


UNIVERSITY OF MUMBAI
No. UG/129 of 2016-17

CIRCULAR:-

A reference is invited to the syllabi relating to the Bachelor of Pharmacy (B.Pharm.) degree course vide this office Circular No.UG/320 of 2007, dated 18th July, 2007 and the Principals of affiliated Colleges in Pharmacy are hereby informed that the recommendation made by Ad-hoc Board of Studies in Pharmacy at its meeting held on 7th July, 2016 has been accepted by the Academic Council at its meeting held on 14th July, 2016 vide item No. 4.15 and that in accordance therewith, the revised syllabus as per Choice Based Credit System for Bachelor of Pharmacy (Sem. I & II), which is available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2016-17.

MUMBAI – 400 032
9th November, 2016


(Dr.M.A.Khan)
REGISTRAR

To,
The Principals of affiliated Colleges in Pharmacy.

A.C/ 4.15/14/07/2016.

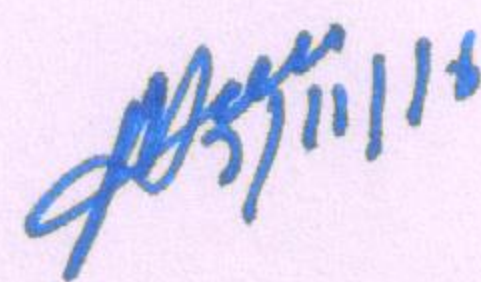
No. UG/129A of 2016

MUMBAI-400 032

9th November, 2016

Copy forwarded with compliments for information to:-

1. The Dean, Faculty of Technology,
2. The Chairmen, Board of the Studies in Pharmacy.
3. The Director, Board of College and University Development,
4. The Controller of Examinations,
5. The Co-Ordinator, University Computerization Centre.


(Dr.M.A.Khan)
REGISTRAR

... PTO

B. Pharm. Choice Based Credit System (CBCS)[2016-17]

**Scheme Examination Semesters I to VIII
&
Syllabus Semesters I to II**

[REVISED 2016]

EXAMINATION SCHEME FOR THE CHOICE BASED CREDIT SYSTEM (CBCS) (2016-17)

SEMESTER I

Course Code	Name	Credits	Hr/Wk	Weightage Internal	Weightage End Semester Exam	Total Marks
BPH_C_101_T	General Chemistry	4	4	20	80	100
BPH_C_102_T	Dispensing and Community Pharmacy	4	4	20	80	100
BPH_C_103_T	Anatomy, Physiology & Pathophysiology I	4	4	20	80	100
BPH_C_104_T	Biochemistry I	4	4	20	80	100
BPH_C_105_T	Communication Skills and Ethics (NUES)	3	3	20	80	100
	TOTAL Theory	19	19	100	400	500
BPH_C_106_L	General Chemistry Lab	2	4	10	40	50
BPH_C_107_L	Dispensing and Community Pharmacy Lab	2	4	10	40	50
BPH_C_108_L	Anatomy, Physiology & Pathophysiology Lab	2	4	10	40	50
	TOTAL Lab	6	12	30	120	150
	TOTAL SEM I	25	31	130	520	650

SEMESTER II

Course Code	Name	Credits	Hr/Wk	Weightage Internal	Weightage End Semester Exam	Total Marks
BPH_C_201_T	Anatomy, Physiology & Pathophysiology II	4	4	20	80	100
BPH_C_202_T	Biochemistry II	4	4	20	80	100
BPH_C_203_T	Pharmacognosy I	4	4	20	80	100
BPH_C_204_T	Hospital Pharmacy and Drug Store Management	4	4	20	80	100
BPH_C_205_T	Environmental Science	3	3	20	80	100
	TOTAL Theory	19	19	100	400	500
BPH_C_206_L	Pharmacognosy Lab I	2	4	10	40	50
BPH_C_207_L	Biochemistry Lab	2	4	10	40	50
BPH_C_208_L	Computer Lab	2	4	10	40	50
	TOTAL Lab	6	12	30	120	150
	TOTAL SEM II	25	31	130	520	650

NO REMEDIAL FOR LATERAL ENTRY AS SEM I AND II SUBJECTS ARE COVERED IN DIPLOMA SYLLABUS

SEMESTER III

Course Code	Name	Credits	Hr/Wk	Weightage Internal	Weightage End Semester Exam	Total Marks
BPH C 301 T	Organic Chemistry I	4	4	20	80	100
BPH C 302 T	Physical Pharmacy I	4	4	20	80	100
BPH_C_303_T	Anatomy, Physiology & Pathophysiology III	4	4	20	80	100
BPH_C_304_T	Pharmaceutical Analysis I	3	3	20	80	100
BPH_C_305_T	Pharmaceutical Engineering	3	3	20	80	100
	TOTAL Theory	18	18	100	400	500
BPH_C_306_L	Organic Chemistry Lab I	2	4	10	40	50
BPH_C_307_L	Physical Pharmacy Lab I	2	4	10	40	50
BPH_C_308_L	Pharmaceutical Analysis Lab I	2	4	10	40	50
	TOTAL Lab	6	12	30	120	150
	TOTAL SEM III	24	30	130	520	650

SEMESTER IV

Course Code	Name	Credits	Hr/Wk	Weightage Internal	Weightage End Semester Exam	Total Marks
BPH C 401 T	Organic Chemistry II	4	4	20	80	100
BPH C 402 T	Physical Pharmacy II	4	4	20	80	100
BPH C 403 T	Pharmaceutics I	3	3	20	80	100
BPH C 404 T	Pharmacology I	4	4	20	80	100
BPH C 405 T	Microbiology	3	3	20	80	100
BPH_C_406_T	Mathematics and Statistics	3	3	20	80	100
	TOTAL Theory	21	21	120	480	600
BPH_C_407_L	Physical Pharmacy Lab II	2	4	10	40	50
BPH C 408 L	Pharmaceutics Lab I	2	4	10	40	50
BPH C 409 L	Pharmacology Lab I	2	4	10	40	50
	TOTAL Lab	6	12	30	120	150
	TOTAL SEM IV	27	33	150	600	750

SEMESTER V

Course Code	Name	Credits	Hr/Wk	Weightage Internal	Weightage End Semester Exam	Total Marks
BPH_C_501_T	Organic Chemistry III	4	4	20	80	100
BPH_C_502_T	Pharmaceutics II	4	4	20	80	100
BPH_C_503_T	Pharmaceutical Biotechnology	4	4	20	80	100
BPH_C_504_T	Pharmacology II	4	4	20	80	100
BPH_E_5xx_T	Choice Based Course I	2	2	10	40	50
BPH_E_5xx_T	Choice Based Course II	2	2	10	40	50
	TOTAL Theory	20	20	100	400	500
BPH_C_505_L	Organic Chemistry Lab II	2	4	10	40	50
BPH_C_506_L	Pharmaceutics Lab II	2	4	10	40	50
BPH_C_507_L	Experimental Techniques in Microbiology and Biotechnology Lab	2	4	10	40	50
	TOTAL Lab	6	12	30	120	150
	TOTAL SEM V	26	32	130	520	650

SEMESTER VI

Course Code	Name	Credits	Hr/Wk	Weightage Internal	Weightage End Semester Exam	Total Marks
BPH_C_601_T	Pharmaceutical Chemistry I	4	4	20	80	100
BPH_C_602_T	Pharmaceutics III	4	4	20	80	100
BPH_C_603_T	Pharmaceutical Analysis II	4	4	20	80	100
BPH_C_604_T	Pharmacognosy II	4	4	20	80	100
BPH_E_6xx_T	Choice Based Course III	4	4	20	80	100
BPH_E_6xx_T	Choice Based Course IV	2	2	10	40	50
	TOTAL Theory	22	22	110	440	550
BPH_C_605_L	Pharmaceutical Chemistry Lab I	2	4	10	40	50
BPH_C_606_L	Pharmaceutics Lab III	2	4	10	40	50
BPH_C_607_L	Pharmaceutical Analysis Lab II	2	4	10	40	50
	TOTAL Lab	6	12	30	120	150
	TOTAL SEM VI	28	34	140	560	700

