharmaceutics-XIII (Biopharmaceutics & Pharmacokinetics)	4	3	60	45	80	80	20	20	200
704	Pharmaceutics –XIV (Cosmetology)	3	3	45	45	80	80	20	20	200
705	Pharmacology - III	4	3	60	45	80	80	20	20	200
706	Professional training	-	3	-	45	-	80	-	20	100
Total		**18**	**18**	**270**	**270**	**-**	**-**	**-**	**-**	**1100**

Plan and scheme of Examination for B. Pharm. Semester - VIII

Sub. Code	**Subject**	**Hrs/ week**		**Hrs/sem**		**Semester Exam.**		**Sessional Exam.**		**Total**
		L	**P**	**L**	**P**	Th.	Prac.	Th.	Prac.	
801	Pharmaceutical Chemistry-X (Medicinal Chemistry–IV)	3	6	45	90	80	80	20	20	200
802	Pharmaceutics –XV (Biotechnology)	3	3	45	45	80	80	20	20	200
803	Pharmacognosy – IV	3	3	45	45	80	80	20	20	200
804	Pharmacology – IV	3	-	45	-	80	-	20	-	200
805	Industrial Management including Marketing	3	-	45	-	80	-	20	-	200
806	Project	-	3	-	45	-	80	-	20	100
Total		**15**	**15**	**225**	**235**	**-**	**-**	**-**	**-**	**1100**

B.PHARM. SEMESTER-I

PHARMACEUTICAL CHEMISTRY-I
(Inorganic Medicinal Chemistry)

THEORY

Subject code -101T Hours – (03/week)

1. **Sources of impurities in pharmaceutical substances; their permissible parameters &**
   Limit tests: for Iron, Arsenic, Lead, Heavy metals, Chloride, Sulphate and the special tests if any, of inorganic pharmaceuticals compounds included in syllabus.

2. **An outline of important physical and chemical properties, medicinal and pharmaceutical uses, storage conditions and identification tests of following classes of drugs included in IP.**

i. **Acids, Bases and buffers:**
Acids and Bases: HCl, H_2SO_4, HNO_3, H_3PO_4, NaOH, Strong NH_3 solution.

ii. **Gastrointestinal agents: Acidifying agents:** Dilute hydrochloric acid.
Antacids: Sodium bicarbonate, Aluminum hydroxide gel, Calcium carbonate, Tri- basic calcium phosphate, Milk of magnesia, Magnesium oxide, Magnesium trisilicate.
Protective and adsorbents: Bismuth subcarbonate, Bismuth subnitrate, Kaolin, Activated charcoal.
Cathartics: Sodium carboxy methylcellulose, Bisacodyl, Sodium phosphate, Potassium sodium tartrate.

iii. **Topical agents**: **Protectives:** Talc, Zinc oxide, Calamine, Zinc stearate, Titanium dioxide.
Astringents: Alum, Aluminum Sulphate**.**
Anti-microbial agents: Hydrogen peroxide, Potassium permanganate, Iodine, Silver nitrate, Boric acid, Chlorinated lime, Borax, Sodium antimony gluconate.

iv. **Major intra - and extra-cellular electrolytes:** Major physiological ions. Electrolytes used for replacement therapy, acid-base balance and electrolyte combination therapy **-** Sodium chloride and its preparations, Potassium chloride and its preparation, Calcium chloride, Calcium lactate, Calcium gluconate, Zinc Sulphate, Sodium acetate, Potassium acetate, Sodium bicarbonate, Sodium dihydrogen phosphate dihydrate, Sodium citrate.

v. **Essential and trace elements**: Transition elements and their compounds of pharmaceutical importance: **Iron and haematinic**- Ferrous Sulphate, Ferrous

gluconate, Ferrous fumorate, Iron-dextran injection, Ferric ammonium citrate, compound of iodine and Calamine.

vi. **Dental products**: Dentrifrices, anti-caries agents- Sodium fluoride, Stannus Fluride, Calcium carbonate, Dicalcium phosphate and Zinc Chloride.

vii. **Miscellaneous agents:**
Gases & vapours: (A) Inhalant – Oxygen (B) Anesthetic - Nitrous oxide
Sclerosing agents-
Emetics-
Expectorants- Ammonium chloride, Potassium iodide.
Antidotes- Sodium nitrite, Sodium Thiosulphate, Activated charcoal, Light Kaolin
Anti-oxidants- Sodium metabisulphite, Sodium bisulphite.

PRACTICALS

1. Limit tests for chloride, sulphate,iron and arsenic in inorganic pharmaceutical compounds
2. Identification and purification tests of selected inorganic pharmaceutical compounds.

BOOKS RECOMMENDED

1. J.H.Block,E.B.Roche,T.O.Soine & C.O.Wilson, 'Inorganic medicinal and pharmaceutical chemistry' Lea & Febiger.
2. N.C.Choudhary,'Pharmaceutical chemistry-I' Valabhrakashan,Delhi.
3. P.Gundu Rao,'Inorganic Pharmaceutical chemistry' Vallabh prakashan,Delhi.
4. H.K.singh,V.K.Kapoor, 'Basic and pharmaceutical chemistry' Vallabh prakashan,Delhi.
5. R.D.Gupta,'A Textbook of Analytical chemistry for Degree students' The National Book House,Jeoni Mandi,Agra.
6. Indian Pharmacopoeia,Govt. of India,Ministry of Health.
7. L.M.Atherden,Bently and Driver's, "A Textbook of pharmaceutical chemistry", Oxford university press.
8. A.H.Backett and J.B. stanlake,"Pharmaceutical chemistry" Part I,The Anthlono press,university of London.

PHARMACEUTICAL CHEMISTRY-II
(Organic Chemistry-I)

THEORY

Subject code -102T Hours – (03/week)

1. **Stereochemistry**- Enantiomerism, Chirality, The Racemic Modification, Configuration (R&S; D&L; d&1), sequence rules, Diastereomers, Meso-

structures, Conformational Isomers, Resolution of a racemic mixture & racemization.

2. **Nucleophilic Aliphatic Substitution**- Nucleophiles and leaving groups,SN_1 & SN_2 reactions, Duality of mechanism, Mechanism of Kinetics and stereochemistry of SN_1 & SN_2 reactions, carbonations and their rearrangements.
3. **Elimination Reactions**-Geometric isomerism, Dehydro-halogenation of alkyl halides (1, 2 elimination), Kinetics of dehydro-halogenation, Duality of mechanism, Mechanism, orientation and reactivity of E2 and E1 reactions, Elimination: E2 v/s E1: Elimination v/s substitution.
4. **Free Radical Substitution**- Halogenation of Alkanes up to four carbons & their relative reactivities, Mechanism & orientation of Halogenation, Ease of formation of free radicals, Transition state for halogenation, Orientation and reactivity, Reactivity and selectivity, Inhibitors.
5. **Electrophilic and Free-radical Addition** Electrophilic addition: Mechanism, Reaction at the carbon-carbon double bond (addition) of Hydrogen, Halogen, Hydrogen Halides, Sulphuric acid & water, Rearrangements in electrophilic addition, orientation & reactivity, Mechanism & orientation of free radical addition.
6. **Conjugation & Resonance-Dienes**-The carbon-carbon bond as a substituent, Free-Radical halogenation of alkenes: Substitution v/s addition, free radical substitution in alkenes; orientation, reactivity and allylic rearrangements. Theory of resonance, The allyl radical as a resonance hybrid, stability & orbital picture of the allyl radical, Resonance stabilization of allyl radicals, The allyl-cation as a resonance hybrid, stabilization of carbo-cation.
7. **Nucleophillic addition:-**
   Aldehydes and ketones: Structures, Physical properties, Nomenclature, preparation and reaction of aldehyde and ketones with due emphasis on Nucleophilic addition reactions.

PRACTICALS

1. Basic Laboratory Techniques
2. To find out melting and boiling point of given samples.
3. To carry out elemental detection in given organic samples.
4. To carry out identification reactions of known functional groups.
5. To identify unknown organic compounds and submit their derivatives.

BOOKS RECOMMENDED:

1. R.T.Morrison & R.N.Boyd,"Organic Chemistry",prentice Hall of India pvt.ltd.,new delhi.
2. I.L.Finar,"Organic chemistry",Vol-1,E.L.B.S.London.
3. R.D.Gupta,"A Text book of Analytical Chemistry"
4. F.G.Mann & B.C. Saunders, "Practical organic Chemistry" Longmans,Green and Co.Ltd.,London.

5. B.S.Furniss,et.al,"Vogal's Textbook of "Practical organic chemistry",E.L.B.S.,London.
6. Wingrove A.S. & Caret R.L.,"Organic chemistry",Harper & Row publishiers,New York.
7. Pine,Handrickson et.al,"Organic chemistry"McGrall Hill Book co.,N.Y.
8. Eliel L."Stereochemistry of carbon compounds"Tata McGrall Hill,Bombay.
9. Singh and kapoor,"Basic and pharmaceutical practical chemistry",Vallabh prakashan,Delhi.

PHARMACEUTICS-I
(Dispensing Pharmacy)

THEORY

Subject code -103T Hours – (03/week)

1. **Definition and Scope;** pharmacy as a career, pharmacy in relation to allied health profession.
2. **Pharmacist**: A Health Care Provider, Concept of pharmaceutical health care, Growth of Pharmacy Practice.
3. **Prescription:** Handling of prescription, source of errors in prescription, Latin terms, General dispensing procedures including labeling of dispensing products.
4. **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, displacement value, etc.
5. **Compounding & Dispensing of medication:** Definition of dispensing & compounding. Good dispensing & compounding practices, fundamental operations in compounding. Containers & closures for dispensed products, labeling & storage of compounded products. Dispensing of prefabricated dosage forms, patient counseling, and documentation of compounding & dispensing records.
6. **Principles involved and procedures adopted in dispensing of:** Typical prescriptions like……
   Mixtures, solutions, emulsions, suspension, creams, ointments, powders, capsules, pastes, jellies, suppositories, ophthalmic, pastilles, lozenges, pills, lotions, liniments, inhalations, paints, sprays, tablet triturates etc.
7. **Dispensing of proprietary medicines.**
8. **Incompatibilities:** Physical 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.

9. **Future trends in dispensing.**

PRACTICALS

1. **Dispensing of prescription falling under the categories:**
   Mixtures, solutions, emulsions, suspension, 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.

BOOKS RECOMMENDED

1. Carter, S.J. Cooper and Gunn's dispensing for Pharmaceutical Students CBS Publishers, Delhi.
2. Stoklosa, M.J. Pharmaceutical Calculations. Lea & Febiger, Philadelphia.
3. British National Formulary.
4. Hoover, J.E. Dispensing of Medication Mack Publishing Co., Easton, PA
5. Martindale's Extra Pharmacopoeia.
6. Martin, E.W. Dispensing of Medication Mack Publishing Co., Easton, PA.
7. National Formulary of India.
8. Remington's The Science & Practice of Pharmacy. Mack Publishing Co.,Easton, P.A.
9. Smith, H.A. Principles and Methods of Pharmacy Management K.M. Vargeshe Co., Mumbai

HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-I

THEORY

Subject code -104T Hours – (03/week)

1. **Scope of anatomy and physiology**: Basic terminology used in these subjects. Structure of cell, its components and their function. Elementary tissues of the human body: Epithelial, connective, muscular and nervous tissues, their sub-type and characteristics.
2. **Skeletal system**: Structure, composition and function of skeleton. Classification of joints, types of movements at joints, disorders of joints. Skeletal muscles: Their gross anatomy, physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.

3. **Blood**: Composition and function of blood and its elements, their disorders, blood group and their significance, mechanism of coagulation, disorders of platelets and coagulation.
4. **Cardiovascular system and circulation**: Basic anatomy of the heart, Physiology of heart, blood vessels and circulation. Blood pressure and factor affecting B.P. Basic understanding of Cardiac cycle, heart sounds and electrocardiogram. Heart disorders.
5. **Lymphatic system**: Composition, formation and circulation of lymph, lymph node and spleen.
6. **Health education**: Concepts of health and disease.
   Classification of food, food requirements, balance diet, nutritional deficiency disorders, their treatment and prevention. Specifications of drinking water.
7. **Demography and family planning**: Demography cycle, family planning, various contraceptive methods.
8. **First aid**: Emergency treatment of shock, snake bite, burns, poisoning, fractures and resuscitation methods.

PRACTICALS:

1. Study of Human Skeleton.
2. Study of different systems of Human body with the help of charts & models.
3. Estimation of Hemoglobin, and determination of clotting time & Bleeding time, RBC, WBC (Total) DLC & ESR.

BOOKS RECOMMENDED:

1. Chatterjee, C.C, Human Physiology, Medical allied agency, Calcutta
2. Shalya, Subhas, Human Physiology CBS publisher Delhi
3. Ross and Wilson, Human anatomy and Physiology
4. Chaurasia, B.D, Human anatomy, Regional and applied. Part-1, CBS publisher New Delhi
5. Parmar N.S. Health education and community pharmacy, CBS publisher New Delhi.

COMPUTER APPLICATION

THEORY

Subject code -105T Hours – (03/week)

1. **Introduction to computer:** Brief history of development of computers, computer system concept, computer system characteristics, capabilities and limitations, Applications in general and pharmacy in particular.
2. **Elements of computer systems:** The architecture of a computer system, CPU – ALU, CU, Memory – Primary and Secondary, Input/Output and Storage Devices - Keyboard, Magnetic Tape, Magnetic Disk, Monitor, Printer, Floppy Disk, Hard

Disk. Data, Need of Data Processing, Information & its Need, Levels of information, Quality of information, Comparison of manual & electronic storage of data. Drives: CD/DVD, pen drive/data drive

3. **Peripheral devices:** mouse, OCR, OMR, MICR, scanner, monitor, Printers – impact and non-impact printers – DMP, daisy wheel, line and drum printers, ink-jet and laser printers, plotters. Types of computers – Analog, Digital, Hybrid, General, Special, Purpose, Micro, Mini, Mainframe, Super, Personal computer (PCs) – Configuration, Pentium and Newer PCs specifications and main characteristics, types of PCs – Desktop, Laptop, Notebook, Palmtop, Workstations etc. – their characteristics.
4. **Software, Types of Software :** System Software, Application Software, Introduction to operating systems MS-DOS, Windows, Linux etc. Concept of programming, programming languages. Types of computer languages, Machine, Assembly, high level language. Examples & areas of use of various high level language & their features. Language translators : Comparative study, assembler, compiler, Interpreter.
5. **Windows :** Windows concepts, Features, Windows Structure, Desktop, Taskbar, Start menu, My Computer, Recycle Bin, Windows Accessories – Calculator, Notepad, Paint, Wordpad, Character Map, Windows Explorer, Entertainment, Managing Hardware & Software, System Tools, Communication, Sharing Information between programs.
6. **MS-Word :** Features, Creating, Saving and Opening Documents in Word, Interface, Toolbars, Ruler, Menus, Keyboard Shortcut, Editing, Previewing, Printing & Formatting a Document, Advanced Features of MS Word, Find & Replace, Using Thesaurus, Using Auto – Multiple Functions, Mail Merge, Handling Graphics, Tables & Charts, Converting a word document into various formats like – Text, Rich Text format etc.
7. **Electronic Spread Sheet:** MS–Excel — Worksheet basics, creating worksheet, entering data into worksheet, heading information, data, text, dates, alphanumeric, values, saving & quitting worksheet, Opening and moving around in an existing worksheet, Toolbars and menus, Keyboard shortcuts, Working with single and multiple workbook, working with formulae & cell referencing, Auto sum, Coping formulae, Absolute & relative addressing, Working with ranges, formatting of worksheet, Previewing & Printing worksheet, Graphs and charts, Database, Creating and using macros, Multiple worksheets – concepts, creating and using.
8. **Presentation Graphics (MS-PowerPoint):** introduction, various uses, creating and saving presentation, creating slides – different types of slides, different views of slides, editing and formatting slides, backgrounds, inserting pictures from files, presentation shows, animation, customization of slides.

