



GLA
UNIVERSITY
MATHURA
Established vide U.P. Act 21 of 2010.

B. PHARM.
COURSE CURRICULUM

INSTITUTE OF
PHARMACEUTICAL RESEARCH

COURSE STRUCTURE

B. PHARM.

First Semester

S. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDITS	CONTACTS HR/WK
			L	T	P		
1.	AHM 1005 OR BPH 1001	REMEDIAL MATHEMATICS	3	2	-	4	5
		OR REMEDIAL BIOLOGY	3	-		3	
2.	BPH 1002	PHARMACEUTICAL ANALYSIS -I	3	0	0	3	3
3.	BPH1003	PHARMACEUTICAL CHEMISTRY-I (Inorganic Pharm.Chem.)	3	0	0	3	3
4.	BPH1004	PHARMACEUTICS-I (General Pharmacy)	3	0	0	3	3
5.	BPH1005	ANATOMY,PHYSIOLOGY & PATHOPHYSIOLOGY-I	3	0	0	3	3
6.	AHE1002	REMEDIAL ENGLISH	4	0	0	4	4
PRACTICALS							
7		REMEDIAL BIOLOGY					
6.	BPH1081	PHARMACEUTICAL ANALYSIS -I	0	0	4	2	4
7.	BPH1082	PHARMACEUTICAL CHEMISTRY-I (Inorganic Pharm. Chem.)	0	0	4	2	4
8.	BPH1083	PHARMACEUTICS-I (General Pharmacy)	0	0	4	2	4
9.	BPH1099	GENERAL PROFICIENCY	0	0	0	1	
		TOTAL	19	2	12	27	33

Second Semester

S. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDITS	CONTACTS HRS/WK
			L	T	P		
1.	BPH2001	PHARMACEUTICAL CHEMISTRY-II (Physical Chem.)	3	0	0	3	3
2.	BPH2002	PHARMACEUTICAL CHEMISTRY-II (Organic Chemistry-I)	3	0	0	3	3
3.	BPH2003	ANATOMY, PHYSIOLOGY& PATHOPHYSIOLOGY-II	3	0	0	3	3
4.	BCA2070	COMPUTER FUNDAMENTALS & PROGRAMMING	3	0	0	3	3
5.	AHM 2005	BIOSTATISTICS	3	1	0	4	4
PRACTICALS							
6.	BPH 2081	PHARMACEUTICAL CHEMISTRY-II (Physical Chem.)	0	0	4	2	4
7.	BPH 2082	PHARMACEUTICAL CHEMISTRY-III (Organic Chemistry-I)	0	0	4	2	4
8.	BPH 2083	ANATOMY, PHYSIOLOGY& PATHOPHYSIOLOGY-II	0	0	4	2	4
9.	BCA 2090	COMPUTER FUNDAMENTALS	0	0	3	2	3
10.	AHE 2083	ENGLISH IN PRACTICE	0	0	4	2	4
11.	BPH 2099	GENERAL PROFICIENCY	0	0	0	1	
		TOTAL	15	1	19	27	35

Third Semester

S. No.	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	CONTACT HRS/WK
			L	T	P		
1	BPH 3001	PHARMACEUTICS-II (Pharmaceutical Engineering-I)	3	0	0	3	3
2	BPH 3002	PHARMACEUTICAL JURISPRUDENCE & ETHICS	3	0	0	3	3
3	BPH 3003	PHARMACOGNOSY-I	3	0	0	3	3
4	BPH 3004	PHARMACEUTICAL CHEMISTRY-IV (Organic Chemistry-II)	3	0	0	3	3
5	BPH 3005	PHARMACEUTICS -III (Community Pharmacy)	3	0	0	3	3
6	BPH 3006	ANATOMY,PHYSIOLOGY & PATHOPHYSIOLOGY-III	3	0	0	3	3
PRACTICALS							
7	BPH 3081	PHARMACEUTICS-II (Pharmaceutical Engineering-I)	0	0	4	2	4
8	BPH 3082	PHARMACOGNOSY -I	0	0	4	2	4
9	BPH 3083	PHARMACEUTICAL CHEMISTRY-IV (Organic Chemistry-II)	0	0	4	2	4
10	BPH 3084	PHARMACEUTICS -III (Community Pharmacy)	0	0	4	2	4
11.	BPH 3099	GENERAL PROFICIENCY	0	0	0	1	4
TOTAL			18		16	27	34

Fourth Semester

S. No.	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	CONTACT HRS/WK
			L	T	P		
1	BPH 4001	PHARMACEUTICS-IV (Pharmaceutical Engineering-II)	3	0	0	3	3
2	BPH 4002	PHARMACEUTICAL MICROBIOLOGY	3	0	0	3	3
3	BPH 4003	PHARMACOGNOSY-II	3	0	0	3	3
4	BPH 4004	PHARMACEUTICAL ANALYSIS-II	3	0	0	3	3
5	BPH 4005	ANATOMY, PHYSIOLOGY & PATHOPHYSIOLOGY-IV	3	0	0	3	3
PRACTICALS							
6	BPH 4081	PHARMACEUTICS-IV (Pharmaceutical Engineering-II)	0	0	4	2	4
7	BPH 4082	PHARMACEUTICAL MICROBIOLOGY	0	0	4	2	4
8	BPH 4083	PHARMACOGNOSY-II	0	0	4	2	4
9	BPH 4084	PHARMACEUTICAL ANALYSIS-II	0	0	4	2	4
10.	BPH 4099	GENERAL PROFICIENCY	0	0	0	1	0
TOTAL			15		16	24	31

Fifth Semester

S. No.	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	CONTACT HRS/WK
			L	T	P		
1	BPH 5001	PHARMACEUTICAL CHEMISTRY-V (Biochemistry)	3	0	0	3	3
2	BPH 5002	PHARMACEUTICS -V (Pharmaceutical Technology-I)	3	0	0	3	3
3	BPH 5003	PHARMACOLOGY-I	3	0	0	3	3
4	BPH 5004	PHARMACEUTICAL CHEMISTRY -VI (Medicinal Chemistry -I)	3	0	0	3	3
5	BPH 5005	PHARMACEUTICS-VI (Physical Pharmacy)	3	0	0	3	3
PRACTICALS							
6	BPH 5081	PHARMACEUTICAL CHEMISTRY-V (Biochemistry)	0	0	4	2	4
7	BPH 5082	PHARMACEUTICS -V (Pharmaceutical Technology-I)	0	0	4	2	4
8	BPH 5083	PHARMACOLOGY-I	0	0	4	2	4
9	BPH 5084	PHARMACEUTICAL CHEMISTRY -VI (Medicinal Chemistry -I)	0	0	4	2	4
10	BPH 5085	PHARMACEUTICS-VI (Physical Pharmacy)	0	0	4	2	4
11.	BPH 5099	GENERAL PROFICIENCY	0	0	0	1	
TOTAL			15		20	26	35

Sixth Semester

S. No.	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	CONTACT HRS/WK
			L	T	P		
1	BPH 6001	PHARMACEUTICAL CHEMISTRY-VII (Medicinal Chemistry -II)	3			3	3
2	BPH 6002	PHARMACEUTICS-VII (Pharmaceutical Technology-II)	3			3	3
3	BPH 6003	PHARMACOLOGY-II	3			3	3
4	BPH 6004	PHARMACOGNOSY-III	3			3	3
5	BPH 6005	PROFESSIONAL COMMUNICATION	3			3	3
6	BPH 6006	ENVIRONMENT AND ECOLOGY	3			3	3
PRACTICALS							
7	BPH 6081	PHARMACEUTICAL CHEMISTRY-VII (Medicinal Chemistry -II)			4	2	4
8	BPH 6082	PHARMACEUTICS-VII (Pharmaceutical Technology-II)			4	2	4
9	BPH 6083	PHARMACOLOGY-II			4	2	4
10	BPH 6084	PHARMACOGNOSY-III			4	2	4
11.	BPH 6099	GENERAL PROFICIENCY				1	
TOTAL			18		16	27	34

Seventh Semester

S. No.	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	CONTACT HRS/WK
			L	T	P		
1	BPH 7001	PHARMACEUTICAL ANALYSIS-III	3	0	0	3	3
2	BPH 7002	PHARMACEUTICS -VIII (Biopharmaceutics & Pharmacokinetics)	3	0	0	3	3
3	BPH 7003	PHARMACOLOGY-III	3	0	0	3	3
4	BPH 7004	PHARMACEUTICAL CHEMISTRY-VIII (Medicinal Chemistry-III)	3	0	0	3	3
5	BPH 7005	PHARMACOGNOSY-IV	3	0	0	3	3
PRACTICALS							
6	BPH 7081	PHARMACEUTICAL ANALYSIS -III	0	0	4	2	4
7	BPH 7082	PHARMACEUTICS -VIII (Biopharmaceutics & Pharmacokinetics)	0	0	4	2	4
8	BPH 7083	PHARMACOLOGY -III	0	0	4	2	4
9	BPH 7084	PHARMACOGNOSY-IV	0	0	4	2	4
10	BPH 7085	INDUSTRIAL TRAINING	0	0	4	2	4
11.	BPH 7099	GENERAL PROFICIENCY	0	0	0	1	0
TOTAL			15		20	26	35

Eighth Semester

S. No.	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	CONTACT HRS/WK
			L	T	P		
1	BPH 8001	PHARMACEUTICAL CHEMISTRY-IX (Chemistry of Natural Products)	3			3	
2	BPH 8002	PHARMACEUTICAL BIOTECHNOLOGY	3			3	
3	BPH 8003	PHARMACEUTICAL INDUSTRIAL MANAGEMENT	3			3	
4	BPH 8004	HOSPITAL PHARMACY	3			3	

ELECTIVE (Any one to be opted)

S. No.	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	CONTACT HRS/WK
			L	T	P		
1	BPH 8005	STANDARDISATION OF HERBAL DRUGS	3	0	0	3	3
2	BPH 8006	DRUG DESIGN	3	0	0	3	3
3	BPH 8007	CLINICAL PHARMACY & DRUG INTRERATIONS	3	0	0	3	3
4	BPH 8008	PHARMACEUTICAL MARKETING	3	0	0	3	3
5	BPH 8009	PHARMACEUTICAL PACKAGING	3	0	0	3	3
6	BPH 8010	NOVEL DRUG DELIVERY SYSTEMS	3	0	0	3	3
7	BPH 8011	DRUG REGULATORY AFFAIRS	3	0	0	3	3
PRACTICALS							
1.	BPH 8081	PHARMACEUTICAL CHEMISTRY-IX (Chemistry of Natural Products)	0	0	4	2	4
2.	BPH 8099	GENERAL PROFICIENCY	0	0	0	1	0

PROJECT ON ELECTIVE (Any one to be opted)							
1	BPH 8082	STANDARDISATION OF HERBAL DRUGS	0	0	4	2	4
2	BPH 8083	DRUG DESIGN	0	0	4	2	4
3	BPH 8084	CLINICAL PHARMACY & DRUG INTRERATIONS	0	0	4	2	4
4	BPH 8085	PHARMACEUTICAL MARKETING	0	0	4	2	4
5	BPH 8086	PHARMACEUTICAL PACKAGING	0	0	4	2	4
6	BPH 8087	NOVEL DRUG DELIVERY SYSTEMS	0	0	4	2	4
7	BPH 8088	DRUG REGULATORY AFFAIRS	0	0	4	2	4
		TOTAL	15		8	20	23

AHM 1005: REMEDIAL MATHEMATICS

Credits: 04

Semester I

L-T-P: 3-2-0

Objective: This course is designed to provide basic understanding in the basics of mathematics which are used in the process of drug discovery. It is intended primarily for under graduate pharmacy students to have a thorough knowledge in algebra, co-ordinate geometry and, differential and integral calculus.

Module No.	Content	Teaching Hours
I	Algebra : Equations reducible to quadratics, Cramer's rule, Algebra of matrices (addition, subtraction, multiplication), Inverse of a matrix. Co-ordinate Geometry: Cartesian coordinates, distance between two points, area of triangle, straight line, intercept and normal forms.	13
II	Differential Calculus: Limit and function, differential coefficient of standard functions (algebraic, trigonometric, logarithmic and exponential), product rule, quotient rule, chain rule, parametric rule.	13
III	Integral Calculus: Integration as inverse of differentiation, integration by parts, substitution & partial fraction. (Simple problems only) Differential Equations: Introduction to ordinary differential equations, order and degree, linear differential equations of n th order with constant coefficients, complementary function and particular integral.	14

Outcome: On successful completion of Remedial Mathematics, students will be able to:

- Outline and critically solve the pharmaceutical problems through applying concepts of algebra and co-ordinate geometry.
- Critically, explain the derivations of pharmaceutical equations through the concepts of calculus and differential equations.

Reference Books:

- A Text Book of Mathematics for XI – XII students, NCERT pub., Vol. I - IV
- S. L. Loney : The elements of Coordinate Geometry, BookPalau, NewDelhi.
- H.Kishan : Differential Calculus, Atlantic publishers and Distributors
- Gorakh Prasad : A Text Book on Integral Calculus, Pothishla(pvt.) ltd.Alaahabad.
- Bali and Goyal : A Text Book of Engg. Mathematics, VIII ed., Univ. Sc. Press.

BPH 1001: REMEDIAL BIOLOGY

Credits: 03

Semester I

L-T-P: 3-0-0

Objective: The course is designed to provide basic knowledge of biology. It is primarily intended for under graduate students to have a through knowledge on cell biology and anatomy of plants. In addition, it also provides general structure and life history of selected invertebrates that are responsible for life threatening communicable diseases.

Module No.	Content	Teaching Hours
I	Cell Biology Cell: Its structure and non living inclusions, Mitosis and Meiosis, Basic concept of Molecular Biology: An idea about Nucleic acid, DNA replication, Protein biosynthesis.	13
II	Botany Methods of classification of plants. Morphology of root, stem, leaf, flower, and seed. Histology of root, leaf and stem. Modification of stems and roots.	13
III	Zoology Methods of classification of animal kingdom. Structure and life history of parasites as illustrated by amoeba, entamoeba, plasmodium, taenia. General structure and life history of insects like mosquito, house fly, mites and silk worm.	14

Outcomes: At the end of the course, the student will be able to

- Critically explain the concept of cell biology which will give better platform to understand Pharmacology, Pharmacognosy, and Microbiology in higher classes.

REMEDIAL BIOLOGY PRACTICAL

Credits: 01

Semester I

L-T-P: 0-0-2

Objective: The course is designed to provide basic practical knowledge on cell biology and anatomy of plants. In addition, it also provides general structure of selected invertebrates that are responsible for life threatening communicable diseases.

Module No.	Content	Lab Hours
I-III	1. Care, use and type of microscopes. 2. Gross identification of slides of structures and life cycle of lower plants/animals mentioned in theory. 3. Morphology of plant parts indicated in theory. 4. Preparation, microscopic examination of stem, root and leaf of monocot and dicot plants. 5. Structure of human parasites and insects mentioned in theory with the help of specimens.	24

Outcome: At the end of the course, the student will be able to

- Critically explain the concept of microscopy, its application in identification of above specimens and morphology of plant parts.

Reference Books:

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

BPH 1002: PHARMACEUTICAL ANALYSIS-I

Credits: 03

Semester I

L-T-P: 3-0-0

Objective: This course is designed to provide basic understanding in the qualitative and quantitative analysis of chemical substances. It is intended primarily for under graduate pharmacy students to have a thorough knowledge in volumetric analysis through applying the concepts of acid-base, oxidation-reduction and precipitation. The course will cover the concepts of gravimetric analysis of the chemicals with medicinal value.

Module No.	Content	Teaching Hours
I	Significance of quantitative analysis in quality control, type of errors, their minimization, significant figures, precision and accuracy, fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards. Law of mass action, common-ion effect, ionization and Ostwald's dilution law, ionic product of water, pH and its determination, hydrolysis of salts, buffer solution and Henderson-Hasselbach equation,	13
II	Acid Base Titrations: Acid base concepts, relative strengths of acids and bases, acid base indicators, neutralization curves and choice of indicators, theory of indicators, and mixed indicators. Oxidation reduction Titrations: Concepts of oxidation and reduction, redox reactions, strengths and equivalent weights of oxidizing and reducing agents, theory of redox titrations, redox indicators, oxidation reduction curves, iodometry and iodometry, redox titrations involving potassium iodate, potassium bromate and potassium permanganate.	13
III	Precipitation Titrations: Precipitation reactions, solubility products, effect of acids, temperature and solvent upon the solubility of precipitate. Mohr's method, Volhard's method, Fajan's method, and Gay Lussac method. Gravimetric Analysis: Precipitation techniques, supersaturation, co-precipitation, post-precipitation, digestion, washing of the precipitate, filtration, filter papers and crucibles, ignition, thermogravimetric estimation and curves, specific examples like barium as barium sulphate, aluminium as aluminium oxide, organic precipitants.	14

Outcome: On successful completion of this course, students should be able to:

- Outline and critically appraise the issues related to volumetric analysis of drugs.
- Explain the issues related to gravimetric analysis.

BPH 1081: PHARMACEUTICAL ANALYSIS-I PRACTICAL

Credits: 02

Semester I

L-T-P: 0-0-4

Objective: This course is designed to provide basic practical understanding in the qualitative and quantitative analysis of chemical substances. It is intended primarily for under graduate pharmacy students to have a thorough practical knowledge in volumetric analysis through applying the concepts of acid-base and oxidation-reduction.

Module No.	Content	Lab Hours
I-III	<p>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 & use of balance, methods of weighing, and errors in weighing. The students should also be acquainted with the general apparatus requiring various analytical procedures.</p> <p>1. Standardization of analytical weights and calibration of volumetric apparatus.</p> <p>2. Acid Base Titrations: Preparation and Standardization of acids and bases, some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures, e.g. boric acid, should also be covered.</p> <p>3. Oxidation Reduction Titrations: Preparation & standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc. Some exercises related to determinations of oxidizing & reducing agents. Exercises involving potassium iodate, potassium bromate, iodine solution.</p>	48

Outcome: On successful completion of this course, students will be able to:

- Outline and critically appraise the issues related to volumetric analysis of drugs.

Reference Books:

- Mendham J, Denny R.C., Barnes J.D., Thomas M, Jeffery G.H., "Vogel's Textbook of Quantitative Chemical Analysis", Pearson Education Asia.
- Connors K.A., "A Text book of Pharmaceutical Analysis", Wiley Inter-science, NewDelhi.
- Beckett, A.H., and Stenlake, J.B., Practical Pharmaceutical Chemistry, Vol. I&II. The Atherden Press of the University of London, C.B.S Publishers & Distributors.
- British Pharmacopocia, Her Majesty's Stationary Office, University Press, Cambridge.
- Alexeyev V. "Quantitative Analysis". CBS Publishers & Distributors.
- The Pharmacopocia of India, Controller of publications, NewDelhi.

BPH 1003: PHARMACEUTICAL CHEMISTRY-I (Inorganic Pharmaceutical Chemistry)

Credits: 03

Semester I

L-T-P: 3-0-0

Objective:

- The students will acquire knowledge about different categories of inorganic drugs/ compounds which are used as medicinal agents and pharmaceutical aids.
- Understand the importance of impurities that are present in pharmaceuticals and to control them.
- To know about the major physiological ions and replacement therapy.
- An introduction to radiopharmaceuticals and their diagnostic and therapeutic uses.

Module No.	Contents	Teaching Hours
I	<p>A. Limit Tests: Sources of impurities in pharmaceutical substances, importance of limit test and general principles and procedures for limit tests of chloride, sulphate, iron, arsenic, lead & heavy metals.</p> <p>B. Extra and Intracellular Electrolytes: Major physiological ions, electrolytes used in replacement therapy, physiological acid-base balance, electrolytes used in acid-base therapy, electrolyte combination therapy, sodium chloride injection, Ringer solution lactated, Ringer injections.</p> <p>C. Essential and Trace Elements: Role of essential and trace elements in biological systems (Manganese, Iodine, Sulfur, Copper, Zinc, Nickel, Chromium, Selenium); Iron & Haematinics (Ferrous fumarate, Ferrous gluconate, Ferrous sulphate, Ferric ammonium citrate).</p>	13
II	<p>An outline of methods of preparation, test for purity, pharmaceutical uses and the following classes of inorganic drugs :</p> <p>A. Pharmaceutical Aids & Necessities: Water (Purified water, Water for injection and Sterile water for injection); Pharmaceutically acceptable glasses; Adsorbents (Activated charcoal); Antioxidant (Sodium metabisulphite).</p> <p>B. Respiratory Drugs: Respiratory stimulants (Ammonium carbonate); Inhalants (Oxygen); Anesthetics (Nitrous oxide); Expectorants & Antitussives (Potassium iodide).</p> <p>C. Dental Products: Anticaries agents (Sodium fluoride); Dentifrices (Calcium carbonate); Desensitizing agents (Zinc chloride).</p> <p>D. Topical Agents: Protectives (Calamine, Titanium dioxide, Talc); Astringents (Zinc oxide, Zinc Sulphate); Antimicrobials (Boric acid, Hydrogen peroxide, Povidone-iodine, Potassium permanganate).</p>	13
III	<p>A. Gastrointestinal Agents: Acidifying agents (Dilute hydrochloric acid); Antacids (Bismuth subcarbonate, Aluminium hydroxide, Magnesium hydroxide, Magnesium carbonate (light & heavy), Magnesium trisilicate); Combination of antacids; Protective & adsorbent (Aluminum sulphate); Cathartic & laxative (Magnesium sulphate); Emetics (Antimony potassium tartarate).</p> <p>B. Antidotes: Classification on the basis of mechanism, (Sodium nitrite, Sodium thiosulphate).</p> <p>C. Radiopharmaceuticals: Radioactivity (alpha, beta and gamma radiations), Biological effects of radiations, radioisotopes, measurement of radioactivity, radiopharmaceutical preparations and their applications: Sodium chromate (Cr-51) injection, Gold (Au-198) injection, Sodium iodide (I-131 and I-125) capsules and solutions. Precautions during handling and storage of radioactive materials.</p>	14

Outcome:

- Students will be able to utilize the limit tests to control various impurities.
- Know the methods of preparation and uses of inorganic drugs used to treat various ailments like gastrointestinal disorders, cough, poisoning, topical and dental problems and in electrolyte replacement therapy.
- Application of radiopharmaceuticals in diagnosis and therapy and precautions during their storage and handling.

