ORDINANCE & SYLLABUS

Four-year Integrated
Bachelor of Pharmacy Course
(Semester System)
(w.e.f. Session 2010-11)

DEPARTMENT OF PHARMACEUTICAL SCIENCES
KUMAUN UNIVERSITY
NAINITAL (UTTARAKHAND)

CONTENTS

ORDINANCES FOR BACHELOR OF PHARMACY

The Bachelor of Pharmacy under Faculty of Science shall comprise of four parts, namely:

i. B. Pharm Semester I
ii. B. Pharm Semester II
iii. B. Pharm Semester III
iv. B. Pharm Semester IV
v. B. Pharm Semester V
vi. B. Pharm Semester VI
vii. B. Pharm Semester VII
viii. B. Pharm Semester VIII

I. ADMISSION :

I.1. **B.Pharm I Semester .** The candidate should have passed the Intermediate (10+2) examination of the Uttaranchal Board, Ramnagar or an examination recognized as equivalent by Kumaun University, with English, Physics, Chemistry and Biology or Mathematics, scoring at least 50% marks in aggregate of the four subjects (45% for SC/ST/OBC candidates).

I.2. The minimum standards of Physical fitness, age and other requirements shall be applicable, as prescribed from time to time.

1.3 A candidate shall be admitted to next higher semester of the course by promotion if he/ she has passed the preceding semester, examination of Kumaun University or cleared the norms for admission to next higher semester.

1.4 **Clause for Diploma Students:** candidates that have passed the Diploma in pharmacy examination as per education regulation of pharmacy council of India, with aggregate of at least 60% marks would be allowed to take direct admission to 2nd year through lateral entry.

II. SCHEME OF COURSES OF STUDY AND EXAMINATIONS:

II.1. Registration :

II.1.1 Every student admitted to the I Semester, II Semester, III Semester, IV Semester, V Semester, VI Semester, VII Semester or VIII Semester of the course must get registered at the beginning of the each Semester in the department by completing the necessary formalities, as specified by the University.

II.1.2 In each Semester, a last date shall be fixed and notified in the beginning of the session after which admissions/re-admissions/promotions/registrations shall not be ordinarily made.

II.2. Regularity and Attendance:

II.2.1. A regular student shall be permitted to appear in End semester examination, unless he/she has regularly attended not less than 75% classes held in aggregate of all subjects. The university may however, condone not more than 10% shortage in attendance in each subject for any of the following reasons.

Participation in NCC/ NSS Camps.
Participation in University/ Inter-university/ State-level Games.

Participation in other extra-curricular activities at University/ Inter-university/ State level.
Prolonged Illness.

A student can avail of this relaxation only on any one of the above grounds. Further, such relaxation can be granted only on submission of certificate/evidence from appropriate authority.

II.3. Course Provisions :

II.3.1. Students admitted to B.Pharm. I Semester, who have passed the intermediate examination with Biology as a subject, shall study Remedial Mathematics in B.Pharm. I Semester. Those students, who have passed intermediate examination with Mathematics as a subject, shall study Remedial Biology. However student having both subjects in intermediate examination may opt either of the above subjects.

II.3.2 The Diploma in Pharmacy students will be admitted to B. Pharm. (2^{nd} year) III^{rd} Semester as per clause I.4. However, they will have to study the following courses of B. Pharm. Ist year in lieu of the courses which they have already studied in Diploma in Pharmacy as mentioned below. Their results will be calculated on the basis of aggregate of B. Pharm. II, III and IV year.

Courses of B. Pharm. Ist Semester to be offered	**Inlieu of courses they have studied in Diploma Pharmacy B.Pharm. (2^{nd} year) III^{rd} Semester**
1. Remedial Mathematics	1. Pharmaceutics-IV (Hospital Pharmacy)
2. Computer (Theory & Lab.)	2. Pharmacognosy I (Theory & Lab.)

II.4. Examination:

II.4.1. For each theory/practical subject, there shall be one End semester examination (of 3 hours duration for each subject) and at least two sessional written tests (of not less than 1 hour duration each). Following shall be the breakup of marks for :

(i)	Regularity & Discipline	10
(ii)	Sessional Tests	20
(iii)	End Semester Examination	70
	Total	**100**

II.4.2 The department shall conduct two sessional examinations in each theory subject and the best of two shall contribute to the final result. Assessment in practical sessional examination shall be based on day-to-day performance, viva-voce, practical exercise and assignments like class-tests, quizzes, herbaria, tour-reports etc.

II.4.3. The applicant, for appearing in an examination, shall fulfill the norms of study in all practical and theory classes, as prescribed in the syllabus. He/ She must also fulfil the norms of regularity, sessional examinations and other tests conducted during the academic year.

III. PROMOTION AND DECLERATION OF RESULTS:

III.1. In order to be declared successful in B.Pharm. examination, a candidate shall have to clear all norms of attendance, sessional examination, annual examination, educational tour reports, herbaria preparation, projects and any other requirements laid down by the department / university.

III.2. A student who fails to pay fee or any other outstanding dues or return library books may not be allowed to appear in university examination.

III.3. In order to pass an examination, an examinee shall obtain:

a. not less than 40% marks in each theory paper including the marks obtained in regularity and sessional examination.
b. not less than 50% marks in each practical paper including the marks obtained in regularity and sessional examination.
c. not less than 50% marks in aggregate of all theory and practical papers including the marks obtained in regularity and sessional examination.

III.4. For the purpose of passing an examination, the theory and practical of a subject shall be considered as separate papers and an examinee shall have to pass theory and practical separately.

III.5. Examinees declared successful in all the eight B.Pharm. Semester examinations shall be placed in divisions on the basis of the aggregate of marks obtained in the examinations of all the four years, as given below:

75% or more marks in aggregate ……..……... Passed with Distinction(Honours)
60% or more marks in aggregate …… Passed in First Division.
50% or more but less than 60% marks in aggregate …… Passed in Second Division.

III.6. A maximum of 5 grace marks may be awarded to an examinee in an examination in not more than two papers to pass the said semester examination.

III.7. The Examinee who failed to secure the prescribed minimum marks in not more than three papers may seek admission into next class subject to the condition that admission in the third, fifth and seventh semester will be permitted only after clearing first, third and fifth semester's all papers and admission in the fourth, sixth and eight semester will be permitted only after clearing second, fourth and sixth semester's all papers.

III.8. The examination of back papers for the students failed in eight semester will be conducted with the next semester examination (odd- semester examinations).

III.9. **Clause for Failed Students:**

The examinee, who fails to secure the prescribed minimum marks in more than three papers shall have to reappear as an external candidate at the next annual examination. The facility of ex-studentship is however, subject to the time-limit stipulated in clauses III.10 and for the completion of the result the marks of regularity, sessional examination shall remain same.

III.10. **Maximum Period of the course :**

Notwithstanding anything contained in the ordinances to the contrary, a student shall have to pass in all papers (theory & practicals separately) of B.Pharm. I semester within three academic sessions. Failure to meet this requirement shall result in automatic cancellation of his/her admission. A student must complete the entire B.Pharm. course in not more than **eight academic years**, starting from the year of his/ her admission to the course. Failure to complete the course in eight years shall render the student unfit for the course and his/ her admission shall automatically be cancelled at the end of eight academic years, without any notice. Students, who are unlikley to satisfy this condition, shall not be allowed to continue the studies any further.

III.11. **Ranking:**

The division of successful examinees at the final semester B.Pharm. examination shall be determined on the basis of the aggregate marks obtained at the first, second, third and final year B.Pharm. examinations taken together & using clause III.5.

IV All other rules implemented by the university from time to time shall be applicable to B.Pharm. students.

Distribution of Subjects, Teaching Hours and Marks

B.Pharm. First semester:

Subject-Code	Subject	Teaching Hr./Week	Regularity	Marks Allotted Sess. Exam.	Final Exam.	Total
Theory:						
1T1	Pharmaceutics-I (Introduction to Pharmacy)	3	10	20	70	100
1T2	Human Anatomy, Physiology & Health education-I	3	10	20	70	100
1T3	Pharmaceutical Chemistry-I (Organic- I)	3	10	20	70	100
1T4	Pharmaceutical Analysis-I	3	10	20	70	100
1T5	Remedial Mathematics OR Remedial Biology	3	10	20	70	100
1T6	Computer Science	3	10	20	70	100
	Total	18	60	120	420	600
Practical:						
1P1	Pharmaceutics-I (Introduction to Pharmacy)	3	10	20	70	100
1P2	Human Anatomy, Physiology & Health education-I	3	10	20	70	100
1P3	Pharmaceutical Chemistry-I (Organic-I)	3	10	20	70	100
1P4	Pharmaceutical Analysis-I	3	10	20	70	100
1P5	Remedial Biology	3	10	20	70	100
1P6	Computer Science	3	10	20	70	100
	Total	15 /18	50 /60	100 /200	350 /420	500 /600
	Grand Total	33 /36	110 120/	220 /240	720 /840	1100/1200

B.Pharm. Second semester:

Subject-Code	Subject	Teaching Hr./Week	Regularity	Marks Allotted Sess. Exam.	Final Exam.	Total
Theory:						
2T1	Human Anatomy, Physiology & Health education -II	3	10	20	70	100
2T2	Pharmaceutical Chemistry-II (Organic –II)	3	10	20	70	100
2T3	Pharmaceutical Chemistry-III (Inorganic)	3	10	20	70	100
2T4	Pharmaceutical Biostatistics	3	10	20	70	100
2T5	Professional Communication	5	10	20	70	100
	Total	17	50	100	350	500
Practical:						
2P1	Human Anatomy, Physiology & Health education -II	3	10	20	70	100
2P2	Pharmaceutical Chemistry-II (Organic –II)	3	10	20	70	100
2P3	Pharmaceutical Chemistry-III (Inorganic)	3	10	20	70	100
	Total	9	30	60	210	300
	Grand Total	26	80	160	560	800

B.Pharm. Third semester:

Subject-Code	Subject	Teaching Hr./Week	Regularity	Marks Allotted Sess. Exam.	Final Exam.	Total
Theory:						
3T1	Pharmaceutics-II (Unit Operation-I)	3	10	20	70	100
3T2	Pharmacology-I	3	10	20	70	100
3T3	Pharmaceutical Chemistry-IV (Chemistry of Natural Products)	3	10	20	70	100
3T4	Pharmaceutical Analysis- II	3	10	20	70	100
3T5	Pharmacognosy -I	3	10	20	70	100
3T6	Pharmaceutics-III (Hospital Pharmacy)	3	10	20	70	100
	Total	18	60	120	420	600
Practical:						
3P1	Pharmaceutics-II (Unit Operation- I)	3	10	20	70	100
3P2	Pharmacology -I	3	10	20	70	100
3P3	Pharmaceutical Chemistry- IV (Chemistry of Natural Products)	3	10	20	70	100
3P4	Pharmaceutical Analysis- II	3	10	20	70	100
3P5	Pharmacognosy-I	3	10	20	70	100
	Total	15	50	100	350	500
	Grand Total	33	110	220	770	1100

B.Pharm. Fourth semester:

Subject-Code	Subject	Teaching Hr./Week	Regularity	Marks Allotted Sess. Exam.	Final Exam.	Total
Theory:						
4T1	Pharmaceutics-IV (Unit Operation-II)	3	10	20	70	100
4T2	Pharmacology-II	3	10	20	70	100
4T3	Pharmaceutical Chemistry-V (Biochemistry)	3	10	20	70	100
4T4	Pharmaceutical Microbiology	3	10	20	70	100
4T5	Pharmacognosy-II	3	10	20	70	100
4T6	Environmental Studies	3	10	20	70	100
	Total	18	60	120	420	600
Practical:						
4P1	Pharmaceutics-IV (Unit Operation-II)	3	10	20	70	100
4P2	Pharmacology-II	3	10	20	70	100
4P3	Pharmaceutical Chemistry-V (Biochemistry)	3	10	20	70	100
4P4	Pharmaceutical Microbiology	3	10	20	70	100
4P5	Pharmacognosy-II	3	10	20	70	100
	Total	15	50	100	350	500
	Grand Total	33	110	220	770	1100

B.Pharm. Fifth semester:

Subject-Code	Subject	Teaching Hr./Week	Regularity	Marks Allotted Sess. Exam.	Final Exam.	Total
Theory:						
5T1	Pharmaceutics-V (Pharmaceutical Technology- I)	3	10	20	70	100
5T2	Pharmaceutics- VI (Physical Pharmacy)	3	10	20	70	100
5T3	Pharmacology-III	3	10	20	70	100
5T4	Pharmaceutical Chemistry- VI (Medicinal Chemistry -I)	3	10	20	70	100
5T5	Pharmacognosy-III	3	10	20	70	100
	Total	15	50	100	350	500
Practical:						
5P1	Pharmaceutics-V (Pharmaceutical Technology -I)	3	10	20	70	100
5P2	Pharmaceutics-VI (Physical Pharmacy)	3	10	20	70	100
5P3	Pharmacology-III	3	10	20	70	100
5P4	Pharmaceutical Chemistry-VI (Medicinal Chemistry -I)	3	10	20	70	100
5P5	Pharmacognosy-III	3	10	20	70	100
	Total	15	50	100	350	500
	Grand Total	30	100	200	700	1100

B.Pharm. Sixth semester:

Subject-Code	Subject	Teaching Hr./Week	Regularity	Marks Allotted Sess. Exam.	Final Exam.	Total
Theory:						
6T1	Pharmaceutics-VII (Pharmaceutical Technology -II	3	10	20	70	100
6T2	Pharmaceutical Chemistry-VII (Medicinal Chemistry- II)	3	10	20	70	100
6T3	Pharmacology- IV	3	10	20	70	100
6T4	Pharmacognosy- IV	3	10	20	70	100
6T5	Pharmaceutical Biotechnology	3	10	20	70	100
6T6	Pharmaceutics-VIII (Jurisprudence)	3	10	20	70	100
	Total	18	60	120	420	600
Practical:						
6P1	Pharmaceutics-VII (Pharmaceutical Technology –II)	3	10	20	70	100
6P2	Pharmacology- IV	3	10	20	70	100
6P3	Pharmaceutical Chemistry-VII (Medicinal Chemistry- II)	3	10	20	70	100
6P4	Pharmacognosy- IV	3	10	20	70	100
	Total	12	50	100	350	500
	Grand Total	30	110	220	770	1100

