INSTITUTE OF CHEMICAL TECHNOLOGY

(Deemed to be University under section 3 of the UGC Act 1956)

DEPARTMENT OF PHARMACEUTICAL SCIENCES AND TECHNOLOGY

Detailed Syllabus for B. Pharm

Syllabus structure B.Pharm First Year

Semester – I

No	Subjects	Credits	Hrs/Week			Marks			
			L	T	P	Continuous Assessment	Periodic Test	Final Exam	Total
BST 1201	Microbiology	3	2	1	0	15	15	20	50
CET 1801	Pharmaceutical Engineering-I	3	2	1	0	15	15	20	50
CHT 1101	Inorganic Chemistry	3	2	1	0	15	15	20	50
CHT 1201	Organic Chemistry-I	4	3	1	0	30	30	40	100
MAT 1201	Mathematics-I	3	2	1	0	15	15	20	50
PHT 1101	Pharmaceutics-I	3	2	1	0	15	15	20	50
BSP 1201	Microbiology Laboratory	2	0	0	4	25	-	25	50
CHP 1102	Inorganic Chemistry Lab	2	0	0	4	25	-	25	50
CHP 1202	Organic Chemistry Laboratory-I	2	0	0	4	25	-	25	50
	TOTAL	25	13	6	12				500

Semester – II

No	Subjects	Credits	Hrs/Week			Marks			
			L	T	P	Continuous Assessment	Periodic Test	Final Exam	Total
CET 1802	Pharmaceutical Engineering-II	3	2	1	0	15	15	20	50
CHT 1203	Organic Chemistry-II	4	3	1	0	30	30	40	100
MAT 1202	Mathematics-II	3	2	1	0	15	15	20	50
PHT 1102	Pharmaceutics-II	3	2	1	0	15	15	20	50
PHT 1201	Anatomy, Physiology & Pathophysiology-I	4	3	1	0	30	30	40	100
CHP 1204	Organic Chemistry Laboratory-II	2	0	0	4	25	-	25	50
CEP 1801	Pharmaceutical Engineering Laboratory	2	0	0	4	25	-	25	50
PHP 1101	Pharmaceutics Laboratory - I	2	0	0	4	25	-	25	50
PHP 1201	Anatomy, Physiology & Pathophysiology- Laboratory	2	0	0	4	25	-	25	50
	TOTAL	25	12	5	16				550

Syllabus structure B. Pharm Second Year

Semester – III

No	Subjects	Credits	Hrs/Week			Marks			
			L	T	P	Continuous Assessment	Periodic Test	Final Exam	Total
BST 1301	Biochemistry-I	4	3	1	0	30	30	40	100
PHT 1103	Physical Pharmacy	4	3	1	0	30	30	40	100
PHT 1104	Dispensing Pharmacy	3	2	1	0	15	15	20	50
PHT 1202	Anatomy, Physiology & Pathophysiology-II	4	3	1	0	30	30	40	100
PHT 1301	Pharmaceutical Analysis-I	3	2	1	0	15	15	20	50
BSP 1301	Biochemistry Laboratory	2	0	0	4	25	-	25	50
PHP 1103	Physical Pharmacy Laboratory	2	0	0	4	25	-	25	50
PHP 1104	Dispensing Pharmacy Laboratory	2	0	0	4	25	-	25	50
	TOTAL	24	13	5	12				550

Semester – IV

	Subjects	Credits	Hrs/Week			Marks			
			L	T	P	Continuous Assessment	Periodic Test	Final Exam	Total
HUT 1101	Psychology and Sociology	3	2	1	0	15	15	20	50
PHT 1105	Pharmaceutics-III	4	3	1	0	30	30	40	100
PHT 1203	Pharmacology- I	4	3	1	0	30	30	40	100
PHT 1302	Pharmaceutical Analysis-II	4	3	1	0	30	30	40	100
PHT 1401	Pharmaceutical and Medicinal Chemistry –I	3	2	1	0	15	15	20	50
PHP 1105	Pharmaceutics Laboratory-II	2	0	0	4	25	-	25	50
PHP 1202	Pharmacology Laboratory-I	2	0	0	4	25	-	25	50
PHP 1301	Pharmaceutical Analysis Laboratory-I	2	0	0	4	25	-	25	50
	TOTAL	24	13	5	12				550