BPH 1082: PHARMACEUTICAL CHEMISTRY-I PRACTICAL (Inorganic Pharm. Chemistry)

Credits: 02

Semester I

L-T-P : 0-0-4

Objective:

- The students will acquire practical knowledge about limit tests of different inorganic substances of pharmaceutical compounds.
- Understand the importance of impurities that are present in pharmaceuticals and to control them.
- Know about the practical aspects of qualitative analysis of inorganic pharmaceutical compounds.

Module No.	Content	Lab Hours
I-III	<ol style="list-style-type: none"> 1. Limit test of chloride, sulphate, iron and arsenic in the given sample of pharmaceutical compound. 2. Preparation of simple inorganic compounds of pharmaceutical importance and perform limit test on them. 3. Qualitative analysis of the mixture of inorganic pharmaceutical compounds. 	48

Outcome:

- Students will be able to utilize the limit tests to control several impurities.
- They will be able to perform qualitative analysis of several mixtures of inorganic pharmaceutical compounds.

Reference Books:

- J. H. Block, E. B. Roche ,Inorganic, Medicinal and Pharmaceutical Chemistry, Indian edition, Varghese Publication.
- Modern Inorganic Pharmaceutical Chemistry by C. A. Dicher.
- Bentley & Driver's Text Book of Pharmaceutical Chemistry Revised by L. M. Atherden, Lartest edition, Oxford Medical Publications.
- Pharmaceutical Inorganic Chemistry by Dhake & Tipnis, Latest edition.
- Cotton & Wilkinson , Advanced Inorganic Chemistry, John Willey &sons, Singapore.
- Inorganic Pharmaceutical Chemistry PRACTICAL, Dhake & Belsare.
- Roger's Inorganic Pharmaceutical Chemistry of Lea and Febiger, Philadelphia, USA.
- Mellor's Modern Inorganic Chemistry, Longman Green and Co., Ltd., London.
- Pharmacopoeia of India, Govt. of India, Ministry of Health, Delhi.
- S.N. Pandeya: A Textbook of inorganic medicinal chemistry, S.G.Publishers, Varanasi.
- M. Ali: Text book of Pharmaceutical Inorganic chemistry, CBS, New Delhi.

BPH 1004: PHARMACEUTICS- I (General Pharmacy)

Credits: 03

Semester I

L-T-P: 3-0-0

Objective: The student shall be oriented about origin of pharmacy, pharmacopoeias, pharmaceutical calculations, various physical processes like size reduction, size separation, extraction, mixing, various types of additives used in various dosage forms and type of dosage forms available in the market.

Module No.	Content	Teaching Hours
I	<ol style="list-style-type: none"> History of Pharmacy: Origin & development of Pharmacy, scope of Pharmacy, introduction to pharmacopoeias with special reference to I.P, B.P., U.S.P, & International Pharmacopoeia, Introduction to National Formulary Pharmaceutical Additives: Coloring, flavouring & sweetening agents, preservatives, surfactants, antioxidants and their applications in pharmacy Pharmaceutical Calculations: Posology, Calculation of doses for infants, adults and elderly patients; enlarging and reducing recipes percentage solutions, allegation methods, alcohol dilution methods, proof spirit. 	13
II	<ol style="list-style-type: none"> Introduction to Pharmaceutical Dosage Forms: A brief theory of: aromatic waters, spirits, paints, syrups, elixirs, tinctures, mouth washes, lotions, liniments, pastes, Inhalations, eye drops and ear drops. Size Reduction: Definition, factors affecting size reduction, principles, laws & factors affecting energy requirements, different methods of size reduction, study of Cutter Mill, hammer mill, ball mill, fluid energy mill & disintegrator, Selection of size reduction equipments. Size Separation: Definition, various methods & equipments employed for size separation e.g. sieving, sedimentation, cyclone separator, elutriation methods. 	13
III	<ol style="list-style-type: none"> Extraction: Extraction processes, study of infusion, decoction, digestion, percolation, maceration & their modifications, factors affecting selection of extraction processes. Mixing: Definition and objectives of mixing, Types of Mixtures, Liquid mixing, Semi-solid mixing and Solid mixing, Selection of mixing, Equipments of mixing. 	14

Outcome:

- With the knowledge of calculation of doses, additives and dosage forms, students will be able to formulate various types of dosage forms and know the doses for different age groups.
- They will be able to use size reduction, size separation, mixing and extraction in formulations and applications in industry.

BPH 1083: PHARMACEUTICS- I PRACTICAL (General Pharmacy)

Credits: 02

Semester: I

L-T-P: 0-0-4

Objective: The student shall be oriented about utilization of pharmaceutical calculation, types of additives used in preparation of dosage forms, various physical processes like size reduction, size separation, extraction and mixing.

Module No.	Content	Lab Hours
I-III	<p>I – Preparation of following classes of Pharmaceutical dosage forms.</p> <p>a) Aromatic Waters b) Solutions c) Syrups d) Elixirs e) Spirits f) Powders g) Lotions h) Liniments i) Mucilage j) Poultice k) Tincture & Extracts</p> <p>II - Experiments to illustrate principles of size reduction using Ball Mill.</p> <ul style="list-style-type: none"> • Effect of size of balls, number of balls and time on the efficiency of ball mill. 	48

Outcome:

- With the knowledge of calculation of doses, additives and dosage forms, students will be able to formulate various types of dosage forms and know the doses for different age groups.
- They will be able to use size reduction, size separation, mixing and extraction in formulations and applications in industry.

Reference Books:

- Pharmacopoeia of India, The Controller of Publications, Delhi,
- British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.
- Carter S.J., "Cooper and Gunn's Tutorial Pharmacy", CBS Publishers, Delhi.
- Rawlins E.A., "Bentley's Text Book of Pharmaceutics", ELBS Bailliere Tyndall,
- Lachman L, Liberman H.A and Kanig J.L., "Theory and Practice of Industrial Pharmacy", Lea and Febiger.
- Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.
- Aulton, M.E, Text Book of Pharmaceutics, Vol., I & II. Churchill Livingstone.
- United States Pharmacopoeia (National Formulary),
- Remington – "The science and practice of pharmacy" Vol. I & II. Wolters Kluwer (India) Pvt.Ltd, NewDelhi, Latest edition.

BPH 1005: ANATOMY, PHYSIOLOGY & PATHOPHYSIOLOGY-I

Credits: 03

Semester I

L-T-P: 3-0-0

Objective: This course is designed to provide basic understanding in the organization of human body. It is intended primarily for under graduate pharmacy students to have a thorough knowledge in cell and different type of tissues present in the human body. The course will cover anatomy and physiology of skeletal and muscular system. Moreover, the course will provide critical analysis on several pathophysiological aspects of disorders of skeletal and muscular system.

Module No.	Content	Teaching Hours
I	a. Organization of human body. b. Functional & structural characteristics of cell, cell division. c. Detailed structure of cell membrane & physiology of transport process. d. Structure & functions of different tissues- epithelial, connective, muscle and nerve.	13
II	Muscular system: Anatomy & physiology of skeletal, smooth and cardiac muscle, physiology of muscle contraction, energy metabolism, types of muscle contraction, muscle tone. Pathophysiology of myasthenia gravis.	13
III	Skeletal system: Structure, composition & functions of skeleton. Classification of joints, types of movements of joints. Pathophysiology of arthritis and gout.	14

Outcome: On successful completion of Anatomy, Physiology and Pathophysiology-I, students should be able to:

1. Outline and critically appraise the anatomy and physiology of skeletal and muscular system.
2. Explain the pathophysiology of several disorders of skeletal and muscular system.
3. Critically review the issues involved in the genesis of diseases of skeletal and muscular system.

Reference Books:

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

AHE 1002: REMEDIAL ENGLISH

Credits: 04
Semester I
L-T-P: 3-1-0

Objective: The course will include intensive reading, writing, and listening practices. Special emphasis will be given on finding out the most frequent mistakes committed by students. The effort is to enable them to overcome these mistakes; and to boost their understanding of language. In writing section, the focus will be on making correct sentences, guided writing, guessing word meaning in context. In reading and listening sections, the focus will be on understanding long sentences, studying the complex sentence structures and understanding main idea. The students will be given practice sheets on some of the grammar topics. The idea is to bring grammar in their practice. The objective of the course is to help students attain a basic proficiency in reading and writing skills.

Module No.	Content	Teaching Hours
I	STRUCTURE A.1. Parts of Speech (a) Noun (b) Pronoun (c) Verb (a list of regular & irregular forms of verb to be supplied) (d) Adjective (e) Adverb (f) Preposition * Classroom activities: The students are expected ✓ to supply the list of all the possible common nouns, verbs, adjectives & adverbs ✓ to identify the parts of speech in sentences A.2. Sequence of words in a sentence (Word Order) Illustration with examples A.3. Word Formation Processes Affixation ✓ Inflectional ✓ Derivational * Classroom activities: The students are expected ✓ to convert word from one grammatical category to another ✓ to be aware of all the affixes used as part of grammatical processes A.4 Putting Words Together A.4.1. Phrase Prepositional phrase Use of noun phrases to give extra information, e.g The man in the blue uniform stopped Jenny. A.4.2. Sentence ✓ Declarative sentence ✓ Interrogatory sentence ✓ Imperative sentence ✓ Concord of nouns, pronouns and possessive adjectives ✓ Difficulties encounter with comparative and superlatives (With special reference to common errors) ✓ Use of Articles A.4.3. Run-on sentence (A sentence that is too long should be broken into two or more sentences. One sentence should present one basic concept; if it presents more than that, it may be a run-on)	20

	<p>A.4.4 Sentence fragment</p> <p>A.4.5 Usage of Conjunctions (Detailed Illustration)</p> <p>* Classroom activities: The students are expected</p> <ul style="list-style-type: none"> ✓ to Listen audio clippings of basic conversation and take a note of the same ✓ to translate small paragraphs on famous personalities, school, places etc.(Different themes of translation to be provided by the course instructor) <p>['*' - to be based on the module (examples or the exercises) prepared by the course instructor.]</p>	
II	<p>A.5 More about Verbs</p> <p>A.5.1. Active vs. Passive (# Confusion of participles: active & passive)</p> <p>A.5.2 Modals (using present modals - obligation, recommendation, permission, e.g. Doctors have to work very long hours.), Putting modals in the past, e.g. Picasso might have painted this picture.</p> <p>A.5.3. Conjugation</p> <p>A.5.4. Tenses (Aspects)</p> <p>*Classroom activities: The students are expected</p> <ul style="list-style-type: none"> ✓ to be able to convert whole paragraph written in active voice into passive ✓ to participate in Story reading, talking about 'Relatives' etc. (Telling the difference. Make sentences with "BUT") <p>A.6. Miscellaneous</p> <p>A.6.1. Direct Object vs. Indirect Object</p> <p>A.6.2. Person</p> <p>A.6.3. The Infinitive</p> <p>A.6.4. Confusion of Adjectives and Adverbs</p> <p>A.6.5 Parsing</p> <p>PUNCTUATION Period/Full Stop, Comma, Apostrophe, Question Mark, Semi colon, Colon, Exclamation mark, Hyphen, Dash. (Illustration with examples)</p>	10
III	<p>THEME BASED WRITING</p> <p><u>Adjectives for People, Adverbs of Time, Animals, Bank, Baseball, Body, Buildings and Places, Car Parts, City, Classroom, Clothes, The Basic Colors (American Spellings) (gray), The Basic Colours (British Spellings) (grey), Cooking, Desserts, Dinner Table, Family Members, Fruit, Geography, House, Restaurant, Tools, Transportation, Vegetables, Weather</u></p> <p>* The same themes can be used for reading activities as well.</p>	15

Outcome: after completing the course students will be able to:

- Comprehend a text and answer the questions based on it clearly.
- Express their ideas in writing according to time and tense.
- Enrich their vocabulary in terms of contextual and situational conversation.
- Enhance their listening skills through the video of the text.

Reference Books:

- Murphy, Raymond, Intermediate English Grammar. Cambridge University Press.
- Robert J. Dixon. Complete Course in English. A new revised edition
- Hornby, A.S., Advanced Learners' Dictionary of Current English, OUP
- Greenberg, Rondinone & Wiener. *The Advancing Writer Book I*, Harper Collins, College Publishers.
- Liz and Soars. *Headway Pre-Intermediate*. OUP
- Sharma, SD. A textbook of professional Communication Skills & ESP for Engineers and Professionals, Sarup & Sons, Delhi

BPH 2001: PHARMACEUTICAL CHEMISTRY – II

(Physical Chemistry)

Credits: 03

Semester II

L-T-P: 3-0-0

Objective: The course is so designed that the students are exposed to the basics of physical chemistry that includes physical properties of chemical compounds.

Module No.	Content	Teaching Hours
I	<p>1. Behaviour of gases: Kinetic theory of gases, deviation from ideal behaviour and liquefaction of gases.</p> <p>2. The liquid state: Determination and applications of surface tension, parachor, viscosity, rheochor, refractive index, optical rotation, dipole moment.</p> <p>3. Solid State and phase equilibria: Amorphous, crystalline state, polymorphism, phase, component, degree of freedom, phase rule (excluding derivation), phase diagrams for one & two component system involving eutectics (examples-water and KI-H₂O system).</p>	13
II	<p>4. Solutions: Raoult's Law, ideal and real solutions, Solutions of gases in liquids (Henry's Law).</p> <p>Colligative properties: Lowering of vapour pressure, elevation in boiling point, depression in freezing point, osmotic pressure & their significance.</p> <p>5. Solubility and distribution: distribution law, limitations & its applications, solubility, solubility curve, factors affecting solubility.</p> <p>6. Thermodynamics: Fundamentals, first, second, third and zeroth law, Joule-Thompson's effect.</p>	13
III	<p>7. Thermo chemistry: Definition, heat of reaction, Hess' law of constant heat summation, heat of formation, heat of solution, heat of neutralisation, heat of combustion and Bomb calorimeter.</p> <p>8. Electro chemistry: Faraday's laws of Electrolysis, specific, equivalent & molar conductivity and their variation with dilution, Kohlrausch law, degree of ionization, Arrhenius theory, theory of strong electrolytes (Debye-Huckle theory).</p> <p>9. Chemical kinetics: Order & molecularity of reaction, Kinetics of zero, first and second order reaction. Effect of temperature on reaction rate.</p> <p>10. Catalysis: Homogenous, Heterogeneous, acid base and enzyme catalysis, their characteristics and applications.</p>	14

Outcome: The students would be in the position to acquire sufficient knowledge which would be of help to them in understanding the Physical pharmacy (i.e. study of physical properties of drug molecules) subject of pharmacy course.

BPH 2081: PHARMACEUTICAL CHEMISTRY – II PRACTICAL

(Physical Chemistry)

Credit: 02

Semester II

L-T-P: 0-0-4

Objective: The course is so designed that the students will learn the practical aspects of physical properties of chemical compounds.

Module No.	Content	Lab Hours
I-III	1. Determination of refractive index of given liquids. 2. Determination of specific rotation of sucrose at various concentrations. 3. Determination of rate constant of simple reaction. 4. Determination of surface tension. 5. Determination of partition co-efficient. (Association and Dissociation) 6. Determination of viscosity. 7. Determination of solubility.	48

Outcome: The students will be able to determine the physical properties of drug molecules and their applications in pharmaceutical sciences.

Reference Books:

- Pali S.R., and Prabartak, S.K.D.E., Practical Physical Chemistry, Haltone Limited, Calcutta.
- Shoemaker, D.P. Garland, C.W., Experiments of Physical Chemistry, MC Graw Hill Book Co.
- Bahl B.S., Tuli G.D. & Bahl Arun, Essential of Physical Chemistry, S. Chand & Co, New Delhi.
- Negi A.S. & Anand S.C. "Textbook of Physical Chemistry" Wiley Eastern Ltd, New Delhi.
- Glasstone S. & Lewis D, Elements of Physical Chemistry, Macmillan Education, New Delhi.
- Atkins P & Paula, J.D. "Atkins Physical Chemistry" Oxford University Press, New Delhi.

BPH 2002: PHARMACEUTICAL CHEMISTRY-III
(Organic Chemistry-I)

Credits: 03

Semester II

L-T-P: 3-0-0

Objective: To acquire the basic knowledge of organic chemistry (aliphatic and aromatic compounds) together with stereochemistry.

Module No.	Content	Teaching Hours
I	<p>Structure and Properties: Atomic orbital, molecular orbital, hybridization, chemical bonding sigma and pi bond,</p> <p>Isomerism: Classification, stereoisomerism, chirality, optical activity (d and l), enantiomerism, diastereoisomerism, meso compounds, specification of configuration (D,L and R,S), Racemic modification and resolution of racemic mixture,</p> <p>Alkane- Nomenclature, Alkyl group, IUPAC names, Physical properties, Methods of preparation, Chemical properties, Mechanism of Free Radical Substitution, Orientation, Relative reactivities, stability of Free Radical conformations in alkane.</p> <p>Alkenes – Structure of Ethylene, Geometrical isomerism (<i>cis</i> and <i>trans</i>, E- & Z isomers), Nomenclature, Physical properties, Preparation, Mechanism of dehydrohalogenation, E₁, E₂ mechanism Elimination Vs substitution. Dehydration of alcohols (mechanism), Hoffman and Saytzeff type elimination, Reactions of alkenes, Heat of hydrogenation, stability of alkenes, Addition of hydrogen halide, Markovnikov's & Anti Markovnikov's rule with mechanisms involved.</p> <p>Alkynes- Structure of acetylene, Nomenclature, Preparation of alkynes, Reaction, Acidity of alkynes.</p>	13
II	<p>Alkyl halides- Nomenclature, Physical properties, Preparation, Reactions, Nucleophilic aliphatic substitutions - Mechanism SN₁, SN₂ Difference amongst 1^o, 2^o, 3^o halides.</p> <p>Alcohols- Classification & Nomenclature, Physical properties, Preparation of alcohols, Reaction of alcohol, Oxidation of alcohol, Differences among 1^o, 2^o, 3^o alcohol.</p> <p>Aromatic compounds – Structure of Benzene and Stability, Resonance in benzene, Aromatic character, Nomenclature Reaction of benzene, Mechanism of Electrophilic Aromatic Substitution, Effect of substituents, Determination of orientation, Nitration sulfonation, Halogenation, Friedel Crafts, alkylation & acylation.</p> <p>Cyclic aliphatic compounds – Nomenclature preparation & reaction. Baeyer strain Theory.</p>	13
III	<p>Aldehydes and Ketones – Structure, Nomenclature, Physical properties, Preparation, Reactions, Mechanism of Nucleophilic Addition, Cannizzaro reaction. Addition of Grignard Reagent, Planning of Grignard syntheses, Reactions involving carbanions, Aldol condensation, Claisen condensation.</p> <p>Amines – Structure, Nomenclature, Classification physical properties, Amines and basicity as related to structure preparation, Synthesis of secondary and tertiary amines, Diazonium salt and its importance.</p> <p>Phenols- Structure and nomenclature physical properties, Acidity of phenols, Preparation Reaction, Reimer -Tieman Reaction, Kolbe reaction Fries Rearrangement.</p> <p>Carboxylic acid and its derivatives – Structure and nomenclature, Acidity of carboxylic acids, Preparation, Reaction of carboxylic acid, Hell-Volhard Zelinsky reaction with mechanism.</p>	14

Outcomes: The students will be able to use the basic knowledge of organic chemistry for advanced organic chemistry.