B.Pharm. Seventh semester:

Subject-Code	Subject	Teaching Hr./Week	Regularity	Marks Allotted Sess. Exam.	Final Exam.	Total
Theory:						
7T1	Pharmaceutical Analysis –III	3	10	20	70	100
7T2	Pharmacognosy-V	3	10	20	70	100
7T3	Pharmaceutical Chemistry-VIII (Medicinal Chemistry- III)	3	10	20	70	100
7T4	Pharmacology- V (Pathophysiology and Pharmacotherapeutics)	3	10	20	70	100
7T5	Pharmaceutical Management	3	10	20	70	100
7T6	Pharmaceutics-IX (Quality Assurance and Drug Regulatory Affairs)	3	10	20	70	100
	Total	18	60	120	420	600
Practical:						
7P1	Pharmaceutical Analysis -III	3	10	20	70	100
7P2	Pharmacognosy-V	3	10	20	70	100
7P3	Industrial Trip					100
	Total	6	20	40	140	300
	Grand Total	24	80	160	560	900

B.Pharm. Eight semester:

Subject-Code	Subject	Teaching Hr./Week	Regularity	Marks Allotted Sess. Exam.	Final Exam.	Total
Theory:						
8T1	Pharmaceutics- X (Biopharmaceutics)	3	10	20	70	100
8T2	Pharmaceutical Analysis- IV	3	10	20	70	100
8T3	Pharmacology- VI (Clinical Pharmacy)	3	10	20	70	100
8T4	Pharmaceutical Chemistry-IX (Medicinal Chemistry- IV)	3	10	20	70	100
8T5	Pharmaceutics- XI Novel Drug Delivery System	3	10	20	70	100
8T6	Pharmaceutical Chemistry X- (Drug Design)	3	10	20	70	100
	Total	18	60	120	420	600
Practical:						
8P1	Pharmaceutics X (Biopharmaceutics)	3	10	20	70	100
8P2	Pharmaceutical Analysis- IV	3	10	20	70	100
8P3	Project Work					100
	Total	6	20	40	180	300
	Grand Total	24	80	160	600	900

1T1- PHARMACEUTICS- 1
(Introduction to Pharmacy)

3 hr/week

Unit-I

History of Pharmacy: Origin & development of pharmacy, scope of pharmacy, introduction to pharmacopoeias with special reference to IP, BP, USP & International Pharmacopoeia.

Pharmaceutical Additives: Coloring, flavoring & sweetening agents, Co-solvents, Preservatives, surfactants, antioxidants. & their applications.

Unit-II

Size Reduction : Definition, Principles and laws Governing size reductions factors affecting size reduction, principles, laws & factors affecting energy requirements, for size reduction different methods of size reduction, study of hammer mill, ball mill, fluid energy mill & disintegrator, various methods & equipments employed for size separation e.g. sieving, sedimentation, cyclone separator, elutriation methods.

Unit-III: Mixing: Theory of mixing, solid-solid, solid-liquid & liquid-liquid mixing equipments.

Unit-IV

Extraction & Galenicals: Extraction processes, study of infusion, decoction, digestion, Percolation, maceration & their modifications, applications in the preparation of tinctures & extracts. Factors affecting selection of extraction processes.

Unit-V Introduction to Pharmaceutical Dosage Forms: A brief theory of : Solutions, mixtures, spirits, aromatic waters, glycerins, paints, syrups, elixirs, mouth washes, mucilages, lotions, liniments, pastes, inhalations powders and ointments.

Unit-VI

Pharmaceutical calculations: Posology, calculation of doses for infants, adults and elderly patients, alcohol dilution, proof spirit.

1P1- PHARMACEUTICS-I (Practical)
(Introduction to Pharmacy)

3 hr/week

I : Preparation of following classes of Pharmaceutical dosage forms (involving the use of calculations in metrology) as official in IP, BP, USP/NF.

a) Aromatic Waters
1. Chloroform water BP
2. Camphor Water BP
3. Rose Water NF

b) Solutions
1. Lysol solution IP
2. Strong Ammonium Acetate solution BP

c) Syrups
1. Simple syrup BP/USP/IP

d) Elixirs
1. Aromatic Elixirs USP/NF

e) Spirits
1. Aromatic Ammonia spirit BP

f) Powders
1. ORS Powder IP
2. Absorbable dusting powder USP/N

g) Lotions
1. Calamine lotion IP
2. Amino benzoic acid lotion BP

h) Liniments
1. Methyl salicylate liniment BP
2. Turpentine liniment BP

i) Mucilage 1. Starch Mucilage IP

j) Glycerins 1. Kaolin Poultice BP

k) Inhalation 1. Benzoin Inhalation BP

l) Tinctures & Extracts
1. Infusion of Tea
2. Decoction of Senna
3. Compound benzoin tincture BP
4. Strong Ginger tincture BP
5. Liquorice liquid extract BP.

II: Experiments to illustrate principles of size reduction using Ball Mill.
_ Effect of size of balls, number of balls and time on the efficiency of ball mill.

III: Experiments to illustrate mixing efficiency.
_ Solid-Solid mixing.

Books Recommended:

1. Pharmacopoeia of India, The Controller of Publications, Delhi.
2. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.

3. Carter S.J., “Cooper and Gunn’s Tutorial Pharmacy”, CBS Publishers, Delhi.
4. Rawlins E.A., “Bentley’s Text Book of Pharmaceutics”, ELBS Bailliere Tyndall.
5. Lachman L,Liberman H.A and Kanig J.L., “Theory and Practice of Industrial Pharmacy”, Lea
and Febiger.
6. Cooper and Gunn’s Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.
7. Aulton, M.E, Text Book of Pharmaceutics, Vol., I & II. Churchill Livingstone.
8. United States Pharmacopoeia (National Formulary).
9. Remington – “The science and practice of pharmacy” Vol. I & II. Mack Publishing Co. Pennsylvania.

1T2- HUMAN ANATOMY, PHYSIOLOGY& HEALTH EDUCATION- I

3 Hr./week

Unit-I

A. **Scope Of Anatomy And Physiology:** Basic terminology used in anatomy and physiology.
B. **Cell And Tissues:** 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.

Unit-II

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.

Unit-III

Haemopoietic System: Composition and function of blood and its elements, their disorders, blood group and their significance, mechanism of coagulation, disorders of platelets and coagulation.

Unit-IV

Cardiovascular System And Circulation: Basic anatomy of the heart, Physiology of heart, blood vessels and circulation. Blood pressure and factors affecting B.P. Basic understanding of Cardiac cycle, heart sounds and electrocardiogram. Heart disorders.

Unit-V

Lymphatic System: Composition, formation and circulation of lymph node and spleen.

Unit-VI

Health Education: Concepts of health and disease. Classification of food requirements, balance diet, nutritional deficiency disorders, their treatment and prevention. Specification of drinking water.

Unit-VII

A. **Demography And Family Planning:** Demography cycle, family planning, various contraceptive methods.
B. **First Aid:** Emergency treatment of shock, snake bite, burns, poisoning, fractures and resuscitation methods.

1P2- HUMAN ANATOMY, PHYSIOLOGY& HEALTH EDUCATION- I (PRACTICAL)

3 Hr./week

1. Study of Human Skeleton.
2. Study of different systems of Human body with the help of charts & models.
3. Microscopic study of different tissues.
4. Recording of Blood pressure and pulse rate.
5. Basic understanding of Electrocardiogram-PQRST waves and their significance.
6. Determination of blood groups and RH factors.
7. Estimation of Hemoglobin, determination of clotting time, bleeding time, RBC count, WBC count (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.
6. Ranade VG, "Text Book of Practical Physiology", Pune Vidyarthi Griha Prakashan, Pune.
7. Difore S.H. "Atlas of Normal Histology" – Lea & Febiger Philadelphia.
8. Guyton AC, Hall JE., "Text book of Medical Physiology", WB Saunders Company.
9. Tortora GJ, & Anagnodokos NP "Principles of Anatomy & Physiology", Harper & Row Publishers, New Delhi.
10. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.

1T3- PHARMACEUTICAL CHEMISTRY- I
(ORGANIC CHEMISTRY-I)

3Hr./week

Unit I

Structure and Properties: Atomic Structure, atomic orbital, molecular orbital, hybridization, sigma and Pi bond, covalent, electrovalent and co-ordinate bond, inductive effect, mesomeric effect, electromeric effect and hyperconjugation, resonance, carbonium ion , carbanions, free radicals and carbenes, Classification and Nomenclature of organic compounds.

Unit II

Isomerism:Structural isomerism, geometrical isomerism, stereoisomerism, optical activity, specification of configuration and conformational analysis including butane and cyclohexane.

Unit III

Nomenclature, general methods of preparation and properties of the following classes of (aliphatic & aromatic) compounds, including reaction mechanisms:
Alkanes, alkenes, alkynes and dienes, alkyl halides, alcohols.

Unit IV

Aromatic Compounds: aromatic character, structure of benzene, resonance, orientation of aromatic substitution, arenes, amines (aliphatic and aromatic), phenols, aryl halides, aldehydes and ketones (aliphatic and aromatic).

1P3- PHARMACEUTICAL CHEMISTRY- I
(ORGANIC CHEMISTRY-I PRACTICALS)

3Hr./week

1. Identification of elements and functional groups in given organic compounds.
2. Purification of solvents like Benzene, Chloroform, Acetone and preparation of absolute Alcohol.
3. Synthesis of compounds involving benzoylation and acetylation.
4. Synthesis of Picric acid, Aniline, Acetanilide, Aspirin, Hippuric acid, p- Bromo acetanilide, Iodoform and Oxalic acid.

BOOKS RECOMMENDED:

1. Mann, F.G, & Saunders, B.C., Practical Organic Chemistry, ELBS/ Longman.
2. Vogel A.I., Textbook of Practical Organic Chemistry, ELBS/Longman.
3. Morrison, R.T., and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt. Ltd, New Delhi.
4. Finar, I.L., Organic Chemistry, Vol. I & II, ELBS/Longman.
5. Jain, M.K. Organic Chemistry, Sohan Lal Nagin Chand & Co. 60 B, Bunglaw Road, Delhi.
6. Hendrikson, Organic Chemistry.
7. Godly, E.W. " Naming organic compounds".
8.Kalsi," Organic reactions Stereochemistry & Mechanism".

1T4- PHARMACEUTICAL ANALYSIS –I

3 Hr./ week

Unit I

Introduction: Significance of qualitative and quantitative analysis in quality control, different techniques of analysis – preliminaries, significant figures, concept of error, mean deviation standard deviation, precision & accuracy, calibration of analytical equipments, analytical balance & its use, use of rider.

Unit II

Fundamentals of Volumetric Analysis: Methods of expressing concentration, primary and secondary standard substances, calculations of titrimetric analysis.

Unit III

Acid Base Titration: 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-Hasselbach equation, buffer solution, neutralization curves, acid-base indicators, theory of indicators, choice of indicators, mixed indicators, polyprotic system.

Unit IV

Oxidation-reduction Titrations: Concepts of oxidations & reduction, redox reaction, strengths & and equivalent weights of oxidants and reductants, theory of redox titration, Iodimetry & Iodometry, Ceric sulphate titrations, Pot. iodate, Potassium permanganate & Pot. dichromate titrations.

Unit V

Precipitation Titrations: Precipitation reactions, solubility products; Effect of acids, temperature & solvents on the solubility of a precipitate; Argentometric titrations, Mohr's & Volhard method, Fazan method, adsorption indicators,

Unit VI

Gravimetric Analysis: Principle of gravimetric analysis, precipitation methods in gravimetry, purity of the ppt; co-preciptations and post precipitation, washing and ignition of ppt; fractional precipitation, organic precipitants, preparation of Gooch crucible for filtration & use of sintered glass crucible, assays based on gravimetric analysis.

1P4- PHARMACEUTICAL ANALYSIS -I PRACTICALS

3 Hr./week

1. The students should be introduced to the main analytical tools through demonstration,. 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.

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

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

4. Oxidation Reduction Titrations: Preparation and standardization of some redox titrants e.g. potassium permanganate, Potassium dichromate, iodine, sodium thiosulphate, etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution and ceric ammonium sulphate.

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

6. Gravimetric Analysis: Preparation of gooch crucible for filtration and use of sintered glass crucible, determination of water of hydration, some exercises related to gravimetric analysis should be covered.

BOOKS RECOMMENDED:

1. Beckett. AII. And Stanlake, J.B. Practical Pharmaceutical Chemistry, Athilone Press, London.

2. Jeffery, G.II. 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, I.M. Bentley and Driver's Textbook of Pharmaceutical Chemistery. 8th ed. Oxford University Press, Delhi. 1969

4. Gary, D.C. Analytical Chemistry 4th ed. John Wiley and Sons, New York, 1986.

3hr./week

1T5- REMEDIAL MATHEMATICS

Unit-I:

Algebra

1. Linear Equations, Quadratic Equations, Equations reducible to quadratic,
2. Algebra of matrices- Addition, Subtraction, Multiplication, Inverse of matrices, Solution of Simultaneous equation by matrices
3. Partial Fraction
4. Introduction to Determinants. Cramer's Rule.

Unit-II:

Geometry

Cartesian co-ordinates, distance between two points, area of triangle, locus of points, straight line, intercept form, normal form of straight lines.

Unit-III:

Differential Calculus

1. Introduction to Limit and functions, Differential coefficient
2. Differential of standard functions, including function of a function, Logarithmic differentiation, Introduction to Partial Differentiation, Maxima and Minima of two variables(Simple Examples)

Unit-IV:

Integral Calculus

1. Indefinite Integral of standard forms
2. Integration by substitution and partial fractions
3. Integration by parts

Unit-V:

Differential Equations

1. Definition and formation of Differential equation.
2. Differential equation of first order and first degree, variable separable, homogenous and linear differential equations, pharmaceutical applications

BOOKS RECOMENDED

1. A textbook of Mathematics for XI-XII Students, NCERT Publication Vol. I-IV.
2. Loney, S.L "Plane Trigonometry" AITBS Publishers.
3. Loney, S.L "The elements of coordinate geometry" AITBS Publishers.
4. Gupta S.P. Statistical Methods, Sultan Chand and Co., New Delhi
5. Narayan Shanti, Integral calculus , Sultan Chand & Co.
6. Prasad Gorakh Text book on differential calculus, Pothishala Pvt. Ltd., Allahabad.
7. Narayan Shanti, Differential calculus , Shyamlal Charitable Trust, New Delhi.
8. Prasad Gorakh Text book on integral calculus , Pothishala Pvt. Ltd., Allahabad.
9. Vishal Mehta, " Remedial Mathematics for Pharmacy'.
10. Shyam, Patkar " Comprehensive remedial mathematics".