SEMESTER VII

Course Code	Name	Credits	Hr/Wk	Weightage Internal	Weightage End Semester Exam	Total Marks
BPH_C_701_T	Pharmaceutical Chemistry II	4	4	20	80	100
BPH_C_702_T	Pharmacognosy III	4	4	20	80	100
BPH_C_703_T	Pharmaceutical Analysis III	4	4	20	80	100
BPH_C_704_T	Pharmacology III	4	4	20	80	100
BPH_C_705_T	Pharmaceutical Jurisprudence	3	3	20	80	100
BPH_E_7xx_T	Choice Based Course V	2	2	10	40	50
	TOTAL Theory	21	21	110	440	550
BPH_C_706_L	Pharmacognosy Lab II	2	4	10	40	50
BPH_C_707_L	Pharmaceutical Analysis Lab III	2	4	10	40	50
BPH_C_708_L	Pharmacology Lab II	2	4	10	40	50
	TOTAL Lab	6	12	30	120	150
	TOTAL SEM VII	27	33	140	560	700

SEMESTER VIII

Course Code	Name	Credits	Hr/Wk	Weightage Internal	Weightage End Semester Exam	Total Marks
BPH_C_801_T	Pharmaceutical Chemistry III	4	4	20	80	100
BPH_C_802_T	Pharmaceutics IV	4	4	20	80	100
BPH_E_8xx_T	Choice Based Course VI	4	4	20	80	100
BPH_E_8xx_T	Choice Based Course VII	4	4	20	80	100
	TOTAL Theory	16	16	80	320	400
BPH_C_803_L	Pharmaceutical Chemistry Lab II	2	4	10	40	50
BPH_C_804_L	Pharmaceutics Lab IV	2	4	10	40	50
BPH_E_805_D	Project	6	12	-	200	200
	TOTAL Lab	10	20	20	280	300
	TOTAL SEM VIII	26	36	100	600	700

SYLLABUS FOR F. Y. B. Pharm.

SEMESTER-I

BPH_C_101_T – General Chemistry – (4 Hr/Wk)

Course Objectives

On completion of following theory topics, learner should be able to understand basic concepts of bonding, principles of chemical reaction and catalytic reaction, role of inorganic reagents as medicinal compounds.

Course Outcomes

- 1) Draw and explain the structures of various molecules or ions based on the concept of ionic and covalent bonding
- 2) Explain the Rate Law of a Chemical Reaction and Apply the knowledge of principles like Hammonds postulate, Reactivity and Selectivity Microscopic reversibility to predict the nature of reaction and product formation rate
- 3) Differentiate the types of catalytic reactions and explain the role of catalyst
- 4) Classify Gastrointestinal Agents, Topical Agents, Saline Cathartics, Expectorants, Emetics, Antidotes and explain their mode of action. Describe sclerosing agents and complexing agents
- 5) Classify electrolytes/ elements and elaborate their physiological role. Explain use of physiological ions in replacement therapy, acid-base balance and combination therapy.
- 6) Explain the basic concepts of radiochemistry and biological effects of radiation; describe diagnostics and therapeutic uses of radiopharmaceuticals.

No.	Details	Hours
1	Review of basic bonding concepts	10
1.1	Quantum numbers, atomic orbitals, electron configuration, electronic diagrams, polar covalent bonds, electronegativity group, electronegativities, electrostatic potential surfaces, inductive effects, bond dipoles, molecular dipoles.	4
1.2	Lewis structures, formal charge.	3
1.3	VSEPR, hybridization involving s, p and d orbitals, hybridization effects	3
2	Kinetics and reaction mechanism	7
2.1	Energy surfaces, reaction coordinate diagrams, activated complex/transition state rate and rate constants, reaction order and rate laws	2
2.2	Kinetic isotope effects	2
2.3	Hammond Postulate, reactivity vs selectivity, Curtin-Hammett Principle, microscopic reversibility, kinetic vs thermodynamic control	3
3	Catalysis:	7
3.1	General principles of catalysis, Forms of catalysis – electrophilic catalysis, acid- base catalysis, nucleophilic catalysis, covalent catalysis, phase transfer catalysis.	4
3.2	Bronsted Acid-base catalysis, correlation of reaction rates with acidity functions.	3
4	Gastrointestinal Agents	4
4.1	Acidifying agents	1
4.2	Antacids: Sodium bicarbonate, aluminum hydroxide, calcium carbonate, tribasic calcium phosphate, magnesium hydroxide, magnesium trisilicate and combination antacid preparations.	1
4.3	Protectives and Adsorbents: Introduction; bismuth subnitrate, bismuth subcarbonate, kaolin, attapulgit and activated charcoal	1
4.4	Cathartics	1
5	Topical Agents	4
5.1	Protective Topical Agents: Definition; talc, insoluble zinc compounds (zinc oxide, calamine, zinc stearate), titanium dioxide.	1
5.2	Antimicrobials and Astringents: Antimicrobial terminology, mechanism of action Antimicrobial Astringent Products: Oxidative antimicrobial agents; (hydrogen peroxide, zinc peroxide, sodium carbonate,	1

	potassium permanganate, sodium hypochlorite, iodine preparation and compounds)	
5.3	Protein Precipitant Antimicrobial Agents: Silver nitrate, mild silver protein and related products, ammoniated mercury, mercuric chloride, sulphur and sulphur compounds, sublimed sulphur and precipitated sulphur, boric acid and sodium borate, antimony potassium tartrate.	1
5.4	Astringents: Official compounds of aluminium and zinc	1
6	Complexing and chelating agents used in therapy, poisons and antidotes	2
7	Miscellaneous inorganic pharmaceutical agents:	2
7.1	Sclerosing agents, expectorants, emetics.	1
7.2	Antioxidants: Theory and principle, selection of antioxidants, official antioxidants (hypophosphorous acid, sodium bisulphite, sodium thiosulphate, sodium nitrite and nitrogen).	1
8	Inorganic Radio Pharmaceuticals: Properties of α , β and γ radiation, biological effect of radiation, half-life, clinical application of radiopharmaceuticals (Chromium-51, Iodine-125 and 131, Technetium-99, Iron-59, Cobalt-57 and 60 and Gold-198)	4
9	Major Intra & Extracellular Electrolytes	5
9.1	Major physiological ions (Role and condition related to change in concentration of following ions: chloride, phosphate, bicarbonate, sodium, potassium, calcium, magnesium)	2
9.2	Electrolytes used in replacement therapy: Sodium replacement (sodium chloride), potassium replacement (potassium chloride), calcium replacement (calcium chloride, calcium gluconate)	1
9.3	Physiological acid base balance: Acids and Bases: Buffers (Pharmaceutical and Physiological) Electrolytes used in acid base therapy (sodium acetate, sodium bicarbonate, sodium biphosphate, sodium citrate, sodium lactate, ammonium chloride). Electrolyte combination therapy.	2
10	Essential and Trace Elements: Iron and haematinics Copper, zinc, molybdenum, selenium and sulphur. Official iodine products (iodine, potassium iodide, sodium iodide).	3
	TOTAL	48

Note: Only Uses of pharmaceutical agents mentioned to be covered. Monographs not to be discussed.

Books:

Latest Edition of all books to be referred.

- 1) Eric V Anslyn and Dennis A Dougherty, Modern Physical Organic Chemistry, John Wiley.
- 2) Inorganic medicinal and pharmaceutical chemistry, J. H. Block, E. B. Roche, T. O. Soine, and C. O. Wilson. Lea &Febiger, Philadelphia, PA.
- 3) Modern Inorganic Pharmaceutical Chemistry, Clarence A. Discher. Wiley, New York.
- 4) Remington: the science and practice of pharmacy, Beringer, P. Lippincott Williams & Wilkins.
- 5) Inorganic Pharmaceutical Chemistry, Bothara, K. G., NiraliPrakashan.
- 6) Inorganic Pharmaceutical Chemistry, A. S. Dhake, H. P. Tipnis, Career Publication.