BPH 2082: PHARMACEUTICAL CHEMISTRY-III PRACTICAL (Organic Chemistry-I)

Credit-02

Semester II

L-T-P: 0-0-4

Objective: To acquire the basic knowledge of synthesis and identification of aliphatic and aromatic compounds.

Module No.	Content	Lab Hours
I-III	1. Identification of organic compounds. 2. Synthesis of simple organic compounds involving benzylation, acetylation, bromination, reduction & oxidation.	48

Outcome: The students will be able to synthesize organic compounds for advanced organic chemistry.

Reference Books:

- Mann, F.G, & Saunders, B.C., Practical Organic Chemistry, Orient Longman, NewDelhi.
- Vogel A.I., Textbook of Practical Organic Chemistry, Pearson Education, NewDelhi.
- Morrison, R.T., and Boyd R.N., Organic Chemistry, Pearson Education, NewDelhi.
- Finar, I.L., Organic Chemistry, Vol. I & II, Pearson Education, NewDelhi.
- Jain, M.K. Organic Chemistry, Sohan Lal Nagin Chand & Co. 60 B, Bunglaow Road, Delhi.
- Hendrikson , Organic Chemistry

BPH 2003: ANATOMY, PHYSIOLOGY & PATHOPHYSIOLOGY-II

Credits: 03

Semesters II

L- T -P: 3-0-0

Objective: This course is designed to provide basic understanding in the circulatory and nervous system of human body. It is intended primarily for under graduate pharmacy students to have a thorough knowledge in haemopoetic, autonomic and central nervous system present in the human body. Moreover, the course will provide critical analysis on several pathophysiological aspects of communicable diseases.

Module No.	Content	Teaching Hours
I	Haemopoietic system: Composition & functions of blood & its elements, erythropoiesis, blood groups, blood coagulation. Pathophysiology of anaemia, acute leukaemia. Lymphatic System : Composition , formation and circulation of lymph, lymph node and spleen.	13
II	Autonomic Nervous System : Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission of A.N.S. Sense Organs : Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds and skin . Pathophysiology of cataract & glaucoma. Communicable Diseases: Brief outline, their causative agents, modes of transmission and prevention (Measles, influenza, tuberculosis, malaria, typhoid, and AIDS).	13
III	Central Nervous System: Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, cranial nerves and their functions. Diseases: Epilepsy, Parkinson & Alzheimer's, Schizophrenia and Mania.	14

Outcome: On successful completion of this course, students will be able to:

1. Outline and critically appraise the anatomy and physiology of circulatory and nervous system.
2. Explain the pathophysiology of several disorders of circulatory and nervous system.
3. Critically review the issues involved in the genesis of communicable diseases.

BPH 2083: ANATOMY, PHYSIOLOGY & PATHOPHYSIOLOGY-II LAB

Credit-02

Semester II

L-T-P: 0-0-4

Objective: This course is designed to provide basic practical understanding in the human skeletal system. It is intended primarily for under graduate pharmacy students to have a thorough knowledge in estimation of several blood and cardiac parameters.

Module No.	Content	Lab Hours
I-III	<ol style="list-style-type: none"> 1. Study of human skeleton. 2. Microscopic study of different tissues. 3. Estimation of haemoglobin in blood, determination of bleeding time, clotting time, R.B.C. count, total leucocyte count, D.L.C., E.S.R. & blood group determination. 4. Recording of body temperature, pulse rate and blood pressure, basic understanding of Electrocardiogram – PQRST waves and electroencephalogram & their significance. 	48

Outcome: On successful completion of this course, students will be able to:

1. Outline and critically appraise the microscopical characteristics of different tissues.
2. Explain the diagnostic parameters related to blood and heart disorders.

Reference Books:

- Ranade VG, Text Book of Practical Physiology, Pune Vidyarthi Griha Prakashan, Pune.
- Difore SH, "Atlas of Normal Histology with functional correlations" B.I Publication, Noida.
- Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
- Guyton AC, Hall JE., Text book of Medical Physiology, WB Saunders Company.
- Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
- Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone, New Delhi.
- Tortora GJ, & Anagnostokos NP, Principles of Anatomy & Physiology, Harper & Rave Publishers, New Delhi.
- Parmar N.S., Health Education & Community Pharmacy CBS Publishers, New Delhi.
- Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
- Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press, New Delhi.

*** BCA 2070: COMPUTER FUNDAMENTALS**

Credits: 03

Semesters II

L- T -P: 3-0-0

Objective: This course is designed to provide basic concepts of computer application in the field of drug discovery. It is intended primarily for under graduate pharmacy students to have a thorough knowledge in the organization of computer, MS-Office and certain selected single and multi-user operating systems.

Module No.	Content	Teaching Hours
I	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.	13
II	Introduction to MS-OFFICE-2003, word 2003 document creation, editing, formatting table handling, mail merge, Excel-2003, editing, working Retrieval, Important functions, short cut keys used in EXCEL. MS-Power point 2003-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 2003, main components of Access tables, Queries, Reports, Forms table handling, working on Query and use of database.	13
III	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. Computer applications in Pharmaceutical and clinical studies, uses of Internet in Pharmaceutical Industry.	14

***The course will be incorporated as received from computer department with code numbers as per norms of GLA University.**

Outcome: On successful completion of this course the students will be able to understand the organization of computer. In addition, they can operate MS-Office programs and certain selected single and multi-user operating systems.

* BCA 2090: COMPUTER FUNDAMENTALS PRACTICALS PRACTICAL

Credit-02

Semester II

L-T-P: 0-0-3

Objective: This course is designed to provide basic practical concepts of computer application in the field of drug discovery. It is intended primarily for under graduate pharmacy students to have a thorough knowledge in MS-Office, internet and computer operating system such as DOS and Windows.

Module No.	Content	Lab Hours
I-III	Software Lab to be used for the following:- 1. Windows, Managing Windows, Working with Disk , Folders and files. 2. MS-Office 2003 (MS Word, MS Power point, MS Excel, MS Access). 3. Computer Operating System Like DOS and Windows. 4. Internet Features (E-mail, Browser etc.)	36

Outcome: On successful completion of this course the students will be able to understand the uses of computer in drug discovery. In addition, they can operate MS-Office programs and DOS operating systems.

Reference Books:

- Sinha, P.K. and Sinha, P, Computer Fundamentals, BPB Publications, New Delhi.
- Raja, R.V, Computer Programming in FORTRAN 77, PHI Learning Private Ltd., New Delhi.
- Hunt, R, Shelley, J, Computers and Common Sense, PHI Learning Private Ltd., New Delhi.
- Jain, Y.K., Elements of Computer Science, CBS Publishers and Distributors, New Delhi.
- Kushwaha, D.S, Thakkar, V.M., Computers and Applications, Tata McGraw Hill Publishing Company Ltd., New Delhi.

***The course will be incorporated as received from computer department with code numbers as per norms of GLA University.**

AHM 2005: PHARMACEUTICAL BIOSTATISTICS

Credits: 04

Semesters II

L- T -P: 3-1-0

Objective: This course is designed to provide basic understanding in the analysis of different sets of data. It is intended primarily for under graduate pharmacy students to have a thorough knowledge in data and its error during sampling. Moreover, the course will provide critical analysis on central tendency, regression, correlation and variance.

Module No.	Content	Teaching Hours
I	Classification of Data: Data collection, diagrammatic representation of data (pie, histogram, bar, circular diagram), classification and tabulation of data. Sampling : Types, merits and limitations, sampling errors and non sampling errors. Measure of Central Tendency: Arithmetic mean, median and mode.	13
II	Measure of Dispersion: Quartile deviation, mean deviation and standard deviation Moments : Central moments, Raw moments and moments about origin, skewness and kurtosis (by the method of moments). Probability Distributions: Binomial, Poisson and Normal distribution.	13
III	Correlation and Regression: Karl Pearson's method of measuring correlation, Spearman's rank correlation method, lines of regression. Curve Fitting: Fitting of straight line & second degree parabola by method of least squares. Testing of hypothesis: Level of significance, Test of significance for large and small samples, t – test and χ^2 test, F – test, ANOVA (one way classification).	14

Outcome: On successful completion of this course, students will be able to:

1. Outline and critically appraise the different sets of data and errors during its sampling.
2. Critically review the issues involved in the methods of analysis of central tendency, regression, correlation and variance.

Reference Books:

- Gupta, S.P, Statistical Methods, Sultan chand & Sons Educational Publishers, New Delhi.
- Negi, K.S, Biostatistics, AITBS Publishers, New Delhi.
- Grewal, B.S, Higher Engineering Mathematics, Khanna Publishers, Delhi.
- Boltan, S., Bon, C., Pharmaceutical Statistics, Practical & clinical applications, Marcel Dekker, N.Y.

AHE 2083: ENGLISH IN PRACTICE-I

Credits: 02

Semester II

L-T-P: 0-0-3

Objective:

At the end of the course, the participant should be able to:

- Understand and communicate with English speakers from different parts of the English-speaking world.
- Discuss and plan holidays in English.
- Understand and tell jokes and stories.
- Discuss elements of popular culture such as TV, radio and music.
- Talk & write about past, memories and ambitions in English.
- Communicate important personal information in spoken English.
- Discuss health, and that of others, in English.

English in Practice I' focuses on communication activities in functional and situational contexts. It encourages students to speak with fluency and accuracy as well as develop the four skills of reading, writing, listening and speaking. The classes will be theme based to provide practice in a meaningful context which can be extended outside the classroom.

Module No.	Content	Teaching Hours
I	<p>STRUCTURAL INPUT</p> <ul style="list-style-type: none"> • Use of Articles (written Drill) - Pp 49, & 50, Exercise 1,2,3,4 • Singular & Plural • Gender • Nouns (Pp 61 Writing) • Tenses (Pp 62 to 63, all sections) • Adjectives & Adverbs (Pp 82 Adjective & Adverbs) • Prepositions (Place, Position, Instrument, Agent, Time) – Pp 158 Exercise no.1, 2 , Pp 159, Exercise no. 3) <p>*All the grammatical elements should be discussed in the light of the exercises.</p>	11
II	<p>(A) SPEAKING AND LISTENING Vocabulary of character description Shopping, Holidays (A list of words related to the themes can be provided as a supplement) ACTIVITIES Pp 118, UNIT I, Listening exercise no 1 (Track 002) Pp 119, UNIT 1, Communication Exercise 4 (Track 003) Pp 121, UNIT 3, Listening Exercise 1 (Track 009) Pp 132, UNIT 9, Communication Exercise 4 (Track 026) (Text to be used: Mani. P. <i>English for Teaching.</i>)</p> <p>(B) READING AND WRITING Vocabulary of character description History, Homes and Houses (A list of words can be provided as a supplement) ACTIVITIES Pp 33, Describing a Process 1 & 2 [All the sections to be covered in the 2 sessions Pp 37 to 38, Study Skills 1.a, b, c Pp 38, Writing 1 & 2 (Text to be used: <i>English for Engineers</i> by RIS, Bangalore.)</p>	13

III	<p>STRUCTURAL INPUT</p> <ul style="list-style-type: none"> Usage of Affixes in forming words belonging to different grammatical categories e.g. -al, ness, -ed, un-, im-, -ish, -ism, etc. Identification of grammatical categories of the word in sentences Error correction with reference to Subject & verb agreement (Pp 94 to 98 Exercise 26, K. R. Laxminarayanan, English for Technical Communication, Vol. 1 & 2, Scitech Pub. Pvt Ltd) <p>Prepositions (Reason, Complement, Ingredient, Beneficiary)</p>	11
IV	<p>A. SPEAKING & LISTENING Vocabulary of character description</p> <p>Education, Defence (A list of words related to the themes can be provided as a supplement)</p> <p>ACTIVITIES Pp 122, UNIT 3, Listening Exercise 2 (Track 010) Pp 121, UNIT 2, Communication Exercise 4 (Track 007) Pp 126 to 127, UNIT 6, Listening Exercise 1 (Track 018) (Text to be used: Mani, P. <i>English for Teaching</i>.)</p> <p>B. READING & WRITING ACTIVITIES Pp 48 Writing</p> <p>Pp 40 to 43, Reading, Chapter 1 & Comprehension Pp 44, Writing Section1 (Some more activities can be added by faculty) (Text to be used: <i>English for Engineers</i> by RIS, Bangalore.)</p>	09

Outcome: The students will be able to attain a higher proficiency in four language skills- listening, speaking, reading and writing.

Reference Books:

- A.S. Hornby, *An Advanced Learners' Dictionary of Current English*, OUP.
- Raymond Murphy, *Intermediate English Grammar*, Cambridge University Press.
- Mani .P & Deepthi. S, *English for Teaching*, CUP
- Regional Institute of English, '*English for Engineers*', Bangalore, Foundation Books Pvt. Ltd.

Material:

Audio-Video Material available in the language Lab and texts such as Newspapers etc

BPH 3001: PHARMACEUTICS -II (Pharmaceutical Engineering-I)

Credits: 03

Semester III

L-T-P: 3-0-0

Objective: To provide knowledge about different aspects of Physical and Chemical process used in a unit operation, knowledge about unit process and fluid flow along with all the laws involved. About mechanism and equipments of Filtration, Centrifugation, Crystallization and HVAC system. Introduce with types of material used in construction and their applications.

Module No.	Content	Teaching Hours
I	<ol style="list-style-type: none"> 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, measurement of flow and pressure. 3. Filtration and Centrifugation : Theory of filtration, filter aids, filter medias, industrial filters including filter press, rotary filter, edge filter. Factors affecting filtration, Principles of centrifugation, industrial centrifugal filters and centrifugal sedimenters. 	13
II	<ol style="list-style-type: none"> 1. 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 balance around Swenson Walker Crystallizer. Supersaturation theory and its limitation. 2. Nucleation mechanisms, crystal growth, Study of various types of Crystallizer, Tanks, agitated batch, Swenson Walker, Single vacuum, circulating magma and Crystal crystallizer, caking of crystals and its prevention. 	13
III	<ol style="list-style-type: none"> 1. Heating, Ventilation & AC Systems: Basic concepts and definitions, wet bulb and adiabatic saturation temperature, Psychrometric chart and measurement of humidity, applications of humidity measurement in pharmacy, equipment for dehumidification operations. Principles and applications of refrigeration and air conditioning. 2. 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. 	14

Outcome: After completion of course students will be able to

- Understand concept involved in unit operation and unit process in the pharmaceutical industry. Fluid flow mechanism of pharmaceutical liquids.
- Utilise the principles of filtration, centrifugation and crystallization in the selection of appropriate equipment for unit process in pharmaceutical industry.

BPH 3081: PHARMACEUTICS-II PRACTICAL

(Pharmaceutical Engineering-I)

Credit: 02

Semester III

L-T-P: 0-0-4

Objective: To provide basic practical knowledge about different aspects of measurement of rate of flow of fluids, filtration, crystallization, centrifugation and psychrometric chart.

Module No.	Content	Lab Hours
I-III	1 Measurement of rate of flow of fluids and pressure by: <ol style="list-style-type: none"> a) Simple and differential manometers b) Venturimeter c) Orifice meter 2. Determination of Reynolds Number. 3. Study of factors affecting rate of filtration <ol style="list-style-type: none"> 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 of principle of centrifugation for <ol style="list-style-type: none"> a) Liquid –Liquid separation and stability of emulsions. b) Solid – liquid separation and stability of suspension. 5. Determination of dry bulb and wet bulb temperature and use of Psychrometric chart. 6. Study of characteristics of crystals. 7. Study of solubility curve of crystals.	48

Outcome: After completion of course students will be able to

- Understand concept involved in different methods of fluid flow instruments used in pharmaceutical industries.
- Utilise the principles of filtration, centrifugation and crystallization in the selection of appropriate equipment for unit process in pharmaceutical industry.

Reference Books:

- Badger, W.L and Banchero, J.T., Introduction to Chemical Engineering, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
- Green, D.W, Perry, R.H, Perry 's Chemical Engineers Handbook, Mc Graw Hill, New York.
- McCabe, W.L, Smith, J.C, Harriott, P, Unit Operations of Chemical Engineering, Mc Graw Hill International edition Co., London.
- Sambhamurthy, K, Pharmaceutical Engineering, New Age International Publishers, New Delhi.
- Gavhane, K.A, Unit Operation-I, Nirali Prakashan, Pune.

BPH 3002: PHARMACEUTICAL JURISPRUDENCE & ETHICS

Credits: 03

Semester III

L-T-P: 3-0-0

Objective: The subject is designed to provide knowledge about the pharmaceutical legislations, pharmaceutical education, pharmaceutical ethics, different laws/acts and rules in the country for regulating the pharmacy courses, manufacturing and testing, import and sale of drugs and cosmetics.

Module No.	Content	Teaching Hours
I	1. Pharmaceutical Legislations – A brief review. 2. Drugs & Pharmaceutical Industry – A brief review. 3. Pharmaceutical Education – A brief review. 4. Pharmaceutical Ethics: 5. An elaborate study of the following: <ol style="list-style-type: none"> a. Pharmacy Act 1948 b. Drugs and Cosmetics Act 1940 and Rules 1945 	13
II	<ol style="list-style-type: none"> a. A.I.C.T.E. Act 1987 b. Patents Act 1970 c. Medicinal & Toilet Preparations (Excise duties Act 1955) d. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules. e. Drugs Price Control Order 1995. 	13
III	A brief study of the following with special reference to the main provisions. <ol style="list-style-type: none"> 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. f. U.S Food and Federal D&C Act 	14

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

Outcome: Students will be able to trace the history of pharmacy and pharmacy education in India, and know about regulatory bodies, role of registered pharmacist.

Reference Books:

- Mittal, B.M, A Textbook of Forensic Pharmacy, Vallabh Prakashan, New Delhi.
- Jain, N.K, A Textbook of Forensic Pharmacy, Vallabh Prakashan, New Delhi.
- Singh, Harkishan, History of Pharmacy in India- Vol.-I, II & III, Vallabh Prakashan, New Delhi.
- Agarwal, S.P, Khanna, R, Pharmaceutical Jurisprudence & Ethics (Forensic Pharmacy), Birla Publications Pvt. Ltd., New Delhi.

BPH 3003: PHARMACOGNOSY – I

Credits: 03

Semesters III

L- T -P: 3-0-0

Objective: To make students familiar with the concept of Pharmacognosy, this shows study of the natural products utilized as drugs, and their medicinal and Pharmaceutical importance. To study cultivation and collection of drugs of natural origin and adulterants in them. Phytochemical and Pharmacognostic features of carbohydrate and lipid containing drugs and types of pharmaceutical aids used in pharmaceutical sciences.

Module No.	Content	Teaching Hours
I	<p>a) Definition history, scope & development of Pharmacognosy. Source & Classification of Drug: Alphabetical, morphological, taxonomical, chemical & pharmacological.</p> <p>b) Quality Control of Crude Drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation including quantitative microscopy. WHO guidelines for standardisation of medicinal plants.</p>	13
II	<p>Cultivation, Collection, Processing & Storage of Crude Drugs:</p> <p>a) Factors influencing cultivation, collection, drying and storage of medicinal plants. Type of soils & fertilizers of common use.</p> <p>b) Pest & pest management, natural pest control agents (Tobacco, Pyrethrum, Cevadilla, Neem, Ryania)</p> <p>c) Plant hormones and their applications.</p> <p>d) Polyploidy, mutation & hybridization with reference to medicinal plants.</p>	13
III	<p>Systematic pharmacognostic study (biological source, chemical constituents & uses) of following drugs:</p> <p>a) Carbohydrates & Derived Products: Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia & Tragacanth.</p> <p>b) Lipids – Beeswax, Castor oil, Cocabutter, Hydnocarpus oil, Cod liver oil, Shark liver oil, Linseed oil, Wool fat.</p> <p>c) Fibres & Pharmaceutical Aids: Cotton, Silk, Wool, Glasswool, Asbestos, Talc, Kaolin, Bentonite, Gelatin, Natural colors.</p>	14

Outcome:

- Identify the parameters for cultivation and collection of medicinal plants.
- Identify adulterants
- Detailed pharmacognostic parameters and phytoconstituents of different categories of medicinal plants

BPH 3082: PHARMACOGNOSY-I PRACTICAL

Credit-02

Semester III

L-T-P: 0-0-4

Objective: The course is primarily focused in the determination of several morphological, microscopical and macroscopical characteristics of starch grains, calcium oxalates, stomata, fibers, natural colours and fats. Further, the course will understand the basic concepts of performing several identification tests of carbohydrates.