3 hr/ week

1T5- REMEDIAL BIOLOGY

Unit-I: General survey of Animal Kingdom. Structure and life history of parasites as illustrated
by amoeba,entamoeba, trypanosoma, plasmodium, taenia, ascaris, schistosoma, oxyuris and ancyclostoma.

Unit-II

General structure and life history of insects like mosquito, house fly, mites and silk worm.

Unit-III

Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed, modification of stems and roots.

Unit-IV

Plant cell: Its structure and non living inclusions, mitosis and meiosis, different types of plant tissues and their functions. Basic concept of molecular biology (DNA,RNA)

Unit-V

Methods of classification of plants.

Unit-VI

Introduction to Plant Genetics.

3 hr/ week

1P5 - REMEDIAL BIOLOGY PRACTICAL

PRACTICAL

1. Morphology of plant parts indicated in theory.
2. Care, use and type of microscopes.
3. Gross identification of slides of structures and life cycle of lower plants/animals mentioned in theory.
4. Morphology of plant parts indicated in theory.
5. Preparation, microscopic examination of stem, root and leaf of monocot and dicot plants.
6. Structure of human parasites and insects mentioned in theory with the help of specimens.

Books Recommended:

1. Dutta A.C. " Botany for Degree students" Oxford.
2. Marshall & Williams "Text Book of Zoology" CBS Publishers & Distrubutors, Delhi.
3. Fahn "Plant Anatomy" Aditya Books Private Limited, New Delhi.
4. Weiz, Paul B "Laboratory Manual in Science of Biology" Mc Graw-hill book company.

1T6- COMPUTER SCIENCE

3 hr/week

Unit-1:

Introduction

Definition and Overview of Computer, Computer classification, Computer Organization, Computer code, computer classification of Boolean algebra. Input Devices Output devices, Storage devices. Computer Software, Types of software. Overview of Computer Networks, LAN, MAN, WAN, Internet, Intranet, network topology. Internetworking: Bridges, Repeaters and Routers.

Unit-2:

Operating system

Operating system and function, Evolution of operating system, Batch,Interactive, Time sharing and Real Time System. Single User Operating System and Multi-user Operating system, Compare MS-DOS vs. UNIX, Various window features. Internal and External commands in MS-DOS.

Unit- 3:

Introduction to MS-OFFICE (current version), word, Document creation, Editing, formatting table handling, mail merge, Excel, Editing, working Retrieval, Important functions, short cut keys used in EXCEL.

Unit 4:

MS-Power point-Job Profile, Elements of Power point ,ways of delivering Presentation, concept of Four P's (Planning , Preparation, Practice and Presentation) ways of handling presentations e.g. creating, saving slides show controls, Adding formatting, animation and multimedia effects. Database system concepts, Data models schema and instance , Database language, Introduction to MS-Access, main components of Access tables, Queries, Reports, Forms table handling, working on Query and use of database.

Unit- 5:

Computer applications in Pharmaceutical and clinical studies, uses of Internet in Pharmaceutical Industry.

BOOKS RECOMMENDED:

1. Sinha, R.K., Computer Fundamentals, BPB Publications.
2. Raja Raman, V, Computer Programming in 'C', PHI Publication.
3. Hunt N and Shelley J. "Computers and Common Sense" Prentice Hall of India.
4. N.K.Tiwari," Computer fundamentals with Pharmacy Applications".
5. G.N.Rao, " Biostatistics & computer Applications".

1P6- COMPUTER SCIENCE (PRACTICAL) 3 hr/week

Computer Fundamentals and Programming

Software Lab to be used for the following:-

1. Windows, Managing Windows, Working with Disk , Folders and files.
2. MS-Office (MS Word, MS Power point, MS Excel, MS Access).
3. Computer Operating System like DOS and Windows.
4. Internet Features (E-mail, Browser etc.)

II SEMESTER

3Hr./week

2T1- HUMAN ANATOMY, PHYSIOLOGY & HEALTH EDUCATION- II

Unit-I

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, constipation, Diarrhea.

Unit-II

Respiratory System: Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiration. Respiratory volumes and capacities, Bronchial asthma, Emphysema.

Unit-III

A. **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, Epilepsy, Schizophrenia, Parkinson's disease.
B. **Autonomic Nervous System:** Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.

Unit-IV

Urinary System: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid -base balance, Renal Failure.

Unit-V

Reproductive System: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization, Sex differentiation, spermatogenesis and oogenesis.

Unit-VI

Endocrine System: Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones and functions.

Unit-VII

Sense Organs: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

Unit-VIII

Communicable Diseases: Brief outline, their causative agents, methods of transmission and prevention (Chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrohea and AIDS.

2P1- HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-II (PRACTICAL)

3Hr./week

1. Study of different systems with the help of charts and models.
2. Microscopic studies of different tissues.
3. Simple experiments involved in the analysis of normal and abnormal urine: Collection of specimen, appearance, determination of pH, sugars, proteins, urea and creatinine.
4. Determination of respiratory volumes and capacities by spirometer.
5. Study of surgical instruments.
6. Recording of human body temperature.

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.
6. Ranade VG, "Text Book of Practical Physiology", Pune Vidyarthi Griha Prakashan, Pune.
7. Difore S.H. "Atlas of Normal Histology" – Lea & Febiger Philadelphia.
8. Guyton AC, Hall JE., "Text book of Medical Physiology", WB Saunders Company.
9. Tortora GJ, & Anagnodokos NP "Principles of Anatomy & Physiology", Harper & Row Publishers, New Delhi.
10. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.

2T2- PHARMACEUTICAL CHEMISTRY- II
(ORGANIC CHEMISTRY-II)

3Hr./week

Unit I

Methods of preparation with mechanism, properties and mechanism of name reaction associated with:

a. Carboxylic acids & their derivatives, di & tricarboxylic acids, hydroxy acids. Organometallic Compounds, Grignard reagent, organolithium compounds.

b. ά, β- Unsaturated carbonyl compounds, cycloaddition.
Compounds containing active methylene group and their synthetic importance- Acetoacetic ester and malonic ester.

Unit II

Heterocyclic Compounds:

Nomenclature, Chemistry, preparation, properties of-
5-membered heterocycles with one hetero atom (Pyrrole, Furan and Thiophene)
5-membered heterocycles with two hetero atoms (Imidazole, Thiazole, Oxazole, Pyrazole)
6-membered heterocycles with one hetero atoms (Pyridine, Pyran)
6-membered heterocycles with two hetero atoms (Pyrimidine, Piperazine)
Benz fused heterocycles (Quinoline, Isoquinoline, Indole)

Unit III

Name Reactions: - Wolf-Kishner reduction, Clemensen reduction, Birch reduction, Meervien-Pondroff Varley reduction, Oppenaur oxidation, Bayer-Villiger oxidation, Backman, Hoffman, Curtius, Schimdt & Pinacol-pinacolone rearrangement, Wittig reaction, Aldol condensation and Claisen condensation.

2P2- PHARMACEUTICAL CHEMISTRY-II
(ORGANIC CHEMISTRY-II Practical)

3Hr./week

1. Identification of organic compound with derivatisation.
2. Synthesize the organic compounds involving Oxidation, Reduction, Rearrangement, Substitution, Condensation, Diazotization reactions.

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 Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Morrison, T.R. and Boyd, R.N., Organic Chemistry, Prentice Hall of India, Private Limited,New Delhi.
4. Finar, I.L., Organic Chemistry Vol. I & II, ELBS/Longman.
5. Jain, M.K. and Sharma S.C, Organic Chemistry, Shoban Lal Nagin Chand & Co., Delhi.
6. Kalsi," Organic Reactions Stereochemistry & Mechanism".

2T3- PHARMACEUTICAL CHEMISTRY-III
(INORGANIC CHEMISTRY)

3 Hr./Week

Methods of preparation, limit tests, chemical properties, and uses of the following:

Unit I

Major Intra and Extra Cellular Electrolytes: Major physiological ions, electrolytes used in replacement therapy (sodium chloride and ptoassium chloride), physiological acid - base balance, electrolytes used in acid base therapy (sodium acetate, potassium acetate, sodium bicarbonate, sodium citrate, potassium citrate, sodium lactate and ammonium chloride). Electrolyte combination therapy, oral rehydration mixtures & rehydration therapy.

Unit II

Gastrointestinal Agents:

a. Antacids: Sod. bicarbonate, aluminium hydroxide, Magnesium carbonate, magnesium trisillicate,magnesium oxide, magaldrate.
b. Protectives and Adsorbants: Kaolin.
c. Saline cathartics: Sodium potassium tartarate and magnesium sulphate.

Unit III

Topical Agents:

a. Protective: Talc, zinc oxide, Calamine, Zinc stearate and Titanium dioxide.
b. Antimicrobials: Hydrogen peroxide, potassium permanganate, chlorinated lime, boric acid, silver nitrate, mercury, yellow mercuric oxide and selenium sulphide.
c. Astringents: Alum and zinc sulphate.

Unit IV

Dental Products:

a. Anti-caries Agents: Sodium fluoride, stannous fluoride.
b. Dentifrices: Calcium carbonate, dicalcium phosphate, sodium metaphosphate, zinc chloride.

Unit V

Radiopharmaecuticals and Contrast Media: Radiopharmaceuticals, radiopharmaceutical preparations and radio – opaque contrast media

Unit VI

Pharmaceutical aids and Necessities:

Official Inorganic Acids: Boric acid, Phosphoric acid.

i. Official inorganic Bases: Strong ammonia solution, calcium hydroxide potassium hydroxide, sodium carbonate.
ii. Buffers: study of various pharmacopoeial buffer systems.
iii. Anti-oxidants: Hypophosphorus acid, sodium bisulphite sodium thiosulphate, sodium nitrite .
iv. Water: Official waters.
v. Pharmaceutically Accepted Glass: Chemistry, types and tests.

Unit VII

Miscellaneous Inorganic Pharmaceutical Agents:

a. Inhalants: Oxygen, carbon dioxide,nitrous oxide
b. Respiratory stimulants: ammonium carbonate.
c. Expectorants and Emetics: Ammonium chloride, potassium iodide and antimony potassium tartrate.
d. Antidotes: Sodium nitrite.

2P3- PHARMACEUTICAL CHEMISTRY-III
(INORGANIC CHEMISTRY PRACTICAL)

3Hr./Week

1. Limit test for impurities in pharmaceutical substances.
2. Preparation of Pharmaceutical inorganic compounds.
3. Identification test for Cations and anions as indicated in the appendix of I.P.
4. Assay of important pharmacopoeiainorganic compounds.

BOOKS RECOMMENDED :

1. Block, J.H. Roche, E, Soine, T and Wilson, C., "Inorganic, Medicinal & Pharmaceutical Chemistry", Lea & Febiger.
2. Discher, C.A.,et.al Modern Inorganic Pharmaceutical Chemistry, waveland press.
3. Pharmacopoceia of India, 1996 edition.
4. Atherden L.M., Bentley and Drivers' "Text Book of Pharmaceutical Chemistry", Oxford University Press, London.

2T4-PHARMACEUTICAL BIOSTATISTICS

3hr/week

Unit-I

Introduction to Statistics

Collection of data, Diagrammatic representation of data, Classification and tabulation of data, Measure of Central tendency (Mean, Mode, Median), Measure of Dispersion (Quartile Deviation, Standard Deviation, Range, Mean Deviation, Variance), Standard Error, Moments, Skewness and Kurtosis.

Unit-II

Correlation and Regression

Introduction, Types of Correlation -Positive or negative, Simple, Multiple or Partial Correlation. Karl Pearson Coefficient of Correlation. Regression-Line of Regression, method of finding regression lines, scatter diagram method, method of least squares. Examples of all methods for correlation and regression.

Unit-III

Statistical Inference-Test of hypothesis

Introduction- Sample and Population. Large and small Samples, Importance of sampling, sampling methods, Sampling with and without replacement.

Introduction, testing of hypothesis – Definitions of hypothesis, statistical hypothesis, null hypothesis, alternative hypothesis, test of a hypothesis, critical region, types of error in testing a hypothesis, level of significance, two –tailed test and one tailed tests, degrees of freedom.

t-test for testing the significance of a single mean, t-test for testing the significance of difference between two means. Z-test for large samples. attributes, Chi-Square test for testing independence of attributes.

Unit-IV

Analysis of variance

Introduction, assumptions of analysis of variance, analysis of variance for one way classification, analysis of variance for two way classification, Examples of one way classification and two way classification.

Unit-V

Experimental designs in clinical research

Introduction, types of designs- parallel design, cross over design-two way and three way cross over, Replicate design. Merits and Demerits of all methods.

BOOKS RECOMMENDED

1. A textbook of Mathematics for XI-XII Students, NCERT Publication Vol. I-IV.
2. Gupta S.P. Statistical Methods, Sultan Chand and Co., New Delhi.
3. Greval B.S., Higher Engineering Mathematics, Khanna Publication, New Delhi.
4. Boltan's Pharmaceutical Statistics, Practical and Clinical Application, Marcel Dekker, N.Y
5. Khan, Khanum," Biostatistics for Pharmacy".
6. Sharma J.K., "Business Statistics", PHI Publication

3 hr/ week

2T5- PROFESSIONAL COMMUNICATION-I

Unit-I

1. Letter writing, Précis and Essay writing Comprehension, Speed reading.
2. Written skills:
   - _ Proposal writings formats.
   - _ Report writings
   - _ Business letters
   - _ Applications
   - _ Covering letters.
   - _ Curriculum Vitae Designing

Unit-II

Presentation techniques, - Tips.
Importance of non-verbal communication,
Debates, Group Discussions (G.D), Extempore

Unit-III

Working on accent neutralisation, pauses, stresses, non words, voice modulation, eye contact for small & large groups.