BPH_C_102_T – Dispensing and Community Pharmacy – (4 Hr/Wk)

Course Objectives

On completion of the theory topics, the learner should have had an understanding of the concept of drug versus dosage forms, basic calculations relating to the practice of dispensing, prescriptions and their types and their compounding and the role of a community pharmacy in healthcare

Course Outcomes

At the end of the course the learner will be able to

1. Define and identify various dosage forms
2. Solve problems relating to pharmaceutical calculations

3. Have knowledge of different prescription types
4. Identify and comprehend different steps involved in dispensing of formulations
5. Understand principles involved in compounding of different dosage forms
6. Identify physical and chemical incompatibilities among different active ingredients and formulations
7. Understand the organization of community pharmacy, provide optimal patient care under the direct personal interaction/ counseling

No.	Details	Hours
1	Concept of formulation: Definition of drug and dosage form Introduction to routes of administration Classification of dosage form and their applications	4
2	Introduction to compounding and dispensing.	1
3	Prescription: Prescription and its parts. Types of prescriptions. Pricing and recording of prescriptions.	2
4	General dispensing: Fundamentals of compounding and dispensing including good practices. Containers and closures/packaging for dispensed products. Storage and stability of dispensed products. Labeling of dispensed preparations. Dispensing of proprietary medicines.	5
5	Pharmaceutical Calculations: Reduction and enlargement of formulae, formula by weight(w/v, w/w, v/v), in parts Calculations based on expressions of concentration and dilution (percentage, parts, alligation), proof strength. Posology.	4
6	General compounding of Products (includes excipients used and compounding procedure): Solutions, suspensions, emulsions and creams, ointments and pastes, gels, suppository and pessaries, powders, granules. and capsules	10
	<i>Self-Study: Compounding of dosage forms such as lozenges, pastilles, pills, tablet triturates.</i>	6
7	Incompatibilities: Physical Incompatibilities, Chemical Incompatibilities.	3
8	Community Pharmacy: Definition and scope Pharmacy and health care system in India Roles and responsibilities of community pharmacist	2
9	Health education: WHO Definition of health, and health promotion Health screening services- definition, importance, methods for screening	3
	<i>Self-Study: Commonly occurring Communicable Diseases, causative agents, Balance diet, treatment & prevention of deficiency disorders, Family planning – role of pharmacist</i>	4
10	Pharmaceutical care: Definition and Principles of Pharmaceutical care, definition and outcomes of patient counseling	2
11	OTC Medication	2
12	Pharmaceutical ethics: Principle and Significance of professional ethics, code of ethics for a pharmacist	2
	TOTAL	48

Books:

1. Cooper and Gunns Dispensing for Pharmaceutical Students, Edns. 11 and 12; Edited by S.J.Carter, Indian Edition, CBS Publishers, Delhi.
2. Pharmaceutical Practice; Edited by D.M.Collet and M.E.Aulton; Churchill Livingstone, ELBS Edition, 1991.
3. Pharmaceutical Practice Edited by A.J.Winfield and R.M.E. Richards, Second Edition, Churchill Livingstone, 1998.]

4. Pharmaceutical Practice; Edited by A.J. Winfield and R.M.E. Richards, Third Edition, Churchill Livingstone, 2004.
5. Husa's Pharmaceutical Dispensing, Edited by Eric Martin, Sixth Edition, Mack Publishing Company, 1996.
6. Pharmaceutical Calculations, A.C. Ansel and M.J. Stoklosa, Lippincott Williams and Wilkins, 2006.
7. Pharmaceutical Calculations – Bradley, Gustafson and Stoklosa, Third Edition, Lea and Febiger, 1957.
8. Parmar N.S. Health Education and Community Pharmacy, 18th ed. India: CBS Publishers & Distributors; 2008.
9. Merchant S.H. and Dr. J.S. Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakashan; 2001
10. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice- essential concepts and skills, 1st ed. Chennai: Orient Longman Private Limited; 2004

BPH_C_103_T - Anatomy, Physiology and Pathophysiology – I (4 Hr/Wk)

Course Objectives

To familiarize the learner with the anatomical organization and physiology of the human body and the pathophysiology of some disease states

Course Outcomes

1. Outline and categorize the various body structural levels (cells, tissues, organs, and systems) and recall the structure, composition and functions of plasma membrane and methods of movement of substances across plasma membrane.
2. Explain anatomy, physiology of lymphatic system, recall & interpret the types of hypersensitivity reactions, and make use of the knowledge of the pathophysiology of AIDS and autoimmune diseases.
3. Tell the composition and functions of blood, explain the process of hemostasis and blood coagulation as well as recall & apply the knowledge of pathophysiology of common haematological disorders.
4. Comprehend the mechanisms of inflammation and repair.
5. Recall the anatomy of skeletal, cardiac and smooth muscle, explain the transmission at the neuromuscular junction and energy metabolism in the muscle as well as the mechanism of skeletal muscle contraction and demonstrate various types of skeletal muscle contractions.

No.	Details	Hours
1.	Brief introduction to human body and organization of human body	1
2.	Structural and functional characteristics of following tissues 1) Epithelial 2) Connective 3) Nervous 4) Muscle	2
3.	Detailed structure of cell membrane and trans-membrane movement of substances	2
4.	Components and functions of lymphatic system <ul style="list-style-type: none"> • Lymphatic organs and tissues • Organization of lymph vessels • Formation and flow of lymph 	4
5.	Pathophysiology of following diseases <ul style="list-style-type: none"> • AIDS • Autoimmune diseases (Rheumatoid arthritis, Grave's disease, Myasthenia Gravis, Rheumatic fever) • Hypersensitivity and types of hypersensitivity reactions. 	6
7.	Haematology <ul style="list-style-type: none"> • Composition of blood • Functions of blood elements • Erythropoiesis and life cycle of RBC. • Synthesis of Haemoglobin • Leucopoiesis • Immunity: Basics and Types • Coagulation of blood • Blood groups 	10
8.	Pathophysiology of following diseases	5

	<ul style="list-style-type: none"> • Anaemias – Types of anaemias • Polycythemia : Physiological and polycythemia vera • Leucopenia • Leukocytosis • Thrombocytopenia • Leukemia 	
6.	<p>Basic mechanism involved in the process of inflammation and repair.</p> <ul style="list-style-type: none"> • Alteration in vascular permeability and blood flow. • Migration of WBC • Acute and chronic inflammation • Brief outline of the process of repair. 	7
9.	<p>Structure and properties of following muscles</p> <ul style="list-style-type: none"> • Cardiac muscles • Smooth muscles • Skeletal muscles • Neuromuscular transmission and contraction of skeletal muscle • Energy metabolism in the muscle • Types of muscle contractions • Muscle tone 	11
	TOTAL	48

Books:

Latest editions of the following books can be referred

1. Ross & Wilson, Anatomy & Physiology in Health & Illness by Anne Waugh and Allison Grant, Published by Churchill Livingstone
2. Gerard J. Tortora & Bryan Derrickson, Principals of Anatomy & Physiology, Published by John Wiley and Sons, Inc.
3. A. C. Guyton & J. E. Hall, Textbook of Medical Physiology, Published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, USA.
4. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander
Published by Churchill Livingstone
5. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques
6. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India
8. Harsh Mohan, Text book of Pathology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

BPH_C_104_T - Biochemistry I (4 Hr/Wk)

Course Objectives

At the end of the theory lectures, the learner should be familiar with the basic building blocks of the biomolecules and the biomacromolecules themselves in a biological system, understand the role of vitamins as cofactors in enzyme reactions and be aware of the principles of thermodynamics as they apply to biosystems.

Course Outcomes

1. List and identify the commonly occurring carbohydrates, amino acids and fatty acids
2. Describe higher order structures like oligo and poly saccharides/peptides and membrane lipids
3. Classify the different vitamins in terms of their aqueous solubility and the biochemical reactions/role they are involved in.
4. Define the laws of thermodynamics and explain the concepts of Gibbs free energy, favorable and unfavourable reactions and role of ATP and NADH as energy carriers
5. Describe the process of digestion, absorption, storage and retrieval of different cellular nutrients

No.	Details	Hours
1.	<p>Introduction to Carbohydrates: Introduction to common monosaccharides ranging from trioses to hexoses Introduction to common disaccharides sucrose, cellobiose, maltose, lactose Introduction to common polysaccharides starch and glycogen</p> <p>Introduction to Proteins:</p>	22