Module No.	Content	Lab Hours
I-III	<ol style="list-style-type: none"> 1. Microscopical measurements of starch grains (Wheat, Maize). 2. Microscopical measurements of starch grains (Rice, Potato). 3. Various types of calcium-oxalate crystals, their study and microscopical measurements 4. (Rhubarb, Senna, Liquorice etc.) 5. Study of various types of phloem fibres. 6. Study of Cotton, Silk and Wool along with their chemical Tests. 7. To study the morphology and chemical tests of Talc, Diatomite, and Kaolin. 8. Morphology and microscopy of Bentonite, Gelatin and natural colours (Saffron). 9. Determination of stomatal number, stomatal index, palisade ratio, vein-islet and vein termination number with the help of camera lucida 10. Chemical Tests of Agar, Acacia, Sterculia and Tragacanth. 11. Chemical tests of Pectin, Starch and Honey. 12. To determine the swelling factor of Isapaghula husk. 13. Physical characteristics of Castor oil, Cod-liver oil, Shark-liver oil and Linseed oil. 14. Physical properties of crude drugs mentioned in theory. 15. Determination of leaf constants such as Stomatal index, Stomatal number, Vein islet number, Vein determination number and palisade ratio. 16. Identification tests of crude drugs belonging to carbohydrates & lipids. 17. Study of fibres and pharmaceutical aids. 18. Preparation of herbarium sheets. 	48

Outcome: Students will be able to:

- Identify the morphological, microscopical and macroscopical characteristics of starch grains, calcium oxalates, stomata, fibers, natural colours and fats.
- Perform several identification tests of carbohydrates.
- Prepare herbarium sheets.

Reference Books:

- Trease G.E., & Evans W.C., "Pharmacognosy", Elsevier Publishers, New Delhi.
- Wallis, T.E. "Text Book of Pharmacognosy" CBS Publisher & Distributor, New Delhi,
- Wallis T.E., Analytical Microscopy, J&A Churchill Limited, London.
- Brain K.R. and Turner T D. "The Practical Evaluation of Phyto Pharmaceutical", Wright, Scientehnica- Bristol.
- Schewer PJ, "Marine Natural products", Academic press, London.

BPH 3004: PHARMACEUTICAL CHEMISTRY - IV

(Organic Chemistry-II)

Credits: 03

Semesters III

L- T -P: 3-0-0

Objectives: The students will be exposed to heterocyclic chemistry, chemistry of polymers, polynuclear compounds, chemistry of biomolecules and certain name reactions. The content will help the students to have deep insight of medicinal compounds derived from organic compounds. The chemistry of biomolecules will help the students to have firm chemistry and basic metabolic pathways involved in biological system.

Module No.	Content	Teaching Hours
I	<p>1. Heterocyclic Compounds– Nomenclature, preparation, properties and medicinal importance of pyrrole, furan, thiophene, pyridine, pyrimidine, imidazole, pyrazole, thiazole, benzimidazole, indole, quinoline & phenothiazine.</p> <p>2. Polymers and Polymerization: Free radical polymerization, copolymerization, ionic polymerization, step reaction polymerization.</p> <p>3. Preparation and synthetic applications of Grignard reagent and organolithium compounds.</p>	13
II	<p>4. Compounds containing Active Methylene Group: Synthetic importance of acetoacetic ester and malonic ester.</p> <p>5. Polynuclear Hydrocarbons- Nomenclature, preparation and reactions of naphthalene, anthracene and phenanthrene.</p> <p>6. Carbohydrates: Definition and Classification.</p> <p>i) Monosaccharides– Structure elucidation of glucose and fructose, stereoisomers, reactions, conversions, configuration, cyclic structure of glucose, determination of ring size in glucose, conformations.</p> <p>ii) Disaccharides and Polysaccharides – Chemical structure, composition and identification of sucrose, lactose, maltose, starch & cellulose.</p>	13
III	<p>7. Name Reactions – Definition, reaction mechanism and synthetic importance of Meerwin Ponndorf Verley reduction, Oppenauer oxidation, Beckmann rearrangement, Mannich reaction, Diel's Alder reaction, Michael reaction, Reformatsky reaction, Knoevenagel condensation & Benzoin condensation.</p> <p>8. Proteins and Amino Acids: Classification, identification, general methods of preparation and reactions of amino acids and proteins. Properties of amino acids: Amino acids as dipolar ions, Isoelectric point of amino acid. Peptides and determination of structure of peptides. Structures and denaturation of proteins.</p> <p>9. Fats, Oils and Waxes : Occurrence and composition of fats, oils and waxes, hydrolysis of fats, unsaturated fats, hardening & drying of oils, analytical constants of fats and oils, methods of their determination and significance.</p>	14

Outcome: Not only theoretical aspects the students would be clear they know the procedure and principle of systematic analysis of organic binary mixture. Able to perform quantitative determination of organic compounds. The knowledge acquired should give better understanding of biochemistry.

BPH 3083: PHARMACEUTICAL CHEMISTRY-IV PRACTICAL (Organic Chemistry-II)

Credit-02

Semester III

L-T-P: 0-0-4

Objective: The students will be exposed to synthesis and identification of several heterocyclic compounds. Further, the course will provide practical hands on experience on identification of oils and fats.

Module No.	Content	Lab Hours
I-III	1. Identification of organic compounds. 2. Synthesis of following organic compounds- Acetanilide, <i>p</i> -Bromo acetanilide, <i>p</i> -Bromo aniline, <i>p</i> -Nitro acetanilide, <i>p</i> -Nitro aniline, Picric acid, 3. Determination of acid, iodine and saponification values of oils and fats.	48

Outcome: Students will be able to:

- Identify and synthesize the heterocyclic compounds.
- Identify the purity of oils and fats.

Reference Books:

- Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.
- 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.
- Morrison, T.R. and Boyd, R.N., Organic Chemistry, Prentice Hall of India, Private Limited, New Delhi.
- Finar, I.L., Organic Chemistry Vol. I & II, ELBS/Longman.
- Jain, M.K. and Sharma S.C, Organic Chemistry, Shoban Lal Nagin Chand & Co., Delhi.
- O.P. Agarwal, Organic Chemistry, Reaction and reagents, Goel's publishing House, Meerut.

BPH 3005: PHARMACEUTICS-III (Community Pharmacy)

Credits: 03

Semesters III

L- T -P: 3-0-0

Objective: To know role and responsibilities of community pharmacist, retail and whole sale drug store, legal requirements for opening of drug store, inventory control, pharmacoeconomics, OTC drugs, communicable disease, adverse drug reaction and prescription handling.

Module No.	Content	Teaching Hours
I	<p>Community Pharmacy Management</p> <p>1. Definition, scope of community pharmacy</p> <ul style="list-style-type: none"> • Roles and responsibilities of community pharmacist, <p>2. Organization and structure of retail and whole sale drug store-types of drug store and design</p> <ul style="list-style-type: none"> • Selection of site, space layout, and design • Legal requirements for establishment, • Maintenance of record • Uses of Computers: Drug Information Services: like Sources of information on drugs, disease, treatment schedules, procurement of information, computerized services (e.g., MEDLINE), retrieval of information, • Inventory control in community pharmacy. Definition, various methods of Inventory Control (ABC, VED, EOQ). 	13
II	<p>Essential Concepts in Community Pharmacy</p> <ul style="list-style-type: none"> • Rational Drug Use • OTC Medication- Definition, OTC medication list & counseling • Pharmacoeconomics : Introduction to pharmacoeconomics, different methods of pharmacoeconomics, • Pharmacoepidemiology: Definition and scope, method to conduct pharmacoepidemiological studies, • Pediatric and Geriatric Pharmacy Practice • Preventive measures for Communicable Diseases 	13
III	<p>Community Pharmacy Practice</p> <p>1. Introduction to Clinical Pharmacy: Definition, development and scope of clinical pharmacy</p> <ul style="list-style-type: none"> • Prescription : Handling of prescription, source of errors in prescription, Latin abbreviations used in prescription • Patient Counselling • Patient Compliance: Definition, factors affecting compliance, role of pharmacist in improving the compliance • Medication related problems: Adverse Drug Reactions (Incidence, and incompatibility) • Health screening services: Definition, importance, methods for screening, definitions of diagnostic tests, study of some health screening methods and diagnostic tests • Interpreting Blood and Urine Data 	14

Outcome: Students will be able to know:

1. The legal requirements for opening of drug store and methods of inventory control.
2. Importance of pharmacoconomics and phrmacoepidemiology.
3. Handling of prescription and dispensing of drugs as per law

BPH 3084: PHARMACEUTICS-III PRACTICAL (Community Pharmacy)

Credit-02

Semester III

L-T-P: 0-0-4

Objective: To know role and responsibilities of community pharmacist, retail and whole sale drug store, legal requirements for opening of drug store, inventory control, pharmacoeconomics, OTC drugs, communicable disease, adverse drug reaction and prescription handling.

Module No.	Content	Lab Hours
I-III	1. Categorization and storage of pharmaceutical products bases on legal requirements of labeling and storage. 2. Project report on visit to the nearby community for counseling on the rational use of drugs and aspects of health care. 3. Preparation of Corrected Incompatible Preparations 4. Health screening services and study of equipments for:- <ul style="list-style-type: none"> • Blood glucose and cholesterol determination • Blood pressure (BP apparatuses) • Lung function test (Spirometer) 5. Design of community pharmacy to incorporate all pharmaceutical care services (as per Schedule N). 6. Study of OTC medications (List & Available brands) 7. Interpretation of various pathological report of blood and urine.	48

Outcome: Students will be able to know:

1. The legal requirements for opening of drug store and methods of inventory control.
2. The utility of equipments used for determination of blood glucose, cholesterol, blood pressure and lung function.

Reference Books:

- Parthasarathi G, Nyfort-Hansen K, Nahata M.C., A Text book of Clinical Pharmacy Practice –Essential Concepts and Skills, Orient Longman.
- Carter S.J. Cooper and Gunn’s Dispensing for Pharmaceutical Students, CBS Publishers, & Delhi.
- Ansel H.C., Introduction to Pharmaceutical Dosage Forms, K.M. Varghese & Co., Bombay.
- Aulton M.E. Pharmaceutics – The Science of Dosage Form Design, ELBS/ Churchill
- Remington Pharmaceutical Sciences, Mack Publishing Co., Pennsylvannia.
- I.P., Govt of India Publication.
- B.P., Her Majesty’s Stationary Office, Cambridge.
- Carter S.J., Cooper and Gunn’s Tutorial Pharmacy, CBS Publishers, Delhi.
- Drugs & Cosmetics Act & Rules.
- Parmar N.S. Community Pharmacy & Health Education, CBS Publishers
- Park K. Preventive and Social Medicines 19th Edition, Bhanot Publishers

BPH 3006: ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-III

Credits: 03

Semesters III

L- T -P: 3-0-0

Objective: To give a knowledge on anatomy and physiology of different systems (Digestive, urinary and reproductive system and endocrine system) and the pathophysiology of their diseases.

Module No.	Content	Teaching Hours
I	Digestive system –Parts of digestive system, their structure and functions. Pathophysiology of disorders related to digestive system: Peptic Ulcer, Ulcerative colitis, Crohns disease, Hepatitis, Cirrhosis of liver.	13
II	Urinary System – Anatomy & physiology of Urinary system, physiology of urine formation, acid- base balance, pathophysiology of renal failure, urinary tract infection. Reproductive system –Male & female reproductive system. Menstruation, spermatogenesis, Oogenesis, Pregnancy.	13
III	Endocrine system – Control of hormone secretion, Anatomy & Physiology of pituitary, thyroid, parathyroid, adrenal, pancreas. Pathophysiology of diabetes mellitus.	14

Outcomes: The students will be able to explain the

1. Digestion, type of digestion, salivary glands and their location and role of saliva indigestion.
2. Role of kidney in homeostasis, physiology of urine formation, male and female reproductive organs and their disease.
3. Feedback mechanism and function of different hormones, what are the pituitary hormone, thyroid hormone and pathophysiology of diabetes mellitus.

Reference Books:

- Difore SH, "Atlas of Normal Histology" Lea & Febiger Philadelphia.
- Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
- Guyton AC, Hall JE., Text book of Medical Physiology, WB Saunders Company.
- Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
- Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
- Tortora GJ, & Anagnodokos NP, Principles of Anatomy & Physiology, Harper & Rave Publishers, New Delhi.
- Parmar N.S., Health Education & Community Pharmacy CBS Publishers, Delhi.
- Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
- Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.
- Dipiro JL, Pharmacotherapy– A Pathophysiological Approach, Elsevier.
- Robbins SL, Kumar V, Basic Pathology, WB Saunders.

BPH 4001: PHARMACEUTICS -IV (Pharmaceutical Engineering-II)

Credits: 03

Semester IV

L-T-P: 3-0-0

Objective: To provide knowledge about material balance, energy balance, molecular units, dimensionless equation, dimensionless formula and types of graphs along with their application in pharmaceutical industry. About concept, principle, equipments and applications of Evaporation, Drying and Distillation. The types of industrial hazards and their prevention.

Module No.	Content	Teaching Hours
I	Stoichiometry: Unit processes, material and energy balances, molecular units, mole fraction, gas laws, mole volume, primary and secondary quantities, equilibrium state, rate process, steady and unsteady states, dimensionless equations, dimensionless formulae, different types of graphic representation.	13
II	1. Evaporation: Introduction to evaporation, factors affecting evaporation, Forced circulation and natural circulation evaporators, film evaporators, single effect and multiple effect evaporator 2. Drying: Moisture content and mechanism of drying, rate of drying curve, classification and type of dryers, dryers used in pharmaceutical industries, tray dryer, fluidized bed dryer, spray dryer, freeze dryer, rotary dryer, drum dryer, and pharmaceutical application of drying.	13
III	1. Distillation: Raoult's law, Phase diagrams, volatility, simple, steam and flash distillation principles of rectification, McCabe thiele method for the calculation of number of theoretical plates, azeotropic and extractive distillation. 2. Industrial Hazards and Safety Precautions: Mechanical, chemical, electrical, fire and dust hazards. Industrial dermatitis.	14

OUTCOME:

- After completion of course students will be able to-
- Understand concept of conservation of energy and matter. Estimation of material and types of energy. Utilise the principles of Evaporation, Drying and Distillation in the selection of appropriate equipment for various unit operations in the pharmaceutical industry and ensuring safety precautions to prevent industrial hazards.

BPH 4081: PHARMACEUTICS –IV PRACTICAL

(Pharmaceutical Engineering – II)

Credit: 02

Semester IV

L-T-P: 0-0-4

Objective: To provide practical knowledge about the concept, principle, equipments and applications of Evaporation, Drying and Distillation. Moreover, the course will provide basic understanding about engineering drawing.

Module No.	Content	Lab Hours
I-III	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) Effect of Surface area b) Effect of 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 a) Alphabets/ letter writing b) Scales c) Orthographic projections – First and third angle projection methods d) Simple Isometric views	48

Outcome: After completion of course students will be able to:

- Understand the principles of Evaporation, Drying and Distillation in the selection of appropriate equipment for various unit operations in the pharmaceutical industry and ensuring safety precautions to prevent industrial hazards.
- Draw basic models of pharmaceutical equipments.

Reference Books:

- Badger, W.L and Banchero, J.T., Introduction to Chemical Engineering, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
- Green, D.W, Perry, R.H, Perry's Chemical Engineers Handbook, Mc Graw Hill, New York.
- McCabe, W.L, Smith, J.C, Harriott, P, Unit Operations of Chemical Engineering, Mc Graw Hill International edition Co., London.
- Sambhamurthy, K, Pharmaceutical Engineering, New Age International Publishers, New Delhi.
- Gavhane, K.A, Unit Operation-I, Nirali Prakashan, Pune.

BPH 4002: PHARMACEUTICAL MICROBIOLOGY

Credits: 03

Semester IV

L-T-P: 3-0-0

Objective: To provide the students with the basic information about microorganisms, their basic structure, mode of growth, use microscopy and staining techniques for identification of microorganisms and study the various physical and chemical microbial growth controlling techniques and various other tests used for detection of microorganisms.

Module No.	Content	Teaching Hours
I	Introduction and General Biology of Bacteria: Historical development, scope of microbiology, morphology of bacteria, nutritional requirements of bacteria Cultivation and Isolation of Bacteria Microscopy: Basic Principles in Microscopy, Light Microscopy, Stains and types of staining techniques, Electron microscopy, Specimen Preparation under Electron Microscope	13
II	Test Procedures as per I.P. a) Microbial assays of Antibiotics: Cup-plate Method and Turbidimetric assay method b) Test for Antimicrobial Preservatives Control of Microbes by Chemical Methods: Disinfection, Factors affecting dynamics of antimicrobial action of disinfectants, Evaluation methods of disinfectants: Phenol coefficient test- Rideal Walker & Chick Martin, demerits and merits of these Methods, Bean & Berry Method, Nephelometric method, Counting method.	13
III	Sterility Testing as per I.P Control of Microbes by Physical Methods: Various methods of sterilization by physical agents, Equipments & validation of sterilization methods a) Dry heat- Design of equipment, applications, advantages and disadvantages, b) Moist heat- Various Methods of Moist Heat sterilization, Factors affecting thermal destruction of microorganisms, advantages and disadvantages of this method, c) Gaseous sterilization d) Sterilization by Filtration methods, e) Sterilization by Radiation	14

Outcome:

- Students will be able to differentiate various types of bacteria on the basis of morphology by various staining techniques and select appropriate sterilization method for inanimate objects, formulations, vaccines, sera.

BPH 4082: PHARMACEUTICAL MICROBIOLOGY PRACTICAL

Credit-02

Semester IV

L-T-P: 0-0-4

Objective: To provide the students with the basic practical aspects of sterilization and preparation of culture media. Further, the course will information about microorganisms, their basic structure, mode of growth, use microscopy and staining techniques for identification of microorganisms and study the various physical and chemical microbial growth controlling techniques and various other tests used for detection of microorganisms.

Module No.	Content	Lab Hours
I-III	1. Study of sterilization methods & equipments <ul style="list-style-type: none"> • Dry heat • Moist heat 2. Preparation of various types of culture media. 3. Isolation of bacteria. 4. Sub-culturing of common bacteria, fungi. 5. Identification and staining of bacteria and fungi <ul style="list-style-type: none"> • Simple staining • Gram staining 6. Handling of phase contrast microscope 7. Evaluation of disinfectants and antiseptics <ul style="list-style-type: none"> • Phenol coefficient test, minimum inhibitory concentration. 	48

Outcome:

- Students will be able to handle various types of microscopic techniques like simple, compound and phase contrast microscopes.
- Students will be able to identify microorganisms with the help of various staining techniques and able to do sub-culturing of common bacteria and fungi.

Reference Books:

- J. Pelczar, Reid and Chan Microbiology, Latest Edition, Tata McGraw Hill Publishing Co., New Delhi.
- S.J. Carter, Cooper and Gunn's Dispensing for Pharmaceutical Students, Pitman Medical Publishing Co., Latest Edition, Chapters 20 to 28.
- Aneja K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom Cultivation, Vishwa Prakashan
- S. J. Carter, Cooper and Gunn, Tutorial Pharmacy, Latest Edition, Pitman Medical.
- Hugo and Russell, Pharmaceutical Microbiology, Black Well Scientific Publication, Oxford.
- Prescott L.M., Harley J.P. & Klien D.A. Microbiology, McGraw Hill.
- Ananthanarayan R & Paniker CKJ, Textbook of Microbiology, Orient Longman Sykes, Disinfection and Sterilization.

BPH 4003: PHAMACOGNOSY - II

Credits: 03

Semesters IV

L- T -P: 3-0-0

Objective: The course is designed to provide knowledge about systematic scientific studies on selected natural products containing volatile oils, resins and tannins of commercial significance. The study of aromatic plants, sweetening agents, natural colours, enzymes which are used in pharmaceutical cosmetic and food industry.

Module No.	Content	Teaching Hours
I	<p>a) Resins: Podophyllum, Cannabis, Capsicum, Shellac, Asafoetida, Benzoin, Turmeric, Ginger, Balsam of Tolu, Balsam of Peru</p> <p>b) Volatile oils: Definition, classification and general methods of obtaining volatile oils from plants. Study of volatile oils from Mentha, Coriander, Cinnamon, Cumin, Black pepper, Cassia, Lemon peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Sandalwood.</p>	13
II	<p>a) Phytochemical Screening: Definition, isolation, classification and properties with qualitative chemical tests of the followings – Alkaloids, Saponins, Cardiac glycosides, Flavonoids, Cyanogenetic glycosides.</p> <p>b) Biological sources, preparation, characters and uses of following enzymes – Diastase, Papain, Pepsin, Penicillinase, Hyaluronidase, Streptokinase, Trypsin, Urokinase</p>	13
III	<p>Tannins : Definition, classification and identification tests of tannins. Study of tannins containing drugs like Pale Catechu, Black Catechu, Galls, Harde, Baheda, Arjuna & Ashoka.</p> <p>Role of aromatic plants in national economy and utilization of aromatic plants & desired products will special reference to Sandalwood oil, Mentha oil, Clove oil, Lemon grass oil & Eucalyptus oil.</p> <p>An overview of plants as sweetener and bitter agents.</p>	14

Outcome: After the study of the course the students shall be able to know

- About the phytopharmaceuticals of commercial significance.
- Role of aromatic and medicinal plants in national economy.
- Different aspects of using natural fibres, colours and sweeteing agents used in the preparation of formulation and cosmetics.