9. **Introduction to networking,** concept of LAN and WAN. Internet Technology : History, requirements, e-mail, search engines, websites and webservers, basics of html, scientific information retrieval using databases, search engines

PRACTICALS:

1. Study of Operating System – Windows.
   (a) To test some of the basic systems operations on files/ folders.- create, rename, cut, copy, paste, delete.
   (b) To use accessories available in Windows
2 Study of Different Software available in Windows.
   (a) Exercises based on word-processing – creating documents, writing text in paragraph etc.
   (b) Writing Informal letter, Formal letter, writing reports on current topics, writing report, news, writing article, creating brochure
3. Exercises based on electronic worksheet – creating sheet, entering data, applying formulae, functions on cells etc.
4. Creating reports based on the experiments done in laboratories.
5. Searching of scientific information using database Pubmed, Searching of scientific information from patent databases, Searching of scientific information using search engines scholar.google.com and scirus.com
6. E-mail, creating of account, drafting, sending, attachments

BOOKS RECOMENDED:

1. Fundamentals of Computers by Rajaraman, Prentice Hall of India
2. Learn MS-Office 2000 by Stultz, BPB Publications.
3. Using Microsoft Windows 1998 by Ivens, Prentice Hall of India.
4. Praveen S. Thakur and Rachna Manchanda; Computer in Pharmacy.
5. Elias M. Award; System Analysis and Design; Edition-II.
6. Thomas C. Bartee; Digital computer fundamentals; Edition –VI.
7. Sinha & Sinha; Computer Fundamentals, Edition-IV.
8. D. P. Sharma; Computer Application in Pharmacy.

MATHEMATICS

THEORY

Subject code -106T Hours – (03/week)

1. Sets, relations and functions equation of straight line. Calculus of finite differences Finite different, difference table finite difference operator and their properties.

2. Linear equation and matrices, solution of linear programming problems by graphical method and simplex method.

3. Differential calculus limits continuity and differentiability. Differentiation: Basic fundamental theorems on differentiation, differentiation of trigonometric and hyperbolic function (including inverse trigonometric and hyperbolic function), logarithmic differentiation. Partial differentiation.

4. Integral Calculus: Integration as inverse process of differentiation. Integration by substitution, integration by parts, integration of algebraic functions.

5. Differential equations: Formation, order and degree of a differential equation. Differential equation of first order and first degree, linear differential equation with constant coefficients. Homogeneous linear differential equations.

6. Laplas and inverse laplas transforms and their properties. Evaluation of laplas and inverse laplas transforms of simple functions (including higher transcedatal functions) Application of laplas and its inverse to solve linear ordinary differential equation.

BOOKS RECOMENDED

1. A Textbook of Mathematics for XI-XII Students. NCERT Publications. Vol I-IV 1991.
2. Grewal, B.S.; Higher Engineering Mathematics. Khanna Publishers, New Delhi,1990.
3. Jain and Rawat; Engineering mathematics-I.
4. Shanti Narayan; Differential calculus.
5. Bansal and Dhami; Differential Equations Vol.-I.
6. Bansal, Bhargava and Agarwal; Integeral Calculus, Mathematics-II.
7. Ansel and Stoklossa; Pharmaceutical Calculations.

B.PHARM. SEMESTER-II

PHARMACEUTICAL ANALYSIS-I

THEORY

Subject code -201T Hours – (03/week)

1. **Significance of quantitative analysis** in quality control, Different techniques of analysis, Preliminaries and definitions, Significant figures, Rules for retaining significant digits, types of errors, Mean, Standard deviation, Statistical Treatment of small data sets, Selection of sample, Precision and accuracy. Fundamentals of

volumetric analysis, methods of expressing concentration, primary and secondary standards.

2. **Acid Base Titrations**: Acid base concepts, Role of solvent, Relative strengths of acids and bases, Ionization, Law of mass action, Common-ion effect, Ionic product of water, pH, Hydrolysis of salts, Henderson-Hesselbach equation, Buffer solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, Mixed indicators, Polyprotic system, applications in assay of H_3PO_4, NaOH, $CaCO_3$, Sod. Carbonate, Sod. Bicarbonate, Ammonia solution, Boric acid, Ammonium chloride, Ammoniated Mercury. etc.
3. **Oxidation Reduction Titrations**: Concepts of Oxidation and reduction, Redox reactions, Strengths and equivalent weights of oxidizing and reducing agents, Theory of Redox titrations, Redox indicators, Cell representations, Measurement of electrode potential, Oxidation-reduction curves, Iodimetry and Iodometry. Assay of Ferrous Sulphate, hydrogen peroxide solution, iodine solution, chlorinated lime, and copper sulphate.
4. **Precipitation Titrations**: Precipitation reactions, Solubility products, Common ion effect, Effects of acids, temperature and solvent upon the solubility of a precipitate. Argenometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, Indicators, Gay-Lucass method; Mohr's method, Volhard's method and Fahjan's method. Assay of sodium chloride injection, yellow mercuric oxide etc.
5. **Gravimetric Analysis**: Theory, sampling, precipitation, the colloidal state, Super-saturation, co-precipitation,, Post-precipitation, Digestion and washing of the precipitates, Filtration, Filter papers and crucibles, Ignition, Specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic precipitants.
6. **Non-aqueous Titrations:-**theoretical consideration, scope and limitations, Acid base equilibrium in non-aqueous media, solvents, titration of weak bases, titration of weak acids, indicators. Assay of Phenobarbitone and Sulphathiazole.
7. **Complexometric Titrations:** concept of complexation and chelation, electronic structure of some complex ions, stability constants, titration curves, masking and demasking agents, types of complexometric titrations, EDTA titrations, metal ion indicators and application in drug analysis. Assay of Calcium gluconate, Magnesium sulphate and zinc sulphate.
8. **Miscellaneous methods:** Sodium nitrite titrations-Assay of Benzocaine, Dapsone, Sulphomethoxazole, Primaquine-phosphate, Procainamide-HCl, Procaine-HCl,Sulphacetamide-sodium, Sulphadoxine, Sulphamethiozole, Sulphomethoxy pyridazine, Sulphapyridine, Sulphathiozole, Sulphadiamidine-Sodium etc.

PRACTICALS

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 assay of H_3PO_4, NaOH, $CaCO_3$, Sod. Carbonate, Sod. Bicarbonate, Ammonia solution, Boric acid, Ammonium chloride, Ammoniated Mercury. etc.
3. **Oxidation Reduction Titrations**: Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc. Assay of Ferrous Sulphate, hydrogen peroxide solution, iodine solution, chlorinated lime, and copper 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.
6. **Non aqueous Titrations:** Preparation and standardization of perchloric acid and sodium/ potassium/ lithium methoxides solutions. Assay of Phenobarbitone and Sulphathiazole. Estimations of some pharmacopoeial products.
7. **Complexometric Titrations:** Preparations and standardization of EDTA solution, Assay of Calcium gluconate, Magnesium sulphate and zinc sulphate.

BOOKS RECOMMENDED

1. Beckett, A.H., and Stanlake, J.B. Practical Pharmaceutical Chemistry, Athilone Press, London.
2. Jeffery, G.H., Bessett, J., Mendham J. and Denney, R.C., Vogel's Textbook of Quantitative Inorganic Analysis including Elementary Instrumental Analysis 4th ed. the ELBS and Longman London, 1978.
3. Atherden, L.M. Bentley and Driver's Textbook of Pharmaceutical Chemistry. 8th ed. Oxford University Press, Delhi. 1969
4. Gary, D.C.Analytical Chemistry 4th ed. John Wiley and Sons, New York, 1986.
5. Connors, K.A. Textbook of Pharmaceutical Analysis.3rd Edition. John Wiley & Sons, New York.
6. Kalthoff, I.M. and Stenger, V.A. Volumetric Analysis Vol.II Titration Methods. Interscience Publishers Inc., New York.
7. Varma, R.M. Analytical Chemistry, Theory & Practice. 3rd edition CBS Publishers & Distributors, New Delhi.

8. I.P. 1996.

PHARMACEUTICAL CHEMISTRY-III
(Organic chemistry-II)

THEORY

Subject code -202T Hours – (03/week)

1. **Aromaticity**- Stability of benzene ring, Orbital picture of benzene, Huckel rule.
2. **Electrophilic aromatic substitution**- Effect of substitutent groups, classification of substituent groups, orientation in disubstituted benzene, Mechanism of nitration, sulfonation, friedel-craft alkylation, Halogenation, protonation, Mechanism of electrophilic aromatic substitution. Theory of reactivity, Theory of orientation, Electron release viz resonance, Effect of halogen on electrophilic aromatic substitution.
3. **Arenes and their derivatives**-The aromatic ring as a substituent, Aromatic-aliphatic hydrocarbons, structure and nomenclature of arenes and their derivatives, Friedel-craft alkylation, Mechanism & limitations, Reactions of alkyl benzene, Oxidation, Electrophilic aromatic substitution, Halogenation, side chain halogenation, Resonance stabilization of benzyl radical.
4. **Nucleophilic acyl substitution**-Role of carbonyl group, Alkyl v/s acyl, Reaction of acid chlorides, acid anhydrides, amides & esters.
5. **Nucleophilic aromatic substitution**-Bimolecular displacement mechanism, Reactivity and orientation in nucleophilic aromatic substitution, Electron withdrawal by resonance, Nucleophilic substitution, Aliphatic and aromatic, Elimination-addition mechanism for nucleophilic aromatic substitution.
6. **Nomenclature, Prep. & properties**- phenol, carboxylic acid, Amines, Naphthalene, Phenanthrene & anthracene.
7. **Heterocyclic-General nomenclature-** occurrence and Pharmaceutical importance of the following heterocycles-Furan, Thiophene, Pyrrole, Oxazole, Isoxazole, Pyrazole, Pyrazine, Pyridine, pyrimidine, pyridazine, Indole, Bezofuran, Quinoline, Isoquinoline, Purine, Phenothiazine, Benzodiazepine.

PRACTICALS

1. Preparation of simple organic compounds involving Sulphonation, Nitration, Acetylation, Halogenation, Oxidation, Reduction (diazotization), Elimination.
2. Preparation of some heterocyclic compounds.

BOOKS RECOMMENDED

1. R. T. Morrison & R. N. Boyd,"Organic chemistry" Prentice Hall of India Pvt.Ltd., New Delhi.

2. I.L.Finar,"Organic chemistry", Vol-I & II,E.L.B.S.London.
3. F.G.Mann & B.C.Saunders, "Practical organic chemistry", Longmans,Green and co.Ltd.,London.
4. B.S.Furniss, et.al,"Vogal's Textbook of "Practical organic chemistry",E.L.B.S.,London.
5. Wingrove A.S & Caret R.L.,"Organic chemistry", Harper & Row Publishers,New York.
6. R.M.Acheson "An introduction to the chemistry of Heterocyclic compounds", Interscience publications,New York.
7. Silverstein & Bassler, "Spectroscopic Identification of organic compounds".
8. Gutschi,"Chemistry of carbonyl compounds", prentice Hall of India Pvt.Ltd.,New Delhi.

PHARMACEUTICS-II
(Pharmaceutical Technology)

THEORY

Subject code -203T Hours – (03/week)

1. **Scope of Pharmacy and Introduction to pharmacopoeias** (IP, BP, USP, BPC and NF of India, Extra Pharmacopoeia and European Pharmacopoeia.
2. **Introduction to Pharmaceutical Dosage Forms :** Classification of dosage forms and definition, general formulations, manufacturing procedures and official products of tablets, capsules, solutions, mixtures, spirits, aromatic waters, glycerites, paints, syrups, elixirs, linctuses, mouth washes, lotions, liniments, ointments, pastes, gels, inhalations and powders.
3. **Pharmaceutical Excipients**: Organoleptic additives, Preservatives, Antioxidants, stabilizers, solubility enhancers.
4. **Powders and granules**: Formulation, preparation and evaluation of various powders and granules. Products like dusting powder, oral dehydration powder, dry syrup formulation, talcum powder, tooth powder, effervescent powder.
5. **Liquid Dosages Forms**: Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors and others, manufacturing packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.
6. **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.
7. **Suppositories**: Ideal requirements, bases, manufacturing procedure, packaging and evaluation.

8. **Extraction and Galenical Products**: Principles and method of extraction. Preparation of infusion, tinctures, dry and soft liquid extracts.

PRACTICALS

1. Preparation, evaluation and packaging of various dosage forms like solutions, suspensions and emulsions, ointments, suppositories, aerosols, eye drops, eye lotions, eye ointments etc.
2. Preparation, evaluation and packaging of powders and granules.
3. Preparation of pharmacopoeial extracts and galenical products utilizing various methods of Extraction.

BOOKS RECOMMENDED

1. Lachman, L., Lieberman, H.A., and Kanig, J.L. The Theory & Practice of Industrial Pharmacy. Lea & Febiger, Philadelphia.
2. Ansel, H.C. Introduction to Pharmaceutical Dosage Forms. V.M. Verghese & Co., Mumbai.
3. Banker, G.S. and Rhode, C.T. Modern Pharmaceutics. Marcel Dekker.
4. Carter, S.J. Cooper & Gunn's Tutorial Pharmacy. CBS Publishers, Delhi.
5. Pharmaceutical Dosage Forms and Drug Delivery Systems. Lea and Febiger, Philadelphia.
6. Rawlins, E.A. Bentley's Textbook of Pharmaceutics. ELBS.

HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-II

THEORY

Subject code -204T Hours – (03/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.
2. **Respiratory System**: Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiratory volumes and vital capacity.
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.
4. **Autonomic Nervous System**: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.
5. **Urinary System**: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base balance.
6. **Reproductive System**: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization, Sex differentiation, spermatogenesis and oogenesis.

7. **Endocrine System**: Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones and functions.
8. **Sense Organs**: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

PRACTICALS:

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

BOOKS RECOMMENDED:

1. Chatterjee, C.C, Human Physiology, Medical allied agency, Calcutta
2. Shalya, Subhas, Human Physiology CBS publisher Delhi
3. Ross and Wilson, Human anatomy and Physiology
4. Chaurasia, B.D, Human anatomy, Regional and applied. Part-1, CBS publisher New Delhi
5. Parmar N.S. Health education and community pharmacy, CBS publisher New Delhi.