	<p>Introduction to amino acids, their classification, three letter and one letter codes</p> <p>Introduction to hierarchy of protein structures</p> <p>Introduction to Lipids:</p> <p>Introduction to common saturated and unsaturated fatty acids</p> <p>Introduction to triacyl glycerol, phospholipids, sphingolipids</p> <p>Introduction to Nucleic acids:</p> <p>Introduction to nitrogen bases, nucleosides and nucleotides</p> <p>Introduction to the structure of DNA (helices), melting and annealing of DNA, melting temperature and introduction to higher order packaging of DNA</p> <p>Introduction to the concept of glycoproteins, proteoglycans, lipopolysaccharides, glycolipids, lipoproteins, proteolipids, nucleoproteins, with examples.</p>	
2.	<p>Vitamins</p> <p>Vitamins as co-enzymes and their significance. Biochemical roles of all the vitamins with details of the mechanisms of their functions. (riboflavin, thiamine, pyridoxal, nicotinamide, biotin, folic acid, ascorbic acid, pantothenic acid, cyanocobalamine, inositol, vitamins A, D, E, K)</p>	15
3.	<p>Biochemical Energetics</p> <p>Introduction to the concept of free energy, standard free energy, transformed free energy. Thermodynamically favorable or unfavorable reactions. Spontaneous versus thermodynamically favorable reactions. Oxidations as a source of energy in biological systems. ATP, NADH and FADH₂ as energy carriers. Introduction to the concepts of anabolism and catabolism. Convergence of metabolic pathways and divergence of anabolic pathways</p>	8
4.	<p>Digestion</p> <p>Digestion of food and absorption of food (carbohydrates, lipids and carbohydrates). Fate of absorbed nutrients and the relationship with regard to immediate use, storage, release and interconversion. Role of liver, muscle, adipose tissue, brain and special features of rbc's.</p>	3
	TOTAL	48

Books:

1. Lehninger, Principles of Biochemistry, Replika Press.
2. Stryer L, Biochemistry, W. H. Freeman & Co.
3. Harper's Biochemistry, Appleton and Lange, USA.
4. Conn E, Stumpf PK, Brueing G and Doi Roy H, Outlines of Biochemistry, Wiley Liss, USA.
5. Wilson and Gisvolds Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams and Wilkins, USA
6. Foye's Principles of Medicinal Chemistry, Lippincott Williams and Wilkins, USA.

BPH_C_105_T - Communication Skills and Ethics (3 Hr/Wk)

Course Objectives

To teach the learner the importance of English language, the vocabulary and grammar for effective scientific and non-scientific communication and inculcate the importance of Life Skills and Ethics in fulfilling the role as a pharmacist, healthcare provider and a world citizen.

Course Outcomes

1. List and identify verbs and the passive voice
2. Apply skills learnt to confidently stand in a group discussion
3. Apply skills learnt to communicate effectively – technically/businesswise
4. Appreciate and imbibe the importance of ethics, human values, honesty and integrity

No.	Details	Hours
1.	Introduction on language and communication: Review of grammar and vocabulary, Effective use of dictionary, Phonetics, Meaning and importance of communication, Objectives of Communication. Need for Communication. Types of communication. Written & Verbal communication. Formal and informal communication, upward and downward communication. Non-Verbal, Body Language and Graphic Language. Barriers to effective communication and how to overcome them; brevity, clarity and appropriateness in	5

	communication.	
2.	Technical Communication: Nature, Origin and Development, Factors involved in Technical Communication (Audience, Purpose, Format & Style), Forms of Technical Communication, Five C's of Technical Communication (Clear, Correct, Concise, Consistent, Comprehensive), Difference between Technical Communication & General Communication	2
3.	Business communication: Objectives & Functions of Business Communication, Importance of written business correspondence, Types of Business correspondence: Enquiry, Order letter, Complaint letter, Adjustment letter, Official letters, electronic communication, Routine Letters and Goodwill Messages, Office Drafting: Circular, Notice, and Memo. Telephone Communication and Cell Phone etiquettes Assignment: Drafting of the above types of business correspondence	3
4.	Career Skills: Interview skills, Applying for job, Cover letters, Resume and Effective Profiling, group discussion, letter writing, e-mail writing and Netiquettes, Academic Application Drafting, Report writing—preparing rough draft, editing and preparing final report, Presentation Skills: (i) How to make a Power Point presentation (ii) Body language during presentation Assignment: Oral presentations by the students, followed by discussion Mock Interview: Each student to face an interview and to demonstrate the above taught skills	4
5	Life Skills – Goal-setting; Self-esteem and Self-Confidence; Problem Solving; Decision Making; Time Management; Stress Management; Positive Thinking; Assertiveness; Teamwork; Interpersonal Relationships; Coping with Life Stresses; Suicidal Tendencies; Peer Pressure; Substance Abuse and Addiction. Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations	4
6.	Effective and Ethical Communication at work: Flow of communication in organizations, Communication Skills & Success at work, How to overcome typical barriers of Communication and ethical response to office gossip	2
7.	Introduction to Ethics and Human Values: Definition – Good Behaviour, Conduct and Character; Importance, Respects for Elders, Use and Relevance in Present-day Society, Individual and Society – Desirable Basic Human Characters - Honesty, Truthfulness, Respect, Punctuality, Responsibility, Courtesy, Discipline, Kindness, courage, Character, Forgiveness, Friendship, Compassion, Consideration, Contentedness, Simplicity, Empathy, Avoiding Greed; Family responsibilities, The 3 Cs of ethics – clarity, courage and creativity,	3
8.	Professional Ethics: Need and Importance – Goals, Dignity of Labour dimensions of ethics; ethics in private and public relationships, Ethical Values in Different Professions – Management, Business, Teaching, Civil Services, Politics, Medicine, Policing, Judiciary.	2
9.	Ethical Practice in Pharmaceutical Industry: Safety norms, quality norms, clinical trials, packaging, labelling, pricing, distribution, disposal of past-expiry products, advertising, use of medical channels for promotional activities, IPR, Role of R&D, profitability and its linkage to R&D	2
10.	Ethics in Media and Technology – Impact on Youth; Cyber Ethics and Etiquette; Mobile Phones, Social Networking; Correct and Judicious Use	1
11.	Leadership and Ethics: What is Ethical Leadership? Principles & commandments of ethical leadership, Characteristics of Ethical leader, Ethical decision making	2
12	Group Projects/ Field Work	6
	Total	36

Group Projects: (6 Hrs)

Students could go on a local field trip and submit an account in about 5 pages. Students can be divided into groups of 5 and one written account can be submitted per group. Different groups can undertake different projects so that the logistics are manageable and

there is also sharing of experiences/ideas. Students are advised to prepare a list of questions before hand so that they are more focussed. **Some suggestions of locations include: Government hospital or dispensary , old age home, Pension Office, Local wholesale market, Industry, Cancer care centre, Orphanage, Homes for mentally challenged, etc**

Books:

1. The right word at the right time A guide to the English language and how to use it, Elison John, The reader's Digest
2. Study writing, Hamplyons Liz & Ben Heasley, Cambridge University Press.
3. Basic Business Communication, LesikerRaymond.V and Maire E Hatley, New York, Tata McGraw Hill
4. Business Ethics- A Global and Managerial Perspective, David J. Fritzsche, Tata McGraw Hill
5. Values and Ethics in Organizations – Theory and Practice, Dr.S.K.Chakraborty, Oxford University Press (OUP)
6. Ethics Omnibus, Dr.S.K.Chakraborty, Oxford University Press (OUP)
7. KK Ramchandran Business communication (Macmilan)
8. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2ndEdition, Pearson Education, 2011
9. Communication skills, Sanjay Kumar, Pushpalata, 1st Edition, OxfordPress, 2011
10. Organizational Behaviour, Stephen .P. Robbins, 1st Edition, Pearson,2013
11. Brilliant- Communication skills, Gill Hasson, 1st Edition, Pearson Life.
12. Personality development and soft skills, Barun K Mitra, 1st Edition,Oxford Press, 2011

BPH_C_106_L – General Chemistry – Lab (4 Hr/Wk)

Course Objective

On completion of general chemistry Lab, learner should be able to prepare, purify and examine inorganic pharmaceutical agents.

Course Outcomes

- 1) Analyze inorganic mixtures qualitatively by semi-micro methods.
- 2) Identify different inorganic impurities in inorganic medicinal agents by performing Pharmacopoeial test. .
- 3) Prepare and purify inorganic pharmaceuticals

Practicals

- 1) The background and systematic qualitative analysis of inorganic mixtures of up to four radicals. Six mixtures to be analyzed, preferably by semi-micro methods.
- 2) Identification tests for pharmacopoeial inorganic pharmaceuticals and qualitative tests for cations and anions should be covered (any two)
- 3) Limit Test for Impurities in Pharmaceutical Compounds: Chloride, sulphate and Iron
- 4) Preparation of Selected Inorganic Pharmaceuticals: Potash alum and ferrous oxalate.
- 5) Purification of Selected Inorganic Pharmaceuticals: Copper sulphate and ferrous sulphate.

References

- 1) Svehla G. Vogel's Textbook of Micro and Semimicro-Qualitative Inorganic Analysis. Orient Longman,Hyderabad. Latest Edition.
- 2) Indian Pharmacopoeia. The Indian Pharmacopoeia Commission, Central Indian Pharmacopoeia Laboratory,Govt. of India. Ministry of Health and Family Welfare, Ghaziabad. Latest Edition.