Unit-IV

Personality types. [06]
Decision making
Motivation
Attitude
Thinking

Unit-V

1. Corporate behaviour, corporate expectation, office etiquettes.
2. Productivity, Time Management simulation exercise
3. Leadership Skills.
4. Team work 'BSC' – Boss, Subordinates & Collegues

Books Recommended

1. Robbins, S "Organisational Behaviour"
2. Raman, Meenakshi & Sharma Sangeeta, Technical Communications- Principles & Practice, Oxford University Press.
3. Sharma R.C. & Krishna Mohan, Business Correspondence & Report Writing, Tata Mc Graw Hill Co.
4. Lesikar RV, Lesikar's Basic Business Communication.

SEMESTER-III

3 hr/week

3T1- PHARMACEUTICS-II
(UNIT OPERATIONS-I)

Unit-I

1. **Unit Operations:** Introduction, basic laws.

2. **Fluid Flow:** Types of flow, Reynold's number, Viscosity, Concept of boundary layer, basic situations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.

Unit-II

3. Water systems – Raw water, soft water, purified water, water for injection, quality requirements and treatment of water. washing, cleaning and standardisation of cleaning.

4. Filtration and Centrifugation : Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter. Factors affecting filtration, Principles of centrifugation, industrial centrifugal filters and centrifugal sedimenters.

Unit-III

5. Crystallization: Characteristics of crystals like-purity, size, shape, geometry, habit, forms, size and factors affecting them, Solubility curves and calculation of yields. Material and heat balances around Swenson Walker Crystallizer. Super-saturation theory and its limitations, Nucleation mechanisms, crystal growth, Study of various types of Crystallizer, Tanks, agitated batch, Swenson Walker, Single vacuum, circulating magma and Krystal crystallizer, Caking of crystals and its prevention.

UNIT – IV

6. Heating, Ventilation & AC Systems: Basic concepts and definition, wet bulb and adiabatic saturation temperatures, Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipment for dehumidification operations, Principles and applications of refrigeration and air conditioning.

Unit-V

7. Material of Construction: General study of composition, corrosion, resistance, Properties and applications of the materials of construction with special reference to stainless steel and glass.

8. Industrial Hazards and Safety Precautions: Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, Accident record.

3 hr/week

3P1- PHARMACEUTICS-II
(UNIT OPERATIONS-I PRACTICAL)

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 Number.
3. 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.
4. Study principle of centrifugation for
a) Liquid –Liquid separation and stability of emulsions.
b) Solid – liquid separation and stability of suspension.
5. Determination of dry bulb and wet bulb temperatures and use of Psychrometric charts.
6. Study of characteristics of crystals
7. 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. Sambhamurthy, Pharmaceutical Engineering, New Age Publishers.
5. Gavhane, K.A. “Unit Opeation-I”, Nirali Prakashan.

3T2- PHARMACOLOGY-I

3 hr/week

Unit I

General Pharmacology: Definition, scope and branches of Pharmacology. History of development of pharmacology, sources of drugs, Routes of drug administration. Pharmacokinetics-ADME Basic pharmacokinetic parameters employed in the use of drugs, their bioavailability and biotransformation, enzyme induction and enzyme inhibition. Mechanism of drug action, principles of drug action, drug receptors and cellular signaling systems, Therapeutic index, LD50 and ED50. Drug antagonism and combined effects of drugs. Factors modifying drug action. Adverse drug recations, Drug tolerance and drug dependence, Iatrogenic diseases, Discovery and development of new drugs.

Unit II

Autonomic Nervous System: Study of general pharmacology, classification, mechanism of action, pharmacology, uses, side effects, drug interaction and contra indication of the following category of drugs.

Parasympathomimetics and parasympatholytics, Sympathomimetics and adrenergic receptor and neuron blocking agents.

Drugs acting on autonomic ganglia.

Unit III

Autocoids:

Histamine and antihistaminics

Serotonin, its agonists and antagonists

Prostaglandins (arachidonic acid metabolites)

Angiotensin, plasmakinins, neurotensin substance P, PAF and leukotrienes

3P2- PHARMACOLOGY-I (PRACTICAL)

3 hr/week

1. Use of computer simulated CDs or Video cassetes for pharmacology practical where possible.
2. Preparation of different solutions for experiments. Drug dilutions, use of molar and w/v solutions in experimental pharmacology.
3. Common laboratory animals and anesthetics used in animal studies.
4. Commonly used instruments in experimental pharmacology.
5. Standard experimental techniques of blood collection
6. Procedures for rendering animals unconscious; pithing, chemical euthanasia.
7. Study of different routes of administration of drugs in mice/rats.
8. To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone sleeping time in mice.
9. Effect of drugs on ciliary movement of frog using computer simulated softwares.

Books Recommended:

1. Tripathi K.D, "Essentials of Medical Pharmacology".
2. Laurence D.R and Bennett P.N., "Clinical Pharmacology".
3. Katzung, B.G. Basic & Clinic Pharmacology, Prentice Hall, International.
4. Satoskar and Bhandarker, "Pharmacology and Pharmacotherapeutics", Popular Prakashan Pvt LTd. Bombay.
5. Goodman A., Gilman R.W.T., Nies A.S. and Palmer T., "Goodman and Gilman's Pharmacological Basis of Therapeutics".
6. Barar F.S.K., "Essentials of Pharmacotherapeutics".
7. Rang H.P., Dale M.M., Ritter J.M., Mouse P.K. 5th ed. Pharmacology.
8. Kulkarni S. K., Handbook of Experimental Pharmacology, Vallabh Prakashan, Delhi.
9. Ghosh M. N., Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
10. Grover J.K, Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.

3T3- PHARMACEUTICAL CHEMISTRY-IV
(CHEMISTRY OF NATURAL PRODUCTS)

3Hr./week

Unit-I

1. Phytochemical identification test of steroids, carbohydrates, terpenoids, aminoacids and proteins, alkaloids, flavonoids and saponins.
2. Different techniques of extraction and isolation of natural compounds.

Unit II

1. **Carbohydrates**: Classification, monosaccharides, glucose, fructose and their reactions, configuration of aldoses, cyclic structure of D-glucose, mutarotation and conformations, disaccharides, maltose, lactose, sucrose, polysaccharides, starch, cellulose.

2. **Glycosides**: Classification, Salicin, amygdalin, cardiac glycosides.

3. **Proteins and Amino acids**: classification Preparation, properties and end group analysis. Protein structure (Primary, secondary, tertiary and quaternary).Nucleoproteins and nucleic acids and general knowledge of nitrogenous bases in nucleic acids, structure of nucleosides and nucleotides, structure of nucleic acids.

4. **Lipids**: Fats, oils and waxes, fatty acids, physical and chemical properties and analysis of lipids, general knowledge of phospholipids, lecithins, cephalins, sphingomyelins, glycolipids.

5. **Terpenoids**:, classification, general methods of determining structure with reference to citral, menthol and camphor (Fundamental chemistry including characterstic reaction only).

6. **Alkaloids**: General methods of determining structure of alkaloids, including structures elucidation of ephedrine, nicotine and atropine.

7. **Puriens and Pyrimidenes:** Structure elucidation of uric acid, caffeine, theobromine and theophylline.

8. **Steriods** :Stereochemistry of steroids and Structural features of cholesterol (excluding chemistry)

3P3- PHARMACEUTICAL CHEMISTRY-IV
(CHEMISTRY OF NATURAL PRODUCTS PRACTICALS)

3Hr./week

1. Experiments based on the determination of saponification value, acid value, ester value and iodine value of vegetable oils.
2. Extraction and isolation of starch, alkaloids and glycosides.
3. Estimation of alkaloids, fats, fixed oils and volatile oils.

BOOKS RECOMMENDED:

1. I.L. Finar, Organic chemistry, Vol. II, 1st Indian ed., Pearson Education Pte Ltd Indian Branch, Delhi, 2002.
2. O.P. Agarwal, Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.
3. Indian pharmacopoeia

3T4- PHARMACEUTICAL ANALYSIS -II

3 Hr/week

Unit I

Complexometric Titrations: Concept of complexation and chelation, Warner's coordination, masking and demasking agents types of complexometric titration, metal – ion indicators, factors influencing stability of complex, its applications.

Unit II

Non-aqueous Titrations: General discussion of titrations in non- aqueous medium, classification of non-aqueous solvents, advantages, titrations with Perchloric acid, Potassium methoxide and Tetrabutyl ammonium hydroxide; indicators.

Unit III

Miscellaneous Methods of Analysis: Diazotization titration, Kieldahl Nitrogen determination, Karl–Fischer titration, determination of alcohol in liquid galenicals, oxygen flask combustion and gasometry.

Unit IV

Electrochemistry: The electric cell, electrode potential, half-cells, types of half-cells, Nernst of equation, salt bridge, reference electrodes, and indicator electrodes.

A. Potentiometry: Theoretical Considerations ion of selective electrodes, measurement of potential, detection of end-point, analytical applications, Ph measurement.
B. Conductometric and High Frequency titrations and their applications.
C. Coulometric titrations: Principle and applications, advantages and limitations, electrode selection.
D. Amperometric titrations and its applications.
E. Nephlometry and turbidimetry.
F. Polarography.

3P4- PHARMACEUTICAL ANALYSIS-II (PRACTICAL)

1. Non-aqueous titrations: Preparation and standardization of perchloric acid. Estimation of some pharmacopoeial products.
2. Complexometric titrations: Preparation and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titration.
3. Exercises involving diazotization, Karl-Fischer methods.

BOOKS RECOMMENDED:

1. Beckett, A H and Stenlake, J.B, Practical Pharmaceutical Chemistry, Vol I and II, The Athlone Press of the University of London.
2. Pharmacopoeia of India, published by The Controller of Publications, Delhi.
3. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.
4. Mendham J. Denny RC Barnes, J.D. Thomas M.J.K. "Vogel's Text Book of Quantitative Chemical Analysis" Pearson Education Asia.
5. Connors KA, A text book of Pharmaceutical Analysis, Wiley Intescience, New York

3T5- PHARMACOGNOSY – I

3 hr/ week

Unit-I : Definition history, scope & development of Pharmacognosy.
1. Source of Drug : Biological, marine, mineral and plant tissue cultures as source of drugs Marine pharmacognosy, Novel medicinal agents from marine sources.
2. Classification of Drugs : Alphabetical, Morphological, taxonomical, chemical & pharmacological.

Unit-II : 3. Plant taxonomy : Study of following families with special reference to medicinally important plants – Apocynacae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Labitae, Acanthaceae, Compositae, Papaveraceae.

Unit-III : 4. Cultivation, Collection, Processing & Storage of crude drugs :
A. Factors influencing cultivation of medicinal plants, type of soils & fertilizers of commonuse.
B. Pest & Pest Management, natural pest control agents.
C. Plant hormones and their applications.
D. Polyploidy, Mutation & hybridization with reference to medicinal plants.
E. Poly Houses/ Green Houses for cultivation, Herbarium techniques.

Unit-IV : 5. Quality Control of crude drugs : Evaluation of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation including Quantitative microscopy in reference to WHO guidelines for standardisation of medicinal plants. Adulteration of crude drugs

Unit-V : 6. Systematic pharmacognostic study of following :
a) Carbohydrates & derived products : Agar, Guar gum, acacia, Honey, Isabgol, pectin, starch, sterculia & tragacanth.
b) Lipids – Beeswax, castor oil, Cocabutter, hydnocarpus oil, shark liver oil, Linseed oil, wool fat, Neem oil, Olive oil.

3P5- PHARMACOGNOSY - I (PRACTICAL)

3 hr/ week

Practicals based on theory.

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
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.
7. Schewer PJ, “Marine Natural products”, Academic press, London.
8. Mohammed Ali, “ Pharmacognosy & Phytochemistry”.

3T6-PHARMACEUTICS- III
(HOSPITAL PHARMACY)

` **3 hr/week**

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

Unit-II : Drug Store Management and Inventory Control: Organization of drug., Types of materials stocked, storage conditions.
Purchase and Inventory control: Principles, purchase procedures, purchase order, procurement and stocking.

Unit-III : Central Sterile Supply Unit and their Management: Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.
Manufacture of Sterile and Nonsterile Products: Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, Master formula record , Production control, Manufacturing records.

Unit-IV: Drug information service: Sources of information on drugs, treatment schedules, procurement of information, computerized services (e.g. MEDLINE), Retrieval of information, Medication error.
Records and Reports: Prescription filling drug profile, Patient medication profile, case on drug interaction & adverse reactions, idiosyncratic cases etc.

Unit-V: Drug distribution systems in Hospitals: Out-patient dispensing, methods adopted, Dispensing of drugs to in-patients. Types of drug distribution systems Charging Policy, labeling, Dispensing of drugs to ambulatory patients, Dispensing of controlled drugs.
Nuclear Pharmacy : Introduction to Radiopharmaceutics- radio-active half life, Units of radioactivity. Production of radio pharmaceuticals, methods of isotonic tagging, preparation of radioisotopes in laboratory using radiation dosimetry, radio-isotope generators, permissible radiation dose level, Radiation hazards and their prevention, specifications for radio-active laboratory.

Books Recommended
1. Hasan, Hospital Pharmacy, Lea & Febiger, Philadelphia.
2. Merchant H.S. and Qadry J.S. Text Book of Hospital Pharmacy, B.S. Shah Prakashan, Ahmedabad.

SEMESTER-IV

4T1- PHARMACEUTICS-IV
(UNIT OPERATIONS – II)

3 hr/week

Unit-I : Stoichiometry: Unit processes material and energy balances, molecular units, mole fraction, tie substance, gas laws, mole volume, primary and secondary quantities, equilibrium state, rate process, steady and unsteady states, dimensionless equations, dimensionless formulae, dimensionless groups, different types of graphic representation.

Unit-II: Evaporation: Basic concepts of phase equilibria, factors affecting evaporation, Evaporators, film evaporators, single effect and multiple evaporators.

Unit -III : Distillation : Raoult' s law, Phase Diagrams, volatility, simple steam and flash distillations , principles of rectification, Mccabe thiele method for the calculations of number of theoretical plates, Azeotropic and extractive distillation .