BPH 4083: PHAMACOGNOSY-II PRACTICAL

Credit-02

Semester IV

L-T-P: 0-0-4

Objective: The course is primarily focused in the determination of several morphological, microscopical and macroscopical characteristics of selected volatile oil drugs. Further, the course will understand the basic concepts of performing several identification tests of alkaloids, glycosides, tannins, steroids and flavonoids.

Module No.	Content	Lab Hours
I-III	1. Morphology of Mentha, Lemongrass, Nutmeg and chenopodium. 2. Morphology of Turmeric, Ginger, Eucalyptus. 3. Morphology and microscopy of Coriander and Cinnamon. 4. Morphology and microscopy of Dill and Caraway. 5. Morphology and microscopy of Cardamom and Fennel. 6. Morphology and microscopy of Clove and to study its transverse section. 7. To perform the chemical tests of Asafoetida. 8. Preparation of reagents for the chemical tests of Alkaloids and to perform the chemical tests on any Alkaloid containing drug. 9. Test for identification of Glycosides (Saponin and Anthraquinone). 10. Test for identification of Tannins. 11. Tests for identification of Steroids. 12. Tests for identification of Flavonoids. PROJECT WORK: Utilization of Aromatic plants (Monograph).	48

Outcome: Students will be able to:

- Identify the morphological, microscopical and macroscopical characteristics of drugs of volatile oil in nature.
- Perform several identification tests of alkaloids, glycosides, tannins, steroids and flavonoids. .
- Prepare Monograph.

Reference Books:

- Trease G.E., & Evans W.C., "Pharmacognosy", Elsevier Publishers, New Delhi.
- Tyler V.E. et al "Pharmacognosy" Lea & febiger, Philadelphia.
- Wallis, T.E. "Text Book of Pharmacognosy" CBS Publisher & Distributor, New Delhi.
- Kokate C.K. et al "Pharmacognosy" Nirali Prakashan, Pune.
- Atal C.K. & Kapur BM, "Cultivation & utilization of Medicinal plant, RRL, Jammu.
- Harborne J B, Phytochemical methods, Chapman & Hall International Edition, London U.K.
- Mohammed Ali," Pharmacognosy & Phytochemistry" Second Edition CBS Publisher & Distributor, New Delhi,

BPH 4004: PHARMACEUTICAL ANALYSIS- II

Credits: 03

Semesters IV

L- T -P: 3-0-0

Objective: To learn about different methods used in analysis including complexometry, Non-aqueous methods and various chromatographic techniques.

Module No.	Content	Teaching Hours
I	Theoretical considerations and application in drug analysis and quality control of the following analytical techniques. Non-aqueous titrations, Complexometric titrations, Diazotization titrations and Karl- Fischer titration. (assays included in the Indian Pharmacopeia 1996)	13
II	General principles, instrumentation and applications: Potentiometry, conductometry, polarography and Amperometry.	13
III	Principle, technique and pharmaceutical applications of Paper, Column chromatography, TLC, HPTLC and Size Exclusion Chromatography, Radio-immunoassay and Electrophoresis.	14

Outcome:

- Students will be in position to justify different methods used for drug analysis.

BPH 4084: PHARMACEUTICAL ANALYSIS-II PRACTICAL

Credit-02

Semester IV

L-T-P: 0-0-4

Objective: To learn practical aspects of standardization of drugs by following methods of non-aqueous, complexometric, diazotization and conductometry titration. Further, the course will provide practical understanding of separation and identification of mixture of drugs by using the methods of TLC and Paper chromatography.

Module No.	Content	Lab Hours
I-III	<p>1. Non-aqueous Titrations: Preparation and standardization of Perchloric acid, Estimation of some pharmacopoeial products.</p> <p>2. Complexometric Titrations : Preparation and standardization of EDTA solution some exercise related to pharmacopoeial assays by Complexometric titrations.</p> <p>3. Preparation and standardization of Sodium nitrite and some exercise related to pharmacopoeial assays by Diazotization.</p> <p>4. Exercise based on acid base titration in aqueous and non-aqueous media, oxidation reduction titrations using potentiometric technique, plotting of titration curves using pH meter.</p> <p>5. Determination of cell constant and Acid base titration using conductivity meter.</p> <p>6. Exercise based on separation and identification of mixtures using TLC and Paper chromatography.</p>	48

Outcome: Students will be able to:

- Standardize the drugs by using methods of non-aqueous, complexometric, diazotization and conductometry titration.
- Perform analytical procedure of TLC and Paper chromatography.

Reference Books:

- Beckett, A. H , Stenlake, J.B, Practical Phamaceutical Chemistry, Vol, I and II, CBS Publishers.
- India Pharmacopoeia , The Controller of Publications, Delhi.
- British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.
- Mendham, J, Denny, R.C, Barnes, J.D, Thomas, M.J.K, Vogel's Text Book of Quantitative chemical analysis, Pearson Education , New Delhi.
- Connors ,K.A, A Textbook of Pharmaceutical Analysis, Wiley Intescience Publication, New York.

BPH 4005: ANATOMY PHYSIOLOGY AND PATHOPHYSIOLOGY –IV

Credits: 03

Semesters IV

L- T -P: 3-0-0

Objective: To give a knowledge of anatomy and physiology of different systems (Respiratory, cardiovascular system and cell injury, adaptation and inflammation) and the pathophysiology of their diseases.

Module No.	Content	Teaching Hours
I	Respiratory System - Anatomy & functions of respiratory organs, Mechanism of respiration, pathophysiology of Asthma, Pneumonia, Bronchitis, Emphysema.	13
II	Cardiovascular System - Functional Anatomy of Heart, conducting system of Heart, Cardiac cycle, Pathophysiology of Hypertension, Angina, CHF, Cardiac arrhythmias, Ischaemic heart disease, Atherosclerosis.	13
III	Cell injury & Adaptation - Courses of cell injury, pathogenesis & morphology of cell injury. Cellular Adaptation : Atrophy, Hypertrophy, Aplasia, Metaplasia, Dysplasia and intracellular accumulation of fat. Pathophysiology of Neoplasm, Hodgkins disease. Basic mechanisms involved in the process of inflammation and tissue repair.	14

Outcome: The students will be able to explain the

1. Respiratory organs and their function and how the voice production occurs.
2. Functions of heart, circulation of blood, correlation between heart and ECG, pathophysiology of disease.
3. Mechanism as well as morphology of acute and chronic cell injury, apoptosis, atrophy, hypertrophy, aplasia, metaplasia and neoplasm.

Reference Books:

1. Difore, S.H, Atlas of Normal Histology, Lippincott Williams & Wilkins, London.
2. Chaurasia, B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
3. Guyton, A.C, Hall, J.E, Text book of Medical Physiology, WB Saunders Company, New Delhi,
4. Chatterjee, C.C, Human Physiology, Medical Allied Agency, Calcutta,
5. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone, New York,
6. Tortora, G.J, & Anagnostikos, N.P, Principles of Anatomy & Physiology, Harper & Rave Publishers, New Delhi,
7. Parmar, N.S, Health Education & Community Pharmacy, CBS Publishers, Delhi,
8. Keele, C.A, Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press, New Delhi,
9. Robbins, S.L, Kumar, V, Basic Pathology, WB Saunders, New Delhi,

BPH 5001: PHARMACEUTICAL CHEMISTRY – V (Biochemistry)

Credits: 03

Semester V

L-T-P: 3-0-0

Objective: The course content is so designed so that the students get familiarise with the basics biochemistry on which the design of drug and their manufacturing are dependent.

Module No.	Content	Teaching Hours
I	<p>1. Enzymes: Nomenclature, IUB classification, Factors affecting enzyme activity (Enzyme kinetics : Michaelis plot, Line weaver Burke plot), Mechanism of enzyme action, Enzyme Inhibition, Isoenzymes, Application of enzymes.</p> <p>2. Co-enzymes: Vitamins as co-enzymes and their significance, Metals as co-enzymes and their significance.</p> <p>3. Carbohydrate metabolism : Glycolysis, Gluconeogenesis , Glycogenolysis. Metabolism of galactose and galactosemia. HMP shunt pathway.</p> <p>4. The citric acid cycle, significance, reactions energetics and amphibolic nature of the cycle.</p>	13
II	<p>5. Lipid metabolism : Oxidation of fatty acids- β oxidation & its energetic. Biosynthesis, utilization and fate of ketone bodies, Biosynthesis of saturated and unsaturated fatty acids.</p> <p>6. Biological Oxidation : The respiratory chain, its role in energy capture & its control. Energetics, mechanism & inhibitors of oxidative phosphorylation. Enzymes involved in biological oxidation.</p>	13
III	<p>7. Metabolism of amino acids- Urea cycle, Metabolism of sulphur containing amino acids, catabolism of tyrosine, tryptophan & phenylalanine. Synthesis and significance of biologically important substances: creatine, histamine, 5-HT, dopamine, noradrenaline & adrenaline. Biosynthesis of purines and pyrimidines.</p> <p>8. DNA biosynthesis and replication, transcription or RNA biosynthesis. DNA repair mechanism & Carcinogenesis.</p> <p>9. Genetic Code and Protein synthesis, components of protein synthesis, inhibition of protein synthesis.</p> <p>10. Regulation of gene expression. (Prokaryote and Eukaryote).</p>	14

Outcome:

- The students would be in position to understand the concepts used in pharmacology and medicinal chemistry.

BPH 5081: PHARMACEUTICAL CHEMISTRY-V PRACTICAL

(Biochemistry)

Credit: 02

Semester V

L-T-P: 0-0-4

Objective: The course is designed in such a way that the students will get practical hands on experience in the separation and identification of biochemical substances such as amino acids, and enzymes in several samples like blood and urine.

Module No.	Content	Lab Hours
I-III	1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH. 2. Titration curve for amino acids. 3. Separation of amino acids by chromatography. 4. Separation of lipids by TLC. 5. Quantitative estimation of amino acids. 6. Determination of glucose by means of the enzyme glucose oxidase. 7. Enzymatic hydrolysis of glycogen by α & β amylase. 8. Effects of temperature on the activity of alpha amylase. 9. Estimation of cholesterol in Blood. 10. Estimation of Glucose in blood & urine. 11. Estimation of Urea in blood. 12. Estimation of ketone bodies in blood. 13. Qualitative analysis of inorganic as well as organic constituents of Urine.	48

Outcome:

- The students will be able to separate and identify the biochemical substances such as amino acids and enzymes in different biological samples.

Reference Books:

- Jayaraman, J, Laboratory Manual in Biochemistry, Wiley Eastern Limited, New York,
- Plummer, David, J, An Introduction to Practical Biochemistry, Mc Graw Hill, New Delhi,
- Singh, S.P, Practical Manual to Biochemistry, CBS Publisher, New Delhi,
- Harpers Review of Biochemistry, Lange Medical Publication, Singapore,
- Conn, E.E & Stumph, P.K, Outline of Biochemistry, John Willery & sons, New York,
- Nelson, D.L & Cox, M.M, Lehninger Principles of Biochemistry, Macmillan Worth Publishers, New York,
- Stryer, L, Biochemistry, WH, Freeman & Company, San Francisco, New York,

BPH 5002: PHARMACEUTICS – V

(Pharmaceutical Technology-I)

Credits: 03

Semester V

L-T-P: 3-0-0

Objective: Knowledge about the importance of pre-formulation factors. Formulation, evaluation and packaging of aerosols, liquid and semisolid dosage form and cosmetic products and their uses.

Module No.	Content	Teaching Hours
I	<p>a) Preformulation Studies: Goal of preformulation study, design of preformulation, principle and evaluations, Areas of preformulation research. Bulk Characterization: crystallinity, polymorphism, particle size, shape and bulk density, wetting, fine powder flow properties, solubility, partition coefficient, dissolution study & its effect on formulation, stability and bioavailability.</p> <p>b) Pharmaceutical aerosol: Propellants, components of aerosol, general formulation, manufacturing and packaging methods, evaluation of aerosol products and their applications.</p>	13
II	<p>a) Liquid dosage form: Introduction, different routes of administration, various 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..</p> <p>b) Semisolid dosage forms: Semisolid dosage forms, definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection, General formulation of semisolids, gels, ointments & their manufacturing procedures, evaluations and packaging.</p>	13
III	<p>a) Suppositories: Ideal requirements, bases, manufacturing procedure, packaging and evaluations.</p> <p>b) Cosmetology and cosmetic Preparations : Structure of skin and hair, formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, protective cream, antiperspirants, deodorant, face powder, shampoos, hair conditioner, Shaving and after shaving products, Dentifrice & Mouthwash, Lipstick, Nail lacquer.</p>	14

Outcome: Students will be able to use knowledge of pre-formulation factors and various techniques involved in designing of dosage forms and cosmetics. Students utilise knowledge regarding the packing and evaluation parameters of dosage forms including the methodologies and standard limits as per pharmacopoeia.

BPH 5082: PHARMACEUTICS-V PRACTICAL (Pharmaceutical Technology -I)

Credit-02

Semester V

L-T-P: 0-0-4

Objective: The course is designed to provide practical hands on experience in the preparation, evaluation and packaging of several pharmaceutical formulations of liquid and semi-solid dosage form.

Module No.	Content	Lab Hours
I-III	<p>1. Preparation, Evaluation, and packing of Medicaments</p> <p>a) Solutions b) Suspensions c) Emulsions d) Ointments e) Suppositories</p> <p>2. Preparation of cosmetic preparations</p> <p>a) Creams b) Shampoo c) Lotions d) Gels e) Powders f) Paste g) Mouth wash h) Face-pack i) Lipsticks</p>	48

Outcome: Students will be able to

- Prepare, evaluate and package of pharmaceutical formulation of liquid and semi-solid dosage form.

Reference Books:

- Remington's Pharmaceutical Sciences, Vol. I & Vol. – II, Mack Publishing Co., U.S.A,
- Cooper, J.W & Gunn,G, Tutorial Pharmacy, Petman Books Ltd., London,
- Lachman L., Lieberman H.A, Kanig J.L, Theory and Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.
- Ansel,H.C, Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.
- Balsam and Sagarin, Cosmetics: Science and Technology, John Wiley and Sons, New York,
- Mittal, B.M & Saha, R.N, A handbook of cosmetics, Vallabh Prakashan, New Delhi,

BPH 5003: PHARMACOLOGY - I

Credits: 03

Semesters V

L- T -P: 3-0-0

Objective: This course is designed to provide basic understanding in the principles of pharmacology. It is intended primarily for under graduate students to have an interest in the therapeutic and toxic effects of drugs. The course will cover the use of different class of drugs in the disorders of autonomic, peripheral and central nervous system of human body.

Module No.	Content	Teaching Hours
I	General Pharmacology - Introduction to pharmacology, routes of administration, concept of receptors, combined effect of drugs, factors modifying drug action, calculation of LD ₅₀ , ED ₅₀ and therapeutic index. Pharmacogenetics, Absorption, Distribution, Biotransformation and excretion of drugs.	13
II	Pharmacology of ANS Parasympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics & adrenergic neuron blocking agents, ganglionic stimulants & blocking agents. Drugs acting on PNS Neuromuscular blockers & Local anaesthetics	13
III	Pharmacology of CNS General Anaesthetics, Sedatives hypnotics, Anti-anxiety agents & centrally acting muscle relaxants. Psychopharmacological agents (antipsychotics), Antidepressants. Antiepileptic drugs. Antiparkinsonian drugs, Narcotic analgesics & their antagonists. Tolerance, Dependence, Drug Addiction & drug abuse.	14

Outcome: On successful completion of Pharmacology-I, students should be able to:

1. Outline and critically appraise the pharmacokinetics and pharmacodynamics of drugs.
2. Explain the rationale for considering a suitable drug in the management of disorders of autonomic, peripheral and central nervous system.
3. Critically review the issues involved in the management of such diseases.

BPH 5083: PHARMACOLOGY-I PRACTICAL

Credit-02

Semester V

L-T-P: 0-0-4

Objective: *This course is designed to provide basic practical understanding in the principles of pharmacology. It is intended primarily for under graduate students to have an interest in the preparation of different solution used in the pharmacological experiments. The course will describe the use of different animals for the pharmacological experiments. Moreover, the course will demonstrate the pharmacological effects of drugs that act on skeletal muscle, central nervous system and inflammation.*

Module No.	Content	Lab Hours
I-III	<ol style="list-style-type: none"> 1. Use of computer simulated CDs for pharmacology practical whenever 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. Commonly used instruments in experimental pharmacology. Some common and standard techniques. 4. Recording of spontaneous motor activity, stereotype, analgesia, anticonvulsant activity, anti-inflammatory activity and muscle relaxant activity of drugs using simple experiments. 	48

Outcome: On successful completion of Pharmacology-I practical, students will be able to:

1. Prepare different solution used in pharmacological experiments.
2. Select suitable animals for pharmacological experiments.
3. Critically review the issues involved in the management of disorders of skeletal muscle, central nervous system and inflammation.

Reference Books:

- Ghosh, M.N, Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
- Kulkarni, S.K, Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi,
- Barar, F.S.K, Text Book of Pharmacology, S.Chand, New Delhi,
- Goodman & Gilman, The Pharmacological basis of Therapeutics, McGraw Hill, New Delhi,
- Katzung, B.G, Basic & Clinic Pharmacology, Tata McGraw –Hill, New Delhi.
- Rang, M.P, Dale, M.M, Riter, J.M, Pharmacology, Churchill Livingstone.
- Tripathi, K.D, Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
- Satoskar & Bhandarkarm, Pharmacology & Pharmacotherapeutics., Popular Prakashan Pvt. Ltd., Bombay,

BPH 5004: PHARMACEUTICAL CHEMISTRY -VI

(Medicinal Chemistry-I)

Credits: 03

Semesters V

L- T -P: 3-0-0

Objective: Aimed at imparting the knowledge about understanding of drugs on molecular aspects. This includes drug mechanisms of action, structure-activity relationships (SAR), acid-base and physicochemical properties and absorption, distribution, metabolism, excretion, and toxicity profiles.

Module No.	Content	Teaching Hours
I	<p>A.Basic Principles of Medicinal Chemistry: Physicochemical properties of drug molecules and biological action - solubility, partition coefficient! acid-base properties and ionization, geometrical, optical isomers & conformers, drug-receptor interactions, forces involved in D-R interactions, Introduction to metabolic pathways of Phase-I and Phase-II reactions.</p> <p>B. Study of classification and mechanism of action of following classes of drugs [Synthesis & uses of individually mentioned drugs and Structure Activity Relationships (SAR) of mentioned categories only].</p> <ol style="list-style-type: none"> 1. Cholinergic Agents- SAR of Cholinergic agonists; Methacholine. 2. Anticholinergic and Antispasmodics - SAR of Anticholinergics; Atropine, Dicyclomine. 3. Anticholinesterases- Neostigmine, Pyridostigmine. 	13
II	<ol style="list-style-type: none"> 4. Neuromuscular BlockingAgents - SAR of Reversible neuromuscular blockers; Gallamine. 5. Adrenergic Agents- SAR of Adrenomimetics; Ephedrine, Isoproterenol, Salbutamol, Adrenaline, Naphazoline. 6. Local Anaesthetics- SAR of Ester and amide derivatives; Lignocaine, Benzocaine. 7. General Anaesthetics- Thiopental, Ketamine, 8. Sedatives and Hypnotics - SAR of Barbiturates; Phenobarbitone, Pentobarbitone, 9. Anticonvulsants- SAR of Hyndatoin and Succinimides; Phenytoin, Ethosuximide. 	13
III	<ol style="list-style-type: none"> 10. Skeletal Muscle Relaxants- Chlorphenesin. 11. Antiparkinsonism drugs- Carbidopa, Levodopa. 12. Antipsychotics (Neuroleptics) - SAR of Phenothiazines and Butyrophenones; Chlorpromazine. 13. Anxiolytics- SAR of Benzodiazepines; Chlordiazepoxide, Diazepam. 14: Antidepressants - SAR of Tricyclic antidepressants; Imipramine, Amitriptyline. 15. CNS Stimulants-Caffeine. 16. Narcotic Analgesics and Antagonists- SAR of Morphine derivatives; Pethidine, Methadone. 17. Antitussives- Dextromethorphan. 	14

Outcome: Students are given basic concepts and the physicochemical properties, structures with the actions of drug molecules and impart the knowledge and advances which are applicable to the drug development.

BPH 5084: PHARMACEUTICAL CHEMISTRY –VI PRACTICAL (Medicinal Chemistry–I)

Credit-02

Semester V

L-T-P: 0-0-4

Objective: The course focuses on the synthesis of selected compounds of medicinal property. Further, the course will provide hands on experience in the establishment of pharmacopoeial standards of such compounds. Additionally, the course will provide practical aspects of purification of different solvents used in the medicinal chemistry.