BPH_C_107_L - Dispensing and Community Pharmacy – (4 Hr/Wk)

Course Objectives

The train the learner in the requirements of a dispensing pharmacist and teach pharmacist-patient interactions at the professional level.

Course Outcomes

1. Read prescriptions, identify commonly used Latin terms in Pharmacy practice
2. Calculate the quantities of active ingredients and excipients required for compounding the required quantity of formulation (expansion and reduction of formula)
3. Compound, label and dispense extemporaneous formulations
4. Understand patient counseling and patient education methods

No.	Details
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1	Solutions: 1. Potassium Permanganate Solution 2. Paediatric Ferrous Sulphate Oral Solution BP 1988
2	Suspensions: 1. Paediatric Chalk Mixture BP 1988 2. Kaolin Mixture BP 1988
3	Emulsions: 1. Arachis Oil Emulsion 2. Calciferol Emulsion 3. Medicated cream
4	Ointment/paste: 1. Zinc and Castor Oil Ointment BP 1988 / Calamine Ointment IP 2010/Compound Zinc Paste BP 1988
5	Jelly: 1. Lubricating jelly
6	Powders: 1. Bulk Powder: Compound Magnesium trisilicate Oral Powder BP 1988 /Zinc, Starch and Talc Dusting Powder BPC 1973 2. Divided Powder : HyoscineHydrobromide Powder
7	Granules: 1. Isapguhl Granules 2. Effervescent Granules
8	Capsules: 1. Chlordiazepoxide capsules BP
9	Suppositories: 1. Compound Bismuth Subgallate Suppositories BP 1980
10	Incompatibility: 1. Eutectic mixture
11	Community Pharmacy project1: Disease state education flip charts, Video library development, Patient Education
12	Community Pharmacy project2: Presentations on patient counseling with reference to indications, mechanism of action, contraindications and drug interactions of a particular drug.

Patient Education: Training for blood glucose meters • Inhaler and other device use (placebo inhaler cartridge) • Smoking cessation products • Have students offer BP readings to patients picking up anti-hypertensive medications • Have students offer blood glucose logs and a review of medications to patients picking up diabetes medications

Video library development: Have the student develop a video library from which patients could check out videos. The student could gather videos, organize them, and create marketing for the library to advertise it to patients.

Disease state education flip charts: Have the student develop a flip chart (that fits into a standard 3-ring binder) that can be used to educate a patient on a disease state. This standardizes the education that is given to each patient

Books:

1. Cooper and Gunns Dispensing for Pharmaceutical Students, Edns. 11 and 12; Edited by S.J.Carter, Indian Edition, CBS Publishers, Delhi.
2. Pharmaceutical Practice; Edited by D.M.Collet and M.E.Aulton; Churchill Livingstone, ELBS Edition, 1991.
3. Pharmaceutical Practice Edited by A.J.Winfield and R.M.E. Richards, Second Edition, Churchill Livingstone, 1998.]
4. Pharmaceutical Practice; Edited by A.J. Winfield and R.M.E. Richards, Third Edition, Churchill Livingstone, 2004.
5. Husa's Pharmaceutical Dispensing, Edited by Eric Martin, Sixth Edition, Mack Publishing Company, 1996.
6. Pharmaceutical Calculations, A.C. Ansel and M.J.Stoklosa, Lippincott Williams and Wilkins, 2006.
7. Pharmaceutical Calculations – Bradley, Gustafson and Stoklosa, Third Edition, Lea and Febiger, 1957.
8. Parmar N.S. Health Education and Community Pharmacy, 18th ed. India: CBS Publishers & Distributors; 2008.
9. Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakashan; 2001
10. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice- essential concepts and skills, 1 st ed. Chennai: Orient Longman Private Limited; 2004

BPH_C_108_L - Anatomy, Physiology and Pathophysiology – Lab I (4 Hr/Wk)

Course Objectives

To familiarize the learner with the diagnostic methods for determination of the pathology of some disease states

Course Outcomes

1. Carry out/Perform RBC count, WBC count, Differential Leukocyte count, ESR, PCV, Bleeding time, clotting time and interpret the results and correlate with clinical conditions and record/measure blood pressure.
2. Identify and locate the bones in human skeleton.
3. Identify and describe the various body tissues and organs based on the structure and organisation of cells.
4. List the common diagnostic and biochemical tests performed in various clinical conditions and make use of it in diagnosis and prognosis of the diseases.

No.	Details	Hours
1.	HEMATOLOGY 1. Red Blood Cell (RBC) Count 2. Total Leukocyte Count 3. Differential Leukocyte (WBC) Count 4. Hemoglobin content of blood 5. Bleeding / Clotting Time 6. Blood groups 7. Erythrocyte Sedimentation Rate (ESR) / Hematocrit (Demonstration)	
2.	Study of human skeleton	
3.	Microscopic study of permanent slides Tissues : - Columnar, Cuboidal, Squamous, Ciliated Epithelium - Cardiac / Skeletal / Smooth muscle - Ovary, Testis, Liver, Pancreas, Thyroid, Tongue, Stomach, Intestine, Kidney, Lung, Spinal Cord, Cerebrum, Artery, Vein	
4.	Measurement of blood pressure	
5.	Tutorial / Discussion on some common investigational procedures used in diagnosis of diseases with the help of charts / slides Name and Importance of following tests : 1. Electroencephalogram (EEG) in diagnosis of Epilepsy 2. Use of Positron emission tomography (PET) Computed tomography scan (CT Scan), Single photon emission computed tomography (SPECT) in diagnosis. 3. Use of flow cytometry as a diagnostic tool. 4. Electrocardiogram (ECG) in diagnosis of cardiac arrhythmia 5. Liver Function Tests – - Serum Bilirubin, - serum glutamate oxaloacetate transaminase (SGOT) - serum glutamate pyruvate transaminase (SGPT) - Urine Bilirubin, - Urine Urobilinogen, 6. Kidney Function Tests – Serum Creatinine, – Serum Urea, Uric Acid – Blood Urea Nitrogen (BUN) 7. Blood Glucose 8. Serum Cholesterol / Triglycerides 9. Serum Alkaline phosphatase (ALT) 10. Serum Acid phosphatase (APT) 11. Serum Lipase 12. Serum Amylase 13. Serum Calcium 14. Serum lactate dehydrogenase (LDH) 15. Thyroid Function Tests – T ₃ , T ₄ 16. Prothrombin time (PT) 17. Partial thromboplastin time (PTT)	

	<p>18. Activated partial thromboplastin time (APTT)</p> <p>19. Diagnostic tests for infectious diseases like</p> <ul style="list-style-type: none">- Malaria- Tuberculosis- Dengue- H1N1 swine flu- Typhoid	
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Books:

1. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander, Published by by Churchill Livingstone
2. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques, Published by Elseviers Publications
3. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India
4. C. L. Ghai, Text book of Practical Physiology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

SEMESTER-II

BPH_C_201_T - Anatomy, Physiology and Pathophysiology – II (4 Hr/Wk)

Course Objectives

To familiarize the learner with the anatomical organization and physiology of the different systems of the human body. To introduce the learner to cancer and the causes of cancer.

Course Outcomes

1. Explain the types of and mechanisms of cellular injuries and cellular adaptation.
2. Compare and contrast between benign and malignant tumours, Classify malignant tumours and explain the etiology and pathogenesis of cancer.
3. Discuss the biological effects of radiations.
4. Explain the anatomy and physiology of the respiratory system, endocrine system, nervous system and the sensory organs.
5. Comprehend the aetiology, pathogenesis, signs, and symptoms of common diseases/disorders of respiratory system, endocrine system and nervous system.