BIOSTATISTICS

THEORY

Subject code -205T Hours – (03/week)

1 Bio-statistics: measure of central tendency (Mean, Mode, Median,), measure of dispersion (Varience, Standard deviation), Standard Error, Tables and graphs 'Life tables' only,

2 Correlation and Regression Analysis: Correlation relationship, Correlation coefficient,Pearsons coefficient, rank coefficient, Types Of Correlation, linear regression Line and equation,

3 Probability and distributions: Events and Probability, Normal distribution, Binomial distribution, Poisson distribution

4. **Test of significance:** Comparison of means of two samples (t-test), Comparison of means by three or more samples(F-test, one way ANOVA)

5. **Transportation and Assignment Problems**

6. **Queuing Theory:** queue length, waiting time in Poisson queue.

7. **Decision Theory:** Decision under uncertainties, mini-max and bay's strategies

8. **Theory of games:** solution of matrix games.

PRACTICALS : Biostatistics and Computer Applications

This course introduces statistical methods commonly used by biologists from the viewpoint of application. Methods include t-test, analysis of variance (ANOVA), correlation and regression analysis. The course will focus on the basic understanding of the statistical concepts, use of computer software (Statistical Analysis System, SAS) to do the analysis, and the interpretation of statistical results.

1 Introduction, basic concepts and descriptive statistics
- Population and samples
- Parameter and statistic
- Frequency distributions, graphics

3 Statistic distributions
- Sampling distribution of mean
- Sampling distribution of difference between two means
- t-distribution
- F distribution

4 Analysis of Variance
- One-way ANOVA

5 Regression and correlation
- Correlation relationship
- Linear regression equation
- Significant test

BOOKS RECOMMENDED

1. Bolton's Pharmaceutical Statistics. Practical and Clinical Applications. Marcel Dekker, New York, 1990
2. Daniel, W.W.Biostatistics. A Foundation for Analysis in Health Sciences. John Wiley, New York 1983
3. Grewal, B.S.Higher Engineering Mathematics. Khanna Publishers, New Delhi, 1990.
4. Gupta, S.P. Statistical Methods. Sultan Chand & Co., New Delhi, 1990.
5. Kapoor V.K.; Operation Research Techniques for Mgt
6. Sharma S.D.; Operation Research
7. Gupta P. K., Swarup Kanti and Manmohan; Operation Research
8. Sharma B. K and Dr Singh Ranjeet; Production & Operation Mgt
9. Hira D.S. and Gupta Prem Kumar; Operation Research
10. Aggrawal N.P.; Operation Research
11. Kapoor V.K.; Operation Research Problems and Solution
12. Bronsan Richard and Naadimuthu Govindsami; Operation Research Edition-II

COMMUNICATION SKILLS

THEORY
Subject code -206T Hours – (03/week)

1. **English Grammar**: Sequences of tenses, voice, articles, direct and indirect speech; degrees of comparison and preposition.
2. **Role and importance of communication:** verbal and non-verbal communication, debates, role play, Group communication, effective communication, barriers of communication, communication media, participating in discussions, conduct of seminars, conferences etc., interacting with learners and teachers, role of wit and humor in communication.
3. **Scientific/technical report writing**: Thesis writing, Letter writing, drafting and delivering a speech, Tips for presentation technique, resume writing and interview techniques.
4. **Types and methods of learning and listening**: learning and listening of knowledge, attitudes, skills, decision making, thinking, motivation and practices.
5. **Agreement and disagreements:** how to use a dictionary; how to use a thesaurus; vocabulary development; synonyms; one word substitutes; comprehension.

BOOKS Recommended:
1. Wray and Martin.
2. Business communication and executive effectiveness by scdl.

B.PHARM. SEMESTER-III

PHARMACEUTICAL CHEMISTRY-IV
(Chemistry of Natural Products)

THEORY
Subject code -301T Hours – (03/week)

1. **Carbohydrates**: Structure, detailed chemistry, properties and reactions of mono, di and polysaccharides and qualitative analysis of carbohydrate.
2. **Cardiac glycosides** Source, chemistry, biogenesis and pharmacological activity of digitoxin, digoxin, diosgenins, strophanthidin and sennosides.
3. **Lipids:** Classification & composition of fats and oils, properties, determination and significance of acetyl value, acid value, saponification and iodine value.

4. **Amino acids, peptides and proteins**: Structure, classification, properties & reactions of amino acids, nomenclature of peptide and protein, solid phase peptide synthesis, classifications of proteins and levels of protein structure and protein denaturation.
5. **Terpenoids & Terpenes:** Sources, classification and structural elucidation and pharmacological activity of menthol, camphor, citral.
6. **Alkaloids:** Source, general classifications, chemistry and structural elucidation and pharmacological activity of atropine, quinine, reserpine, morphine, papavarine, ephedrine, ergot and vinca alkaloids.
7. **Lignins and flavonoids:** Chemistry and biogenesis of medicinally important lignans and flavonoids.

PRACTICALS

1. Qualitative analysis of selected natural products-Alkaloids, carbohydrates, Proteins, Amino acids & Tannins.
2. Analysis of essential oils & fats.

BOOKS RECOMMENDED

1. Morrison R.T. & Boyd R.N., Organic Chemistry, Prentice Hall India Pvt. Ltd., New Delhi.
2. Finar I.L., Organic Chemistry, Vol –II, E.L.B.S., London.
3. Mann F. G. & Saunders B. C., Practical Organic Chemistry, Longmans, Green and Co. Ltd., London.
4. Furniss B. S., et. al, Vogal's Textbook of "Practical Organic Chemistry, E.L.B.S., London.
5. Wingrove A.S. & Caret R.L.; Organic Chemistry, Harper & Row Publishers, New York.
6. Acheson R.N., An Introduction to the chemistry of Heterocyclic compounds, Interscience Publications, New York.
7. Gutschi, Chemistry of Carbonyl Compounds, Prentice Hall India Pvt. Ltd., New Delhi.
8. Remington Pharmaceutical Sciences.
9. Acheson R. N., An Introduction to the chemistry of Heterocyclic Compounds, Interscience Publishers, New York.
10. Finar I. L., Organic Chemistry, Vol. II., The Fundamentals and Principles, ELBS/Longman.
11. Textbook of Practical Organic Chemistry, The ELBS/Longman, Longman, London.
12. Jurs P. C. Computer Software Application in Chemistry, John Wiley & Sons, New York.

13. Roberts J. D. and Caserio M. C., Basic Principles of Organic Chemistry, W. A. Benjamin, Inc., New York.
14. Sykes P. A. Guidebook to Mechanisum in Organic Chemistry, Orient Longman, New Delhi.
15. Agarwal O. P., "Natutral Products" Vol.-I & II

PHARMACEUTICAL CHEMISTRY-V
(Biochemistry-I)

THEORY

Subject code -302T Hours – (03/week)

1. **Foundation of biochemistry:** Cellular, chemical, physical, genetic, evolutionary.
2. **Animal cell and biomembrane:** cell structure, functions, cellular components and their functions. Biomembranes, their structure and transportation through membrane.
3. **Bioenergetics:** Introduction, concept of free energy, Role of high energy phosphate Nucleotide phosphates, production of ATP and its biological significance.
4. **Biological oxidation:** Redox-potential, enzymes and co-enzymes involved in oxidations, reduction and its control, respiratory chain, its role in energy capture and its control, energetics, and mechanism of oxidative phosphorylation, inhibitors of respiratory chain.
5. **Enzymes:** Properties, Nomenclature, Classification, Mechanism of action, kinetics, Michaelis-Menten equation, enzyme inhibition, factor affecting enzyme action, iso-enzymes, co-enzymes, metalo-enzymes, allosteric-enzymes, regulatory enzymes, enzyme inhibition, clinical and therapeutic uses of enzymes.
6. **Vitamins:** Classification and biological importance of vitamin A, vitamin D, vitamin E, vitamin K, vitamin B-complex and ascorbic acid.
7. **Carbohydrates:** Properties, classification, metabolism: glycolysis, citric acid cycle, hexose monophosphate shunt, uronic acid pathway, glucogenesis, glycogenolysis, gluconeogenesis, glyoxylate cycle, uremic acid cycle, regulation of metabolism, metabolism of fructose, galactose, abnormalities of carbohydrate metabolism, qualitative identification tests.
8. **Lipids:** Properties, classification, storage of lipids, structural lipids in membranes, lipids as signals, cofactors and pigments, digestion, mobilization and transport of fats, oxidation of glycerol, oxidation of fatty acids, ketone bodies, biosynthesis of fatty acids, eicosanoids, triglycerides, phosphnolipids, cholesterol, steroids, isoprenoids, regulation of fatty acids metabolism, phospholipids, sphingolipids, eicosanoids, abnormalities of lipid metabolism, qualitative identification tests.

PRACTICALS

1. Qualitative identification tests for carbohydrates.
2. Qualitative identification tests lipids.
3. Quantitative estimation of carbohydrates.
4. Urine analysis for normal components.
5. Urine analysis for abnormal components.
6. Determination of glucose by means of enzyme glucose oxidase.
7. Effect of temperature on activity of alpha amylase.
8. Estimation of blood cholesterol.
9. Qualitative identification tests for vitamins.
10. Test for immobilization of enzymes.
11. Withdrawal of blood samples.
12. Separation of blood components.

BOOKS RECOMMENDED

1. Lehninger A. L., Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
2. Stryer L., Biochemistry, W H Freeman and Company, San Francisco.
3. Rama Rao. A.S.S.V; A Text book of Biochemistry; L. K. & S. Publishers, Visakhapatnam.
4. Conn E. E. and Stumpf P. K., Outlines of Biochemistry, John Wiley and Sons, New york.
5. Harrow B. and Mazur A., Textbook of Biochemistry, W. B. Saunders Co., Philadelphia.
6. Jayraman J., Laboratory Manual in Biochemistry, Wiley Eastern Limited, New Delhi.
7. Martin D. W., Mays P. A. and Redwell V. M., Harpers Biochemistry, Lange Medicak Publications.
8. Mussay R. K., Granner D. K., Mayous P. A. and Rodwell; Harpers Biochemistry, Prentice-Hall International, Inc.
9. Plumer D. T., An Introduction to Practical Biochemistry, Tata MacGraw Hill, New Delhi.
10. Deb A.C., Fundamentals of Biochemistry, New Central Book Agency Pvt. Ltd.
11. Varley H. Practical Clinical Biochemistry, CBS Publishers & Distributors.

PHARMACEUTICS-III
(Pharmaceutical Microbiology)

THEORY

Subject code -303T Hours – (03/week)

1. **Introduction to microbiology:** History and scope, Classification of microbes of following category – bacteria, fungi, protozoa, viruses, actinomycetes, rickettse, spirochetes. Types of microscope and a brief about their working. Types of staining.

2. **Morphology, nutrition, identification, cultivation and isolation of:** Bacteria, fungi and viruses. Growth of microorganisms in culture: batch, continuous and synchronous cultures.
3. **Immunity and infection:** Host-microbe interactions (infection), types of infection, mode of transmission, the process of infection, natural resistance and nonspecific defense mechanisms, basic and theoretical aspects of immunity and immune response.
4. **Common diseases:** their mode of transmission, methods of control, causative-organism & their treatment and precise knowledge of following diseases: Rheumatic fever, Pneumonia, Gonorrhoea, Cerebrospinal-Meningitis, Diphtheria, Typhoid fever, Bacillary and Amoebic dysentry, Cholera, Plague, Influenza, pertussis, whooping-cough, Gas-Gangrene, Tetanus, Tuberculosis, Leprosy, Relapsing fever, syphillis, Rickettsia, Rabies, Poliomyelitis, Dangue, small pox, chicken pox, Measles, Mumps and Malaria.
5. **Control of microbes**: physical and chemical methods, evolution of anti-microbial chemical agents.
6. **Sterilization and Disinfection:** different methods, sterility testing of pharmaceutical products as per IP.

PRACTICALS

1. Working of microscope.
2. Working of various equipments used in laboratory such as: Hot-air Oven, Autoclave, Colony counter etc.
3. Various staining methods.
4. Various methods of isolation and identification of microbes.
5. Experiments devised to prepare various types of culture media, Sub culturing of common aerobic and anaerobic bacteria, fungi and yeast,
6. Counting active microbial colonies.

BOOKS RECOMMENDED

1. Peleczar M.J. Jr., Chan E.C.S., & Krieg N.R., Microbiology, Tata McGraw Hill, Publishing Co. Ltd., Delhi.
2. Hugo and Russel, Pharmaceutical Microbiology, Blackwell Scientific Publication, Oxford.
3. Rawlins E. A., Bentley's textbook of Pharmaceutics, ELBS Bacilliere Tindal.
4. Carter S. J., Cooper and Gunn's Tutorial Pharmacy, CBS Publishers, Delhi.
5. Remington's The Science and Practice of Pharmacy, Mack Publishing Co. Easton, Pernsybrania.
6. Vyas, Dixit, Pharmaceutical Biotechnology.
7. Jain N. K., Textbook of Microbiology.
8. Casida, Industrial Microbiology.
9. Prescott and Dunn, Industrial Microbiology, McGraw Hill Book Co. Inc.

10. Standury P. F. & Whitaker A., Principles of Fermentation Technology, Pergamon Press, Oxford.

PHARMACEUTICS-IV
(Physical Pharmacy–I)

THEORY

Subject code -304T Hours – (03/week)

1. **Intermolecular forces & states of matter:-**Binding forces between molecules,states of matter,the gasous state,the liquid state,solid amorphous crystralline state,latent heats and vapour pressure,sublimation,relative humidity,phase equilibria and phase rule.
2. **Micromeritics**- Particle size distribution, average particle size, number and weight distribution, particle number, methods for determining particle size, optical microscopy, sieving, sedimentation, particle volume measurement, particle shape, specific surface methods for determining surface area, permeability method, adsorption methods, derived, properties of powder, porosity, packing arrangement, densities, bulkness, flow properties.
3. **Solubility & Distribution Phenomenon**: Solubility, factors affecting solubility, expression of solubility, dissolution rate, solvent-solute interaction, polar and non polar solvents, solubility of gases in liquid, liquid in liquid, effect of pressure, temperature, salting-out, chemical reasons, solubility calculations, ideal and real solution, colligative properties and mol. wt. determinations, Miscibility, influence of foreign substances, dielectric constant and solubility, solubility of solid in liquids, ideal & non ideal solutions, solution and association in solution, solubility of slightly soluble and week electrolytes, Henderson haselbatch equation, influence of solvents on the solubility of drugs, combined effect of pH and solvents, preservation, action of weak acids, distribution of solutes between immiscible solvents, effect of ionic dissociation and molecular association on partition co-efficient & drug action.
4. **Colloidal Dispersion & Gels:** Dispersion system size and shape of colloidal particles, pharmaceutical applications, type-lyophillic, lyophobic association colloidal, optical, kinetic and electrical properties of colloids, gel-structure properties, applications.
5. **Coarse Dispersion & Emulsions**: Interfacial properties of suspended particles, settling in suspensions, Theory of sedimentation effect of Brownian movement, sedimentation of flocculated particles, wetting of particles, controlled flocculation, flocculation in structural vehicles-Rheological consideration.

PRACTICALS

1. Average particle size determination.

2. Bulk density/True density.
3. Angle of repose.
4. Partition co-efficient.
5. Solubility of solid in liquid.
6. Solubility of liquid in liquid.