Unit –IV: Drying: Moisture content and mechanism of drying, rate of drying and time of drying calculations, classification and type of dryers, dryers used in pharmaceutical industries Tray dryer, Fluidized bed dryer, spray dryer and special drying methods.

Unit-V: Automated Process Control Systems: Process variables, temperature, pressure, flow level and vacuum and their measurements. Elements of automatic process control and introduction to automatic process control systems. Elements of computer aided manufacturing (CAM). Reactors and fundamentals of reactor design for chemical reactions.

Unit-VI: Compaction and Compression
Objectives, theory, process of compression, effect of compressional force of powders/granules. Applications in tablet dosage forms (direct compression, etc.) Hecker and Kawakita equations.

4P1- PHARMACEUTICS –IV
(UNIT OPERATIONS-II PRACTICAL) 3 hr/week

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.
5. Experiments based on
a) Steam distillation
b) Extractive distillation
c) Azeotropic distillation
6. Elementary knowledge of engineering drawing
_ Alphabets/ letter writing
_ Scales
_ Orthographic projections – First and third angle projection methods
_ Simple Isometric views

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.

4T2- PHARMACOLOGY-II

3 hr/week

Unit I

Drugs Acting On Central Nervous System: General anesthetics, alcohol, sedatives and hypnotics, central analgesics, antipyretics, NSAIDs, opiods and their antagonists, antigout drugs, anticonvulsants, antipsychotics, antianxiety, antidepressant drugs, antimanic drugs, antiparkinsonism drugs, cerebroactive drugs, drug addiction and abuse.

Unit II

Drugs Acting On Peripheral Nervous System: Local anesthetics, Neuromuscular blocking agents and centrally acting muscle relaxants.

Unit III

Drugs Used In Ocular Pharmacology: Mydriatics, Miotic agents and drugs used in glaucoma.

Unit IV

Drugs Acting On Respiratory System: Expectorants, Antitussive, Anti asthmatics.

Unit V

Drugs Acting On GIT: Carminatives, Antacids and treatment of peptic ulcer, Purgatives and laxatives, Antidiarrhoal drugs, Emetics and antiemetics, Digestants.

4P2-PHARMACOLOGY-II (PRACTICAL)

3 Hr./week

1.The study of pentobarbitone induced hypnosis (demonstration)
2.Determination of analgesic activity.
3.Determination of anticonvulsant activity of drugs.
4.Determination of muscle relaxant activity of drugs.
5.Determination of anti-inflammatory activity of drugs.
6.Determination of CNS stimulant and depressant activity of drugs.
7.Effect of autonomic drugs on rabbit eye using computer simulated softwares.

Books Recommended:

1. Tripathi K.D, "Essentials of Medical Pharmacology".
2. Laurence D.R and Bennett P.N., "Clinical Pharmacology".
3. Katzung, B.G. Basic & Clinic Pharmacology, Prentice Hall, International.
4. Satoskar and Bhandarker, "Pharmacology and Pharmacotherapeutics", Popular Prakashan Pvt LTd. Bombay.
5. Goodman A., Gilman R.W.T., Nies A.S. and Palmer T., "Goodman and Gilman's Pharmacological Basis of Therapeutics".
6. Barar F.S.K., "Essentials of Pharmacotherapeutics".
7. Rang H.P., Dale M.M., Ritter J.M., Mouse P.K. 5th ed. Pharmacology.
8. Kulkarni S. K., Handbook of Experimental Pharmacology, Vallabh Prakashan, Delhi.
9. Ghosh M. N., Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
10. Grover J.K, Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.

4T3- PHARMACEUTICAL CHEMISTRY-V
(BIOCHEMISTRY)

3 Hr./week

Unit-I:

1. Enzymes: Nomenclature, enzymes-kinetics and mechanism of action, mechanism of Inhibition of enzymes and is enzymes in chemical diagnosis.

2. Co-enzymes: Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance.

Unit-II

3. Carbohydrate metabolism: Glycolysis, Gluconeogenesis and Glycogenolysis. Pentose phosphate pathway.

4. The citric acid cycle, significance, reactions and energetics of the cycle. Blood sugar and its regulation, Abnormalities of carbohydrate metabolisms.

Unit-III

5. Lipid metabolism: Oxidation of fatty acid & energetics, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids., regulation of lipid metabolism, essential fatty acids. cholesterol metabolism, abnormalities of lipid metabolism.

6. Biological Oxidation : The respiratory chain, its role in energy capture & control, Energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation.

Unit-IV

7. General biochemical raction of amino acids like transamination, deamination and decarboxylation, urea cycle, biosynthesis of purine and pyrimidine., formation of deoxyribonucleotides. Abnormalities of nucleic acid metabolism.

8. Biosynthesis of RNA, DNA replication, Carcinogensis & DNA repair mechanism.

Unit-V

9. Genetic Code and Protein synthesis, components of protein synthesis, inhibition of protein synthesis.

10. Genetic diseases.

4P3- PHARMACEUTICAL CHEMISTRY-V
(BIOCHEMISTRY PRACTICAL)

3hr/week

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH
2. Determination of glucose by means of the enzyme glucose oxidase.
3. Effects of temperature on the activity of alpha amylase.
4. Estimation of cholesterol in Blood.
5. Estimation of Glucose in blood & urine.
6. Estimation of Urea in blood.
7. Qualitative analysis of normal as well as abnormal constituents of Urine.
8. Food analysis.

BOOKS RECOMMENDED :

1. Jayaraman J., Laboratory Manual in Biochemistry, Wiley Eastern Limited.
2. Plummer, David J., An Introduction to Practical Biochemistry, Mc Graw Hill, New Delhi.
3. Singh S.P., Practical Manual to Biochemistry, CBS Publisher, New Delhi.
4. "Harpers Review of Biochemistry" Lange Medical Publication.
5. Conn E.E. & Stumph P.K., Outline of Biochemistry, John Willery & sons, New York.
6. Nelson DL & Cox MM, Lehninger Principles of Biochemistry, Macmillan Worth Publishers.
7. Stryer L., Biochemistry, WH, Freeman & Company, San Francisco.
8. Harrow B. & Mazur A., Text book of Biochemistry, W.B. Saunders Co., Philadephia.
9. Narayanan P., Bioinformatics- A Premier, New Age International Publishers Delhi.
10. Nelson, L.David, ' Lehninger , Principles of Biochemistry".

4T4- PHARMACEUTICAL MICROBIOLOGY

3 hr/week

Unit-I:

1. Introduction to the History & scope of microbiology.
2. Structure of bacterial cell.
3. Classification of microbes and their taxonomy: Bacteria and viruses.
4. A brief study on rickettsias, Chlamydia, Mycoplasma, protozoa.

Unit-II:

4. Identification of Microbes: Stains and types of staining techniques, different microscopic techniques used in microbiology.
5. Nutrition, cultivation & isolation of bacteria & viruses.

Unit-III:

6. Control of microbes by physical and chemical methods.

A. Disinfection, factors influencing disinfectants, dynamics of disinfection disinfectants and antiseptics and their evaluation.

B. Sterilization, different methods, validation of sterilization methods & equipments.

Unit-IV:

7. Microbial assays of antibiotics, sterility testing as per I.P.
8. Introduction to common microbial pathogens, virulence & Pathogenicity, nosocomial infection, control of hospital infections.

BOOKS RECOMMENDED:

1. Aneja K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom Cultivation, Vishwa Prakashan.
2. Gunasekaran P, Lab Manual of Microbiology, New Age Publishers.
3. Davis, Dulbetco, Eisen Microbiology.
4. Stanier R.Y., Ingraham, J.L., Wheelis M.L. & Painter P.R. General Microbiology, Macmillan Press Limited.
5. Hugo and Russell, Pharmaceutical Microbiology, Black Well Scientific Publication, Oxford.
6. Prescott L.M., Harley J.P. & Klien D.A. Microbiology, McGraw Hill.
7. Sykes, Disinfection and Sterilization.
8. Pelczar & Reid, Microbiology, Tata Mc Graw Hill, Delhi.
9. Virella G. Microbiology and Infectious Diseases, William & Wilkins.
10. Ananthanarayan R & Paniker CKJ, Textbook of Microbiology, Orient Longman.

4P4- PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)

3hr/week

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

SUGGESTED PRACTICALS

1. Study of sterilization methods & equipments such as dry heat and moist heat sterilization.
2. Preparation of various types of culture media.
3. Isolation of bacteria.
4. Sub-culturing of common bacteria, fungi, yeast.
5. Identification and staining of bacteria by simple staining, Gram staining, acid fast staining and Hanging drop method.
6. Evaluation of disinfectants and antiseptics.
7. Test for sterility of pharmaceutical products as per IP.
8. Microbial assay of antibiotics as per IP.

4T5- PHAMACOGNOSY – II

3 hr/ week

Unit-I : Resins : Study of drugs containing Resins and Resin Combination like Podophyllum, Cannabis, Capsicum, Shellac, Asafoetida, Balsam of tolu, Balsam of peru, Benzoin, Turmeric, Ginger.

Unit-II : Volatile oils : General methods of obtaining volatile oils from plants, Study of volatile oils from Mentha, Coriander, Cinnamon, Jatamansi, Cumin, Black pepper, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Sandalwood

Unit-III : Phytochemical Screening : An introduction to active constituents of drugs : Extraction, isolation, classification, properties and Qualitative chemical tests of the followings –
Alkaloids, glycosides, flavanoids and volatile oils.

Unit-IV : Fibres : Study of fibres used in pharmacy such as cotton, silk, wool, jute and Hemp
Pharmaceutical aids :- Study of Pharmaceutical aids like Talc, Diatomite, Kaolin, Bentonite, Fullers earth, Gelatin and Natural colors.

Unit-V : Utilization of aromatic plants & desired products will special reference to Sandalwood oil, Mentha oil, Lemon grass oil, Vetiver oil, Geranium oil & Eucalyptus oil.
Role of aromatic plants in national economy.

4P5- PHARMACOGNOSY – II (PRACTICAL)

3 hr/ week

Study of crude drugs mentioned in theory.

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.
7. Mohammed Ali," Pharmacognosy & Phytochemistry".

4T6- ENVIRONMENTAL STUDIES

3 hr/ week

Unit-I Environment studies

A- Definition, scope, importance& multidisciplinary nature of Environmental Studies
B- Natural Resources – renewable & non renewable
C- Use, utilization, exploitation and associated problems of forests, Water resources, Mineral resources, Food resources, Energy resources, Land resources.
D- Equitable use of resources for sustainable life style, role of an individual in conservation.

Unit-II Ecosystems
A. Introduction, types features & functions of different ecosystems- Forest Grassland, Desert and Aquatic.
B. Biodiversity & its conservation with special reference to India.
C. Biogeochemical cycles and their importance (Carbon, Nitrogen, Phosphorus)

Unit-III- Environmental pollution
Air, Water, Soil, Marine, Noise, Thermal, Nuclear- Introduction causes and control measures.

Unit IV - Laws related to Environmental Protection
Primary and Secondary pollutants
Air (Prevention and Control of pollution)Act 1987
Water prevention & Control of Pollution Act. 1974
Environmental Protection Act -1986
Forest Act 1980
Wild Life Act, 1972
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Books Recommended
1. Principles of Environmental Studies, C. Manoharachary, P. Jyaranama Reddy, Pharma Book Syndicate, Hyderabad.
2. Handbook of Environmental Laws, Acts, Guidelines, Compliances & Standards Vol. I &II. R.K.Trivedy, Pharma Book Syndiacte, Hyderabad
3. Relevant Acts & Rules published by Govt. of India with latest amendments.
4. Reddy, M.Anji , ‘ Text Book of Environmental Sciences & Techgnology”.

SEMESTER- V

5T1- PHARMACEUTICS- V
(PHARMACEUTICAL TECHNOLOGY –I)

3 hr/ week

Unit-I: Preformulation studies:
Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability.

Unit-II : Liquid Dosage Forms : Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavours and others, Manufacturing packaging & evaluation of clear liquids, suspensions and emulsions.

Unit-III : 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.

Unit-IV: Suppositories: Ideal requirements, bases, manufacturing procedure, packaging and evaluation.
Pharmaceutical Aerosols: Definition, Propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications.

Unit-V: Cosmetology and cosmetic Preparations: Structure of skin, formulation of cold cream, vanishing cream, and cleansing cream, all purpose cream, protective cream, antiperspirants, deodorant, face powder. Hair structure, shampoos, conditioners, shaving and after shaving products, dentifrices & mouthwashes, lipsticks and nail lacquers.

Unit-VI: Surgical Products: Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc, bandages, adhesive type, protective cellulosic hemostasis, official dressings, absorbable and non absorbable sutures, ligatures and catguts.

5P1- PHARMACEUTICS- V
(PHARMACEUTICAL TECHNOLOGY-I PRACTICAL)

3 hr/week

1. Preparation of cold cream, vanishing cream, cleansing lotion and creams. Moisturising creams, Skin tonics, Hair creams, Hair Conditioners, Shampoos, Shaving creams and sticks. Tooth powder, Tooth pastes, After shave lotion and other cosmetic preparations.
2. Preparation, evaluation and packing of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, eye drops, eye ointments etc.

Suggested Practicals

1. Preparation, evaluation, and packing of (10 preparations =5 labs)

I- Liquid Orals

a) Solutions : Strong Sodium salicylate oral solution BP
Chloral hydrate oral solution BP
b) Suspensions : Magnesium sulphate oral suspension BP
Milk of magnesia IP Aluminium hydroxide gel IP
c) Emulsions : Liquid paraffin oral emulsion BP

II – Semi-Solids

d) Ointments Salicylic acid ointment BP
Whitfield ointment BP
Compound benzoic acid ointment

III - Suppositories

e) Suppositories : Glycerin suppositories BP
Lactic acid suppositories BP

3. Preparation of cosmetic preparations (30 preparation = 10 labs)

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

Books Recommended

1. Remington's Pharmaceutical Sciences, Vol. I & Vol. – II, Mack Publishing Co., U.S.A.
2. J.W. Cooper, & G. Gunn, Tutorial Pharmacy, Petman Books Ltd., London.
3. Lachman L., Lieberman H.A, Kanig J.L, Theory and Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.
4. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.
5 R.L. Juliano, Drug Delivery Systems, Oxford University Press, Oxford.
6. Harrys Cosmetology

7. Balsam and Sagarin, Cosmetics: Science and Technology.
8. Thomssen E.G. Modern Cosmetics, Universal Publishing Corporation.
9. Mittal B.M. & Saha R.N.-a handbook of cosmetics, Vallabh Prakashan.
10. Harry G.Brittain," Polymorphin in Pharmaceuticals Solids".