No.	Details	Hours
1.	Principles of cell injury and adaptation <ul style="list-style-type: none">• Causes of cell injury• Pathogenesis and morphology of cell injury.• Cellular adaptation• Cellular atrophy and hypertrophy.	4
2.	- Disturbances of growth of cells <ul style="list-style-type: none">• Differences between benign and malignant tumor• Classification of malignant tumors• Etiology and pathogenesis of cancer- Invasion, metastasis and patterns of spread of cancer.	3
3.	Biological effects of radiation <ul style="list-style-type: none">• Nuclear radiation• U.V. radiation.• X-ray and other radiations.	3
4.	Anatomy and Physiology of Respiratory System <ul style="list-style-type: none">• Exchange of gases• External and internal respiration• Mechanism and regulation of respiration• Lung volumes and lung capacities	4
5.	Pathophysiology of following diseases <ul style="list-style-type: none">• Asthma• Pneumonia• Bronchitis• Emphysema• Respiratory Acidosis and Alkalosis	4
6.	Endocrine System Anatomy and physiology of following endocrine glands : <ul style="list-style-type: none">• Pituitary• Thyroid & Parathyroid• Adrenal• Pancreas	8
7.	Pathophysiology of hypo and hyper secretion of above endocrine glands and related diseases	4
8.	Nervous System	8

	Neurons, Neurotransmitter and neurotransmission Anatomy and physiology of : <ul style="list-style-type: none"> ● Central Nervous System (CNS) - Autonomic Nervous System (ANS) - Cranial and spinal nerves - Sensory and Motor pathways	
9.	Pathophysiology of following diseases <ul style="list-style-type: none"> ● Epilepsy ● Parkinsonism ● Alzheimer's Disease ● Cerebral Hypoxia ● Stroke (Cerebrovascular disease) ● Anxiety & Depression ● Mania and Schizophrenia 	4
10.	Structure and Function of following sensory organs <ul style="list-style-type: none"> ● Eye ● Ear ● Tongue ● Nose ● Skin 	6
TOTAL		48

Books:

Latest editions of the following books can be referred

1. Ross & Wilson , Anatomy & Physiology in Health & Illness by Anne Waugh and Allison Grant, Published by Churchill Livingstone
2. Gerard J. Tortora & Bryan Derrickson, Principals of Anatomy & Physiology, Published by John Wiley and Sons, Inc.
3. A. C. Guyton & J. E. Hall, Textbook of Medical Physiology, Published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, USA.
4. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander, Published by Churchill Livingstone
5. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques
6. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India
8. Harsh Mohan, Text book of Pathology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

BPH_C_202_T - Biochemistry II (4 Hr/Wk)

Course Objectives

To teach the learner the different pathways of intermediary metabolism, their interplay, metabolism based disorders and drugs to treat the same.

Course Outcomes

1. Discuss carbohydrate metabolism with respect to different pathways, structures of intermediates, enzymes and cofactors involved, energy requirements/yields, regulation and drugs affecting metabolism
2. Discuss lipid metabolism with respect to different pathways, structures of intermediates, enzymes and cofactors involved, energy requirements/yields, regulation and drugs affecting metabolism
3. Discuss nucleic metabolism with respect to different pathways, structures of intermediates, enzymes and cofactors involved, energy requirements/yields, regulation and drugs affecting metabolism

No.	Details	Hours
1	Carbohydrate metabolism discussed with respect to the structures of intermediates, enzymes and cofactors, energy yield/requirements and regulation. Examples of drugs modulating carbohydrate metabolism.	20
1.1	Glycolysis (Embden Meyerhoff Pathway), TCA cycle (Kreb's Cycle, Citric acid Cycle) and glyoxalate shunt. Entry of sugars other than glucose into glycolytic pathway. Discussion of shuttle systems to transfer NADH to the mitochondria.	08
1.2	Electron Transport Chain discussed with respect to the components of the ETC,	04

	explanation of oxidative phosphorylation vs substrate level phosphorylation. Discussion of proton motive force and generation of ATP using proton gradients. Discussion of uncouplers of oxidative phosphorylation.	
1.3	Discussion of pentose phosphate pathway, glycogenesis, glycogenolysis, gluconeogenesis and other systems involved in carbohydrate metabolism	08
2	Lipid metabolism discussed with respect to the structures of intermediates, enzymes and cofactors involved, energy yield/requirements and regulation.	18
2.1	Beta oxidation pathway for catabolism of saturated and unsaturated even number fatty acids, catabolism of odd number carbon containing fatty acids, formation of ketone bodies	08
2.2	Acetate mevalonate pathway to cholesterol biosynthesis,	04
2.3	Biosynthesis of fatty acids, prostaglandins, leukotrienes and phospholipids.	04
2.4	Examples of drugs modulating lipid/cholesterol metabolism.	02
3	Nucleic Acid Metabolism discussed with respect to the structures of intermediates, enzymes and cofactors, energy yield/requirements and regulation	10
3.1	Discussion of biosynthesis of purines.	04
3.2	Discussion of biosynthesis of pyrimidines.	02
3.3	Salvage pathways for nucleic acid metabolism. Examples of drugs modulating purine/pyrimidine biosynthesis.	04
	TOTAL	48

Books

1. Lehninger, Principles of Biochemistry, Replika Press.
2. Stryer L, Biochemistry, W. H. Freeman & Co.
3. Harper's Biochemistry, Appleton and Lange, USA.
4. Conn E, Stumpf PK, Brueing G and Doi Roy H, Outlines of Biochemistry, Wiley Liss, USA.
5. Wilson and Gisvolds Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams and Wilkins, USA
6. Foye's Principles of Medicinal Chemistry, Lippincott Williams and Wilkins, USA.

BPH_C_203_T – Pharmacognosy I (4 Hr/Wk)

Course Objectives

This subject highlights the understanding of natural drugs, their cultivation and preparation, phytochemistry and their derivatives used in Allopathic and Complementary Systems of Medicine.

Course Outcomes

1	Student will be able to outline the Alternative and complementary systems of medicine, classify drugs of natural origin
2	Student will able to describe Primary and secondary plant metabolites their biosynthesis, evaluation and therapeutic application
3	Student will be able to understand the morphological and Microscopic features of medicinal plants
4	Student will be able to elaborate commercial production, collection, preparation, storage and factors affecting cultivation of medicinal plants
5	Student will be able to describe chemistry, source, preparation, evaluation of carbohydrate containing crude drugs and their commercial utility as Pharmaceutical Aids and Medicines
6	Student will be able to describe the source, composition, preparation and applications of fibers, minerals, important protein and enzymes of natural origin.

No.	Details	Hours
1.	Introduction, development, present status, significance and future scope of pharmacognosy. Alternative and Complementary systems of medicine Ayurveda, Unani, Siddha, Homeopathy, Chinese medicine and Aromatherapy. Self study: Examples of sources of DONO • Examples of drugs used in different traditional systems of medicine.	2 1
2	Classification of drugs: Alphabetical, morphological, taxonomical, pharmacological and chemical	1
3	Techniques in microscopy of powdered drugs covering use of mountants, clearing agents, chemomicroscopic reagents, micrometer, quantitative microscopy	2

4	Plant description, morphology, cell differentiation and ergastic cell contents: Study of plant parts, cell and tissue, underground or subterranean drugs, roots, rhizomes, corms, bulb, tubers, stolens, runners, and suckers; Leaves: Simple and compound, stomata, stomata number, stomatal index, palisade - ratio, hydathodes and water pores, epidermal trichomes, calcium oxalate crystals, vein-islet number, vein termination number; Inflorescence and flowers; Fruits; Seeds; Barks, and wood. Unorganised drugs: Dried latex, dried juices, dried extracts, gums and mucilages, resins.	7
5	Introduction, classification with examples and important biological activities of following groups of plant constituents: Carbohydrates; Alkaloids, Glycosides, saponins, steroids and triterpenoids Flavonoids, lignans, coumarins, tannins and polyphenolic compounds, Lipids and volatile oils; Gums, mucilages, resins and resin combinations with examples. Details of Phytochemical test for the evaluation of each class	12
6	Cultivation, Collection, Processing and storage of crude drugs: Factors influencing cultivation of medicinal plants. Types of soils and fertilizers of common use. Pest management and natural pest control agents. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants.	4
7	Study of plant, animal & mineral fibres with respect to their classification, sources, production, chemistry, commercial utility and significance in Pharmaceutical Industry for the following: Absorbent & nonabsorbent cotton, jute, flax, hemp, asbestos, glass wool, silk, wool, rayon, viscose	3
8	Systematic pharmacognostic study of following a) Carbohydrates and derived products: agar, guar gum acacia, Honey, Isabgol, pectin, Starch, sterculia chitin, xanthan gum, tamarind kernel powder (TKP) and Tragacanth. b) Lipids: Bees wax, Castor oil, Arachis oil, Cocoa butter, Shea butter, Cod-liver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice Bran oil, Wheat germ oil, Shark liver oil and Wool fat	7
9	Proteins and Enzymes Study of Proteins and Enzymes with respect to sources, preparation and uses - protein hydrolysates, gelatin, casein, thyroid hormones, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin). Study of plant lectins with respect to sources, composition and applications for Abrin, ricin. Self study: • Marketed formulations containing serratiopeptidase and their applications	4 1
10	Biological source, chemical constituents and uses of the following: Chirata, Shatavari, Kalmegh, Karela, Punarnava, Guggul, Tinospora. Self study: Brahmi, Neem, Tulsi, Amla,	2 1
11	Self study: Minerals: Kiselghur, Chalk, Talc, and Bentonite.	1
TOTAL		48