BOOKS RECOMMENDED:

1. Cooper & Gunns Tutorial Pharmacy.
2. Martin Physical Pharmacy.
3. Remington's Pharmaceutical Sciences

PHARMACOGNOSY – I

THEORY

Subject code -305T Hours – (03/week)

1. Scope and significance of pharmaceutical biology in pharmaceutical field.
2. Definition history, scope & development of Pharmacognosy.
3. Source of Drug: Biological, marine, mineral, microbes and plant tissue cultures as source of drugs.
4. Classification of Drugs: Alphabetical, Morphological, taxonomical, chemical, chemotaxonomical & pharmacological.
5. Plant taxonomy: Study of following families with special reference to medicinally important plants – Apocynacae, Solanacae, Rutaceae, Umbellifarae, Leguminasae, Rubiaceae, Liliaceae, Labiatae, Papavereceae, Crucifereae, Graminae.
6. Study of plant cell, plant tissues and non living cell inclusion.
7. Techniques in microscopy: Various tools used in microscopy (microscopes, micrometers, camira lucida, microphotography etc.,) preparation of drugs for microscopical examination, general use of different reagents used in microscopy. Quantitative microscopy: Lycopodium spore method and leaf constants viz. stomatal number, stomatal index, vein-islet number, vein-termination number and palisade ratio.
8. Cultivation, Collection, Processing & Storage of crude drugs. Factors influencing cultivation of medicinal plants, Type of Soils & fertilizers of common use. Deterioration of crude drugs.
9. Pest Management & natural pest control agents.
10. Plant hormones and their applications.
11. Polyploidy, Mutation, chemodems & hybridization with reference to medicinal plants.

12. Quality Control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation including qualitative and quantitative microscopy.
13. An introduction to active constituents of drugs: Their isolation, classification and properties.
14. Systematic pharmacognostic study of following drugs including chemical tests and pharmaceutical importance also.
15. Carbohydrates & derived products: Agar, Guargum, acacia, Honey, Isabgol, pectin, starch, sterculia & tragacanth.
16. Lipids – Beeswax, castor oil, Cocabutter, Kokum butter, hydnocarpus oil, Codliver oil, sharkliver oil, Linseed oil, wool fat, Rice-bran oil, Lard.

PRACTICALS:

1. Morphological characteristics of plant families mentioned in Theory.
2. Care use and type of microscopes.
3. Microscopical Measurements of cell & cell contents Starch grains, Calcium oxalate Crystals & Phloem Fibres.
4. Determination of leaf Constants such as Stomatal index, Stomatal numbers, Veinislet numbers, Vein termination number and palisade ratio.
5. Identification of crude drugs belonging to carbohydrates & lipids.
6. Extraction and microscopical measurements of starch grains of different sources.
7. Various types of calcium-oxalate crystals, their study and microscopical measurements
8. Swelling factor of Isapaghula husk.
9. Physical characteristics of Caster oil, Cod-liver oil, Shark-liver oil and Linserd oil.
10. Preparation of herbarium sheets.

BOOKS RECOMMENDED

1. Trease, G.E. & Evans, W.C., "Pharmacognosy" Bailleire tindall East bourne, U.K.
2. Wallis, T.E., Text book of Pharmacognosy, J.A. Churchill, Ltd.
3. Kokate, C.K. "Practical Pharmacognosy" Vallabh Prakashan, Delhi.
4. Wallis T.E., Analytical Microscopy, J&A Churchill Limited, London.
5. Brain K.R. and Turner T D. "The Practical Evaluation of Phyto Pharmaceutical", Wright,Scientechnica- Bristol.
6. Kokate, C.K. Pharmacognosy, Nirali Prakashan, Pune.
7. Schewer PJ, "Marine Natural products", Academic press, London.
8. Dutta A.C. " Botany for Degree students" Oxford.
9. Marshall & Williams "Text Book of Zoology" CBS Publishers & Distrubutors, Delhi.
10. Fahn "Plant Anatomy" Aditya Books Private Limited, New Delhi.

11. Weiz, Paul B "Laboratory Manual in Science of Biology" Mc Graw-hill book company.

PHARMACEUTICS-V
(Pharm. Engineering-I)

THEORY

Subject code -306T Hours – (03/week)

1. **Materials of pharmaceutical Plant construction:** Factors affecting selection of material for pharmaceutical metal-ferrous metals-cast-iron-steels, stainless steels, non ferrous metals, copper, copper alloys, aluminium, lead, tin, silver, nickel, chromium, non-metals, inorganic-glass, stonewarestone, slate brick and concrete, asbestos, organic-plastic, rubber and timber.
2. **Corrosion and its prevention:** Introduction, types of corrosion, causes of corrosion, theories of corrosion, methods of prevention of corrosion.
3. **Industrial Hazards and Safety precautions:** Mechanical, Chemical, electrical, fire, dust hazards, safety requirements, fire extinguishers, accident records.
4. **Humidification and dehumidification:** definition of various terms, adiabetic conditions, humidity charts, determination of humidity, methods of increasing and decreasing humidity.
5. **Refrigeration and Air Conditioning:** Principles and applications of refrigeration and air conditioning.
6. **Storage of materials:** solids outdoor storage bins-siol indoor storage in warehouse; liquid storage in tanks, storage of volatile liquids, gases-gas holder cylinder.
7. **Environmental pollution:** an introduction.

BOOKS RECOMMENDED

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

B.PHARM. SEMESTER-IV

PHARMACEUTICAL CHEMISTRY-VI
(Biochemistry-II)

THEORY

Subject code -401T Hours – (03/week)

1. **Amino acids, peptides and proteins:** Properties, structure, classification, three-dimensional structure of proteins – primary, secondary, tertiary and quaternary, functions of protein-reversible binding of protein to a ligand, complementary interactions between proteins and ligands, protein interactions modulated by chemical energy, catabolism of amino acids, biosynthesis of amino acids, urea cycle, biosynthesis of porphyrin and bile pigments, regulation and abnormalities of metabolism of amino acids, peptides and proteins, qualitative identification test of amino acids and proteins.
2. **Genetic code and protein biosynthesis:** Genetic code, protein biosynthesis and its inhibition, regulation of gene expression – principles, regulation in prokaryotes and eukaryotes.
3. **Nucleic acids:** Brief introduction of genetic organization (genes and chromosomes), structure and chemistry of nucleic acids, biosynthesis of purine and pyrimidine, biosynthesis and degradation of nucleotides.
4. **Regulation of gene expression:** Introduction to DNA & RNA, biosynthesis, replication and repair mechanism of DNA, biosynthesis of RNA, mutagenesis and qualitative identification test of RNA & DNA.
5. **Clinical pathology:** Various Pathological tests and their clinical significance. Lymphocytes and platelets: role in health and disease**.** Erythrocytes: Role, abnormal cells and their significance.
6. **Liver and kidney:** Functions, normal and abnormal constituents of urine and their significance, kidney and liver function tests.
7. **Metabolic effects of various hormones:** insulin, glucagon, etc. Disorders due to deficiencies in metabolism of carbohydrates, lipids and proteins.
8. **Study of porphyrins, haemoglobin and bile pigments.**

PRACTICALS

1. Qualitative identification tests proteins and amino acid.
2. Qualitative identification tests nucleic acids.
3. Urine analysis for normal components.
4. Urine analysis for abnormal components.
5. Quantitative estimation of amino acids.
6. Quantitative estimation of proteins.
7. Identification of C-terminal amino acids of protein.
8. Estimation of SGOT, SGPT, Albumin in the serum.

9. Examination of liver pigments.
10. Thin Layer Chromatography of different amino acids and proteins.
11. Examination of sputum. (microscopic & staining).
12. Examination of faeces (microscopic & staining).
13. Practice in injecting drugs by intramuscular, subcutaneous and intravenous routes.

BOOKS RECOMMENDED

1. Lehninger A. L., Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
2. Stryer L., Biochemistry, W H Freeman and Company, San Francisco.
3. Rama Rao. A.S.S.V; A Text book of Biochemistry; L. K. & S. Publishers, Visakhapatnam.
4. Conn E. E. and Stumpf P. K., Outlines of Biochemistry, John Wiley and Sons, New york.
5. Harrow B. and Mazur A., Textbook of Biochemistry, W. B. Saunders Co., Philadelphia.
6. Jayraman J., Laboratory Manual in Biochemistry, Wiley Eastern Limited, New Delhi.
7. Martin D. W., Mays P. A. and Redwell V. M., Harpers Biochemistry, Lange Medicak Publications.
8. Mussay R. K., Granner D. K., Mayous P. A. and Rodwell; Harpers Biochemistry, Prentice-Hall International, Inc.
9. Plumer D. T., An Introduction to Practical Biochemistry, Tata MacGraw Hill, New Delhi.
10. Deb A.C., Fundamentals of Biochemistry, New Central Book Agency Pvt. Ltd.
11. Varley H. Practical Clinical Biochemistry, CBS Publishers & Distributors.

PHARMACEUTICS-VI
(Biological pharmacy)

THEORY

Subject code -402T Hours – (03/week)

1. **Nucleic acids, the genetic code and protein synthesis:** DNA: Synthesis (polymerization of nucleotides into DNA) – Basic chemical structure, replication and its role in protein synthesis. Synthesis of proteins – roles of RNA in Translation, (mRNA, tRNA and rRNA). Genetic engineering and its application in pharmaceutical biotechnology. Recombinant-DNA techniques.
2. **Manufacturing and quality control of immunological products:** Introduction, vaccines, in-vivo diagnostics, and immuno-sera, human immunoglobulin including important bacterial and viral vaccines (highlights on its source material, processing, potency assay and safety tests).
3. **Standardization of antibiotics.**
4. **Microbial assays of antibiotics.**

5. **Fermentation technology:** Introduction, Fermenter: Types of fermenter, its design, control of different parameters, downstream process, production of lactic acid, alcohol, penicillin and vitamin B_{12}.

PRACTICALS

1. Sterilization techniques.
2. Evaluation of antiseptics and disinfectants.
3. Sterility testing of pharmaceutical products as per I.P. requirements.
4. Microbial assay of antibiotics.
5. Immobilization of enzymes.
6. Standardisation of inoculum and estimation of MIC by serial dilution.

BOOKS RECOMMENDED

1. Peleczar M.J. Jr., Chan E.C.S., & Krieg N.R., Microbiology, Tata McGraw Hill, Publishing Co. Ltd., Delhi.
2. Hugo and Russel, Pharmaceutical Microbiology, Blackwell Scientific Publication, Oxford.
3. Rawlins E. A., Bentley's textbook of Pharmaceutics, ELBS Bacilliere Tindal.
4. Carter S. J., Cooper and Gunn's Tutorial Pharmacy, CBS Publishers, Delhi.
5. Remington's The Science and Practice of Pharmacy, Mack Publishing Co. Easton, Pernsybrania.
6. Vyas, Dixit, Pharmaceutical Biotechnology.
7. Jain N. K., Textbook of Microbiology.
8. Casida, Industrial Microbiology.
9. Prescott and Dunn, Industrial Microbiology, McGraw Hill Book Co. Inc.
10. Standury P. F. & Whitaker A., Principles of Fermentation Technology, Pergamon Press, Oxford.

PHARMACEUTICS-VII
(Pharm. Engineering-II)

THEORY

Subject code -403T Hours – (03/week)

1. **Unit Operations**: Introduction, basic laws.
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.
3. **Material Handling Systems**:

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. **Size reduction**: Importance in pharmacy, factors influencing size reduction grinding mills of various types like hammer mill, cutter mill, ball mill, edge and end runner mill, fluid energy mill.

5. **Size separation:** Sieves, sifting, size gradation, size distribution- methods of determining size distribution.
6. **Powder & semisolid mixing**: Mechanism of mixing, various types of trough mixers, sigma and ribbon blenders, paddle mixers, tumblers like cube and double cone. Planetary mixer.
7. **Unit processes and equipment used for manufacturing of non** sterile monophasic liquids, mechanism of liquid mixing, impellers, propeller type mixers, tanks, baffles, prevention of aeration and foam.

PRACTICALS

1. Measurement of rate of flow of fluids and pressure by:
   a) Simple and differential manometers
   b) Venturimeter
   c) Orifice meter
2. Determination of Reynold's Number.
3. Performs size reduction and size separation.
4. Perform mixing (Powders, Liquids, Semisolids)

Books Recommended

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

PHAMACOGNOSY – II

THEORY -

Subject code -404T Hours – (03/week)

1. Systematic study of biological source, cultivation, collection, processing, chemical constituents, chemical tests, uses possible adultration of the following drugs –
   - **A.** Drug containing resins and Resin Combination like Podophyllum, Cannabis, Capsicum, Shellac, Asafoetida, Balsam of tolu, Balsam of peru, Benzoin, Turmeric, Ginger, colophony, Jalap, kaladana, Colocynth, cannabis.

B. Drug containing alkaloids : Lobelia, Nicotiana, belladonna, Hyoscyamus, Datura, Withania, Cocoa, Cinchona, Ipecac, Curare, Opium, Nux vomica, Ergot, Rauwolfia, Catharanthus, Aconite, Veratrum, Ephedra, Colchicum.

C. Drug containing Volatile oils : General methods of obtaining volatile oils from plants, Study of volatile oils from Mentha, Corianders, Cinnamon, Jatamansi, Cumin, Black pepper, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearming, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamon, Valerian, Musk, Palmarosa, Gaultheria, Sandalwood.

D. Terpenes: Menthol, Thymol.

E. Flavonoida and Coumarin containing drugs: Rutin, Psoralin Xanthotoxin.

F. Miscellaneous drugs: Gelatin, Jatamansi, Malefern, sausera.

2. Phytochemical Screening: An introduction to active constituents of drugs: Their isolation, classification and properties with Qualitative chemical tests of the followings – Alkaloids, flavanoids, glycosides, volatile oils, fat and waxes, tannins, carbohydrates, resin.
3. Fibres: Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glasswool, polyester and asbestos.
4. Pharmaceutical aids:- Study of Pharmaceutical aids like Talc, Diatomite, Kaolin, Bentonite, Fullers earth, Gelatin and Natural colors.
5. Tannins: Study of tannins & tannin containing drugs like Gumbir (Pale Catechu), Black Catechu, Gall and Myrobalans (Harde, Baheda, Arjuna & Ashoka).
6. Utilization of aromatic plants & desired products will special reference to Sandalwood oil, Mentha oil, Lemon grass oil, Vetiver oil, Geranium oil & Eucalyptus oil.
7. Role of aromatic plants in national economy.

PRACTICALS

1. Identification of crude drugs mentioned in Theory.
2. Study of fibres and pharmaceutical aids.
3. Microscopic study of seven selected drugs and their powders mentioned under the category of volatile oils in Theory with their chemical tests.
4. Morphology of Mentha, Lemangrass, Nutmeg and chenopodium, Turmeric, Ginger, Cannabis, Euncalyptus.
5. Study of Cotton, Silk and Wool along with their chemical Tests.
6. To study the morphology and chemical tests of Talc, Diatomite, Kaolin, Bentonite, Gelatin and natural colours (Turmeric, Saffron etc).
7. To perform the chemical tests of resin drugs like Balsam (Tolu and Peru) and Asafoetida.
8. Preparation of reagents for the chemical tests of Alkaloids and to perform the chemical tests on any Alkaloid, Glycosides (Saponin and Anthraquinone). Tannins, steroids, flavonoids.
9. Preparation of monograph of aromatic plants.