Module No.	Content	Lab Hours
I-III	1. Synthesis of Methyl Salicylate. 2. To establish Pharmacopoeial standards of Methyl Salicylate. 3. Synthesis of Phenolphthalein. 4. To establish Pharmacopoeial standards of Phenolphthalein. 5. To synthesize Benzocaine. 6. To establish pharmacopoeial standards of Benzocaine. 7. Synthesis of Phenytoin. B. To establish pharmacopoeial standards of Phenytoin. 9. Synthesis of Chlorbutol. 10. To establish pharmacopoeial standards of Chlorbutol. 11. Synthesis of the following compounds- 2-Phenyl Indole, Methyl orange, Diazoaminobezene. 12. Purification of solvents like Benzene, Chloroform, Acetone and preparation of absolute alcohol.	48

Outcome: Students will be able to:

- Synthesize different medicinal compounds.
- Standardize based on pharmacopoeial standards.

Reference Books:

- Mann ,F.G. & Saunders, B. C., Practical Organic Chemistry, Orient Longman, London.
- Furniss B S, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The Orient Longman, London.
- Pharmacopoeia of India, Minsitry of Health, Govt. of India.
- Abraham, D.T., Burger's Medicinal Chemistry and Drug Discovery, John Wiley & Sons, New York.
- Block, J.H. and Beale,J.M. ., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
- Foye, W.C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
- Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
- Nogrady T and Weaver, D.F., Medicinal Chemistry – A Molecular and Biochemical Approach, Oxford University Press, NewYork, Oxford.
- Finar I L, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
- Lednicer, D. The Organic Chemistry of Drug Synthesis Vol. I-V, John Wiley & Sons Inc. New York.

BPH 5005: PHARMACEUTICS -VI (Physical Pharmacy)

Credits: 03

Semesters V

L- T -P: 3-0-0

Objective: To understand significance of physicochemical properties of materials in pharmaceutical sciences and their application in development of stable and effective dosage form.

Module No.	Content	Teaching Hours
I	<p>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.</p> <p>Surface and Interfacial Phenomenon: Liquid interface, surface and interfacial tension, spreading coefficient, Surface active agents, HLB classification, electrical properties of interface, measurement of surface and interfacial tension.</p>	13
II	<p>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.</p> <p>Kinetics and Drug Stability : General considerations & concepts, Degradative pathways, half life, self life determination, Influence of temperature, light, solvent, catalytic species and other factors, Accelerated stability study, expiration dating. ICH guidelines for stability.</p>	13
III	<p>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.</p>	14

Outcome:

- The students will utilize the knowledge of micromeritics, rheology, surface and interfacial phenomenon, kinetics stability, ICH guidelines, dispersing system in designing of desired pharmaceutical formulations.

BPH 5085: PHARMACEUTICS –VI PRACTICAL

(Physical Pharmacy)

Credit-02

Semester V

L-T-P: 0-0-4

Objective: The course focuses on the determination of several physico-chemical properties of particle, powder, surfactants and colloids. Further, the course will provide hands on experience in the preparation and stability of liquid dosage forms. In addition, the course will also cover the basic practical understanding in the performance of accelerated stability studies.

Module No.	Content	Lab Hours
I-III	<ol style="list-style-type: none"> 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. 14. Determination of intrinsic viscosity. 	48

Outcome: Students will be able to:

- Explain the size and shape of particles used in several pharmaceutical preparations.
- Explain the physical properties of powders, surfactants and colloids.
- Prepare and standardize emulsion and suspension dosage forms.
- Perform accelerated stability studies.

Reference Books:

- Martin A, Swarbrick, J. Physical Pharmacy, Lea & Febiger, Philadelphia.
- Shotten E & Ridgeway K, Physical Pharmaceutics, Oxford University Press, London.
- D.V.Derle, " Essentials of Physical Pharmacy".
- Abraham, D.T., Burger's Medicinal Chemistry and Drug Discovery, John Wiley & Sons, New York.
- 1. Block, J.H. and Beale, J.M. , Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
- 2. Foye, W.C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
- 3. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
- 4. Nogrady T and Weaver, D.F., Medicinal Chemistry – A Molecular and Biochemical Approach, Oxford University Press, New York, Oxford.
- 5. Finar I L, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
- 6. Lednicer, D. The Organic Chemistry of Drug Synthesis Vol. I-V, John Wiley & Sons Inc. New York.

BPH 6001: PHARMACEUTICAL CHEMISTRY-VII
(Medicinal Chemistry - II)

Credits: 03

Semester VI

L-T-P: 3-0-0

Objective: Course is designed to expose B. Pharm students to the theory and practicals of Medicinal Chemistry. Course content covered basics of medicinal chemistry, drug design and development process including prodrug concept, classification, mechanism of action of drugs, structure-activity relationship (SAR), synthetic approach of drugs and their uses.

Module No.	Content	Teaching Hours
I	A. Principles of Drug Design- Different approaches of drug design (Classical approach & mechanism based approach), Discovery & Identification of lead compound (Random screening Natural Product screening and Endogeneous sources), optimization of lead via Analog Design (Identification of Pharmacophore, homologation, cyclization, branching of chain, and Bioisosterism). QSAR- Definition, QSAR parameters (hydrophobic electronic & steric parameters), quantitative methods (Hansch approach) and applications of QSAR. Prodrugs- Definition & types of prodrugs, applications of prodrug approach.	13
II	B. Study of classification and mechanism of action of following classes of drugs [Synthesis & uses of individually mentioned drugs and Structure Activity Relationships (SAR) of mentioned categories only]. 1. Cardiotonics - SAR of cardiac glycosides; Amirinone. 2. Antianginal & vasodilators- Isosorbide dinitrate. 3. Antiarrhythmics- SAR of 1, 4-dihydropyridines; Procainamide & Nifedipine. 4. Antihypertensives- SAR of Reserpine & its derivatives, ACE inhibitors and p-adrenergic receptor antagonists; Captopril, Methyldopa, Prazosin & Propanolol. 5. Antihyperlipidemics- SAR of statin derivatives, Clofibrate. 6. Heparin and Oral Anticoagulants- SAR of coumarin derivatives, Warfarin	13
III	7. Diuretics - SAR of carbonic anhydrase inhibitors and thiazide derivatives; Acetazolamide, Chlorthiazide; Frusemide & Spironolactone. 8. Antihistaminics : i) H₁-receptor antagonists – SAR of H ₁ - antagonists; Diphenhydramine, Promethazine, Cyproheptadine & Cetirizine. ii) H₂-receptor antagonists – SAR of H ₂ -antagonists & Ranitidine. 9. Proton Pump Inhibitors- Omeprazole. 10. Prostaglandins and Other Eicosanoids – SAR of Prostaglandins; Misoprostol & Carboprost. 11. Analgesics and Antipyretics – SAR of salicylic acid, N-anthranilic acid, aryl acetic acid and aniline & p-amino phenol derivatives, Mefenamic Acid, Ibuprofen, Diclofenac & Paracetamol. 12. Diagnostic Aids: Iopanoic Acid	14

Outcome:

- Students would have an idea of structure of drugs and outline of how they are synthesized and also the relationship the drug have with their action.

BPH 6081: PHARMACEUTICAL CHEMISTRY-VII PRACTICAL (Medicinal Chemistry-II)

Credit: 02

Semester VI

L-T-P: 0-0-4

Objective: The course focuses on the synthesis of selected compounds of medicinal property. Further, the course will provide hands on experience in the establishment of pharmacopoeial standards of such compounds.

Module No.	Content	Lab Hours
I-III	1. Synthesis of Paracetamol. 2. To establish pharmacopoeial standards of Paracetamol. 3. Synthesis of Aspirin. 4. To establish pharmacopoeial standards of Aspirin . 5. Synthesis of Fluorescein sodium. 6. To establish pharmacopoeial standards of Fluorescein sodium 7. Synthesis of Mefenamic acid. 8. To establish pharmacopoeial standards of Mefenamic acid. 9. Synthesis of Benzyl benzoate. 10. To establish pharmacopoeial standards of Benzyl benzoate. 11. Synthesis of the following compounds- 1,2,3,4-tetrahydrocarbazole, Phenyl urea, β -naphthol orange, Phenyl azo β -naphthol, Caprolactam	48

Outcome: Students will be able to:

- Synthesize different medicinal compounds.
- Standardize based on pharmacopoeial standards.

Reference Books:

- Mann ,F.G. & Saunders, B. C., Practical Organic Chemistry, Orient Longman, London.
- Furniss B S, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The Orient Longman, London.
- Pharmacopoeia of India, Ministry of Health, Govt. of India.
- Abraham, D.T., Burger's Medicinal Chemistry and Drug Discovery, John Wiley & Sons, New York.
- Block, J.H. and Beale, J.M. ., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
- Foye, W.C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
- Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
- Nogrady T and Weaver, D.F., Medicinal Chemistry – A Molecular and Biochemical Approach, Oxford University Press, New York, Oxford.
- Finar I L, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
- Lednicer, D. The Organic Chemistry of Drug Synthesis Vol. I-V, John Wiley & Sons Inc. New York.

BPH 6002: PHARMACEUTICS-VII
(Pharmaceutical Technology-II)

Credits: 03

Semester VI

L-T-P: 3-0-0

Objective: To convey extensive knowledge about the preparation and evaluation of types of tablets, capsules and parenteral dosage form. Advantages, disadvantages and factors affecting the preparations of above mentioned dosage form. Additionally, the composition of different types of surgical products and their use will be discussed.

Module No.	Content	Teaching Hours
I	(a) Capsules: Advantages and disadvantages of capsule dosage form, materials for production of hard gelatin capsule, size of capsules, methods of capsule filling soft gelatin capsule shell and its capsule content, importance of base adsorption and minim/gm factors in soft capsule, quality control, stability testing and storage of capsule dosage forms. (b) Micro-encapsulation: Definition of microencapsule, importance of microencapsulation in pharmacy, microencapsulation by coacervation-phase separation, multi orifice, spray drying spray congealing polymerisation, complex formulation, emulsion, air suspension technique, coating pan and other techniques, evaluation of microcapsules.	13
II	(a) Tablets: 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 and Stability study.	13
III	a) 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. b) Surgical Products: Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc, bandages, adhesive gpe, protectives, absorbable and non absorbable sutures, ligatures and catguts	14

Outcome: Students will be able to use pre-formulation factors and various techniques involved in the formulation and evaluation of tablets, capsules, injections and surgical products.

BPH 6082: PHARMACEUTICS-VII PRACTICAL (Pharmaceutical Technology-II)

Credit-02

Semester VI

L-T-P: 0-0-4

Objective: The course is designed to provide practical hands on experience in the preparation, evaluation and packaging of capsules, microcapsules, tablets, parenteral, ophthalmic sustained and extensive release dosage forms. Further, the course will provide practical aspects of the evaluation of packages.

Module No.	Content	Lab Hours
I-III	1. Preparation, Evaluation, Packing of the following dosage forms. a) Capsules b) Microcapsules d) Tablets e) Parenteral f) Ophthalmic preparation 2. Formulation and evaluation of sustained release dosage forms – Aspirin Extended release (Matrix embedding method, Granules USP/NF coating of granules) 3. Evaluation of packages – containers & closures.	48

Outcome: Students will be able to:

- Prepare, evaluate and packaging of different solid and semi-solid dosage formulations.
- Evaluation of packages.

Reference Books:

- Remington: The Science and Practice of Pharmacy Pharmaceutical Sciences Vol. I & III, Lippincott Williams Wilkins, U.S.A.
- R.E. Avis, Pharmaceutical Dosage Forms : Parenteral Medication, Vol-I, Marcel Dekker-Inc, New York & Basel.
- Allen, L.V., Ansel H.C., Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.
- R.C. Juliano, Drug Delivery Systems, Oxford University Press, Oxford.
- Lachman, L. Liebermann, L. Theory & Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.
- Manohar A. Potdar, 'C-GMP for Pharmaceuticals'.

BPH 6003: PHARMACOLOGY-II

Credits: 03

Semesters VI

L- T -P: 3-0-0

Objective: The goal of this subject is to provide the basic concepts and scientific understanding about the drugs acting on cardiovascular system, respiratory system, gastrointestinal system and autocooids. It provides an essential knowledge about the drug usage, adverse effect, interactions as well as their clinical significance.

Module No.	Content	Teaching Hours
I	<p>Pharmacology of CVS: Cardiac glycosides, Antihypertensive drugs, Antianginal drugs, Antiarrhythmics drugs, Antihyperlipidemics drugs.</p> <p>Drugs Acting on Hemopoietic System Haematinics, Vit. K & anticoagulants, Fibrinolytics , Antifibrinolytic, antiplatelet drugs & Plasma Volume expanders.</p>	13
II	<p>Autocooids: Histamine, 5HT and their antagonists, Prostaglandins, Thromboxanes, Leukotrienes, Angiotensin Bradykinin, Substance P, Vasoactive peptides. NSAIDS & Antipyretic analgesics, Anti-gout & Anti-arthritic drugs. Diuretics.</p>	13
III	<p>Drugs Acting on Respiratory System Anti-asthmatic drugs, Anti-tussives, Expectorants & Respiratory Stimulants</p> <p>Drugs acting on GIT Antacids and Antiulcer drugs, Laxatives and antidiarrhoeal Agents, Emetics, antiemetics, Appetite stimulants, carminative and demulsents.</p>	14

Outcome:

- The student will be able to know about the rational use of drugs, mechanism of action, interactions and toxicity. The students will be able to outline and critically understand the principle aspects of pharmacodynamics of the concerned system.

BPH 6083: PHARMACOLOGY-II PRACTICAL

Credit-02

Semester VI

L-T-P: 0-0-4

Objective: *The goal of this subject is to provide the basic practical concepts and scientific understanding about the bioassay of different drugs.*

Module No.	Content	Lab Hours
I-III	1. To record the dose response curve (DRC) of Acetylcholine using rat ileum preparation. 2. To study the parallel shift of DRC in presence of competitive antagonist on DRC of Ach using rat ileum. 3. To study the effect of physostigmine on DRC of rat ileum. 4. To study the CRC of histamine on guinea pig ileum preparation & study the effect of antihistaminics.	48

Outcome: Students will be able to:

- Perform bioassay of different pharmacological agents.

Reference Books:

- Ghosh M.N. Fundamentals of Experimental Pharmacology, Hilton and Company, Calcutta.
- Grover, J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
- Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
- Barar F.S.K : Text Book of Pharmacology, Interprint, New Delhi.
- Goodman & Gilman, The Pharmacological basis of Therapeutics, Pergamon Press.
- Editors :- J.G. Hardman, Le Limbird, PB Molinoss, RW Ruddon & AG Gil, Pergamon Press.
- Katzung, B.G. Basic & Clinical Pharmacology, McGraw Hill International,
- Laurene, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.
- Rang MP, Dale MM, Riter JM, Pharmacology Churchill Livingstone.
- Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
- Satoskar & Bhandarkar : Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.

BPH 6004: PHARMACOGNOSY – III

Credits: 03

Semesters VI

L- T -P: 3-0-0

Objective:

- The course is designed to the students to study the biological source, cultivation, collection, morphology, microscopy, chemical constituents and utilization aspects of herbal and traditional drugs.
- To give exposure to understand the concepts and principles of alternative systems of medicine like Ayurveda, Siddha, Homeopathy and Unani system of medicine.
- To acquire knowledge of the methods of preparation and use of formulations of various systems of medicines.

Module No.	Content	Teaching Hours
I	<p>a) Glycosides: Definition, classification and general methods of obtaining Glycosides. Study of the biological sources, cultivation, collection, chemical constituents, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides:</p> <p>1. Saponins drugs: Liquorice, Ginseng, Dioscorea</p> <p>2. Cardioactive drugs : Digitalis, Squill, Strophanthus, Thevetia</p> <p>3. Anthraquinone drugs : Aloe, Senna, Rhubarb & Cascara.</p> <p>Utilization and production of phytoconstituents such as Calcium sennosides, Diosgenin, Solasodine and Podophyllotoxins.</p>	13
II	<p>Coumarin glycosides: Psoralea, Ammi majus, Ammi visnaga</p> <p>Glycosidal bitters and Miscellaneous glycosides: Gentian, Saffron, Chirata, Quassia , Bitter almond and Andrographis paniculata.</p> <p>Brief Introduction to Herbal Pharmacopoeia and principals of Ayurvedic, Unani , Siddha Chinese and Homeopathic systems of medicines.</p>	13
III	<p>Preparation of Ayurvedic formulations like Arishtas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas.</p> <p>Studies of traditional drugs: Biological sources, morphology, chemical constituents, pharmacology and common uses of following indigenous drugs: Amla, Kantakari, Satavari, Tylophora, Bael, Kalijiri, Vach, Rasna, Punarnava, Chitrak, Apamarg, Gokhru, Shankpushpi, Brahmi Methi, Lehsun, Palash, Guggul, Gymnema, Shilajit, Tulsi, Nagarmotha , Guduchi, Majith, Malkanguni, Neem, Bhringa raj</p>	14

Outcome:

- The students will gain knowledge about the traditional/ ethno medicinal plants and their phytoconstituents, different alternative system of medicine. Thus the students will apply the knowledge to develop herbal formulations.

BPH 6084: PHARMACOGNOSY – III PRACTICAL

Credit-02

Semester VI

L-T-P: 0-0-4

Objective: The course is designed to provide practical knowledge on morphological and microscopical characteristics of selected herbal drugs used in the Ayurvedic formulation. Further, the course will demonstrate the preparation and standardization of different Ayurvedic formulations.

Module No.	Content	Lab Hours
I-III	1. Morphology and microscopy (powder) of Liquorice along with its chemical tests. 2. Morphology of Aloe and chemical tests on Aloe-extracts. 3. Morphology and microscopy (powder) of Rhubarb 4. Morphology of Psoralea, Saffron and Chirata. 5. Morphology of Amla, Kantkari, Shatavari and Vach. 6. Morphology of Punarnava, Apamarg, Gokhru, and Shankhpushpi. 7. Morphology of Brahmi, Methi, Lehsun and Palash. 8. a) Morphology of Nagarmotha. b) Identification Tests for Guggul lipids. 9. To study the following standards a) Loss on drying. b) Extractive values. c) Ash values. d) pH of 1% solution, in water and alcohol of any Ayurvedic formulation (solid) available in the market. PROJECT WORK A report on marketed preparations based on traditional drugs mentioned in theory.	48

Outcome: Students will be able to:

- Identify herbal drugs used in the Ayurvedic formulations.
- Prepare Ayurvedic formulations.

Reference Books:

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., "Pharmacognosy", Elsevier Publishers, New Delhi
4. Tyler V.E. et al : "Pharmacognosy" Lea & Febiger, Philadelphia.
5. Wallis, T.E. "Text Book of Pharmacognosy" CBS Publisher & Distributor, New Delhi,
6. Kokate C.K. et al "Pharmacognosy" Nirali Prakashan, Pune,
7. Medicinal plants of India I&II, Indian council of Medical Research, New Delhi.
8. Nadkarni A.K. Indian Materia Medica 1-2, Popular Prakashan (P) Ltd. Bombay,
9. Atal C.K. & Kapur B.M. "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. Indian Ayurvedic Pharmacopoeia, Govt. of India.
14. Kokate, C.K. Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan, Pune,

BPH 6005: PROFESSIONAL COMMUNICATION

Credits: 03

Semesters VI

L- T -P: 3-0-0

Objective: The course is designed to impart written skills, effective time management skills and working in teams, readiness for group discussion and interviews.

Module No.	Content	Teaching Hours
I	1. Written skills: <ul style="list-style-type: none"> • Proposal writings formats • Report writings • Business letters • Applications • Covering letters. • Curriculum Vitae Designing 	13
II	2. Productivity, Time Management simulation exercise 3. Leadership Skills. 4. Team work 'BSC'- Boss, Subordinates & Colleagues 5. Corporate behaviour, corporate expectation, office etiquettes 6. Extempore	13
III	7. Group Discussions (G.D) <ul style="list-style-type: none"> • Tips GD 8. Interview Tips :- <ul style="list-style-type: none"> • What student is supposed to do before the interview, during the interview, after the interview & on the day of interview. • Various questions that may be asked in an interview. • Model interview (Video-shooting & displaying optional) 9. Exit Interview	14

Outcome: Students will acquire written skills, understand the importance of team work and time management, learn the techniques of group discussion and facing interviews.

BPH 6006: ENVIRONMENT AND ECOLOGY

Credit-03

Semester VI

L-T-P: 3-0-0

Objective:

- To understand the concept of maintaining, protecting & improving the quality of environment, as a contribution to the protection of human health and safeguarding the ecological balance.
- To inculcate the environmental values translating into pro-conservation actions.
- To correlate the exploitation and utilization of conventional and non-conventional resources.

Module No.	Content	Teaching Hours
I	Environment studies Definition, scope & importance of Environment, Natural Resources – renewable & non renewable. Water resources, Mineral resources, Food resources, Energy resources, Land resources. Role of an individual in conservation. Biodiversity & its conservation with special reference to India.	13
II	Environmental pollution- Air, Water, Soil, Marine, Noise, Thermal, Nuclear-Introduction, causes and control measures. Ecosystems Introduction, types features & functions of difference ecosystems- Forest Grassland, Desert and Aquatic.	13
III	Law related to Environmental Protection Air (Prevention and Control of pollution)Act 1987 Water prevention & Control of Pollution Act. 1974 Noise Pollution Hazardous Wastes Hazardous Chemical, Hazardous Microorganism	14

Outcome:

- Understand and realize the multi-disciplinary nature of the environment, its components, and inter-relationship between man and environment.
- Identify different types of environmental pollution and control measures.
- Student will be able to play a proactive role in conserving the environment and balance the ecosystem.