Books

1. Trease D. & Evans W. C.: Text Book of Pharmacognosy: W. B. Saunders.
2. Tyler V.E., Brady L.R. & Robbers J. E.: Pharmacognosy; LeaFeibger, USA.
3. Wallis T. E.; Text Book of Pharmacognosy; CBS Publishers, Delhi.
4. Kokate C.K., Purohit A. P. & Gokhale S. B.: Pharmacognosy; Nirali Publications, Pune.
5. Harbone J. B.: Phytochemical Methods: A guide to modern techniques Analysis: Chapman & Hall, London.
6. Bruneton J.: Pharmacognosy, Phytochemistry, Medicinal Plants: Intercept Limited.
7. Vasudevan T.N. & Laddha K.S.: A Textbook of Pharmacognosy, Vrinda Publication House, Jalgaon.
8. The Indian Pharmacopeia: The Controller of Publication; Delhi.
9. Brain K.R. & Turner T. D.: The Practical Evaluation of Phytopharmaceuticals: Wright, Scientica, Bristol.

BPH_C_204_T – Hospital Pharmacy and Drug Store Management (4 Hr/Wk)

Course Objectives

To introduce the learner to the organization and functioning of a retail pharmacy and a hospital pharmacy.

Course Outcomes

The learner should be able to:

1. Appreciate the difference in the functions, layout, legal requirements, organization, drug procurement, storage and dispensing of medicines in a retail versus hospital pharmacy setting.
2. Appreciate the importance of documentation in the functioning of a pharmacy
3. Understand the importance of a hospital level formulation and compounding of parenterals.
4. Understand the importance and functioning of the hospital sterile supply services department
5. Appreciate the dangers/detection/reporting of fraudulent pharmacy practices
6. Appreciate the concept of Rational Drug Therapy

Unit No.	Sub-unit	TOPICS	DURATION (HOURS)
1	1.1	Hospitals: Definition, Organization Structure, Classification, Functions	2
	1.2	Hospital Pharmacy: Definition, Organization structure, Location, Layout and staff requirements and responsibilities and functions of hospital pharmacists.	2
	1.3	Budget of Hospital Pharmacy: Preparation and Implementation	1
2.	2.1	Drug Distribution Systems in Hospitals: Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labeling, Dispensing of drugs to ambulatory patients, and Dispensing of Controlled Substances including Hospital Control Procedures	4
3	3.1	Pharmacy and Therapeutics Committee (PTC): Objective, composition, Functions, Role of PTC in Drug Safety, Adverse Drug Reaction Monitoring and Emergency Drug Lists.	3
4	4.1	Hospital formulary: Definition, Advantages and Disadvantages, contents of hospital formulary, Differentiation of hospital formulary and Drug list, Preparation and revision, and addition and deletion of drug from hospital formulary. <i>Medication errors and ASHP Guidelines to prevent errors, Infection control in hospitals (Self Study)</i>	3
	4.2		2
5	5.1	<i>Drug Utilization Review(Self Study)</i>	2
	5.2	<i>Safe Use of Medications in Hospitals(Self Study)</i>	2
	5.3	Handling of radiopharmaceuticals in hospitals	2
6		Central Sterile Supply Services	8
	6.1	Introduction to sterilization, basic techniques used for sterilization of hospital supplies	2
	6.2	Advantages, Plan, Location, Layout	4
	6.3	Sterilization of surgical dressings – methods of packing, loading and prevention of wetting of dressings. Sterilization of rubber gloves, syringes, needles, catheters, tubings, surgical instruments, mattresses, utensils and bedpans and other accessories	
6.4	Manufacturing and Bulk compounding of large volume parenterals, Total Parenteral Nutrition and Intravenous additives.	2	
7	7.1	Planning of retail pharmacy and entrepreneurship	1
	7.2	<i>(Self-study) Forms of Business Organization: Sole Proprietor, Partnership, Hindu Undivided Family, Joint Stock Company and Co-operative Society</i>	2
	7.3	<i>Channels of Distribution for Pharmaceuticals: Wholesaler, Retailer</i>	1
8	8.1	Setting Up and management of a Drug Store- Legal Aspects and Registrations	2
	8.2	Selection of site, Space layout, Location Analysis and Layout design and staff	2
	8.3	Materials- Coding, stocking, maintenance of various registers,	1
	8.4	Use of Computers: Business and health care soft wares	1
	8.5	Sales promotion and window display	2
9	9.1	Purchasing and Inventory control in drug store: Purchasing procedure in retail trade	2
	9.2	Definition of inventory control, various methods of Inventory Control (Want Book, Systematic Want Book, Open to Buy budgeting, ABC,VED, EOQ analysis),	2
10	10.1	Risk management, Insurance policies and Frauds in retail practice	1
TOTAL			46

Books:

1. Hospital Pharmacy, W. E. Hassan, Edition, Lea and Febiger, Philadelphia.
2. A text – book of Hospital Pharmacy, S.H. Merchant and Dr. J.S. Quadry, B.S. Shah Prakashan, Ahmedabad.
3. Hospital Pharmacy, Dr. H. P. Tipnis and Dr. Amrita Bajaj, Career Publication, Maharashtra.
4. Gennaro Alfonso R, Remington – The Science and Practice of Pharmacy”, Lippincott Williams and Wilkins.
5. Principles and methods of Pharmacy Management, Smith, Lea and Febiger, Philadelphia.
6. Drug store management, Nolen and Maynard. McGraw Hill.
7. Drug Store and Business Management, A. P. Battasse, Unique Publication.
8. Text book of Forensic Pharmacy, N. K. Jain, Vallabh Prakashan.

BPH_C_205_T - Environmental Science (3 Hr/Wk)

Course Objectives

1.	To study the importance of environmental science and environmental studies
2.	To know the importance of key to the future of mankind.
3.	To study continuing problems of pollution, loss of forest, solid waste disposal, degradation of environment, issues like economic productivity and national security
4.	Study of Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues.

Course Outcomes

1. Describe the basics of Environmental sciences like need and purpose of study the subject, Ecology, food chain and ecological pyramids, sustainable development
 2. Outline, Environmental Legislation, role of different ministries and environment control boards
 3. Classify and compare different sources of energies
 4. Relate technology to control pollution and economic benefits thereof, infer, the concept of green building, carbon credit and disaster management
- Realize the environment related moral responsibilities and identify Legal (environmental) aspects for becoming entrepreneur in future

No.	Details	Hours
1.	Multidisciplinary Nature of Environmental Studies: <ul style="list-style-type: none"> ● Scope and Importance ● Need for Public Awareness ● Depleting Nature of Environmental resources such as Soil, Water, Minerals, and Forests. ● Global Environmental Crisis related to Population, Water, Sanitation and Land. ● Ecosystem: Concept, Classification, Structure of Ecosystem, overview of Food chain, Food web and Ecological Pyramid 	5
2.	Sustainable Development <ul style="list-style-type: none"> ● Concept of sustainable development ● Social, Economical and Environmental aspect of sustainable development. ● Control Measures: 3R (Reuse, Recovery, Recycle), Appropriate Technology, Environmental education, Resource utilization as per the carrying capacity. 	5
3.	Environmental Pollution: <ul style="list-style-type: none"> ● Air Pollution: Sources, Effects of air pollution with respect to Global Warming, Ozone layer Depletion, Acid Rain, Photochemical smog, Two Control Measures, Bag house Filter, Venturi scrubber. Case Study: Bhopal Gas Tragedy ● Water Pollution: Sources and Treatment, Concept of waste waters - Domestic & Industrial and treatment. Case Study: Minamata Disease. ● Land Pollution: Solid waste, Solid waste Management by Land filling, Composting. ● Noise Pollution; Sources and Effects ● E-Pollution: Sources and Effects. 	11