Syllabus structure B.Pharm Third Year

Semester – V

No	Subjects	Credits	Hrs/Week			Marks			
			L	T	P	Continuous Assessment	Periodic Test	Final Exam	Total
BST 1202	Molecular Biology & Biotechnology	3	2	1	0	15	15	20	50
BST 1302	Biochemistry II	3	2	1	0	15	15	20	50
HUT 1201	Pharmaceutical Management	4	3	1	0	30	30	40	100
PHT 1106	Cosmeticology	3	2	1	0	15	15	20	50
PHT 1402	Pharmaceutical & Medicinal Chemistry–II	4	3	1	0	30	30	40	100
BSP 1202	Molecular Biology & Biotechnology Laboratory	2	0	0	4	25	-	25	50
PHP 1106	Cosmeticology Laboratory	2	0	0	4	25	-	25	50
PHP 1401	Pharmaceutical & Medicinal Chemistry Laboratory-I	2	0	0	4	25	-	25	50
	TOTAL	23	12	5	12				500

Semester – VI

No	Subjects	Credits	Hrs/Week			Marks			
			L	T	P	Continuous Assessment	Periodic Test	Final Exam	Total
PHT 1107	Hospital Pharmacy and Drug Store Management	3	2	1	0	15	15	20	50
PHT 1108	Biopharmaceutics and Pharmacokinetics	3	2	1	0	15	15	20	50
PHT 1204	Pharmacology-II	3	2	1	0	15	15	20	50
PHT 1403	Pharmaceutical & Medicinal Chemistry – III	3	2	1	0	15	15	20	50
PHT 1501	Pharmacognosy-I	3	2	1	0	15	15	20	50
IPP 1101	Computer application In Pharmacy	2	0	0	4	25	-	25	50
PHP 1203	Pharmacology Laboratory- I I	2	0	0	4	25	-	25	50
PHP 1302	Pharmaceutical Analysis Laboratory-II	2	0	0	4	25	-	25	50
PHP 1501	Pharmacognosy Laboratory-I	2	0	0	4	25	-	25	50
PHP 1701	Seminar	2	0	0	4			20 (Report) 30(Presentation)	50
	TOTAL	25	10	5	16				500

Syllabus structure B.Pharm Final Year

Semester – VII

No	Subjects	Credits	Hrs/Week			Marks			
			L	T	P	Continuous Assessment	Periodic Test	Final Exam	Total
PHT 1109	Pharmaceutics- IV	4	3	1	0	30	30	40	100
PHT 1205	Pharmacology- III	3	2	1	0	15	15	20	50
PHT 1303	Pharmaceutical Analysis-III	4	3	1	0	30	30	40	100
PHT 1404	Pharmaceutical & Medicinal Chemistry – IV	3	2	1	0	15	15	20	50
PHT 1502	Pharmacognosy-II	3	2	1	0	15	15	20	50
PHT 1601	Pharmaceutical Biotechnology	3	2	1	0	15	15	20	50
PHP 1109	Pharmaceutics IV and Biopharmaceutics Lab.	2	0	0	4	25	-	25	50
PHP 1303	Pharmaceutical Analysis Laboratory-III	2	0	0	4	25	-	25	50
PHP 1502	Pharmacognosy Laboratory-II	2	0	0	4	25	-	25	50
PHP 1702	In plant training report and presentation and Community service	2	0	0	4	-	-	50(Reports and Presentation)	50
	TOTAL	28	14	6	16				600