Reference Books:

- Principles of Environmental Studies, C. Manoharachary, P. Jyaranama Reddy, Pharma Book Syndicate, Hyderabad.
- Handbook of Environmental Laws, Acts, Guidelines, Compliances & Standards Vol. I &II.
- Trivedy R.K., Pharma Book Syndiacte, Hyderabad,
- Relevant Acts & Rules published by Govt. of India with latest amendments

BPH 7001: PHARMACEUTICAL ANALYSIS -III

Credit-03

Semester VII

L-T-P: 3-0-0

Objective:

- To learn various spectroscopic techniques like UV, IR, Mass and NMR, and the estimation of drugs by HPLC.

Module No.	Content	Teaching Hours
I	Colorimetry- Theory, Instrumentation and applications. Ultra violet and Visible Spectrophotometry- Qualitative and quantitative applications, Lambert Beer's law and its deviations, Instrumentation of single and double beam spectrophotometer. Fluorimetric Analysis- Theory, Instrumentation and applications.	13
II	Infra-Red spectrophotometry-Theory, instrumentation, applications in pharmaceutical analysis, vibrational region and finger print region. Mass Spectroscopy-Theory, Instrumentation, Fragmentation and applications.	13
III	NMR Spectroscopy- Theory of ¹ H NMR, chemical shift, shielding & desheilding, spin-spin coupling, Instrumentation and applications. Chromatographic techniques- Principle, Instrumentation and applications of GLC, HPLC and LC-MS. Flame Photometry - Principle, Instrumentation and applications.	14

Outcome:

- Students will learn the utility of various instruments like UV, IR, Mass, NMR and HPLC and also learn the handling of instruments.

BPH 7081: PHARMACEUTICAL ANALYSIS-III PRACTICAL

Credit-02

Semester VII

L-T-P: 0-0-4

Objective: The course is designed to provide practical knowledge on Karl Fisher, Colorimetric and Fluorimetric titration, spectroscopy and chromatography techniques.

Module No.	Content	Lab Hours
I-III	<ol style="list-style-type: none"> 1. Assay of official formulation containing single and more active ingredients using instrumental techniques. 2. Exercise based on Karl fisher titration. 3. Interpretation of a few spectra. 4. Demonstration of HPLC. 5. Exercise based on Colorimetric Titration 6. Exercise based on Fluorimetric Analysis 7. Perform experiments based on TLC and Paper chromatography. 	48

Outcome: Students will be able to:

- Determine moisture content in different pharmaceutical formulations.
- Interpret the data of spectroscopy and chromatography.
- Perform colorimetric and fluorimetric titrations.

Reference Books:

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

BPH 7002: PHARMACEUTICS -VIII

(Biopharmaceutics & Pharmacokinetics)

Credit-03

Semester VII

L-T-P: 3-0-0

Objective: The course is designed to make students to understand the concept of bioavailability, bioequivalence and factors affecting bioavailability, pharmacokinetic parameter like ADME, non-linear and time dependant pharmacokinetics. They will study the drug interactions & problems associated in pharmacokinetic parameters calculations.

Module No.	Content	Teaching Hours
I	<ol style="list-style-type: none"> Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting. Biopharmaceutics: <ol style="list-style-type: none"> Passage of drugs across biological barrier (Passive diffusion, Active transport, Facilitated diffusion and Pinocytosis). Factors influencing absorption – Physicochemical, Physiological and Pharmaceutical. Drug distribution in the body, Plasma protein binding. 	13
II	<ol style="list-style-type: none"> Pharmacokinetics : <ol style="list-style-type: none"> Basic considerations, Plasma drug concentration time profile and its pharmacokinetic and pharmacodynamic parameters, types of models. Pharmacokinetics of drug absorption – zero order and first order absorption rate constant using Wagner – Nelson, Loo-Reigelman method. 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. Clinical Pharmacokinetics: Designing of dosage regimens, Individualization, Therapeutic drug monitoring. 	13
III	<ol style="list-style-type: none"> Bioavailability and Bioequivalence: <ol style="list-style-type: none"> Bioavailability: Objectives, Considerations in an <i>in-vivo</i> bioavailability design, Measures of bioavailability, Method of enhancement of bioavailability, IVIV correlation and its levels. Bioequivalence: Introduction, Experimental designing for conduction of bioequivalent studies. Dosage adjustment in patients with and without renal and hepatic failure. Pharmacokinetic drug interactions and their significance in therapy. 	14

Outcome:

- The students will be able to utilize knowledge of drugs and various factors which influence them and pharmacokinetic in the design of dosage forms which are bioavailable with therapeutic efficacy in normal and diseased state.

BPH 7082: PHARMACEUTICS –VIII PRACTICAL (Biopharmaceutics & Pharmacokinetics)

Credit-02

Semester VII

L-T-P: 0-0-4

Objective: The course is designed to provide practical knowledge on in-vitro drug release study of several solid dosage formulations. Further, the course will provide hands on experience in evaluation of several pharmacokinetic parameters of selected drugs in different sample preparations.

Module No.	Content	Lab Hours
I-III	<ol style="list-style-type: none"> 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. To study the effect of hardness of tablet on dissolution rate. 7. To study the effect of various diluents on dissolution rate of dosage form (Tablets, Capsules, Ointment etc.). 8. To study the effect of formulation on drug release (Powder, Suspension etc.). 9. To determine the % protein binding of the given drugs. 10. To calculate various Pharmacokinetic parameters from the given zero order drug release data. 11. To calculate various Pharmacokinetic parameters from the given first order drug release data. 12. To calculate the various Pharmacokinetic parameters from the given blood data of I.V bolus injection (one compartment model). 13. 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). 14. To study the passive diffusion of the given drug using egg or goat membrane or cellophane membrane. 15. To determine the various Pharmacokinetic parameters from the given blood data of oral administration of dosage form. 	48

Outcome: Students will be able to:

- Perform in-vitro drug release study of different drugs.
- Evaluate pharmacokinetic parameters of drugs in different sample preparations.

Reference Books:

- Notari, R.E, Biopharmaceutics and Pharmacokinetics – An introduction Marcel Dekker Inc. N.Y.
- Rowland M, and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, N.Y.
- Wagner J.G. Fundamentals of Clinical Pharmacokinetics, Drugs Intelligence Publishers, Hamilton.
- Wagner J.G. Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A.G. Basel, Switzerland.
- Prabakaran L. "Text Book of Modern Pharmacokinetics and Biopharmaceutics".
- Gibaldi, M. Biopharmaceutics & Clinical Pharmacokinetics, PharmaBook Syndicate.
- Robert , Rodriguezdiaz, Analytical Techniques for Biopharmaceutics Development.
- Curry, StephenH., " Drug Disposition & Pharmacokinetics".

BPH 7003: PHARMACOLOGY -III

Credit-03

Semester VII

L-T-P: 3-0-0

Objective: The subject defines the study of interaction of drugs with human beings, basic understanding about drugs acting on endocrine system, chemotherapeutic agents and the principles of toxicology, so that students could infer an appropriate use of drugs. It also explains the principles of management of poisoning with reference to barbiturates, opioids, organophosphorous and heavy metals.

Module No.	Content	Teaching Hours
I	Pharmacology of Endocrine System Drugs related to Hypothalamic & Pituitary hormones, Thyroid hormones & Thyroid Drugs, Parathormone, Calcitonin & Vitamin D, Insulin, Oral hypoglycemic agents & Glucagon. ACTH & Cortico steroids, Androgens & anabolic steroids, Estrogens, Progesterone & Oral Contraceptives, Drugs acting on uterus.	13
II	Chemotherapy General Principles of Chemotherapy, Sulfonamides, Quinolones, Antibiotics – Penicillins, Cephalosporins, Chloramphenicol, Tetracyclines, Macrolides, Aminoglycosides and urinary antiseptics.	13
III	Antimalarials, Antifungal and Antiviral agents, Antitubercular, Antileprotic, Antiamoebic and Anthelmintics. Introduction to chemotherapy of cancer and immunomodulators. Principles of Toxicology Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous & Heavy metal.	14

Outcome: The students will understand the mechanism of action, interactions and adverse effects of the drugs covered. The students will also acquire knowledge about the usage of medication that improves quality of life with minimum risks.

BPH 7083: PHARMACOLOGY –III PRACTICAL

Credit-02

Semester VII

L-T-P: 0-0-4

Objective: *The course is designed to provide basic practical knowledge on performance of different bioassay of drugs.*

Module No.	Content	Lab Hours
I-III	<ol style="list-style-type: none"> Bioassay and biological standardization To calculate the pA₂ value of Atropine & Chlorpheniramine. Bioassay of Ach, Histamine & Oxytocin on suitable isolated preparations using matching assay and bracketing assay. 	48

Outcome: Students will be able to:

- Perform bioassay of different pharmacological agents.

Reference Books:

- Ghosh M.N. Fundamentals of Experimental Pharmacology, Hilton and Company, Calcutta.
- Grover, J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
- Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
- Barar F.S.K : Text Book of Pharmacology, Interprint, New Delhi.
- Goodman & Gilman, The Pharmacological basis of Therapeutics, Pergamon Press.
- Editors :- J.G. Hardman, Le Limbird, PB Molinoss, RW Ruddon & AG Gil, Pergamon Press.
- Katzung, B.G. Basic & Clinical Pharmacology, McGraw Hill International,
- Laurene, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.
- Rang MP, Dale MM, Riter JM, Pharmacology Churchill Livingstone.
- Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
- Satoskar & Bhandarkar : Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.
- Paul. L., Principles of Pharmacology, Chapman and Hall.

BPH 7004: PHARMACEUTICAL CHEMISTRY –VIII
(Medicinal Chemistry - III)

Credit-03

Semester VII

L-T-P: 3-0-0

Objective:

- Course is designed for advanced understanding of the core principles and topics of medicinal chemistry and to enable students to acquire a specialized knowledge and understanding of selected aspects. Course content covered classification, mechanism of action of drugs, structure-activity relationship (SAR), synthetic approach of following drugs and their uses.

Study of classification and mechanism of action of following classes of drugs [Synthesis & uses of individually mentioned drugs and Structure Activity Relationships (SAR) of mentioned categories only.

Module No.	Content	Teaching Hours
I	<p>1. Steroids and related drugs : Introduction, Nomenclature Structure of cholesterol (excluding synthesis) with Stereochemistry.</p> <p>(a) Androgens and Anabolic steroids – SAR of Androgens; Testosterone, Stanozolol.</p> <p>(b) Estrogens & Progestational agents – SAR of Estrogens & Progestins; Progesterone, Estradiol.</p> <p>(c) Adrenocorticoids – SAR of Adrenocorticoids; Prednisolone.</p> <p>2. Thyroid and Antithyroids – SAR of Thyroid hormones; Carbimazole, Levothyroxine, Propylthiouracil.</p> <p>3. Insulin & Oral Hypoglycaemics – SAR of Sulphonyl ureas and Biguanides; Chlorpropamide, Glibenclamide, Metformin.</p>	13
II	<p>4. Antibacterials – (a) Sulphonamides - SAR of Sulphonamides; Sulphamethoxazole Sulphacetamide.</p> <p>(b) Quinolones - SAR of Fluoroquinolones; Nalidixic acid, Norfloxacin.</p> <p>5. Antibiotics-(a) β-lactam antibiotics - (i) Penicillins - SAR of Penicillins; Ampicillin</p> <p>(ii) Cephalosporins- SAR of Cephalosporins; Cephalexin</p> <p>(b) Chemistry of Aminoglycoside antibiotics</p> <p>(c) Broad Spectrum Antibiotics - SAR of Tetracyclins; Chloramphenicol.</p> <p>6. Antimycobacterial Agents: SAR of Isonicotinic acid Hydrazides and Sulphones; Isoniazid, Ethambutol, Dapsone.</p>	13
III	<p>7. Antimalarials: SAR of Quinine antimalarials, 4- aminoquinolines and 8-aminoquinolines; Choloquine, Primaquine, Pyrimethamine</p> <p>8. Antiamoebics: SAR of 5-nitro-imidazoles; Metronidazole, Diloxanide</p> <p>9. Anthelmintics- SAR of Benzimidazoles; Mebendazole.</p> <p>10. Antifungals- SAR of azole antifungals; Clotrimazole.</p> <p>11. Antiseptics & Disinfectants – Benzalkonium chloride</p> <p>12. Anti-HIV agents – Zidovudine, Saquinavir.</p> <p>13. Antivirals – SAR of adamantane derivatives, Amantadine, Acyclovir.</p> <p>14. Antineoplastics : SAR of alkylating agents; Chlorambucil, Carmustine, 5-Fluorouracil, and 6-Mecaptopurine.</p>	14

Outcome:

- Students will have an understanding of structure of drugs and outline of how they are synthesized and also the relationship the drug have with their action.

Reference Books:

- Pharmacopoeia of India, Ministry of Health, Govt. of India. Latest edition.
- Abraham, D.T., Burger's Medicinal Chemistry and Drug Discovery, John Wiley & Sons, New York.
- Block, J.H. and Beale, J.M. ., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
- Foye, W.C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
- Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
- Nogrady T and Weaver, D.F., Medicinal Chemistry – A Molecular and Biochemical Approach, Oxford University Press, New York, Oxford.
- Finar I L, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
- Lednicer, D. The Organic Chemistry of Drug Synthesis Vol. I-V, John Wiley & Sons Inc. New York.

BPH 7005: PHARMACOGNOSY-IV

Credit-03

Semester VII

L-T-P: 3-0-0

Objective:

- The course is designed to the students to study the alkaloidal herbal drugs with respect to biological source, cultivation, collection, morphology, microscopy, chemical constituents, identification tests and uses.
- To study the various herbal drugs involved in the formulation of herbal cosmetics including skin, hair cosmetic preparation.
- To provide information on different types of chromatographic techniques involved in the evaluation of herbal drugs and to study of various techniques of plant tissue culture.

Module No.	Content	Teaching Hours
I	A) Alkaloids: Definition, classification and general methods of obtaining alkaloids. B) Systematic study of source, Cultivation, Collection, Chemical constituents, Uses, Diagnostic macroscopic & Microscopic features & chemical tests of following alkaloid containing drugs. (a).Tropane :Belladonna, Hyoscyamus, Datura (b) Quinoline & Isoquinoline : Cinchona, Ipecac & Opium.. (c) Indole : Ergot, Rauwolfia, Catharanthus & Nux-vomica. (d) Quinazoline : Vasaka.	13
II	A) Biological source, chemical constituents and uses of the following crude drugs: a) Pyridine-piperidine : Tobacco, Areca & Lobelia b) Imidazole : Pilocarpus. c) Steroidal : Withania, Veratrum & Kurchi. d) Alkaloidal amine : Ephedra & Colchicum. e) Purines : Coffee & Tea B) Worldwide trade in Medicinal plants & derived product: Cinchona, Ipecac, Rauwolfia, Digitalis, Liquorice, Ginseng. C) Introduction, Classification and study of different Chromatographic methods. Application of chromatographic techniques in evaluation of herbal drugs.	13
III	A) Utilisation and production of phytoconstituents such as- Tropane alkaloids, Isoquinoline and Quinoline alkaloids B) Plant biotechnology: Historical development of plant tissue culture, type of culture, Nutritional requirement, growth & their maintenance. Application of plant tissue culture in pharmacognosy. c) Herbal cosmetics: Amla, Henna, Hibiscus, Tea, Aloe, Turmeric (Biological source, chemical constituents and uses) d) Marine Pharmacognosy: Definition, Classification and Application.	14

Outcome:

- Students shall able to know about the organoleptic characters, microscopical characters and their chemical constituents present in the crude drugs and the raw materials used in the formulation of herbal cosmetics.
- Students will be able to utilize the various chromatographic techniques to separate the phytoconstituents and apply various strategies of plant tissue culture.

Reference Books:

- Kokate, C.K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.
- Wallis T.E. Analytical Microscopy, J&A Churchill Ltd, London.
- Ganborg & Wetter, Plant Tissue Culture Methods, National Research Council of Canada, Saskatchewan.
- Clarke ECG, Isolation & Identification of drugs. The Pharmaceutical Press, London.
- Trease G.E., & Evans W.C., "Pharmacognosy", Elsevier Publishers, New Delhi
- Tyler V.E. etal Pharmacognosy, Lea & Febiger Phjadelphia.
- Wallis, T.E. "Text Book of Pharmacognosy" CBS Publisher & Distributor, New Delhi,
- Kokate, C.K. etal Pharmacognosy" Nirali Prakashan, Pune,
- Atal & Kapur, Cultivation & Utilization of Medicinal Plants, RRL, Jammu.
- Stahl. E, Thin Layer Chromatography. A laboratory handbook, Springer Verlog, Berlin.
- Henry TA. The Plant Alkaloids, McGraw Hill, New York.
- Dixit, V.K., Vyas. S.P. Pharmaceutical Biotechnology, CBS Publication, ND.
- Street H.E. Tissue Culture & Plant Science, Academic Press, London.
- Kokate, C.K. Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan, Pune,

BPH 7084: PHARMACOGNOSY-IV PRACTICAL

Credit-02

Semester VII

L-T-P: 0-0-4

Objective: The course is designed to provide basic practical knowledge on morphology, microscopy and chemical tests of selected herbal drugs. Further, the course will demonstrate the tissue culture aspects of herbal drugs.

Module No.	Content	Lab Hours
I-III	1. To study the morphology and microscopy of Datura and Withania. 2. To study the morphology and microscopy of Ipecac and Rauwolfia. 3. To study the morphology and microscopy of Catharanthus and Nux-vomica. 4. To study the morphology and microscopy of Ephedra and Kurchi. 5. To study the morphology and microscopy of Solanum and Vasaka. 6. a) Morphology of Areca, Colchicum. b) Transverse section of Catharanthus leaf and Kurchi bark. 7. To study the TLC profile of Catharanthus leaf. 8. To study the TLC profile of Withania root. 9. Chemical test of Tea, Tobacco, Datura and Withania. 10. Chemical test of Nux-vomica, Ephedra, and Kurchi. 11. Introduction of plant-tissue culture techniques on laboratory scale. 12. Preparation of Agar slants. 13. To grow callus in any defined media. 14. Maintenance of callus culture. PROJECT : World wide trade of medicinal plants. (Monograph).	48

Outcome: Students will be able to:

- Identify the selected herbal drugs.
- Prepare the media for tissue culture study of herbal drugs.

BPH 7085: INDUSTRIAL TRAINING

BPH 8001: PHARMACEUTICAL CHEMISTRY -IX (Chemistry of Natural Products)

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective:

- The subject provides a survey of natural products chemistry including biogenesis by enzyme-mediated pathways, structure determination, medicinal and biochemical significance and synthesis.
- To recognize the chemical building blocks in nature that enable student to link structures to biosynthetic hypotheses.
- To identify different types of natural products, their occurrence, structure, biosynthesis, properties and applications.

Module No.	Content	Teaching Hours
I	1. Chemical & spectral approaches to simple molecules of natural origin. 2. General techniques of biosynthetic studies and basic metabolic pathways . Brief introduction to biogenesis of secondary metabolites of Pharmaceutical importance. alkaloids, terpenes and steroids. 3. Extraction, Isolation & Chemistry of – Glycosides - Digitoxin, Digoxin, Hecogenin, Diosgenin & Sarasapogenin	13
II	4. Introduction to Lignans, Quassinoids and Flavonoids (Quercetin) 5. Extraction, Isolation & Chemistry of - Alkaloids – Atropine, Quinine, Reserpine, Morphine, Papaverine, Ephedrine, Ergotamine..	13
III	7. Extraction, Isolation & Chemistry of – Terpenoids - Camphor, Menthol, Citral, α -Pinene. 8. Carotenoids and Vitamins : β - Carotene, Vitamin A , α - tocopherol, Xanthophylls 9. Recent developments of natural products used as anticancer agents and antidiabetics	14

Outcome:

- Familiar with the physical, chemical and spectral approaches for structure elucidation of natural compounds.
- Understand the isolation procedure of alkaloids, glycosides and terpenes.
- Know the techniques used in biosynthetic studies.
- Aware of the recent advances in natural products used to treat diabetes and cancer.

BPH 8081: PHARMACEUTICAL CHEMISTRY –IX PRACTICAL (Chemistry Of Natural Products)

Credit-02

Semester VIII

L-T-P: 0-0-4

Objective: The course is designed to provide practical knowledge on isolation and identification of active chemical constituent of selected natural drugs.