5T2- PHARMACEUTICS- VI
(PHYSICAL PHARMACY)

3 hr/week

Unit-I :(A) Matter, properties of Matter: States of matter, change in the state of matter, latent heat and vapor pressure, sublimation critical point, Eutectic mixtures, gases, relative humidity, liquid complexes, liquid crystals, glassy state, solids-crystalline, amorphous and polymorphism.

(B) Kinetics and Drug Stability: General considerations & concepts, Degradative pathways, half life determination, Influence of temperature, light, solvent, catalytic species and other factors, Accelerated stability study, expiration dating. ICH guidelines for stability.

(C) Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting is tonicity.

Unit-II: Micromeritics and Powder Rheology: Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

Unit-III : Surface and Interfacial Phenomenon : Liquid interface, surface and interfacial tension, surface free energy, measurement of surface and interfacial tension, spreading coefficient, adsorption at liquid interfaces, Surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid- gas and solid-liquid interfaces, complex films,electrical properties of interface.

Unit-IV: Viscosity and rheology: Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotrophy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers.

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

Unit-V : Dispersion Systems : Colloidal Dispersions : Definition, types, properties of colloids, protective colloids, application of colloids in pharmacy; Suspensions and Emulsions; Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations; Emulsions-types, theories, physical stability.

5P2- PHARMACEUTICS-VI
(PHYSICAL PHARMACY PRACTICAL)

3 hr/week

PRACTICAL

1. Determination of particle size, Particle size distribution and surface area using various methods of particle size analysis.
2. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
3. Determination of surface/ interfacial tension, HLB value and critical micellar concentration of surfactants.
4. Study of rheological properties of various types of systems using different Viscometers.
5. Studies of different types of colloids and their properties.
6. Preparation of various types of suspensions and determination of their sedimentation parameters.
7. Preparation and stability studies of emulsions.
8. Studies of different types of complexes and determination of their stability constants.
9. Determination of half-life, rate constant and order of reaction.
10. To study the influence of various factors on the rate of reaction.
11. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.
12. Preparation of pharmaceutical buffers and determination of buffer capacity.
13. Experiments involving tonicity adjustments.

Books recommended:

1. Martin A, Bustamante P. & Chun A.H.C- Physical Pharmacy, Lea & Febiger, Philadelphia.
2. Shotten E & Ridgaway K, Physical Pharmaceutics, Oxford University Press, London.
3 D.V.Derle ," Essentials of Physical Pharmacy".

5T3- PHARMACOLOGY-III

3 Hr./week

UNIT-I

Drugs acting on Haemopoietic System: Drugs acting on blood and blood forming agents, Coagulants, anticoagulants, antiplatelets, fibrinolytics. Haematinics and plasma volume expanders.

UNIT-II

Drugs Acting on Cardiovascular system: Cardiac glycosides and positive ionotropic agents, antiarrythmic drugs, antihypertensives, coronary vasodilators and antianginals, drugs used for the treatment of hyperlipidemia.

UNIT-III

Diuretics: Classification, mechanism of action, adverse effect and therapeutic uses of diuretics

UNIT-IV

Pharmacology of Endocrine System: Pituitary hormones, Thyroid hormones and anti thyroid drugs, Androgens, progestins, estrogens, Insulin, oral hypoglycemics, Adrenocorticosteroids and their antagonists, Oral contraceptives and drugs used in infertility, Drugs regulating calcium homeostasis, Drugs acting on uterus.

5P3- PHARMACOLOGY-III (PRACTICAL)

3 Hr./week

1. To record the concentration response curve (CRC) of Acetylcholine using ileum of Chicken.
2. To study the parallel shift of CRC in presence of competitive antagonist on DRC of Ach using Chicken ileum.
3. To study the effect of physostigmine on CRC of acetylcholine on Chicken ileum.
4. To study the CRC of histamine on guinea pig ileum preparation & study the effect of Antihistaminics using software.
5. Determination of dose ratio.
6. Effect of various drugs on isolated tissues preparations (rat and guinea pig ileum).

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, LeLimbird,PB Molinoss, RW Ruddon & AG Gil, Pergamon Press.
6. Katzung, B.G. Basic & Clinical Pharmacology, Prentice Hall, International.
7. Laurence, DR & Bennet 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.
12. Sheffield Bioscience Programms, U.K., ISBN, 1-874758-02-6.

5T4- PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY -I)

2Hr./week

Unit I

Basic Principles of Medicinal Chemistry: Physico-chemical aspects (optical, geometric and bioisosterism) of drug molecules and biological actions. Drug receptor interactions including transduction mechanism.

Unit II

The following topics shall be covered with respect to nomenclature, classification, structure- activity relationships (where stated), mode of action (biochemical and molecular basis wherever applicable), therapeutic uses & synthesis of enlisted compounds.

a. **Anaesthetics**: Halothane, thiopental sodium, Lidocaine, Benzocaine, Procaine.
b. **Hypnotics and Sedatives**: Phenobarbitone, Pentobarbitone, Quinalbarbitone sodium, SAR in Barbiturates.
c. **Anti-convulsants**: Phenytoin, Sodium valproate, Ethosuximide, Carbamazepine, Vigabatrin, Progabide, SAR in Benzodiazepine, Hydantoin.
d. **Psychopharmacological Agents**:Chlorpromazine, Chlordiazepoxide, Chlorcyclizine,,Trifluperazine, Triflupromazine, Promethazine, Fluphenazine, Haloperidol, Diazepam, Alprazolam, Amitriptyline, S.A.R. in Phenothiazines and Butyrophenones.
e. **Analgesics, Antipyretics and Anti-inflammatory Agents**: Morphine, Codeine, Pethidine, Nalorphine, Diclofenac, Paracetamol, Mefenamic acid, Phenyulbutazone, Indomethacin, Ibuprofen and Aspirin, SAR in Opoid analgesics,Arylpropionic acid.
f. **Eicosenoids**: Prostaglandins, prostacyclines, leucotrienes; their biosynthesis, physiological importance and uses
g. **Central Nervous System Stimulants**: Caffeine, Nikethamide, Dextroamphetamine sulfate.

5P4- PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY – I PRACTICALS)

Synthesis of drugs involving not more than two steps.

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. Finar I L. Organic Chemistry, Vol I & II, ELBS/ Longman, London.

5T5- PHARMACOGNOSY – III

3 hr/ week

Unit-I : (A) Study of the biological sources, Commercial varieties cultivation, collection uses, diagnostic macroscopic and microscopic features n, chemical constituents, adulterants, substitutes and specific chemical tests of following groups of drugs containing.

Glycosides :

1. Saponins : Liquorice, Ginseng, Dioscorea, Senega .

2. Cardioactive sterols : Digitalis, Squill, Stropanthus & Thevetia

3. Anthraquinone Cathartics : Aloe, Senna, Rhubarb & Cascara.

Others : Psoralea, Ammi majus, Ammi visnaga, Gentian, Saffron, Chirata, Quassia and Andrographis paniculata.

(B) Production and Utilization of phytoconstituents such as calcium sennsoides, Diosgenin, Solasodine & Podophyllotoxins

Unit- II: Studies of traditional drugs : 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, Rasnam, Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Brahmi, Methi, Lehsun,
Palash, Guggul, Gymnema, Shilajit, Tulsi, Nagarmotha, Majith, Malkangni and Neem.

Unit-III: Brief Introduction and principles of Ayurvedic, Unani, Siddha and Homeopathic systems of medicines. Introduction to Ayurvedic formulations with special reference to. Arishtas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas.

5P5- PHARMACOGNOSY – III (PRACTICAL)

3 hr/ week

Study of crude drugs listed 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. Qadry J.S.,” Pharmacognosy” B.S.Shah Prakashan.
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, New Delhi.
12. Compendium of Indian Medicinal Plants I-IV, Rastogi & Malhotra.
13. Ayurvedic Pharmacopoeia of India, Govt. of India.
14. Indian Pharmacopoeia.
15. Mohammed Ali,” Pharmacognosy & Plant Cultivation”

SEMESTER- VI

6T1- PHARMACEUTICS-VII
(PHARMACEUTICAL TECHNOLOGY - II)

3 hr/week

Unit-I: 1. Tablets : (A) Formulation of different types of tablets, granulation technology on large-scale by various techniques, physics of tablets making, different types of tablet compression machinery and the equipments employed, evaluation of tablets.
(B) Coating of Tablets : Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablet. Stability kinetics and quality assurance.

Unit-II: 1. Capsules: Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsule, size of capsules, methods of capsule filling, soft gelatin capsule shell and capsule content, importane of base adsorption and minim/gm factors in soft capsule, quality control, stability testing and storage of capsule dosage forms.

2. Micro-encapsulation: Types of microcapsule, importance of microencapsulation in pharmacy, microencapsulation by phase co-acervation separation, multi orifice, spray drying, spray congealing, polymerisation, complex, formulation, emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.

Unit-III: Formulation and evaluation of Ophthalmic, Nasal and Ear products.

Unit-IV: Parenteral Products:
Preformulation factors, routes of administration, water for injection, pyrogenicity, nonaqueous vehicles. Formulation details, containers and closures and their selection. Prefilling treatment, washing of containers and closures, preparation of solution and suspensions, filling and sealing of ampoules, vial, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products.

Unit-V
Packaging of Pharmaceutical Products: Packaging component types, specifications and methods of evaluation, stability aspects of packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.

6P1- PHARMACEUTICS-VII
(PHARMACEUTICAL TECHNOLOGY - II PRACTICAL)

3 hr/week

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.

Suggested Practicals

I – 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 IPs
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
II - Formulation and evaluation of sustained release dosage forms – Aspirin Extended release (Matrix embedding method, Granules USP/NF coating of granules)
III - 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.
6. Manohar A.Potdar,' C,GMP for Pharmaceuticals".

6T2- PHARMACEUTICAL CHEMISTRY-VII
(MEDICINAL CHEMISTRY –II)

2Hr./week

The following topics shall be covered with respect to nomenclature, classification, structure- activity relationships (where stated), mode of action (biochemical and molecular basis wherever applicable), therapeutic uses & synthesis of enlisted compounds.

a. **Diuretics**: Aminophylline, Acetazolamide, Chlorthiazide, Hydrochlorthiazide, Frusemide, Spironolactone and S.A.R. in Thiazides and related agents, CA-inhibitors, 5- sulfamoyl-2-&-3-aminobenzoic acid derivatives.
b. **Adrenergic & Cholinergic Agents**: Epinephrine, Norepinephrine, Ephedrine, Pilocarpine nitrate, Neostigmine bromide, Physostigmine and Acetylcholine, S.A.R with reference to Ach & analogs.
c. **Anti-cholinergics**: Atropine, Benztropine and SAR in Anti-cholinergics.
d. **Anti-adrenergics**: Phentolamine, Phenoxybenzamine, Ergotamine, Atenolol, Pindolol, Timolol. SAR in beta-blockers
e. **Expectorants & Antitussive Agents**: Codeine, Dextromethorphan hydrobromide, Bromhexine. Antiasthmatic drugs
f.. **Gastro-intestinal drugs**: Antispasmodics (Dicylomine), Antiulcer agent (Ranitidin, Famotidine.Omeprazole), Drugs used in treatment of Diarrhea and constipation (Bisacodyl) Emetics and Antiemetics.

6P2- PHARMACEUTICAL CHEMISTRY-VII
(MEDICINAL CHEMISTRY – II PRACTICAL)

Synthesis of drugs involving not more than three steps.

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. Wolff ME. Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
4. 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.
5. Foye W C. Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
6. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
7. Nogrady T, Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York, Oxford.
8. Finar I L. Organic Chemistry, Vol I & II, ELBS/ Longman, London.

6T3- PHARMACOLOGY-IV

3 Hr./week

UNIT-1

Chemotherapy: General principles of chemotherapy, Sulphonamides, Cotrimoxazole, quinolones, penicillins, cephalosporins, aminoglycosides, tetracyclines, chloramphenicol and macrolides.

UNIT-II

Chemotherapy of Parasitic Infections: Tuberculosis and leprosy, Malaria, Fungal infections, Amoebiasis, Helminthiasis

UNIT-III

Chemotherapy of Viral diseases and cancer chemotherapy.

UNIT-IV

Immunosuppressants and immunostimulants.

UNIT-V

Bioassays: General principles and methods of bioassays. Official methods and bioassay of Insulin, Oxytocin, d-tubocurarine, Heparin, Digitalis, Histamine, Adrenaline & Acetyl Choline.

UNIT-VI

Toxicology: General methods for the treatment of poisoning. Symptoms and management of heavy metal poisoning (lead, mercury, copper, arsenic and iron) and drugs (morphine and their derivatives, barbiturates, benzodiazepines, organophosphates and alcohols)

6P3- PHARMACOLOGY-IV (PRACTICAL)

3 Hr./week

1. To calculate the pA2 value of Atropine & chlorpheniramine.
2. Bioassay of Ach, histamine & oxytocin using matching assay, bracketing assay, three point assay & four point assay on chicken ileum.
3. Bioassay of histamine and acetylcholine using matching and interpolation method on chicken ileum.

All experiments will be conducted using software wherever possible.

Books Recommended:

1. Ghosh M.N. 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 F.S.K : Text Book of Pharmacology, Interprint, New Delhi.
5. Goodman & Gilman, The Pharmacological basis of Therapeutics, Pergamon Press.
6. Editors: - J.G. Hardman, Le Limbird, PB Molinoss, RW Ruddon & AG Gil, Pergamon Press.
7. Katzung, B.G. Basic & Clinical Pharmacology, Prentice Hall, International.
8. Laurence, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.