4.	Environmental Legislation: <ul style="list-style-type: none"> ● Overview ● Ministry of Environment and Forests (MoE&F). Organizational structure of MoE&F. ● Functions and powers of Central Control Pollution Board. ● Functions and powers of State Control Pollution Board. ● Environmental Clearance, Consent and Authorization Mechanism. ● Environmental Protection Act ● Any two case studies pertaining to Environmental Legislation. 	5
5.	Renewable sources of Energy: <ul style="list-style-type: none"> ● Limitations of conventional sources of Energy. ● Various renewable energy sources. ● Solar Energy: Principle, Working of Flat plate collector & Photovoltaic cell. ● Wind Energy: Principle, Wind Turbines. ● Hydel Energy: Principle, Hydropower generation. ● Geothermal Energy: Introduction, Steam Power Plant 	5
6.	Environment and Technology <ul style="list-style-type: none"> ● Role of Technology in Environment and health ● Concept of Green Buildings, Indoor air pollution ● Carbon Credit: Introduction, General concept. ● Disaster Management: Two Events: Tsunami, Earthquakes, Techniques of Disaster Management ● Case Study: Earthquake in Japan 	5
TOTAL		36

Books:

1. Hazardous Waste Incineration, Brunner R.C., McGraw Hill Inc
2. Global Biodiversity Assessment, Heywood V.H and Waston R.T., Cambridge Univ. Press
3. Environmental Science systems & Solutions, Mckinney M.L. and School R.M., Web enhanced edition.
4. Fundamentals of Ecology, Odum E.P., W.B. Saunders Co. USA.
5. Textbook of Environmental studies by Erach Bharucha, University Press.
6. Environmental Studies by R. Rajagopalan, Oxford University Press.
7. Essentials of Environmental Studies by Kurian Joseph & Nagendran, Pearson Education
8. Renewable Energy by Godfrey Boyle, Oxford Publications.
9. Perspective Of Environmental Studies, by Kaushik and Kaushik, New Age International
10. Environmental Studies by. Anandita Basak, Pearson Education
11. Textbook of Environmental Studies by Dave and Katewa, Cengage Learning
12. Environmental Studies by Benny Joseph, Tata McGraw Hill

BPH_C_206_L – Pharmacognosy Lab I (4 Hr/Wk)

Course Objectives

This subject highlights the morphological, microscopic and phytochemical evaluation of natural drugs used in Allopathic as well as Complementary Systems of Medicine.

Course Outcomes

1	Students will be able to carry out quantitative microscopy for leaf constants
2	Students will be able to determine different extractive and ash values as per pharmacopoeial requirements
3	Students will be able to identify diagnostic features of plants such as calcium-oxalate, starch and trichomes
4	Student will be able to differentiate between different plant parts based on morphological and microscopic evaluation
5	Students will be able to identify fibers and carbohydrates based on chemical evaluation

No.	Experiments
1.	Quantitative microscopy (Estimation of Leaf constants i.e. Stomatal Index, Vein islet number and Vein termination number, Palisade ratio)
2	Determination of alcohol soluble and water soluble extractives, Total ash value and acid insoluble ash and water soluble ash value for any one crude drug as per IP.
3	Study of different types of starch grains, calcium oxalate crystals, Trichomes and stomata
4	Identification of Fibres based on chemical tests as covered in theory. Tests for detection of honey, starch, tragacanth, acacia, guar gum, agar
5	Microscopical Studies of basic tissues <ol style="list-style-type: none">Stem: EphedraLeaves: Vasaka, SennaRoots: RauwolfiaBark: CinchonaSeed: Nux vomica, LinseedFruits: Fennel

Books:

1. Trease D. & Evans W. C.: Text Book of Pharmacognosy: W. B. Saunders.
2. Tyler V.E., Brady L.R. & Robbers J. E.: Pharmacognosy; LeaFeibger, USA.
3. Wallis T. E.; Text Book of Pharmacognosy; CBS Publishers, Delhi.
4. Kokate C.K., Purohit A. P. & Gokhale S. B.: Pharmacognosy; Nirali Publications, Pune.
5. Harbone J. B.: Phytochemical Methods: A guide to modern techniques Analysis: Chapman & Hall, London.
6. Bruneton J.: Pharmacognosy, Phytochemistry, Medicinal Plants: Intercept Limited.
7. Vasudevan T.N. & Laddha K.S.: A Textbook of Pharmacognosy, Vrinda Publication House, Jalgaon.
8. The Indian Pharmacopoeia: The Controller of Publication; Delhi.
9. Brain K.R. & Turner T. D.: The Practical Evaluation of Phytopharmaceuticals: Wright, Scientica, Bristol.

BPH_C_207_L - Biochemistry Lab (4 Hr/Wk)

Course Objectives

To teach the learner the methods for the detection and estimation of different biomolecules

Course Outcomes

The learners should be able to understand the principles and methods for the estimation of

1. Carbohydrates
2. Amino acids and proteins
3. Fats and Lipids
4. Nucleic acids
5. Enzyme kinetic parameters
6. Enzyme activity as diagnostic markers

EXPERIMENTS

1. Qualitative tests for carbohydrates and confirmatory tests by osazone formation
2. Qualitative test and simple color reactions for amino acids and proteins. Precipitation reactions of proteins.

3. Chromatographic separation of amino acids.
4. Quantitative estimation of glucose (Willstater and Lane & Eynon's methods). Estimation of sucrose. Colorimetric estimation of glucose.
5. Quantitative estimation of proteins by Biuret method and Folin method (one titrimetry and one by colorimetry)
6. Estimation of enzyme activity – ptyline (amylase) in saliva and alkaline phosphatase (including plotting of data to determine Km and Vmax for any one of these enzymes)
7. Quantitative estimation of properties of lipids – acid value, iodine value, saponification value.
8. Quantitative estimation of RNA and DNA.
9. Demonstrations of estimation of blood glucose, SGOT or SGPT using commercial kits (suggest that students should volunteer for fasting and post prandial glucose determinations)
10. Demonstration of isolation of DNA.

Books

1. An Introduction to Practical Biochemistry – Plummer D.T., Tata Mcgraw Hill, N Delhi, India
2. Laboratory Manual In Biochemistry, Jayaraman J, Wiley Easter, N Delhi. India

BPH_C_208_L - Computer Lab (4 Hr/Wk)

Course Objectives

To Introduce the learner to the importance of computers – hardware and software – and their potential applications to the pharmacy profession

Course Outcomes

1. Describe the components of a PC
2. Compare the different operating systems
3. Record simple programs using BASIC and C programming languages
4. Apply knowledge gained for use of computers in pharmacy

No.	Details	Hours
1.	Introduction to Computers.	2
2.	History of Computer development and respective generation: Abacus, Napier's Bones, Slide rule, Pascal's Calculator. General use of computers in everyday life. Computer Classification: Mainframe, Mini and Micro Computers, comparison of Analog & Digital Computers, Hardware and Software. Calculator and Computer	5
3.1	Operating Systems: Introduction to types of operating systems, UNIX, MS-DOS, etc. RAM, ROM, Virtual Memory etc	4
3.2	Students should learn on Windows and Linux OS based systems use of basic Windows and Linux commands	4
4.1	Type of Languages: Conventional languages; their advantages, limitations; C, Pascal, FORTRAN, Programming of these languages	4
4.2	Students should be taught some programming in BASIC and C	4
5.1	Introduction to Computer Networks: Architecture of seven layers of communications Students should be taken to a computer lab with has a network and shown the basic connections and operation of different types of networks.	4
5.2		3
6.1	Introduction to Data Structure: Like Queues, list, trees, Binary trees algorithms, Flow chart, Structured Systems, Analysis and development, Ingress-SQL, Gateways etc. Statistics, methodologies. Basic Language: Constants and Variables: Character set, constants, variables, Naming the variables getting data into memory, LET, INPUT, READ. DATA, Print Statement Expressions: Arithmetic expression, Hierarchy of operations, Rules of Arithmetic, Evaluation of expressions, Relational expressions, Logical operations, Library functions Printer Control: Comma and semicolon control, the TAB function, PRINT, LPRINT Functions and Subroutines: User defined functions, subroutines, subscripted variables The above concepts should be introduced practically to students with examples, while working on a computer system.	8

6.2		
7.	Computer Graphics:	5
8.	Computer applications in pharmaceutical area and in clinical studies	5

Books:

1. Basic Electronics and Computer Applications, Rajiv Khanna, New Age International Publishers
2. Fundamentals of Computers, V. Rajaraman, Prentice Hall of India Pvt. Ltd.
3. Schaums Outline Series, Theory and Problems of Introduction to Computer Science, Francis Scheid, McGraw Hill Book Co.