BOOKS RECOMMENDED

1. Trease G.E., & Evans W.C., "Pharmacognosy" Balliere Tindall East Bourne U.K.
2. Tyler V.E. et al "Pharmacognosy" Lea & febiger, Philadelphia.
3. Wallis, T.E. "Text Book of Pharmacognosy" J&A Churchill Ltd, London.
4. Kokate C.K. et al "Pharmacognosy" Nirali Prakashan, Pune.
5. Atal C.K. & Kapur BM, "Cultivation & utilization of Medicinal plant, RRL, Jammu.
6. Harborne J B, Phytochemical method, Chapman & Hall International Edition, London.

PHARMACEUTICS-VIII
(Physical Pharmacy–II)

THEORY

Subject code -405T Hours – (03/week)

1. Surface Phenomenon: Liquid interfaces: surface and interfacial tension, surface free energy, measurement of surface and interfacial tension, spreading co-effcient, absorption at liquid interfaces, surface active agents, HLB, solubilisation, detergency, adsorption at solid interfaces, complex films, electrical properties.
2. Viscosity & Rheology: Newtonian system-law of flow, kinematic viscosity, effect of temp. non-newtonian system-pseudo plastic dilatic, thixotropy, measurement of thixotropy, thixotropy in formulation, determination of viscosity capillary, falling ball, rotational viscometers.
3. Complexation & chelation, types of complexes, its application.
4. Thermodynamics: - the first law of thermodynamics, thermochemistry, the second law of thermodynamic, Entorpy, the third law of thermodynamics, free energy functions and applications, the van't-hoff equation.
5. Buffered and isotonic solutions:- Buffer equation, Buffer Capacity, Buffers in Pharmaceutical and Biologic systems, Buffered isotonic solutions, Methods of adjusting tonicity and pH
6. Biomaterials: - Historical Background, Molecular weight and conformations, polymers in solutions, polymers in the solid state, fabrication, polymers in drug delivery.

PRACTICALS

1. Methods/Surface tension determination method.

2. Methods to determine viscosity of Newtonian and non-Newtonian fluids.
3. HLB value determination.
4. Rate of sedimentation of flocculated and non-flocculated suspension.
5. Order of reaction,
6. Rate of reaction.

BOOKS RECOMMENDED:

1. Cooper & Gunns Tutorial Pharmacy.
2. Martin Physical Pharmacy.
3. Remington's Pharmaceutical Sciences.

DRUG STORE AND BUSINESS MANAGEMENT-I

THEORY

Subject code -406T Hours – (03/week)

1. **Introduction:** Commerce and industry, subdivision of commerce and functions of different division, Levels of management and importance & functions of management, Classification of industry on different basis, Forms of business organization.
2. **Drug house management:** Selection of location of drug store, Layout and legal aspects of a drug store, objectives and procedure of purchasing, selection of suppliers, credit information, Tenders, Contracts, Storage, Codification of various items of drug store, Pricing methods, Legal requirements and price control,
3. **Inventory control:** Objectives and functions, Various techniques of inventory control.
4. **Sales promotion:** Objective and techniques, salesmanship, Qualities of salesman, Advertising, Window display, market research.
5. **HRD:** Recruitment, Selection, Training, Evaluation and Compensation to the pharmacist.
6. **Channel of distribution:** Schematic diagram, Wholesalers, Retailers, Retail departmental store, Multiple shops, Mail order business, Consumer cooperative store.
7. **Banking and finance:** Types of banks, Financial planning, Sources of finance.
8. **Drug price control act (DPCO)**
9. **Factory's act**

Books Recommended:

1. Jain & Khandelwal: Mathematics for B.Pharm.
2. R.M. Mehta: DSBM
3. N.K.Jain

B.PHARM. SEMESTER-V

PHARMACEUTICAL CHEMISTRY-VII
(Medicinal Chemistry-I)

THEORY

Subject code -501T Hours – (03/week)

1. **Basic Principles of Medicinal Chemistry:** Physicochemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action. Drug-receptor interaction including transduction mechanism, Introduction of QSAR

Classification with structures, mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only)

2. **Autonomous nervous system.**

A. Cholinergic, Anticholinergic & Anticholinesterases-Neostigmine, Physostigmine, Methacholine, Pilocarpine, Atropine.

B. Adrenergic Drugs-Ephedrine, Isoproterenol, Amphetamine, Salbutamol, Terbutaline,
Adrenaline.

C. Antiadrenergic Drugs

D. Neuromuscular Blocking Agents – Gallamine Triethiodide, Mephenesin, Pancuronium.

E. Drugs used in the treatment of Alzheimer's disease

3. Analgesics: Opiate analgesic: Morphine, Codeine, Non opiate analgesic: Mepiridine
4. Nonsteroidal anti-inflammatory agents and antipyretics: Aspirin, Salicylamide, Aminopyrin, Phenylbutazone, oxyphenbytazone, mefenamic acid, indomethacin, Tolmetin, Ibuprofen, Naproxen, Piroxicam, Analgin, Paracetamol
5. **Autocoids :**

Antihistaminics :

i) H1 antagonists – Diphenhydramine, Promethazine, Cyproheptadine, Cetrizine.
ii) H2 antagonists **–** Ranitidine, Famotidine.
iii) Prostaglandins- Mesoprostol

PRACTICAL:

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Separation and identification of organic mixtures containing not more than two compounds.

BOOKS RECOMMENDED:

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.

2. Furniss B A, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Pharmacopoeia of India, Minsitry of Health, Govt. of India.
4. Wolff ME. Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
5. Degado J.N. and Remers W A R, 10th eds., Wilson and Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
6. Foye W C. Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
8. Nogrady T, Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York, Oxford.
9. Finar I L. Organic Chemistry, Vol I & II, ELBS/ Longman, London.

PHARMACEUTICS-IX
(Pharm. Engineering-III)

THEORY

Subject code -502T Hours – (03/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.
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.
3. **Evaporation:** Basic concept of phase equilibria, factor affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators.
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.
5. **Drying:** Moisture content and mechanism of drying, rate of drying and time of drying calculations; classification and types of dryers, behavior of solids during drying, MC, EMC, CMC and LOD, dryers used in pharmaceutical industries and special drying methods like freeze drying.
6. **Filtration and Centrifugation**: Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, and centrifugal sedimenters.
7. **Crystallization:** Characteristics of crystals like-purity, size, shape, geometry, habit, forms size and factors affecting them. Solubility curves and calculation of

yields. Super-saturation Theory and its limitations, Nucleation mechanisms, Crystal growth. Study of various types of Crystallizers, tanks, Caking of crystals and its prevention.

8. Fundamentals of Automated Process control system and Computer aided manufacturing (CAM).

9. Reactors and fundamentals of reactors design for chemical reaction.

PRACTICALS

1. Determination of overall heat transfer coefficient.
2. Study of factors affecting rate of evaporation:-

a) Effect of surface area

b) Effect of temperature

3. Study of factors affecting rate of drying

a) Surface area

b) Temperature

4. Determination of rate of drying, free moisture content and bound moisture content,CMC and EMC.
5. Experiments based on

a) Steam distillation

b) Azeotropic distillation

6. Study of factors affecting rate of filtration

   a) Effect of different filter media

   b) Effect of viscosity of filtrate

   c) Effect of pressure

   d) Effect of thickness of cake

   e) Effect of filter aids.

7. Study principle of centrifugation for

   a) Liquid –Liquid separation and stability of emulsions.

   b) Solid – liquid separation and stability of suspension.

8. Determination of dry bulb and wet bulb temperatures and use of Psychometric charts.
9. Study of characteristics of crystals
10. Study of solubility curve of crystals.

BOOKS RECOMMENDED:

1. Badger W.L. and Banchero J.T. Introduction to Chemical Engineering Mc Graw Hill
   International Book Co., London.
2. Perry R.H. & Chilton C.H. Chemical Engineers Handbook, Mc Graw Kogakusha Ltd.
3. McCabe W.L. and Smith J.C. Unit Operation of Chemical Engineering Mc Graw Hill
   International Book Co., London.

4. Gavhane, K.A. "Unit Operation-II", Nirali Prakashan.
5. Sambhamurthi Pharmaceutical Engineering, New Age Publishers.

PHARMACEUTICS-X
(Dosage form design-I)

THEORY

Subject code -503T Hours – (03/week)

1. Pre-formulation studies:

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.

1. Study of pro-drugs in solving problems related to stability, bioavailability and elegancy of formulation.

2. Tablets:

a. Formulation of different types of tablets, granulation technology or large scale manufacturing 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.

3. Capsules: Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, method of capsule filling, soft gelatin, capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

4. Parenteral Products:

a. Preformulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.

b. Formulation details, containers, 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. **Ophthalmic Preparations**: Requirements, formulation, methods of preparation, containers, evaluation.
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.
7. **Radiopharmaceuticals-** Production, therapeutic, and diagnostic uses, Instruments for detection.

PRACTICALS

1. Experiments to illustrate preparation, stabilization & physical evaluation of pharmaceutical products like powders, capsules, tablets, parenterals & microcapsules.
2. Evaluation of Materials used in pharmaceutical packaging.
3. Preparation, Evaluation, Packing of the following dosage forms.

a) Capsules : Chloramphenicol capsules IP
b) Microcapsules : Coacervation Phase separation (Temperature change)
c) Tablets : Uncoated – Paracetamol tablets IP
d) Tablets : Film coated – Ibuprofen tablets IP
e) Tablets : Enteric coated – Aspirin tablets
f) Parenteral : Disodium EDTA injection IP (vials)
g) Parenteral : Dextrose – NaCl IV infusion IP (Infusion boilers)
h) Parentrals : Water for infection IP (Ampoule)
i) Eye drops : Zinc sulphate IP
j) Eye ointment : Sulphacetamide Sodium IP

4. Formulation and evaluation of sustained release dosage forms – Aspirin Extended release (Matrix embedding method, Granules USP/NF coating of granules)
5. Evaluation of packages – containers & closures.

BOOKS RECOMMENDED

1. Remington: The Science and Practice of Pharmacy Pharmaceutical Sciences Vol. I & III, Mack Publishing Company, U.S.A.
2. R.E. Avis, Pharmaceutical Dosage Forms: Parenteral Medication, Vol-I, Marcel Dekker-Inc, New York & Basel.
3. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.
4. R.C. Juliano, Drug Delivery Systems, Oxford University Press, Oxford.
5. Herbert A. Liebermann & Leon Lachman, Theory & Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A

PHARMACOLOGY -I

THEORY

Subject code -504T Hours – (03/week)

1. **General Pharmacology**: Introduction to pharmacology, sources of drugs, dosage forms and routes of administration.
2. **Pharmacokinetics:** Absorption, distribution, metabolism and excretion of drugs, principles of basic and clinical pharmaco-kinetics, adverse drug reactions and ADME drug interactions.
3. **Pharmacodynamics:** Mechanism of drug action, drug receptor interactions, combined effect of drugs, factors modifying drug action, tolerance, dependence, therapeutic index, efficacy, potency.
4. **Pharmacology of Peripheral nervous system:**

(a) Neurohumoral transmission (autonomic and somatic).

(b) Parasympathomimetics, parasympatholytics, sympathomimetics, sympatholytics ganglionic stimulants and blocking agents.

(c) Neuromuscular blocking agents. (d) Local anesthetics.

5. **Drugs used in ocular pharmacology**: Mydriatics, miotic agents and drugs used in glaucoma.

6. Autocoids & anti histaminic:

(a) Histamine, 5-HT and their antagonists.

(b) Prostaglandins, thromboxanes, leukotreines and PAF.

(c) Pentagastrin, cholecystokinin, angiotensin, bradykinin and substance P.

PRACTICALS:

1. Introduction to experimental pharmacology: Preparation of different solution for experiments. Drug dilutions, use of molar and w/v solution in experimental pharmacology. Common laboratory animals and anesthetics used in animal studies. Commonly used instruments in experimental pharmacology. Some common and standard techniques. Bleeding and intravenous injection, intragastric administration. Procedures for rendering animals unconscious-stunning of rodents, pithing of frogs, chemical euthanasia.
2. Experiments on intact preparations: Study of different routs of administration of drugs in mice/rats.
3. To study the effect of various agonists and antagonists and their characterization using isolated preparation like frog's rectus abdominis muscle and isolated ileum preparations of rat, guinea pig and rabbit, viz.:

(a) To record the concentration response curve (CRC) and PD_2 value of acetylcholine using rectus abdominis muscle preparation of frog.

(b) To study the effects of physostigmine and d-tubocurarine on the CRC and PD_2 value of acetylcholine using frog rectus abdominis muscles preparation of frog.

(c) To record the CRC and PD_2 value of histamine on guinea pig ileum preparation.

(d) To study the effect of adrenaline on rabbit duodenum.
4. To study the effect of autonomic drugs and local anaesthetic on rabbit eye.
5. To identify unknown drug sample by using guinea pig ileum preparation.

BOOKS RECOMENDED

1. Goyal R.K. – Practicals in pharmacology (1994-95) 1st Edn. M/s. B.S.Shah Prakashan, Ahmedabad.
2. Sheth U.K. etal – Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
3. Kulkarni S.K. – Handbook of experimental pharmacology(1993) 2nd Edn. Vallabh Prakashan, New Delhi.
4. Ghoosh M.N. – Essentials of experimental pharmacology scientific book agency, Culcutta, 1984.
5. Rang. H.P., Dale M.M., etal –Pharmacology (1995) 3rd Edn. Churchil livingstone,USA.
6. Satoskar R.S., etal – Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
7. Harvel, R.A., Champe P. C. etal, Pharmacology (1997) 2nd edition, Lippincott-Raven Company, Philadelphia, New Yor.
8. Craig C. R. Stitzel, R. E.-Modern Pharmacology (1994) 4th edition. Little Browth and Company, U.S.A.
9. Seth S. D., Text Book of Pharmacology, B. I. Churchill, 1997.
10. Goodman and Gillman's The Pharmacological Basis of Therapeutics Edition/ Hardroan, et al/McGraw Hill.

PHARMACOGNOSY – III

THEORY

Subject code -505T Hours – (03/week)

1. Study of the biological sources, cultivation, collection, Commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing. Drug containing Glycosides: senna, Aloe, Rhubarb, Cascara, Digitalis, WStrophantus, Scilla, Thevetia, Dioscorea, Glurrhiza, Psoralia, Gentian, Picorrhiza, Chirata, Quassia, Catechu, Myriobalan, Ammimajus, Quillaia Liquorice, Ginseng, Coleus species. Digitals, Squill, Stropanthus & Thevetia. Aloe, Senna, Rhubarb & Cascara. Psoralea, Ammi majus, Ammi visnaga, Gentian, Saffron, Chirata, Quassia and Andrographis paniculata.