Module No.	Content	Lab Hours
I-III	1. Isolation of Caffeine from Tea leaves. 2. Isolation of Piperine from Black Pepper. 3. Isolation of Hesperidin from Orange Peel. 4. Isolation of Clove oil from Clove. 5. Isolation of Caraway oil from Caraway. 6. Isolation of Cumin oil from Cumin. 7. To study the TLC profile of extracted oils. 8. To performs the Column chromatography of any available herb. 9. To study the Paper chromatographic profile of glycone portion separated from Senna. 10. To isolate the active constituent of any available drug with the help of preparative TLC. 11. Quantitative determination of Ascorbic acid present in Amla. (Fresh/ Dry).	48

Outcome: Students will be able to:

- Isolate and identify the active constituents in selected natural drugs.

Reference Books:

- Brain, K.R., & Turner T.D, The Practical evaluation of phytopharmaceutical, Wright, Bristol.
- Sim, Medicinal Plant Alkaloids & Glycosides.
- Kokate, C.K., "Practical Pharmacognosy" Vallabh Prakashan, New Delhi.
- Stahl, E. "Thin layer chromatography" A Laboratory Hand Book, Springer Verlag, Berlin.
- Harborne, J.B. Phytochemical Methods Chapman & Hall, International Ed, London. Pharmacopoeia of India.
- Finar I.L. Organic chemistry" Vol. I & II ELBS, London.
- Agarwal, O.P., Chemistry of Organic Natural Product Vol. I & II Goel Pub. House, Meerut.
- Trease, G.E. & Evan, W.C., Pharmacognosy Saunder's International,
- Tyler V.E. etal "Pharmacognosy" Lea & Febiger Philadelphia.
- Kokate, C.K. "Pharmacognosy" Nirali Prakashan, Pune.
- Pridham, J.B. & Swain T. Biosynthetic pathway Higher plants, Academic Press, New York.

BPH 8002: PHARMACEUTICAL BIOTECHNOLOGY

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective:

- This course is designed to give scientifically knowledge on isolation of industrially useful microbes, various techniques employed in biotechnology like DNA technology, Hybridoma technology, enzyme technology and the products derived using these techniques. It also provides different aspects of immunology and immunological preparations like vaccine and sera.

Module No.	Content	Teaching Hours
I	Immunology and Immunological Preparations: <ul style="list-style-type: none"> • Principles • Cellular/Humoral immunity • Active and Passive immunization • Antigens and Haptens • Immunological tolerance • Antigen-Antibody reactions and their applications • Hypersensitivity • Vaccines and sera: their preparation, standardization and storage of BCG • Development of monoclonal antibodies 	13
II	Genetic Recombination: <ul style="list-style-type: none"> • Natural Method of Gene Transfer: Transduction, Conjugation, Transformation. • Basic Techniques of Gene manipulations : Electrophoretic Techniques, Blotting Techniques, Principles of PCR Techniques, The role of vector, Gene Cloning Techniques • Methods of gene transfer in plants. Agrobacterium mediated, Direct gene transfer methods, Transfection methods. • Protoplast isolation, protoplast fusion, somatic hybridization, applications of protoplast fusion. • Animal cell and tissue culture, media, application of transgenic animals 	13
III	Industrial and Microbial Biotechnology: <ul style="list-style-type: none"> • Enzyme immobilizations: Techniques and application. • Historical development of antibiotics. Antimicrobial spectrum and methods used for their standardization. Screening of soil for organisms producing antibiotics, Mutation, Isolation of mutants, factors influencing rate of mutation. • Design of fermentation process, Control of different parameters, Isolation of fermentation products with special reference to penicillins and tetracyclines. • Introduction to microbial transformations, types of reactions mediated by microorganisms, Bio-transformation process in steroid conversion. 	14

Outcome: Students will have knowledge of

- Screening of industrially interesting microbes used in pharmaceutical industry.
- Optimize fermentation process parameters.
- about preparation, standardization, storage and labeling of biotechnologically derived product.
- Basic techniques of gene manipulation, method of gene transfer, role of vector in gene transfer.
- About antimicrobial spectrum and method used for their standardization
- Microbial transformation, and their types of reaction mediated by microorganism.
- About the regulatory control of biotechnological products.

Reference Books:

- Vyas S.P. and V.K.Dixit, Pharmaceutical Biotechnology, CBS Publication, New Delhi.
- Prescott and Dunn's Industrial Microbiology, CBS Publishers and Distributors, Delhi.
- Stanbury, P.F. & Aghitar A. Principles of Fermentation Technology.
- Crueger W. & Crueger A, Biotechnology-A Textbook of Industrial Microbiology, Panima Publishing Corporation, Delhi.
- Zaborsky, Immobilized Enzymes, CRC Press, Degraland, Ohio.
- Primrose S.B., Molecular Biotechnology Blackwell Scientific Publication.
- Kindt, T.J., Goldsby, R.A. Kuby Immunology, 6th edition, W.H. Freeman Company, N.Y.

BPH 8003: PHARMACEUTICAL INDUSTRIAL MANAGEMENT

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective: The course focuses on enhancing the creativity, the ability to achieve, developing the required professional skills to excel in leading and management positions across the pharmaceutical industry. The course provides the foundation to master the skills of business development, product launch, strategic management, product life cycle management, marketing intelligence, licensing, negotiation, market access management, HRM and value creation with focus on pharmaceutical industry.

Module No.	Content	Teaching Hours
I	<ol style="list-style-type: none"> 1. Concept of Management- Functions of management (planning, organizing, staffing, directing & controlling), principles of management (co-ordination, communication, motivation, leadership, decision making, innovation & creativity, delegation of authority, centralization & decentralization). 2. Human Resource Management- Concept of HRM, attitudes & personality, perception, learning, Interpersonal skills, recruitment, selection, training & performance evaluation of employees and compensation (determination of wages & salaries and other benefits), job satisfaction & productivity, effective team management. 	13
II	<ol style="list-style-type: none"> 1. Accountancy- Introduction to the concept of Ledger & Journal, preparation of trial balance, bank reconciliation statement, balance sheet and profit & loss account. 2. Economics- Introduction, law of demand & supply, demand schedule & demand curves, inland & international trade (procedures for exporting & importing goods), general principles of insurance special reference to third party. 3. Measuring & forecasting market demand- Outlines of marketing research process, major concepts in demand measurement, estimating current demand, industry sales & market share, estimating future demand. 	13
III	<ol style="list-style-type: none"> 1. Marketing- Concept of marketing, functions, buying & selling, marketing mix, market segmentation, targeting & positioning, significance of packaging & labeling of a product and the pricing objective, planning for new product development, distribution channels (wholesaler, retailer) & transportation, advertising, sales promotion, public relations; objectives of sales force, personal selling and sales representative. 2. Materials Management- Introduction, objectives, scope, purchasing & purchasing procedures, considerations in price determination, stores & inventory control, significance of inspection and evaluation of materials management. 3. Production & Operations Management- Introduction, scope, functions, production planning & control, production schedule, production cycle, QC tools & TQM. 	14

Outcome:

- The students will be able to develop an understanding of various concepts concerning management, communication and develop soft skills so that they can find positions in pharmaceutical sales, quality control management, health care market research and consultancy.

Reference Books:

- Malhotra, N.K., Market Research, Pearson Education Inc., Delhi.
- Chary S.N, Production and Operative Management, Tata Mc Graw Hill Education, Delhi.
- Datta A.K., Material Management, PHI Learning Pvt,Ltd, New Delhi.
- Robbins, S. P. “Organisational Behaviour”- Pearson Education Inc., Delhi.
- Bedik, Production and Operative Management, Oxford University Press, New Delhi.
- Maheshwari, S.N, and Maheshwari, S.K, ‘Accountancy’ , Vikas Publishing House, Noida.
- Jain, N.C., ‘Management- Theory & Practice’, A.I.T.B.S. Publishers, Delhi.
- Vidya sagar, Pharmaceutical Industrial Management, Pharma Med Press, Hyderabad.
- Agrawal R.D., Organization & Management, Tata Mc Graw Hill Education, Delhi.
- Philip Kottler, Marketing Management- Pearson Education Inc., Delhi.

BPH 8004: HOSPITAL PHARMACY

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective: To give a fundamental knowledge of Pharmacy and therapeutic committee, hospital formulary, budget preparation and implementation, drug distribution system in hospitals, manufacturing of sterile and nonsterile products as well as their quality control. Students will learn about the drug information services, production of radiopharmaceuticals and their role in treatment and diagnosis of disease.

Module No.	Content	Teaching Hours
I	<ol style="list-style-type: none"> 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. 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. 	13
II	<ol style="list-style-type: none"> 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. 	13
III	<ol style="list-style-type: none"> Drug information service: Sources of information on drugs, procurement of information, computerized services, retrieval of information, Medication error. Records and Reports: Prescription filling drug profile, patient medication profile, drug interaction & adverse reactions,. Nuclear Pharmacy: Introduction to Radio pharmaceuticals- radio-active half life, Units of radioactivity. Methods of production of radio pharmaceuticals and their application in pharmacy. 	14

Outcome: The students will be able to explain

- Organization of hospital, preparation of hospital formulary and role of PTC in hospitals.
- To demonstrate the sterilization techniques for different type of materials.
- Prescription filling, drug interaction and adverse drug reactions use of radiopharmaceuticals and how to use different drug information sources.

Reference Books:

- Beri, Market Research, Tata Mc Graw Hill
- Chary, S.N, Production and Operative Management .Tata Mc Graw Hill.
- Datta, A.K., Material Management ,PHI.
- Chadwick ,Leslie, The Essence of management accounting, PHI.
- Massie L. Joseph Essentials of Management ,PHI.
- Barthwal R.R, Industrial Economics ,New Age International.
- Shreenivasan K.R., An Introduction to Industrial Management, Vikas.
- Daver Rustam S. Salesmanship and Publicity ,Vikas.
- Mukopadhyay Sekhar, Pharmaceutical Selling, Sterling Publishers.
- Koontz H, Weihrich H, Essentials of Management, Tata Mc Graw Hill.
- Vidya Sagar.G. Pharmaceutical Industrial Management, Pharma Book Syndicate.

ELECTIVES

BPH 8005: STANDARDISATION OF HERBAL DRUGS

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective: The students will learn the concepts of standardization of herbal drugs as per WHO guidelines and their screening for biological activities.

Module No.	Content	Teaching Hours
I	Standardisation of plant material as per WHO guidelines. Analysis of official formulations derived from crude drugs including some ayurvedic preparations	13
II	Methods of extraction and modern techniques for the isolation, purification, separation estimation and characterisation of active plant constituents.	13
III	General methods of screening of natural products for following biological activity: a) Anti-inflammatory b) Hypoglycaemic c) Antibacterial d) Antifertility e) Psychopharmacological	14

Outcome: The students will acquire knowledge of standardization of traditional formulations and their screening for several biological activities.

Reference Books:

- Trease, G.E. & Evan, W.C., Pharmacognosy Saunder's International.
- Tyler V.E. et al "Pharmacognosy" Lea & Febiger Philadelphia.
- Wallis, T.E, Text book of Pharmacognosy, CBS Publishers, New Delhi,
- Harborne, J.B. Phytochemical Methods Chapman & Hall, International Ed, London. Pharmacopoeia of India.
- Handa, S.S, Kapoor, V.K, A Text Book of Pharmacognosy , Vallabh Prakashan, New Delhi,
- The Wealth of India, NISCAIR, New Delhi.

BPH 8006: DRUG DESIGN

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective: The students will learn the concepts of drug design and the different stages in the design of drugs.

Module No.	Content	Teaching Hours
I	Principles of Drug design: Introduction, objectives, Discovery & Identification of lead compound (Random screening, Natural Product screening, Endogeneous sources and Rational drug design); Receptors, Drug-receptor interactions & their theories, forces involved in Drug-receptor interactions.	13
II	Physicochemical properties and stereochemical aspects in drug design, Optimization of Lead via Analog Design (Identification of pharmacophore, bio-isosteric replacement, homologation, cyclization and branching of chain). Combinatorial chemistry-Definition, advantages and applications.	13
III	Drug metabolism- Phase-I & Phase-II Metabolic Reactions. Prodrugs- Definition, types of prodrugs, prodrug designing, limitations of prodrug approach, hard and soft drugs. QSAR- Definition, QSAR parameters (hydrophobic, electronic and steric parameters) quantitative models (Hansch analysis, and Free-Wilson analysis) and applications of QSAR. Molecular Modeling and CADD –Introduction to molecular mechanics and quantum mechanics, molecular dynamics and molecular docking and their advantages.	14

Outcome: The students will acquire knowledge of different aspects of drug design, QSAR, molecular modeling and CADD.

Reference Books:

- Ariens, E. J, Drug Design, Elsevier Pvt.Ltd., India.
- Burger's Medical Chemistry and drug discovery, Replica Press Pvt. Ltd.
- Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co, Philadelphia,
- Perun, T.S, Propst, C.L, Computer aided Drug Design methods Applications, Saurabh Printers Pvt. Ltd., New Delhi..
- Nogrady, T& Weaver, D.F, Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York, Oxford,
- Hansch, C, Comprehensive Medicinal Chemistry, Vol. IV, Quantitative Drug Design, Pergamon Press, Oxford,

BPH 8007: CLINICAL PHARMACY AND DRUG INTERACTIONS

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective: This course is designed to provide basic understanding in the principles of clinical pharmacy and drug interactions. It is intended primarily for under graduate students to have an interest in the therapeutic and toxic effects of drugs in human subjects. Moreover, the course will provide critical analysis on clinical management of several disorders. In addition, this course will provide a strong knowledge base of pharmacogenetics and pharmacovigilance.

Module No.	Content	Teaching Hours
I	Introduction to Clinical pharmacokinetics. Individualization of doses like in infants, child and elderly patients. Use of drugs in different physiological and pathological states like pregnancy, renal failure, liver dysfunction, Iatrogenic diseases.	13
II	Therapeutic Drug Monitoring. Concept of Essential Drugs and Rational Drug use. Drug -Drug interactions, Drugs food interaction and Drug excipient interaction. Introduction to Pharmacovigilance and Pharmacogenomics.	13
III	Important Disorders of Organ Systems and their Management: Cardiovascular Disorders: Hypertension, Congestive Heart Failure, Angina, Acute Myocardial Infarction, Cardiac arrhythmias. CNS Disorders: Epilepsy, Parkinsonism. Respiratory Diseases: Asthma. Gastrointestinal Disorders: Peptic ulcer, liver dysfunction. Kidney: Renal failure.	14

Outcome: On successful completion of Clinical Pharmacy and drug interactions, students should be able to:

- Outline and critically appraise the principal steps involved in practice of clinical pharmacy.
- Explain the rationale for considering the appropriate model in clinical trials.
- Critically review the issues involved in the management of clinical studies.

Reference Books:

- Barar, F.S.K, Essentials of Pharmacotherapeutics, S.Chand & Company, New Delhi.
- Goodman & Gilman's The Pharmacological basis of Therapeutics, Hardman, Le Limbird, PB Molinoss, RW Ruddon & AG Gill, Pergamon Press.
- Katzung, B.G, Basic & Clinical Pharmacology, Prentice Hall, International.
- Rang, M.P, Dale, M.M, Riter, J.M, Pharmacology, Churchill Livingstone.
- Tripathi, K.D, Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
- Davidson's Principles and Practice of Medicine, ELBS/Churchill Livingstone.

BPH 8008: PHARMACEUTIAL MARKETING

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective: *The students will learn the concepts of marketing with reference to the pharmaceutical industries.*

Module No.	Content	Teaching Hours
I	Introduction to Pharmaceutical Marketing- objectives, functions and Importance of Pharmaceutical Marketing, Marketing Vs Pharmaceutical Marketing, Marketing mix, Identification of pharmaceutical market, Market Behavior, Product life cycle, Prescribing habits of physician patient and consumer motivation.	13
II	Recruitment, Selection, Training and Performance evaluation of medical representative. Overview of World Pharmaceutical Industry, New drug Development, Market Research, Project Management, Research Productivity, Pharmaceutical Product Registration, Marketing of generic drugs & Non-prescription Drugs,	13
III	Distribution channels - Manufacturer, Wholesaler, Retailer, Stockist and Distributors. Advertising, Detailing, and other promotions, retail competition and ethics of sale. International marketing and environment for International marketing.	14

Outcome: The students will acquire knowledge of marketing of generic and branded drugs, and their distribution. In addition, they will know about the international marketing scenario.

Reference Books:

- Smith, Mickey C, **Principles of Pharmaceutical Marketing**, CBS Publishers & Distributors, India,
- Kotler, Phillip, **Marketing management**, Pearson Education Asia,
- Sagar, Vidya, **Pharmaceutical industrial Management**, Pharma Book Syndicate, Hyderabad,
- Remington, The Science and Practice of Pharmacy, Lippincott Williams & Wilkins, Philadelphia,

BPH 8009: PHARMACEUTICAL PACKAGING

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective: The students will learn the concepts of packaging with reference to the materials and techniques used in the pharmaceutical industries.

Module No.	Content	Teaching Hours
I	1- New Concepts in Pharmaceutical packaging. 2- Packaged system, packaged design research. 3- Corrugated fibers board materials, label and leaflets Preparation Legal requirement.	13
II	1- Packaging materials with special reference to polymers,metals,glass and Plastics,control of packaging materials. 2- Blister and strip packaging. 3- Packaging of parenterals, ophthalmic and aerosols.	13
III	1- Testing of containers &Closures, Pharmacopoeial tests and Specifications, Defects in packages. 2- Stability of packaged and packaging materials. 3- Ancillary materials used in packaging.	14

Outcome: The students will acquire knowledge of the materials used and packaging technology used for pharmaceutical formulations and raw materials in the Industry.

Reference Books:

- Jain, U.K, Gopale, D.C, Nayak, S, Pharmaceutical Packaging Technology, Pharma BookSyndicate, Hyderabad,
- Remington, The Science and Practice of Pharmacy, Lippincott Williams & Wilkins, Philadelphia,

BPH 8010: NOVEL DRUG DELIVERY SYSTEM

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective: The student will acquire extensive knowledge of different aspects of controlled release drug delivery systems (CRDDS) of oral, parenteral, trans-dermal, implants, bio-adhesives and targeted drug delivery in depth and their design, evaluation and applications.

Module No.	Content	Teaching Hours
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.	13
II	1. Microencapsulation: Methods, kinetics of drug release from microcapsules technology and applications. 2. Transdermal Drug Delivery Systems: Theory, formulation and evaluation, iontophoresis.	13
III	1. Targeted Drug Delivery Systems: Concept of Drug Targeting, importance in therapeutics, methods in drug targeting, nanoparticles, liposomes, neosomes and erythrocytes. 2. Advances in drug delivery systems. An Introduction to buccal, ocular and colonic delivery.	14

Outcome: The students will be able to carry out fabrication, design, evaluation of different controlled release drug delivery systems.

Reference Books:

- Roche, E. B. Design of Biopharmaceutical Properties Through Prodrug and Analogs. Am. Pharm. Assoc. Academy of Pharm. Sci.
- Juliano, R. L. Drug Delivery Systems. Oxford University Press, Oxford,
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BPH 8011: DRUG REGULATORY AFFAIRS AND INTELLECTUAL PROPERTY RIGHTS

Credit-03

Semester VIII

L-T-P: 3-0-0

Objective: The course is designed to acquire knowledge regarding the regulatory aspects involved in the pharmaceutical industries and the development/research of new drugs including IND, NDA, ANDA, ICH guidelines. To give more emphasis on Intellectual Property Rights – Patent Act, Trademark Act, Copyright Act.

Module No.	Content	Teaching Hours
I	Drug & Cosmetics Act. , Schedule Y, IND, NDA and ANDA filing procedure as per USFDA. Bioequivalence studies as per USFDA guideline	13
II	Intellectual property rights patents, Trademarks, Copyrights, Patents Act. (Major emphasis on Patents related to: ➤ Patentable subject matter ➤ Non-Patentable subject matter ➤ Criteria for getting a patent ➤ Types of patent and its usefulness ➤ Filing procedure for patents ➤ Patent cooperation treaty ➤ Indian process patent Trade related aspect of intellectual property rights Factory act	13
III	cGMP, GLP and TQM ICH Guideline- An Introduction, Quality assurance & Quality control. Specification of new drug substance and products (Q6A) Analytical methodology, Impurities in New drug substances (Q3A(R)), Impurities: Residual solvent (Q3C)	14

Outcome:

- Students will know various regulatory authorities globally and the filing procedures mentioned in different regulatory drug approach such as IND, NDA and ANDA.
- Students will be aware of technical aspects pertaining to the research and marketing of new drugs and the patent laws, intellectual property rights and drug regulation in India and abroad.

Reference Books:

- Willing, S.W., & Stoker, Good Manufacturing Practices for Pharmaceuticals, Marcel Dekker, New York.
- Guarino, R.A., New Drug Approval Process, Marcel Dekker, New York.
- Drug & Cosmetic Act.
- Patents Act.
- Federal Food, Drug & Cosmetic Act.
- Pisano-FDA Regulatory Affairs.