6T4- PHARMACOGNOSY-IV

3 hr/ week

Unit-1 : 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, & Stramonium
(C) Quinoline & Isoquinoline : Cinchona, Ipecac & Opium..
(D) Indole : Ergot, Rauwolfia, Catharanthus & Nux-vomica.
(E) Imidazole : Pilocarpus.
(F) Steroidal : Veratrum, Withania & Kurchi.
(G) Alkaloidal amine : Ephedra & Colchicum.
(H) Glycoalkaloid : Solanum.
(I) Purines : Coffee & Tea
(J) Quinazoline : Vasaka.
Unit-III
(A) World wide trade in Medicinal plants & derived product. Tropane alkaloids containing drugs, Cinchona, Ipecac, Rauwolfia, Taxol. Diosgenin, Digitalis, Liquorice, Papain, Ginseng, Aloe, Valerian, & plant laxatives.
Unit-IV
Biological sources, preparation, Identification tests and uses of the following –
Diastase, Papain, Penicillinase, Hyalluronidase, Streptokinase.
Plant Bitters & Sweeteners.
Unit-V Biogenetic Investigations and basic metabolic pathways, (alkaloids, terpenes, steroids) Brief introduction to biogenesis of secondary metabolites of Pharmaceutical importance.

6P4- PHARMACOGNOSY –IV (PRACTICAL) 3 hr/ week

1. Identificaiton of crude drugs listed above.

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. Qadry J.S., " Pharmacognosy" B.S.Shah Prakashan."
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.
15. Mohammed Ali," Pharmacognosy & Plant Cultivation".
16. Mohammed Ali," Pharmacognosy & Phytochemistry".
17. Indian Pharmacopoeia.

6T5- PHARMACEUTICAL BIOTECHNOLOGY

3hr/week

Unit-I : Immunology and Immunological preparations :
Principles, Antigen and haptens, immune system, Cellular, and humoral immunity, antigen-antibody reactions and their applications, hypersensitivity reactions, immunization, vaccines, sera, toxoid preparation.

Unit-II : Genetic Recombination
Transformation, conjugation, transduction, protoplast fusion, gene cloning and their applications, study of drugs produced by biotechnology such as Insulin, recombinant hepatitis B vaccine..

Unit-III : Antibiotics :
Historical development of antibiotics, Antimicrobial spectrum and methods used for their standardization. Fermentor, its design and control of different parameters. Fermentation of penicillin and streptomycin.

Unit-IV : Microbial Transformation and enzyme immobilization
Introduction, types of reactions mediated by microorganisms, Design of Bio-transformation process, selection of organisms. Techniques of immobilization of enzymes, study of enzymes such as hyaluronidase, penicillanase, streptokinase, amylase and protease.

Unit-V : Advanced tools in biotechnology:
Hybridoma technology and monoclonal antibody production, Instrumentation and application of following techniques viz: PCR, electrophoresis, ELISA, RIA.

BOOKS RECOMMENDED :
1. S.P. Vyas and V.K. Dixit, Pharmaceutical Biotechnology, CBS Publication, New Delhi.
2. Prescott and Dunn's Industrial Microbiology, 4th Ed, 1987, CBS Publishers and Distributors, Delhi.
3. P.F. Stanbury & A. Ahhitar Principles of Fermentation Technology.
4. K. Kieslich Ed. Biotechnology Vol. 69 Verleg Chernie Switzerland 1984.
5. P.F. Standury & A. Whitaker & Hall S.J. Principles of Fermentation, Aditya Book Private Limited, New Delhi.
6. Crueger W. & Crueger A, Biotechnology-A Textbook of Industrial Microbiology, Panima Publishing Corporation, Delhi.
7. Johan, D.Souza," Biotechnology & Fermentation"

6T6- PHARMACEUTICAL JURISPRUDENCE & ETHICS

3 hr/ week

Unit-1 : Introduction
1. Pharmaceutical Legislations – A brief review.
2. Drugs & Pharmaceutical Industry – A brief review.
3. Pharmaceutical Education – A brief review.
4. Pharmaceutical Ethics:

Unit-II : An elaborate study of the following:
(A) Pharmacy Act 1948
(B) Drugs and Cosmetics Act 1940 and Rules 1945

Unit-III : (A) Medicinal & Toilet preparations (Excise duties Act 1955)
(B) Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
(C) Drugs Price Control Order 1995.

Unit-IV : A brief study of the following with special reference to the main provisions.
(A) Poisons Act 1919
(B) Drugs and Magic remedies (Objectionable Advertisements) Act 1954.
(C) Medical termination of Pregnancy Act 1970 & Rules 1975.
(D) Prevention of Cruelty to Animals Act 1961.
(E) States Shops & Establishments Act & Rules.

Unit-V : (A) A.I.C.T.E. Act 1987
(B) Patents Act 1970
(C) Insecticides Act 1968
(D) Factories Act 1948
(E) Minimum Wages Act, 1948
Note : The teaching of all the above Acts should cover the latest amendments.

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

SEMESTER- VII

7T1- PHARMACEUTICAL ANALYSIS -III

3 Hr/week

Unit I

Chromatography: Introduction, principles, instrumentation, techniques and applications of Thin Layer Chromatography, Paper Partition Chromatography and Column Chromatography Ion exchange, size exclusion chromatography, GC, HPLC, HPTLC.

Unit II

Theoretical aspects, basic instrumentation, and applications of the following analytical techniques:

a Polarimetry
b Refractometry
d. Flame Photometry.
e. Emission spectroscopy.
f. Atomic absorption spectroscopy.
g. X-ray Diffraction.

7P1- PHARMACEUTICAL ANALYSIS-III (PRACTICAL)

1. Exercises involving Paper, Thin Layer Chromatographic & HPLC Technique.

2. Determination of Sodium and Potassium ion by Flame Photometry.

BOOKS RECOMMENDED:

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Beckett, A H and Stenlake, J.B, Practical Pharmaceutical Chemistry, Vol I and II, The Athlone Press of the University of London.
3. Willard H.H. and Merrit L. Jr and Dean J.A., Instrumental methods of analsis Van Nostrand Renhold,New York.
4. Obonson J.W.R. Undergraduate Instrumental Analysis, Marcel Dekker Inc, New York, 1970.
5. Parikh V.H. Absorption Spectroscopy of Organic Molecules Addison-Wesley Publishing Co., London 1974.

7T2- PHARMACOGNOSY –V

3 hr/ week

Unit-I : : Introduction, classification & study of different chromatographic methods. Application of chromatographic techniques in evaluation of herbal drugs. Chemical & Spectral approaches to simple molecules of natural origin.

Unit-II

Historical development of plant tissue culture, type of culture, Nutritional requirement, growth & their maintenance. Application of plant tissue culture in pharmacognosy.

Unit-III :

Standardisation of plant material as per WHO guidelines. Analysis of official formulations derived from crude drugs including some ayurvedic preparations.

Unit-IV:

Introduction to Herbal monograph as per national and international guidelines.

Unit-V

Herbal Cosmetics and their formulation.

Recent developments in the field of natural products

7P2- PHARMACOGNOSY –V (PRACTICAL)

3 hr/ week

Practical based on theory above.

Book Recommended:

1. Trease, G.E. Evans W.C,. Pharmacognosy ELBS.
2. Tyler Varro. E., Brady Lynn. R. Robbers J.E. Pharmacognosy
3. Wallis T.E..Text book of Pharmacognosy
4. Harborne Phytochemical methods of chemical analysis .
5. Pharmacoepial standards for Ayurvedic formulations CCRAS, Delhi.
6. Vapoorte, Swendson Chromatography of alkaloids.
7. Lala P.K., Elements of chromatography
8. Mottal.A.C. Clerk's isolation & identifications of drugs
9. Dhavan B.N. & Srimal R.C, The use of pharmacological techniques for evaluation of natural products. CDRI Lucknow.
10. Brain K.R. and Turner T.D, The practical evaluation of phytopharmaceuticals
11. Peach K. & Tracey MV, Modern methods of plant analysis
12. British herbal phamacopocia.
13. Indian herbal pharmacopocia.
14. Chaudhary.R.R., Herbal drug industry

7T3- PHARMACEUTICAL CHEMISTRY-VIII
(MEDICINAL CHEMISTRY- III)

The following topics shall cover: Nomenclature and classification, Structure Activity Relationship (SAR) where stated, Synthesis of selected drugs, Mode of action, (Biochemical and molecular basis, wherever applicable) and Therapeutic uses of the following:

Unit I

Cardiovascular Agents: Antianginal & vasodilators, antiarrhythmics, antihypertensives,anticoagulants, antihyperlipidemics & cardiotonics – Nifedipine, Procainamide, Propranolol, Methyldopa, Captopril, Clofibrate, Warfarin, Phenidione.

Unit II

Steroids: Isolation, colour reactions and nomenclature of steroids, Chemistry of cholesterol, Testosterone, progesterone, cortisone acetate Diethylstilbosterol (DES), SAR of estrogens, androgens, progesterone, adrenocortiod hormones.

Unit III

Hormones Related Drugs: Thyroid and Antithyroids – Carbimazole, Levothyroxine,Propylthiouracil, Methimazole. Insulin & Oral Hypoglycaemics ,Chlorpropamide, Metformin, Tolbutamide, Glybenclamide.

Unit IV

Vitamins: Vitamin A, thiamine, riboflavin, ascorbic acid and folic acid, pantothenic acid, pyridoxine, tocopherol.

Unit V

. **AUTOCOIDS**

(i) Antihistaminics**:**

H_1antagonists–Diphenhydramine,Promethazine, Cyproheptadine, Cetrizine.

H_2 antagonists – Ranitidine, Famotidine.

(ii) 5HT, 5HT-antagonist,

(iii) Angiotensin antagonist,

(iv) Prostaglandin analogues- Mesoprostol, Carboprost.

Unit VI

Eicosenoids: Prostaglandins, prostacyclines, leucotrienes; their biosynthesis, physiological importance and uses.

BOOKS RECOMMENDED:

1. Pharmacopoeia of India, Minsitry of Health, Govt. of India.
2. Wolff ME. Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
3. 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.
4. Foye W C. Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
5. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Nogrady T, Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York, Oxford.
7. Finar I L. Organic Chemistry, Vol I & II, ELBS/ Longman, London.

7T4- PHARMACOLOGY-V (PATHOPHYSIOLOGY & PHARMACOTHERAPEUTICS)

3 Hr./week

Unit I

Fundamentals of General Pathology:

A. Cell injury & Adaptation: Causes of cell injury, Pathogenesis of Cell injury, morphology of cell injury; Intracellular alterations in lipids, proteins & Carbohydrates; cellular adaptation: Atrophy, Hypertrophy.

B. Inflammation & Repair – Changes in blood flow & vascular permeability leucocyte migration Acute & chronic inflammation, mediators of inflammation, morphologic patterns of inflammation, outcomes of inflammetion. Brief outline of the process of repair.

Unit II

Pathophysiology & Pharmacotherapy of following Diseases:

A. Cardio-vascular Disorders: Hypertension, Congestive Heart failure, Angina pectoris & Acute Myocardial Infarction.

B. CNS Disorders: Epilepsy, Parkinsonism, Schizophrenia & Depression.

C. Respiratory Disorders: Asthma

D. GIT Disorders: Peptic Ulcer, Ulcerative Colitis

E. Endocrine Disorders : Diabetes Mellitus, Myxedema & Grave's Disease

F. Hematopoietic Disorders: Iron Deficiency Anemia, Pernicious Anemia & Hemolytic Anemia

G. Joint Disorders – Rheumatoid Arthritis, Gout.

H. Infectious Diseases: Upper Respiratory Infections, Urinary Tract Infections, Tuberculosis, Syphilis, Gonorrhoea, Typhoid, Cholera, Amoebiasis and AIDS.

Books Recommended:

1. Katzung B.G. Basic and Clinical Pharmacology.
2. Golan D.E., Tashjian A.H., Armstrong E.J., Armstrong A.W. Princilpes of Pharmacology: The Pathophysiologic Basis of Drug Therapy.
3. Dipiro JL, Pharmacotherpay-A Pathophysiological Approach, Elsevier.
4. Robbins S.L., Kumar V., Basic Pathology, WB Saunders.
5. Sharma S.C., Understanding of Human Disease:Pathophysiology of Major Diseases.
6. McPhee S.J., Lingappa V.R., Ganong W.T., Lange J.D., Pathophysiology of Disease: An Introduction to Clinical Medicine.
7. Bennet P.N., Brown M.J., Clinical Pharmacology.

7T5- PHARMACEUTICAL MANAGEMENT

3 hr/ week

Unit-I :

1. **Concept of Management :** Evolution of Management Theory
2. Principles of Management (Planning, Organizing Staffing Directing and Controlling, Coordination, Communication, Motivation, Decision making, leadership, Innovation Creativity, Delegation of Authority / Responsibility). Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/ Morale).

Unit-II

Economics : Principles of economics with special reference to the Laws of demand and supply, demand schedule, demand curves labor welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.

Accountancy : Principles of Accountancy, Ledger posting and book entries preparation of trial balance, columns of a cash book, Bank reconciliation statement, rectification of errors, profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques bills of exchange, promissory notes and bundles documentary bills.

Unit-III

3. Pharmaceutical Marketing : Functions, buying, selling, transportation, storage financed feedback information, channels of distribution, wholesale, retail, department store, multiple shop and mail order business.

4. Salesmanship : Principle of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, Recruitment, training, evaluation , compensation to the pharmacist.

Unit-IV

5. Market Research

(A) Measuring & Forecasting Market Demand - Major concept in demand measurement, Estimating current demand Geo-demo-graphic analysis. Estimating industry sales, Market share and future demand.

(B) Market segmentation & Market targeting.

Unit-V

6. Materials Management : A brief exposure of basic principles of management major areas, scope, purchase, stores, inventory control and evaluation of materials management.

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

Books Recommended:

1. Beri, Market Researth – Tata Mc Graw Hill
2. Chary S.N, Production and Operative Management / Tata Mc Graw Hill.
3. Datta A.K., Material Management / PHI.
4. Chadwick Leslie, The essence of management accounting / PHI.
5. Massie L. Joseph Essentials of Management / PHI.
6. Barthwal R.R, Industrial Economics –. / New Age International.
7. Shreenivasan K.R., An Introduction to Industrial Management –/ Vikas.
8. Daver Rustam S. Salesmanship and Publicity –/ Vikas.
9. Mukopadhyay Sekhar, Pharmaceutical Selling, Sterling Publishers.
10. Koontz H, Weihrich H, Essentials of Management, Tata Mc Graw Hill.