2. Utilization and production of phytoconstituents such as calcium sennsoides, Diosgenin, Solasodine & Podophyllotoxins.

3. Studies of traditional drugs: Common Vernacular name, Biological sources, morphology, chemical nature of chief constituents, pharmacology, categories and

common uses and toxicological activity of marketed formulations of following indigenous drugs: Amla, Kantkari, Satavari, Tylophora, Bhilwa, Kalijiri, Vach, Rasna. Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Brahmi, Methi, Lehsun, Palash, Guggul, Gymnema, Shilajit, Tulsi, Nagarmotha, Majith, Malkanguni and Neem.

4. Brief Introduction and principals of Ayurvedic, Unani , Siddha and Homeopathic systems of medicines. Introduction to Herbal Pharmacopoeia with special reference to Arishtas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas.
5. Study of biological sources, chemical tests, microscopic features of –
   - **i.** Cellulose and its derivatives: Cotton wool, oxidized cotton, methyl cellulose, carboxy methyl cellulose, cellulose wedding.
   - **ii.** Vegetable animal and synthetic fibres: Jute, wool, silk, nylon, Terylene, polythene.
   - **iii.** Inorganic pharmaceutical aids: talc, Diatomite, Asbestos, Bentonite, Fullers earth.
6. Introduction, classification, and study of different chromatographic methods and their merits and demerits and application in pharmaceutical field.
7. Introduction of mushroom, natural anti oxidants, Herbal cosmetics.

PRACTICALS:

1. Identification of crude drugs listed in Theory.
2. Microscopic study of some important glycoside containing drugs as outlined above, Study of powdered drugs.
3. Standardization of some traditional drug formulations.
4. Morphology and microscopy (powder) of Liquorice (powder) of Rhubarb along with its chemical tests.
5. Morphology of Aloe and chemical tests on Aloe-extracts.
6. Morphology of Psoralia, Ammimaus, Saffron and Chirata. Amla, Kantkari, Shatavari and Vach Punarnava, Apamarg, Gokhru, and Shankhpushpi Brahmi, Methi, Lehsun and Palash Nagarmotha and Neem.
7. Identification Tests for Guggul lipids.
8. To study the following standards of any Ayurvedic formulation (solid/ liquid) available in the market.
   - ✓ Loss on drying.
   - ✓ Extractive values.
   - ✓ Ash values.
   - ✓ pH of 1% solution, in water and alcohol
9. Preparation of medicated oil.
10. PROJECT WORK - A report on marketed preparations based on traditional drugs mentioned in Theory.

BOOKS RECOMMENDED:

1. Kokate C.K. “Practical Pharmacognosy” Vallabh Prakashan, New Delhi.

2. Wallis T.E. "Analytical Microscopy" J&A Churchill Ltd., London.
3. Trease, G.E., & Evans, W.C., Evans, W.C., "Pharmacognosy" Bailliere Tindall east Baorne, U.K.
4. Tyler V.E. et al: "Pharmacognosy" Lea & Febiger, Philadelphia.
5. Wallis. T.E. "Text Book of Pharmacognosy" J&A Churchill Ltd. London.
6. Kokate C.K. et al "Pharmacognosy" Nirali Prakashan, Pune.
7. Medicinal plants of India I&II, Indian council of Medical Reasearch, New Delhi.
8. Nadkarni A.K. Indian Materia Medica 1-2, Popular Prakashan (P) Ltd. Bombay.
9. Atal C.K. & Kapur BM. "Cultivation & utilization of Medicinal plants, RRL, Jammu.
10. Indian Herbal Pharmacopoeia, vol. I&II, ICMR & RRL, Jammu.
11. The wealth of India, Raw Materials (All volumes) Council of Scientific & Industrial Research, NewDelhi.
12. Compendium of Indian Medicinal Plants I-IV, Rastogi & Malhotra.
13. Indian Ayurvedic Pharmacopoeia, Govt. of India.
14. Kokate CK, Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan.

DRUG STORE AND BUSINESS MANAGEMENT-II

THEORY

Subject code -506T Hours – (03/week)

1. Accountancy: Introduction to the accounting concepts and conventions, Different kinds of accounts, Double entry bookkeeping, Recording of transactions- Journal, Ledger, Trial balance, Profit & loss account, Balance sheet, Cash book. Rectification of error, Bills of exchange, Depreciation, Consignment accounts, Joint stock company accounts-issue of shares and debentures, Elementary knowledge of final accounts of a company.

2. Cost accounting: Cost ascertainment, various elements of cost sheet preparation, Statement of cost. Marginal costing, elementary knowledge of cash flow statement and fund flow statement. Computation of various ratios and analysis of final statement.

3. Budgeting: Meaning, importance and types of budgets, Elementary knowledge of preparing sales, cash, production and flexible budgets.

4. Auditing: Meaning, Objects, Vouching, Internal control rights, Duties and liabilities of an auditor, Auditor and location of errors and frauds.

5. Minimum wages act

6. Drug and pharmaceutical industry- A Review

BOOKS RECOMMENDED:

1. Introduction to Accountancy: Gerwal, T.S.
2. Cost accounting-S.P.Jain & N.L.Narang.
3. Auditing: T.R.Verma.
4. Management Accounting: S.N.Maheshwari
5. R.G.Saxena, Principles and practice of auditing.
6. I.M.Pandey: financial management, Vikas publishers
7. Jain & Khandelwal: Mathematics for B.Pharm.
8. R.M. Mehta: DSBM
9. N.K.Jain: Forensic Pharmacy

B.PHARM. SEMESTER-VI

PHARMACEUTICAL CHEMISTRY-VIII
(Medicinal Chemistry-II)

THEORY

Subject code -601T Hours – (03/week)

Classification with structures, mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only)

1. **Central nervous systerm-i** :
   General Anaesthetics-Thiopental, Ketamine, Methohexital.
   Local Anaesthetics-Lignocaine, Benzocaine.
   Hypnotics and Sedatives-Phenobarbitone, Pentobarbitone.
   Opioid Analgesics-Pethidine, Methadone, Pentazocine.
   Nonsteroidal anti-inflammatory agents – Aspirin, Mefeanamic Acid, Ibuprofen, Diclofenac
2. **Central nervous system-ii**
   Neuroleptics – Imipramine, Amitryptyline.
   Antidepressants – Meprobamate, Chlordiazepoxide, Diazepam.
   Antianxiety agent- Chlordiazepoxide, Diazepam, Hydroxyzine, Tybamate
   Anticonvulsants-Phenytoin, Carbamazepine, Ethosuximide, Valproic Acid.
3. **Hormones Related Drugs**: Thyroid and Antithyroids – Carbimazole, Levothyroxine, Propylthiouracil, Methimazole. Insulin & Oral Hypoglycaemics – Chlorpropamide, Metformin, Tolbutamide, Glybenclamide.
4. **Oxytocics:** Oxytocin
5. **Antitussives-**caramiphen, dextromethorphan, diphenhydramine

6. **Muscle relaxants-** Mephensin, Methocarbamol, Carisoprodol, Metaxalone, Chlorzoxazone, Orphenadrine
   Antiparkinsonism drugs-Carbidopa, Levodopa.
   CNS Stimulants-Caffeine, Nikethamide.
6. **Respiratory system drugs:** Antiasthmatic drugs

7. **Gastrointestinal agent:** Antispasmodics (Dicyclomine), Antiulcer agent (Ranitidine, Famotidine, Omeprazole), Drugs used in treatment of Diarrhea and constipation (Bisacodyl), Emetics and Antiemetics.

PRACTICAL:

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Characterization of the synthesized medicinal compounds by TLC & melting point.

BOOKS RECOMMENDED:

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.
2. Furniss B S, Hannaford A J, Smith P W G and Tathell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Pharmacopoeia of India, Ministry of Health, Govt. of India.
4. Wolff ME, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
5. Delagado J N and Remers W A R, Eds., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
6. Foye W C, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh Harkishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.

Pharmaceutical Analysis-II

THEORY

Subject code -602T Hours – (03/week)

1. **The theoretical aspects, basic instrumentation, Fundaments and overview of spectra, and applications of the following analytical techniques……**
   1. Ultraviolet and visible spectrophotometry.
   2. Infrared spectrophotometry
   3. Fluorimetry and phosphometry.
   4. Flame Photometry
   5. Atomic Absorption Spectroscopy.
   6. Emission Spectroscopy
   7. Nuclear Magnetic resonance spectroscopy including $_{13}C$- NMR, $_{1}H$ NMR.
   8. Mass Spectrometry
2. Regulatory control, regulatory drug analysis, interpretation of analytical data.
3. Validation, quality audit, quality of equipment, validation of equipment, validation of analytical procedures

PRACTICALS

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;- NH_2-OH, etc)
4. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS.
5. Assay of at least 10 official formulation containing single and more active ingredients using instrumental techniques.

BOOKS RECOMMENDED

1. Connors, K.A.A Textbook of Pharmaceutical Analysis. Wiley Intersinces.
2. Joffery Vogel's Textbook of Quantitative Chemical Analysis.
3. Silverstein, R.M. and Webster, F.X. Spectrometric identification of organic compounds 6th Ed.John Wiley.
4. Pharmacopoeia of India, Ministry of Health, Govt of India.
5. Becket A.H. and Stenlake J.B. Practical Pharmaceutical Chemistry Vol. I and II, The Athlone Press of the University of London.
6. Chatten L.G. A text book of Pharmaceutical Chemistry Vol. I & II Marcel, Dekker, New York.
7. Willard H.H. and Merrit L. Jr and Dean J.A., Instrumental methods of analysis Van Nostrand Renhold, New York.
8. Obonson J.W.R. Undergraduate Instrumental Analysis, Marcel Dekker Inc, New York, 1970.
9. Parikh V.H. Absorption Spectroscopy of Organic Molecules Addison-Wesley Publishing Co., London 1974.
10. Skoog V, Principles of Instrumental Analysis, Holler-Neimen

PHARMACEUTICS-XI
(Dosage form design-II)

THEORY

Subject code -603T Hours – (03/week)

1. **Design, development** and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions. (Pilot plant techniques)
2. **Stabilization and stability;** testing protocols for various pharmaceutical products, determination of expiry date and overage calculations, factors affecting physical and chemical stability.
3. **Performance evaluation methods**
   - **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 correlation and bio-waiver.
   - **c.** Important federal considerations for bio-availability and bio-equivalence studies for oral products; Statistical considerations including Crossover ANOVA.

4. **Sustained release/ Controlled release (CR) delivery systems:** Advantages and Disadvantages, Classification and types of oral, transdermal and parenteral CR drug delivery agents. Design, development, production and evaluation of Novel drug delivery systems (NDDS).
5. **Microencapsulation**: 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.
6. **Pharmaceutical Aerosols:** Definitions, propellants, general formulation, manufacturing evaluation, packaging methods and pharmaceutical applications.
7. **GMP, Quality audit, optimization and validation of manufacturing processes.**

PRACTICALS

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. Ansel, H.C. Introduction to Pharmaceutical Dosage Forms. K.M. Verghese & Co. Mumbai.
2. Aulton, M.E. Pharmaceutics: The Science of Dosage Form Design ELBS.
3. Avis, K.E., Lachman, L & Liberman, H.A., Pharmaceutical Dosage forms: Paraenteral medications Vols. 1 & 2 Marcel Dekker, N.Y.
4. Juliano, R.L. Drug Delivery Systems Oxford University Press, Oxford.
5. Pharmaceutical Dosage Forms & Drug Delivery systems Lea & Febiger, Philadolphia.
6. Lieberman,H.A. Lachman, L & Schwartz, J.B. Pharmaceutical Dosage Forms. Tablets Vols. 1-3, Marcel Dekker.
7. Robinson, J.R. & Lea Vincet Controlled Drug Delivery: Fundamentals & Applications, Marcel Dekker.
8. Lachman, L., Lieberman, H.A. & Kanig, J.L, The Theory & and Practice of Industrial Pharmacy. Lea and Febiger, Philadelphia.
9. Loftus B.T. & Nash Robert Pharmaceutical Process Validation Marcel Dekker.

47

10. Willing, S.H. Good Manufacturing Practices for Pharmaceuticals Marcel Dekker.

PHARMACOLOGY –II

THEORY

Subject code -604T Hours – (03/week)

1. **Pharmacology of Central nervous system.**
   a. Neurohumoral transmission in the CNS.
   b. General anaesthetics.
   c. Alcohol and disulfiram.
   d. Sedatives, hypnotics, anti-anxiety agents and centrally acting muscle relaxants.
   e. Psychopharmacological agents (antipsychotics), drugs used in affective disorders and hallucinogens.
   f. Anti-epileptic drugs.
   g. Anti-parkinsonism drugs.
   h. Analgesics, antipyretics, anti-inflammatory and anti-gout drugs.
   i. Narcotic analgesics and antagonists .
   j. C.N.S. stimulants.
   k. Drug abuse.
2. **Drugs Acting on Respiratory System**
   Anti-asthmatic drugs, Anti-tussives & Expectorants, Respiratory Stimulants.
3. **Diuretics & anti-diuretics**
4. **Drugs acting on GIT**
   Antacids and Antiulcer drugs, Laxatives and antidiarrhoeal Agents, Emetics and antiemetics, anti motility agent.
5. **Endocrine pharmacology**
   (a) Hypothalamic and pituitary hormones.
   (b) Thyroid and anti-thyroid drugs, parathormone, calcitonin and vitamin D.
   (c) Insulin, oral hypoglycemic agents and glucagons.
   (d) ACTH and corticosteroids.
   (e) Androgens and anabolic steroids.
   (f) Estrogens, progestagens and oral contraceptives.
   (g) Drugs acting on uterus.

PRACTICAL

1. Experiments on urinary excretion of drugs/their metabolites.
2. To record the CRC and PD_2 value of 5-HT on rat fundus preparation
3. To record the CRC and PD_2 value of oxytocin using rat uterus preparation.
4. Experiment based on Theory.

BOOKS RECOMMENDED:

1. Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
2. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
3. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
4. Barar FSK : Text Book of Pharmacology, Interprint, New Delhi.
5. Goodman & Gilman, The Pharmacological basis of Therapeutics, Editors:-JG Hardman, Le Limbird, PB Molinoss, RW Ruddon & AG Gil, Pergamon Press.
6. Katzung, B.G. Basic & Clinical Pharmacology, Prentice Hall, International.
7. Laurence, DR & Bannet PN; Clinical Pharmacology, Churchill Livingstone.
8. Rang MP, Date MM, Riter JM, Pharmacology Churchill Livingstone.
9. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
10. Satoskar & Bhandarkar; Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.
11. Craig, C.R. and Stitzel, R.R., Modern Pharmacology, Little Brown and Co., 1994.