7T6- PHARMACEUTICS-IX
(DRUG REGULARITY AFFAIRS & QUALITY ASSURANCE)

Unit-I

1. Requirements of CGMP, GLP, USFDA, WHO guidelines and ISO 9000 series.

Unit-II

2. Documentation- Protocols, Forms and maintenance of records in Pharmaceutical industry.
3. Preparation of documents for new drug approval and export registration.

Unit-III

4. Basic concept of quality assurance, Quality assurance systems, Sources and control of quality variation- raw materials, containers, closures, personnel, environment etc

Unit-IV

5. Concepts in validation, equipment validation, process validation, validation of Solid dosage and sterile dosage form, applications of process validation.

Unit-V

6. In process quality control tests, IPQC problems in pharmaceutical industries.
7. Sampling plans Sampling and operating characteristics curves.

Books Recommended:

1. Willing, Tuckerman and Hitchings, Good Manufacturing Practices for Pharmaceuticals.
2. OPPI, Quality Assurance.
3. Loftus and Nash, Pharmaceutical Process Validation.
4. Florey, Analytical Profile of Drugs (All volumes).
5. Indian Pharmacopoeia.
6. United States Pharmacopoeia.
7. British Pharmacopoeia.
8. Garfield, Quality Assurance Principles for Analytical Laboratories.`
9. Manohar A. Potdar," C.GMP for Pharmaceuticals'

SEMESTER- VIII

8T1- PHARMACEUTICS-X (BIOPHARMACEUTICS)

3 hr/week

Unit-1: Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting.

Biopharmaceutics :
(A) Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
(B) Factors influencing absorption – Physicochemical, physiological and pharmaceutical.
(C) Drug distribution in the body, plasma protein binding.

Unit-II: Pharmacokinetics :
(A) Significance of plasma drug concentration measurement.
(B) Compartment model and Non-compartment model. Definition and Scope.
(C) Pharmacokinetics of drug absorption – zero order and first order absorption rate constant using Wagner – Nelson, Loo-Reigelman method.

Unit-III: (A) Volume of distribution and distribution coefficient.
(B) Compartment kinetics – One compartment and Preliminary information of multicompartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.
(C) Clinical Pharmacokinetics: Definition and scope

Unit-IV:
(A) Dosage adjustment in patients with and without renal and hepatic failure.
(B) Pharmacokinetic drug interactions and their significance in combination therapy.

Unit-V: Bioavailability and Bioequivalence:
(A) Measures of bioavailability, C-max, and area under the curve (AUC).
(B) Review of regulatory requirements for conduction of bioequivalent studies.

8P1- PHARMACEUTICS-X
(BIOPHARMACEUTICS PRACTICAL)

3 hr/week

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

Suggested Practicals

1. In-vitro drug release study of the given powder dosage form using various dissolution media.
2. In-vitro drug release study of the given uncoated tablet dosage form using different dissolution media.
3. In-vitro drug release study of the given capsule dosage form using various dissolution media.
4. In-vitro drug release study of the given film coated dosage form using various dissolution media.
5. In-vitro dissolution study of the given sustained release dosage form.
6. In-vitro dissolution study of the given fast release (M.D, Dispersible etc.) dosage form.
7. To study the effect of hardness of tablet on dissolution rate.
8. To study the effect of various diluents on dissolution rate of dosage form (Tablets, Capsules, Ointment etc.).
9. To study the effect of formulation on drug release (powder, suspension etc.).
10. To determine the % protein binding of the given drugs.
11. To determine the effect of protein binding on drug bioavailability.
12. To calculate various Pharmacokinetic parameters from the given zero order drug release data.
13. To calculate various Pharmacokinetic parameters from the given first order drug release data.
14. To calculate the various Pharmacokinetic parameters from the given blood data of I.V bolus injection (one compartment model).
15. To calculate various Pharmacokinetic parameters from the given urinary excretion data of *I.V* bolus.injection using both methods (Rate of elimination & sigma minus method one compartment model).
16. To study the in-vitro drug- drug interaction.
17. To study the passive diffusion of the given drug using cellophane membrane.
18. To study the passive diffusion of the given drug using egg or goat membrane.
19. To determine the various Pharmacokinetic parameters from the given blood data of oral administration of dosge form.

Demonstration Experiments

1. Dissolution Apparatus.
2. Preparation of Buffers & membranes.
3. Use of semilog paper.
4. Operation of colorimeter & U.V spectrophotometer.

Books Recommended:

1. Notari, R.E, Biopharmaceutics and Pharmacokinetics – An introduction Marcel Dekker Inc. N.Y.
2. Rowland M, and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, N.Y.
3. Wagner J.G. Fundamentals of Clinical Pharmacokinetics, Drugs Intelligence Publishers, Hamilton.
4. Wagner J.G. Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A.G. Basel, Switzerland.
5. Gibaldi, Milo' Biopharmaceutics & Clinical pharcokinatics".
6. Robert , Rodriguezdiaz," Analytical Techniques for Biopharmaceuticals Development".
7. John. G.Wagner," Pharmacokinetics for the Pharmaceutical Scientist'.
8. Curry, StephenH., " Drug Disposition & Pharmacokinetics".

8T2- PHARMACEUTICAL ANALYSIS -IV

3 Hr/week

Unit I Theoretical aspects, basic instrumentation, elements of interpretation of spectra and applications of the following analytical techniques:

a. Visible and UV spectrophotometry.
b. Fluorimetry.
c. IR- spectrophotometry.
d. NMR.
e. Mass Spectroscopy

Unit II Theoretical aspect, types, basic instrumentation and pharmaceutical application of Electrophoresis.

Unit III Theoretical aspect, basic instrumentation and pharmaceutical application Radio-immunoassay
.

8P2- PHARMACEUTICAL ANALYSIS-IV (PRACTICAL)

1. Excercises in analysis of complex drug formulations containing not more than two components, using instrumental methods of analysis.
2. Interpretation of spectra.

BOOKS RECOMMENDED:

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Beckett, A H and Stenlake, J.B, Practical Pharmaceutical Chemistry, Vol I and II, The Athlone Press
of the University of London.
3. Chatten L.G. A text book of Pharmaceutical Che mistry Vol I and II Marcel, Dekker, New York.
4. Willard H.H. and Merrit L. Jr and Dean J.A., Instrumental methods of analsis Van Nostrand Renhold,
New York.
5. Obonson J.W.R. Undergraduate Instrumental Analysis, Marcel Dekker Inc, New York, 1970.
6. Parikh V.H. Absorption Spectroscopy of Organic Molecules Addison-Wesley Publishing Co., London
1974.
7. Silver stein RM & Webster FX, Spectrometric Identification of Organic Compounds, John Wiley &
Sons.
8. Skoog V, Principles of Instrumental Analysis, Holler-Neimen.

8T3- PHARMACOLOGY-VI (CLINICAL PHARMACY)

3 Hr./week

1. Development and scope of clinical pharmacy, concept of health care team, role of clinical pharmacist as a member of health care team, functions of clinical pharmacist.
2. Medication History: Interviewing the patients, recording medication history, patient medication profile, self medication and non prescription drug usage, factors associated with it.
4. Research design and conduct of clinical trials: Research support including planning and execution of clinical trials. Guidelines for good clinical research practice and ethical requirements. Various phases of Clinical trials.
3. Patient compliance: type of compliance, non compliance and factors associated with it, methods to improve compliance including compliance aids.
4. Patient counseling and education: techniques and methods used.
5. Drugs used in infancy, elderly (pediatrics and geriatrics) and pregnancy.
6. Drug interactions; mechanism of drug interaction, types, methods of minimizing clinically relevant drug interactions.
7. Adverse drug reaction, types, monitoring and prevention of A.D.R.
8. General principles of clinical toxicology.
9. Therapeutic drug monitoring.
10. Concepts of Essential Drugs & Rational Drug use.
11. Interpretation of clinical laboratory tests.
12. Drug information services: Source of information, computerized services, retrieval of information, setting up a drug information centre.

Books Recommended:

1. Walker R., Clinical Pharmacy and therapeutics, 2nd ed, Churchill Livingstone, N.Y. 1999.
2. Lawson D.H., Clinical Pharmacy and Hospital Management, 1st ed. Chapmen Hall, N.Y. 1980.
3. Winfield A.J. & Richards R.M.E. Pharmaceutical practice; 2nd ed. Churchill Livingstone, N.Y. 1999.
4. Hassan W.E., Hospital Pharmacy, 3rd ed, Lea and Fiebiger, Philadelphia, USA 1974.
5. Gennaro A.R., Remington's the science and practice of Pharmacy vol. I & II, 20th ed. Lippincott William and Wilkins, Philadelphia, N.Y. 2000.
6. Goyal R.K., Bhatt P.A., Burande M.D., 1st ed. 2003-04, B.S. Shah Prakashan, Ahemdabad.
7. Parthasarthi G, Nyfort-Hansen K, Nahata M.C., A textbook of Clinical Pharmact Practice-Essential concepts and Skills, Orient Longman.

8T4- PHARMACEUTICAL CHEMISTRY-IX
(MEDICINAL CHEMISTRY- IV)

The following topics shall cover: Nomenclature and classification, Structure Activity Relationship (SAR) where stated, Synthesis of selected drugs, Mode of action, (Biochemical and molecular basis, wherever applicable) and Therapeutic uses of the following

a. **Sulphonamides**: Sulphanilamide, Sulphamethoxazole, Sulphadiazine, sulphathiazole & SAR in Sulphonamides
b. **Antibiotics**: Pencillins, chloramphenicol, Griseofulvin, cycloserine and SAR in Penicillins, Cephalosporins, tetracycline, Norfloxacin, Nalidixic acid, Ciprofloxacine.
c. .**Antimycobacterial agents**: A general survey of antitubercular and antileprosy drugs. PAS. isoniazid,pyrazinamide and sulphones SAR in hydrazide series and sulphones.
d. **Antimalarials**: Primaquine, chloroquine, amodiaquine and pyrimethamine, SAR in 4- and 8- aminoquinolines.
e. **Antiamoebics**: Metronidazole and Tinidazole, Diloxanide furoate, a study of emetine and antibiotics as antiamoebics.
f. **Anti-Neoplastic Drugs**: Chlorambucil, Cyclophosphamide, 5-fluorouracil, Methotrexate and Dacarbazine .SAR of alkylating agents.
g. **Antiviral Agents**: Idoxuridine, Amantadine, Rimantadine, Anti AIDS – Zidovudine and Didanosine.

BOOKS RECOMMENDED:

1. Wolff ME. Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
2. 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.
3. Foye W C. Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
4. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
5. Nogrady T, Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York, Oxford.
6. Finar I L. Organic Chemistry, Vol I & II, ELBS/ Longman, London.

8T5- PHARMACEUTICS-XI
(NOVEL DRUG DELIVERY SYSTEM)

Unit-I

1. Theory of controlled release drug delivery systems.
2. Release and diffusion of drugs from C.D.D.S., General methods of design and evaluation of C.D.D.S.

Unit-II

3. Carriers for drug delivery systems, Prodrugs, Physical, chemical and biomedical engineering approach to achieve controlled drug delivery.
4. Microencapsulation: Methods, kinetics of drug release from microcapsules technology and applications.

Unit-III

5. Transdermal drug delivery systems: Theory, formulation and evaluation, ionotophoresis.
6. Implants and inserts: Types, design and evaluation methods, Osmotic pumps.

Unit-IV

7. Targeted Drug delivery systems: Concept of drug targeting, importance in therapeutics, methods in drug targeting, drug immobilization techniques, nanoparticles, liposomes, neosomes, pharmacosomes and erythrocytes.

Unit-V

8. Advances in drug delivery systems. An Introduction to buccal, nasal, ocular, pulmonary colonic delivery, etc.

BOOKS RECOMMENDED

1. Roiche, Design of Biopharmaceutical Properties Through Produrugs and Analogs.
2. Jolles and Wooldbridge, Drug Design: Facts or Fantasy.
3. Julian, Drug Delivery Systems.
4. Robinson and Vincent, Controlled Drug Delivery.
5. Robinson, Sustained and Conrolled Drug Delivery Systems.
6. Noxon, Microencapsulation.
7. Chien, Novel Drug Delivery Systems.
8. Deasy, Microencapsulation and Related Processes.
9. Gutcho, Microencapsulation and Related Processes.
10. Lisbeth, Illum & Davis, Polymers in Controlled Drug Delivery.
11. Ghosh, Premamoy<’ Polymer Science & Technology”.

8T6- PHARMACEUTICAL CHEMISTRY-X
(DRUG DESIGN)

Unit I

Physical properties & biological activity: Solubility, ionization, active ions, hydrogen bonding, chelation, surfactants. Stereochemistry& biological activity:
Introduction, complimentarity between drug & receptor, examples from analgesics, cholinergic antagonists and agonists, catecholamines & related compounds.

Unit II

Metabolic antagonism: Essential metabolite, type of antagonism, antimetabolites. Woods-Field Theory, competitive inhibition, examples from purines & pyrimidines, amino-acid antagonists, antivitamins.

Unit III

Isosterism & Bioisosterism: Concept of isosterism, applications of bioisosterism, classical isosteres, non classical isosteres, ring Vs open structures, non isosteric groups.

Unit IV

Receptor & Theories of drug action: Nature of receptor, drug –receptor interactions, topography of analgesic, anti-inflammatory, cholinergic, adrenergic, histaminic, serotonin, diuretic receptors. Theories of drug action, occupation theory, rate theory, induced fit theory, macromolecular perturbation theory.

Unit V

Quantitative Structure Activity Relationships: A brief introduction to various mathematical models.

BOOKS RECOMMENDED

1. E.J. Ariens : Drug Design, Academic Press New York (1975).
2. S.H. Salkovisky. A.A. Sinkula and S.C. Valvani, Physical Chemical Properties of Drug, Marcel Dekker Inc. New York.
3. M.E. Wolff, Burger's Medical Chemistry, John Willey and Sons. New York.
4. R.F. Doerge, Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, J.Lippincott Co., Philadelphia.
5. J. March, Advanced Organic Chemistry, Reaction Mechanism and Structure, John Wiley and Sons, New York.
6. E.S. Gould, Mechanism and Structure in Organic Chemistry Holt, Rinewart and Winston, New York.