PHARMACEUTICS-XII
(Hospital & Community Pharmacy)

THEORY

Subject code -605T Hours – (03/week)

1. **Organization and structure:** Organization of a hospital, organization & personnel of hospital pharmacy, responsibilities of a hospital pharmacist, pharmacy procedural manual, Budget preparation and Implementation, Pharmacy and Therapeutic Committee, Hospital Formulary and its contents, preparation and revision of hospital formulary.
2. **Drugs store Management and inventory control:**
   (a) Organization of drugs store, Types of materials stocked, storage conditions
   (b) Purchase and inventory control principles, purchase procedures, purchase order, procurement and stocking.
   (c) Quality control of drugs in hospitals.
3. **Drug distribution systems in hospitals**:
   a) Dispensing of drugs to out-patients.
   b) Dispensing of drugs to in-patients.
   c) Dispensing of controlled drugs.
   d) Pre-packaging and labeling.
   e) Drug charges and charging policy.
   f) Central Sterile Supply Unit and their Management.
   g) Surgical supplies and health accessories

4. **Duties and responsibilities of hospital pharmacist**
5. **Hospital formulary:** Format and appearance of the formulary, distribution of the formulary, keeping the formulary currentuse of nonformulary drugs, the legal basis of the formulary stystem,anti substitution laws and formulary, Preparation of the formulary, formulary Vs. drug catalogue or list, selection of guiding for admission or deletion of drug, conteins, prescription writing, format, size, loose leaf Vs bound publication, formulary drug listing service preparation, categorizing and indexing, sample pharmacologic index, text, specialty formulary.
6. **Nuclear pharmacy:** Introduction to Radio-pharmaceuticals, radio-active half life, Units of radio-activity Production of radio-pharmaceuticals, methods of isotopic tagging, preparation of radio-isotopes in laboratory using radiation dosimetry, radio-isotope generators, permissible radiation dose level, radiation hazards and their prevention, specifications for radio-active laboratory.
7. **Retail and whole sale drugs store:** Organization and structure of retail and whole sale drug store, types of drug stores and design, maintenance of drug store, dispensing of proprietary products, maintenance of records of retail and wholesale
8. **Records and Reports:** Prescription filling, drug profile, patient medication profile, annual report
9. **Patient counseling and Patient Compliance:** Role of pharmacist in community health care and education.
10. **Drugs Information Services:** Sources of Information on drugs, disease, treatment schedules, procurement of information, computerized services (e.g. MEDLINE, MEDLAR etc.), retrieval of information, medication error, safe use of medicine, drug Information center, pharmacist as a information specialist.
11. **Use of computer in hospital:** Terminology, program criteria, managing computer system, development of ASHP technical assistant bulletin on hospital drug distribution and control, impact of the computer in dispensing time, model computer regulations.

BOOKS RECOMMENDED:

1. Merchant and Quadry, text book of hospital pharmacy-(B S shah prakashan)
2. Hassan, Hospital pharmacy(Lee and Febiger)
3. Parmar N S Health education and community pharmacy

FORENSIC PHARMACY

THEORY

Subject code -606T Hours – (03/week)

1. **Pharmacy an Introduction:** Origin, development, scope, objectives and nature of pharmaceutical legislation in India. Evolution of the "Concept of Pharmacy" as an integral part of the health care system.
2. **Pharmaceutical education:** A brief review.
3. **Pharmacy Act, 1948**: The general study of the Pharmacy Act with special reference to Pharmacy Council of India, Education Regulations, working of State and Central Councils, constitutions and functions of these councils, registration procedures under the Act.
4. **The Drugs and Cosmetics Act, 1940 & Rules 1945:** General study of the Drugs and Cosmetics Act and the Rules there under. Definitions and salient features related to retail and wholesale distribution of drugs. The powers of inspectors, the sampling procedures and the procedure and formalities in obtaining licences under the rule. Facilities to be provided for running a Pharmacy effectively. General study of the schedules with special reference to schedules C, C_1, F, G, J, H, P and X and salient features of labeling and storage conditions of drugs.
5. **AICTE Act, 1987:** A brief study.
6. **An elaborate study of the following:** (as amended to date)
   (a) Medicinal and Toilet Preparations (Excise Duties) Act, 1955
   (b) Poisons Act 1919
   (c) Patents Act 1970
7. **Narcotic Drugs and Psychotropic Substances Act, 1985:** A brief study of the Act with special reference to its objectives, offences and punishment.
8. **A brief study of the following with special reference to the main provisions:** (as amended to date)
   (a) Medical Termination of Pregnancy Act, 1970 & Rules 1975
   (b) Prevention of Cruelty to Animals Act, 1960
9. **The Drugs and Magic Remedies (Objectionable Advertisement) Act, 1954:** General study of the Act, objectives, special reference to be laid on advertisements, magic remedies and objectionable and permitted advertisement and diseases which cannot be claimed to be cured.
10. Drugs & Pharmaceutical Industry – A brief review.
11. Principles and significance of professional ethics. Critical study of the code of pharmaceutical ethics drafted by Pharmacy Council of India.

BOOKS RECOMMENDED:

1. B.M. Mittal – Textbook of Forensic Pharmacy Vallabh Prakashan, 10th Ed., 1999.
2. Jain, N.K.A Textbook of Forensic Pharmacy. Vallabh Prakashan, New Delhi.

B.PHARM. SEMESTER-VII

Pharmaceutical Analysis-III

THEORY

Subject code -701T Hours – (03/week)

1. **Chromatography:** fundamentals of the following techniques with relevant examples of pharmaceutical and/or natural products TLC, HPTLC, HPLC, GLC, paper chromatography and column chromatography.
2. **Electrochemistry:-**the electric cell, electrode potential, half cells, sign convention, Nernst equation, the salt bridge, activity series, standard potential, standard hydrogen electrode, reference electrode, indicator electrode, measurement of relative voltage of half-cells and calculation of std potential.
   - **A) Potentiometry**: - Theoretical consideration, ion-selective electrodes, measurement of potential location of the end-point, instrumentation. analytical application.pH meter, definition of pH, relationship between pH and potential, equipment and applications
   - **B) Conductometry** :- Ohm's law, specific resistance, specific conductance, conductivity cell, ionic conductivity, change of conductivity during titration, change in volume during conductometric titration, method and instrumentation.
   - **C) Coulometric Titration**: - Principles and application, controlled potential coulometry, cell design, instrumentation, method, electrode selection and advantages and limitations.
   - **D) Polarography**: - Theory, mass transport processes, current potential relationship, polarization choice of electrode, effect of oxygen, instrumentation and calculation of concentration.
   - **E) Amperometric titration and its application**
3. **Miscellaneous methods of Analysis:-**basic principles, instrument and application of……..
   - A) Diazotisation titration
   - B) Kjeldahl method of nitrogen estimation
   - C) Determination of water by Karl-Fisher titration
   - D) Alcohol estimation in Galenicals.
   - E) Gasometry
4. **X-ray diffraction.**

PRACTICALS:

1. Chromatographic analysis of some pharmaceutical products.
2. Exercises based on acid base titration in aqueous and non-aqueous media, oxidation-reduction titrations using potentiometric technique, Determination of acid-base disassociation constants and plotting of titration curves using pH meter.
3. Exercises involving polarimetry.

4. Exercises involving conductometric and polarographic techniques.
5. Miscellaneous Determinations: Exercises involving diazotisation, Kjeldahl, Karl-Fischer and gasometry methods. Determination of alcohol content in liquid galenicals, procedure (BPC) shall be covered.

Books Recommended

1. Beckett, A.H. & Stenlake, J.B. Practical Pharmaceutical Chemistry. Athlone Press, London.
2. Chatten, L.G. (Editor) Pharmaceutical Chemistry Vol. I & II. Marcel Dekker, Inc., N.Y.
3. Connors, K.A. A Textbook of Pharmaceutical Analysis Johan Wiley & Sons, N.Y.
4. Kolthoff, I.M. and Stenger, V.A. Volumetric Analysis Vol.II Titration Methods. Interscience Pub., N.Y.
5. Knevel, A.M. and Digangi, F.E. Jenkin's Quantitative Pharmaceutical Chemistry

PHARMACEUTICAL CHEMISTRY-IX
(Medicinal Chemistry-III)

THEORY

Subject code -702T Hours – (04/week)

Classification with structures, mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only)

1. **Chemotherapy:** Antibacterial agent: Sulphonamides-Sulphamethoxazole, Sulphadiazine, Sulphacetamide, and nalidixic acid, Antiseptics & Disinfectants **–** Benzalkonium chloride, Antibiotics-Penicillins, Semi-synthetic, penicillins, streptomycin, Tetracyclines, Cephalosporins, Chloramphenicol, Fluroquinolones. Antimycobacterial Agents: PAS, Ethambutol, Isoniazid, Dapsone
   Antifungal agents (ketoconazole)
2. **Antiprotozoal drugs:** Antimalarials: Chloroquine, Primaquine, Pyrimethamine
   Antiamoebics: Metronidazole, Tinidazole, Diloxanide
   Antilieshmanic drugs, Antitrypnosomal drugs, Antifilarial drugs-Ivermectin, Anthelmintics- Mebendazole
3. **Antiviral agents:** Antivirals – Amantadine, Acyclovir, Lamivudine.
   Anti – HIV agents – Zidovudine, Zalcitabine, Saquinavir.
4. **Antineoplastic agents:** Alkylating agents, folic acid antagonist, natural anticancer agents, Cisplatin, Chlorambucil, 5- Fluorouracil, methotrexate, Cyclophosphamide, busulphan

5. Immunostimulant and Immunosuppressant.
6. Anti-ageing agent.

PRACTICAL:

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Characterization of the synthesized compounds by TLC, melting point, instrumental techniques and spectroscopic methods.

BOOKS RECOMMENDED:

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.
2. Furniss B S, Hannaford A J, Smith P W G and Tathell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Pharmacopoeia of India, Ministry of Health, Govt. of India.
4. Wolff ME, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
5. Delagado J N and Remers W A R, Eds., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
6. Foye W C, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh Harkishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.

Pharmaceutics-XIII
(Biopharmaceutics and Pharmacokinetics)

THEORY

Subject code -703T Hours – (04/week)

1. Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical testing.
2. **Biopharmaceutics :**
   - **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:**
   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. **Clinical Pharmacokinetics:**
   a. Definition and scope,Dosage adjustment in patients with and without renal failure.
5. **Biovailability and bioequivalence:**
   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.

PRACTICALS

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. & Perrier, D.Pharmacokinetics. Marcel Dekker Inc. N.Y.
4. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics. Lea & Febiger, Philadelphia.
5. Pecile, A & Rescigno, A. Pharmacokinetics. Plenum Press, N.Y.
6. Remington's The Science & Practice of Pharmacy. Mack Publishing Co., Easton, Pennsylvania.
7. Ritschel, W.A. Handbook of Basic Pharmacokinetics. Drug Intelligence Publications, Hamilton.
8. Shargel, L. and Yu, A. Applied Biopharmaceutics and Pharmacokinetics. Appleton & large, Norwalk.

9. Wagner, J.G. Fundamentals of Clinical Pharmacokinetics. Drug Intelligence Publications, Hamilton.
10. Wagner, J.G. Pharmacokinetics for Pharmaceutical Scientists. Technomic Publishing, A.G. Basel, Switzerland.
11. Winter, M.E. Basic Clinical Pharmacokinetics. Applied Therapeutics, Inc., San Fransisco.
12. Welling, P.G. & Tse. Francis L.S. Pharmacokinetics, Marcel Dekker, NY.
13. Madan, P.L. Biopharmaceutics & Pharmacokinetics.
14. Venkateswarm, V. Fundamentals of Biopharmaceutics and Pharmacoknitics, Paras Publishing.
15. Brahmankar and Jaiswal, Biopharmaceutics and Pharmacokinetics; A treatise, Vallabh Prakashan

PHARMACEUTICS-XIV
(Cosmetology)

THEORY

Subject code -704T Hours – (03/week)

1. Origin and development of cosmetic Sciences and technology.
2. Structure and physiology of skin.
3. Definition and general formulation, manufacturing process and evaluation of following preparations….
Creams, Lotions, Face powder, Lip sticks, Mouth washes, Shaving preparations, Shampoos, Baby toiletries, Antiperspirants, Deodorants, Nail Licquers, Tooth powders, hair preparations, herbal cosmetics, eye makeup preparations..
4. Packaging of Cosmetics.
5. Evaluation of Cosmetics.
6. Clinical safety testing: Clinical safety testing and protocols for Irritation, sensitization, photo-irritation, photo-allergy, and ocular irritation.
7. Regulatory requirements: Manufacturing and sale of cosmetics

PRACTICALS

1) Cold cream
2) Vanishing cream
3) Cleansing cream
4) All purpose cream
5) Protective cream
6) Foundation lotion
7) Sunscreen lotion
8) Face powder
9) Body powder
10) Hand cream
11) Face pack
12) Deodorant
13) Antiperspirant
16) Cream shampoo
17) Clear liquid shampoo
18) Shaving cream
19) Brushless shaving cream
20) After shave lotion
21) Hair fixer gel
22) Tooth powder
23) Tooth paste
24) Mouth wash
25) Hair conditioner
26) Anti dandruff shampoo
27) Depilatory cream
28) Bleach cream

14) Shampoo- powder 29) Hair setting lotion
15) Oily shampoo 30) Tooth gel

BOOKS RECOMMENDED

1. Poucher's Cosmeticology.
2. R.L. Juliano, Drug Delivery Systems, Oxford University Press, Oxford.
3. Harrys Cosmetology
4. Balsam and Sagarin, Cosmetics: Science and Technology.
5. Thomssen E.G. Modern Cosmetics, Universal Publishing Corporation.
6. Mittal B.M. & Saha R.N.-a handbook of cosmetics, Vallabh Prakashan.
7. Sagarin & Balsam, M.S. Cosmetic Science & Technology. Vol. 1-3 2nd ed. John Wiley.
8. Jellinek, J.S. Formulation and Function of Cosmetics. John Wiley & Sons.
9. Kac Chensney, J.C. Packaging of Cosmetics and Toiletries. Newness Butter Worth London.
10. Thomssen, S.G. Modern Cosmetics Universal Publishing Corp., Mumbai.

PHARMACOLOGY –III

THEORY

Subject code -705T Hours – (04/week)

1. **Pharmacology of CVS:** Cardiac glycosides, Antihypertensive drugs, Antianginal drugs, Antiarrhythmics, Antihyperlipidemics, Therapy of Shock.
2. **Drugs Acting on Hemopoeitic System:** Haematinics, Vit. K & anticoagulants, Fibrinolytics & antiplatelet drugs, Plasma Volume expanders.
3. **Chemotherapy:** General principles of chemotherapy.
   Sulphonamides, quinolones, penicillins, cephalosporins, aminoglycosides, tetracyclines, chloramphenicol and macrolides. Anti-malarial, Antiamoebics, Antileishmenics, Antitrypnosoma, Anthelmentics, Antifungal and Antiviral & Drugs used for the treatment of AIDS.Chemotherapy of tuberculosis and leprosy, Urinary antiseptics. Chemotherapy for Cancer.
4. **Bioassay**s: General principles and methods of bioassays. Official methods of bioassay of Insulin, Oxytocin, d-tubocurarine, Heparin, Digitalis, Histamine, Adrenaline & Acetyl Choline.

PRACTICAL

1. Bioassay of agonist and antagonist.
2. Determination of PA_2 value.

BOOKS RECOMENDED

1. Goyal R.K. – Practicals in pharmacology (1994-95) 1st Edn. M/s. B.S. Shah Prakashan, Ahmedabad
2. Sheth U.K. etal – Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
3. Kulkarni S.K. – Handbook of experimental pharmacology(1993) 2nd Edn. Vallabh Prakashan, New Delhi.

4. Ghoosh M.N. – Essentials of experimental pharmacology scientific book agency, Culcutta, 1984. 5. Rang. H.P., Dale M.M., etal –Pharmacology(1995) 3rd Edn. Churchil livingstone,USA.
6. Satoskar R.S. , etal – Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
7. Harvel, R.A., Champe P. C. etal, Pharmacology (1997) 2nd edition, Lippincott-Raven Company, Philadelphia, New Yor.
8. Craig C. R. Stitzel, R. E.-Modern Pharmacology (1994) 4th edition. Little Browth and Company, U.S.A. 9. Goodman and Gilman's –The Pharmacological Basis of Therapeutics (1996) 9th edition. Pergamon Press, Singapore.

10. Seth S. D., Text Book of Pharmacology, B. I. Churchill, 1997

PROFESSIONAL TRAINING

Subject code -706T Hours – (03/week)

Every candidate shall be required to work for at least four weeks in a Pharmaceutical Industry after the Semester- IV of the course of study. The candidate may undergo practical training in parts, each constituting not less than two weeks. Candidate shall undergo professional training in a training center (Pharmaceutical Manufacturing Unit /Analytical Laboratory / Bulk Drug Manufacturing Unit / Hospital Pharmacy) allotted by Training officer of the institute.

Candidate shall prepare and submit two copies of training report in prescribed format printed or type written in bound form. One copy is to be submitted to the research board and one copy to be retained by the candidate for his / her own reference. The report shall contain the certificate of training from the head of the respective training center and shall be duly accepted and certified by the Dean, faculty.

Marks for professional training shall be awarded on the basis of training report, interview and viva voce by a board consisting of training in-charge and one examiner (appointed by the Dean, faculty) and the Dean, faculty or his nominee who shall be the chairman of the board.

B. Pharm. Semester- VIII

PHARMACEUTICAL CHEMISTRY-X
(Medicinal Chemistry-IV)

THEORY

Subject code -801T Hours – (03/week)

1. **Cardiovascular agents:** Antianginal & vasodilators, antiarrhythmics, antihypertensives, anticoagulants, antihyperlipidemics & cardiotonics, Plasma expanders – Nifedipine, Procainamide, Propranolol, Methyldopa, Captopril, Clofibrate, Warfarin, Phenindione.
2. **Diuretics:** Acetazolamide, Chlorthiazide; Frusemide, Spironolactone.
3. Vitamins: Classification, general chemistry and structural formulae of Vitamins included in I.P., Detailed chemistry of Vit. A, Vit.D, Vit.B1, B2, and Vit. C.
4. **Steroids and related drugs:** Introduction, Classification, Nomenclature & Stereochemistry, SAR and use.

(A) Androgens and Anabolic steroids – Testosterone, Stanazolol.
(B) Estrogens and Progestational agents – Progesterone, Estradiol.
(C) Adrenocorticoids – Prednisolone, Dexamethasone, Betamethasone.

5. Plasma expanders and diagnostic agents: Iodohippurate, Diatrizoate, Iothalamate, Metrizamide, Iopanoic acid Propyliodone, Aminohippuric acid, Ipodate, Rosebengal, Fluorescein, Chlormerodin, Metyrapone, Evansblue

Practical:

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Characterization of the synthesized compounds by TLC, melting point, instrumental techniques and spectroscopic methods.

BOOKS RECOMMENDED:

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.
2. Furniss B S, Hannaford A J, Smith P W G and Tathell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Pharmacopoeia of India, Ministry of Health, Govt. of India.
4. Wolff ME, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
5. Delagado J N and Remers W A R, Eds., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
6. Foye W C, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh Harkishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi

Pharmaceutics-XV
(Biotechnology)

THEORY

Subject code -802T Hours – (03/week)

1. **Bacterial genetics:** Introduction, basic principles of molecular biology, extra chromosomal genetic elements, genotypic and phenotypic variations, mutation, transmission of genetic, material, genetic mechanisms of drug resistance in bacteria, transposable genetic elements and bacterial genetics applications.
2. **Enzyme technology:** Sources of enzymes, production, isolation and purification. Application in pharmaceutical industry and clinical analysis. Production of amyloglucosidase, glucose-isomerase, amylase, cellulose, takadiastase, trypsin, streptokinase and urokinase.
3. **Enzyme immobilization:** Techniques of immobilization, and their applications in the industry, dynamics of enzymatic activity, factors affecting enzyme kinetics, study of enzymes such as hyaluronidase, penicillinase, streptokinase, streptodornase, amylases and proteases, immobilization of bacteria and plant cells.
4. **Plant tissue culture:** Introduction, culture media, application in pharmaceutical industry.
5. **Current developments in immunotechnology:** Diagnostic kits for: HIV, VDRL and other clinical pathological tests.
6. **Fermentation technology:** Introduction, development of industrial fermentation processes, fermentors, downstream processing and industrial processing.
7. Animal cell culture techniques.
8. Production of Monoclonal Ab's. and their diagnostic/ therapeutic application.
9. Recombinant DNA technology and its application.
10. Radioimmunoassay's, ELISA, PCR & its application.

PRACTICALS

1. Experiments devised to prepare various types of culture media,
2. Sub culturing of common aerobic and anaerobic bacteria, fungi and yeast,
3. Various staining methods,
4. Various methods of isolation and identification of microbes,
5. Sterilization techniques and their validation,
6. Evaluation of antiseptics and disinfectants,
7. Testing the sterility of pharmaceutical products as per I.P. requirements,
8. Microbial assay of antibiotics and vitamins etc.
9. Preparation and standardization of immobilized preparations,
10. Fermentative production of antibiotics,
11. Immobilization of enzymes.
12. Standardisation of inoculum and estimation of MIC by serial dilution.

BOOKS RECOMENDED

1. Peleczar M.J. Jr., Chan E.C.S., & Krieg N.R., Microbiology, Tata McGraw Hill, Publishing Co. Ltd., Delhi.
2. Hugo and Russel, Pharmaceutical Microbiology, Blackwell Scientific Publication, Oxford.
3. Rawlins E. A., Bentley's textbook of Pharmaceutics, ELBS Bacilliere Tindal.
4. Carter S. J., Cooper and Gunn's Tutorial Pharmacy, CBS Publishers, Delhi.
5. Remington's The Science and Practice of Pharmacy, Mack Publishing Co. Easton, Pernsybrania.
6. Vyas, Dixit, Pharmaceutical Biotechnology.
7. Jain N. K., Textbook of Microbiology.
8. Casida, Industrial Microbiology.
9. Prescott and Dunn, Industrial Microbiology, McGraw Hill Book Co. Inc.
10. Standury P. F. & Whitaker A., Principles of Fermentation Technology, Pergamon Press, Oxford.

PHARMACOGNOSY-IV

THEORY

Subject code -803T Hours – (03/week)

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes adulterants, uses, diagnostic macroscopic & microscopic features & specific chemical tests of following alkaloid containing drugs.
   A. Pyridine-piperidine: Tobacco, Areca & Lobelia.
   B. Tropane: Belladona, Hyoscyamus, Datura, Coca & Withania.
   C. Quinoline & Isoquinoline: Cinchona, Ipecac & Opium.
   D. Indole: Ergot, Rauwolfia, Catharanthus & Nux-vomica.
   E. Imidazole : Pilocarpus.
   F. Steroidal: Veratrum & Kurchi.
   G. Alkaloidal amine: Ephedra & Colchicum.
   H. Glycoalkaloid: Solanum.
   I. Purines : Coffee & Tea
   J. Quinazoline: Vasaka.
2. Utilization & production of phytoconstituents such as – Tropane Alkaloids, Isoquinoline & Quinoline Alkaloids.
3. World wide trade in Medicinal plants & derived product. Tropane alkaloids containing drugs, Cinchona, Ipecac, Rauwolfia, Taxol. Diosgenin, Digitalis, Liquorice, Papain, Ginseng, Aloe, Valerian.
4. Role of Medicinal & aromatic plants in National Economy.
5. Biological sources, preparation, Identification tests and uses of following enzymes – Diastase, Papain, Penicillinase, Hyalluronidase, Streptokinase, Trypsin, Pancretin.

6. Plant Bitters, Sweeteners & plant laxatives.
7. Introduction, classification & study of different chromatographic methods. Application of chromatographic techniques in evaluation of herbal drugs.
8. Historical development of plant tissue culture, type of culture, Nutritional requirement, growth & their maintenance. Application of plant tissue culture in pharmacognosy.
9. General principals of formation of primary and secondary plant metabolites. Biogenesis of medicinally important alkaloids, glycosides, carbohydrates, lipids, volatile oils, and steroids etc.
10. Study of natural allergens, hallucinogens and antitumar drugs.

PRACTICAL

1. Identificaiton of crude drugs listed Theory.
2. Microscopic study of characters of selected drugs given in Theory in entire and powder form.
3. Chemical evaluation of powdered drugs & Enzymes.
4. Chromatographic studies of some herbal constituents.
5. Experiments related to plant tissue culture.
6. To study the morphology and microscopy of Datura and Withania Ipecac and Rauwolfia. Catharanthus and Nux-vomica Ephedra and Kurchi Solanum and Vasaka.
7. To study the morphology and microscopy including T.S. and powder microscopy of Areca, Colchicum. Catharanthus leaf and Kurchi bark.
8. To study the TLC profile of Catharanthus leaf.
9. To study the TLC profile of Withania root.
10. Chemical test of Tea, Tobacco, Datura and Withania.
11. Chemical test of Nux-vomica, Ephedra, and Kurchi.
12. Introduction of plant-tissue culture techniques on laboratory scale.
13. Preparation of Agar slants.
14. To grow callus in any defined media.
15. Maintenance of callus culture.

BOOKS RECOMMENDED:

1. Kokate, C.K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.
2. Wallis T.E. Analytical Microscopy, J&A Churchill Ltd, London.
3. Ganborg & Wetter, Plant Tissue Culture Methods, National Research Council of Canada, Saskatchewan.
4. Clarke ECG, Isolation & Identification of drugs. The Pharmaceutical Press, London.
5. Trease, G.E. & Evans, W.C. "Pharmacognosy" Bailliere Tindall East Bourne, U.K.
6. Tyler V.E. etal Pharmacognosy, Lea & Febiger Phjadelphia.
7. Wallis T.E. Text book of Pharmacognosy" J&A Churchill Ltd. London.

8. Kokate, C.K. etal Pharmacognosy" Nirali Prakashan, Pune.
9. Atal & Kapur, Cultivation & Utilization of Medicinal Plants, RRL, Jammu.
10. Stahl. E, Thin Layer Chromatography. A laboratory handbook, Springer Verlog, Berlin.
11. Henry TA. The Plant Alkaloids, McGraw Hill, New York.
12. Dixit, V.K., Vyas. S.P. Pharmaceutical Biotechnology, CBS Publication, ND.
13. Street H.E. Tissue Culture & Plant Science, Academic Press, London.
14. Kokate, C.K. Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan.

PHARMACOLOGY-IV

Subject code -804T Hours – (03/week)

1. **Immunology**: immunosuppressant, immuno-enhancers and immuno-modulators.
2. **Pharmacogenetics, pharmacovigilance, Therapeutic drug monitoring, Patient compliance and drug allergy.**
3. **Development of new drugs:** Method of drug discovery, Pre clinical evaluation (animal studies), Clinical evaluation (Human studies), Phases of clinical trial (Phase I, II, III & IV), ICH & GCP guide lines.
4. **Toxicology:** Types of toxicity (acute, sub acute and chronic toxicity tests), Heavy metals, drugs like opoids, atropine, barbiturates, diazepam, alcohol, organo- phosphorus, General principles of treatment of acute poisoning,
5. **Geriatric pharmacology:** Drug therapy in geriatrics, Mechanism of altered drug effects in elderly, ADRs, Effect of age on drug disposition.
6. **Drug therapy in Pediatric patients:** Pharmacokinetic considerations and therapeutic monitoring, Drugs in antenatal period (during pregnancy), adverse drug reactions and toxicity, Drug therapy during lactation, Immunization.

BOOKS RECOMMENDED

1. Clinical Pharmacokinetics /3rd Edition/Rowland and Tibzer/Williams & Wilkins
2. Clinical Pharmacokinetics - Pocket Reference, 2nd Edition/Murphy/American Society
of Health-System Pharmacists
3. Drug Interaction Facts/Facts and Comparisons/up-dated quarterly
4. Drug Facts and Comparisons/Covington, et al/Facts and Comparisons/updated monthly.
5. Pharmacology/4th Edition/H. Rang/Harcourt Health Sciences Group
6. Pharmacotherapy: A Physiologic Approach/3rd Edition/Appleton & Lange 7. Oouriey/lippincott Williams and Wilkins

INDUSTRIAL MANAGEMENT INCLUDING MARKETING

THEORY

Subject code -805T Hours – (03/week)

1. **Management**: Meaning, evolution (Scientific administrative and human relation approach) and process of management (planning,organising staffing,directing,coordinating and controlling -a preliminary idea of their concepts, processes and techniques), Functional areas of management:production management, marketing management, personnel management, financial management (their meaning and functions)

2. **Production management**:- Production planning and control, production processes:mass, job and project; materials management and inventory control; plant location and lay out; work study (preliminary idea only).

3. **Marketing management**:-Evolution of modern concept; market segmentation; concept of marketing mix; market research; product planning; pricing, promotion; channels of distribution; Indian marketing environment.

4. **Industrial psychology**-Transactional analysis (Meaning, Ego status,types of transactions and life positions-a preliminary idea). organisation development (Preliminary idea), Motivation-Maslow's Theory, Approaches and styles of leadership (Preliminary idea).

5. **Personnel Management**:-Recruitment and selection of man power, wage and salary administration, retrenchment, lay off and discharge.

Books Recommended:

1. Tripathi P.C. and Reddy P.N.:Management; Tata Mc Graw Hill.
2. Shukla M.C.:Business organization and management;S.Chand and company.
3. Sherlakar S.A.:Business organization and management;Himalaya.
4. Filippo E.B.:Personnel management;McGraw Hill.
5. Kotler Philip:Marketing Management;prentice Hall of India
6. Rao and Narayan: Organizational Behaviour; Konark publishers.

PROJECT

Subject code -806 Hours – (03/week)

Before the end of Semester VI (B.Pharm Part-III), for each candidate, a project supervisor shall be appointed by the Dean, faculty. The candidate shall choose a project topic in consultation with the supervisor. A synopsis on the project topic should be prepared in the prescribed format and submitted to the respective head for approval. Candidate shall carry out literature survey on the approved topic during semester VII & VIII (B.Pharm Part-IV) under the guidance of the supervisor.

Candidate shall prepare and submit three copies of project report in prescribed format in bound form. Two copies are to be submitted to the research board and one copy to be retained by the candidate for his/her own reference. The project report should contain a copy of approved synopsis and certificate from the supervisor, certifying that the work has been undertaken and written under his/her supervision and meets the requirements of the course, countersigned and duly forwarded by the chairman of the research board.

Marks for project shall be awarded on the basis of project report, seminar and viva voce by a board consisting of supervisor, one examiner (appointed by the research board) and the chairman of research board or his nominee who shall be the chairman of the board.