Semester – VIII

No	Subjects	Credits	Hrs/Week			Marks			
			L	T	P	Continuous Assessment	Periodic Test	Final Exam	Total
PHT 1110	Pharmaceutics- V	4	3	1	0	30	30	40	100
PHT 1111	Forensic Pharmacy	3	2	1	0	15	15	20	50
PHT 1206	Clinical Pharmacy and Drug Interactions	3	2	1	0	15	15	20	50
PHT 1405	Pharmaceutical & Medicinal Chemistry–V	3	2	1	0	15	15	20	50
PHT 1503	Pharmacognosy-III	3	2	1	0	15	15	20	50
PHP 1110	Pharmaceutics Laboratory-IV.	2	0	0	4	25	-	25	50
PHP 1402	Pharmaceutical & Medicinal Chemistry Laboratory – II	2	0	0	4	25	-	25	50
PHP 1503	Pharmacognosy Laboratory-III	2	0	0	4	25	-	25	50
PHP 1703	Project	4	0	0	6	-	-	(30Report) (20Presentation) 50(Viva-Voce)	100
	TOTAL	26	11	5	18				550

Detailed Syllabus for First Year B. Pharm

Semester I

Sr. No.	Topics	Hrs
1.	**BST 1201 – Microbiology (50 marks) 3hr./week**	
	History (main focus on discovery of microscope, Louis Pasteur's contribution, Koch Postulates)	**1**
	Application of Microbiology in the field of pharmacy	2
	Different types of microscopes	**1**
	Different types of staining techniques (with reference to bacteria) • Monochromatic staining • Gram staining • Acid fast staining • Capsule, flagella spore, cell wall staining • Negative staining • Motility	**1**
	Classification of microorganisms as bacteria, yeast, mould, virus, rickettsiae, algae, protozoa (with reference to eukaryotic and prokaryotic micro-organisms)	**1**
	Bacteria: * Morphology * Cell characteristics, habitat, nutrition * Reproduction, cultivation *Growth phases of bacteria, measurement of growth, factors affecting growth *Isolation and identification of pure cultures of bacteria with reference to some special biochemical testes (IMVic to diff between E. Coli and enterobacter *Culture media such as cultivation, storage media, enrichment media, diferentia media and microbiological assay media	**1** 1 **1** **1** **2** **2**
	Virus: * Morphological characteristics * Cultivation of viruses, Reproduction * Oncogenic and HIV viruses	**2**
	Yeasts / Molds: * Morphology, habitat, nutrition * Reproduction in yeast * Molds of Clinical significance	**1**
	Algae * Morphology habitat * Economic significance of algae	**1**

	Protozoa * Morphology * Clinical significance of protozoa	**1**
	Rickettsiae * Morphology (diseases caused malaria, amoebic dysentery) * Diseases caused by rickettsiae	1
	Microbial Mutation * Types of mutation * Mutagenic agents * Mechanism of mutation	2
	Diseases caused by the following microorganisms and their detection 1) Mycobacterium 2) Salmonella 3) E. coli 4) Clostridium 5) Staphylococcus	2
	Sterilization - Different methods of sterilization - Aseptic techniques	5
	Disinfection and disinfectants	1
	• Microbiology Concepts And Applications M. J. Pelczar Jr., E. C. S. Chan And N. R. Krieg 5th edition, 1996 McGraw Hill, Inc., USA • Fundamentals Of Microbiology M.Frobisher, R. D. Hinsdill, K. T. Crabtree And C. R. Goodheart 9th ,edition, 1968 Saunders College Publishing, Philadelphia • Pharmaceutical Microbiology W. B.Hugo And A. D. Russel 6th edition, 2003 Blackwell Science Ltd. Uk, • Text Book Of Microbiology R. Ananthanarayan And C.K. J. Paniker 7th edition, 2005 Orient Longman Pvt. Ltd. Hyderabad	
2.	**CET 1801– Pharmaceutical Engineering-I (50 marks) 3hr./week**	
	Unit operations- Introduction, classification of unit operations, fundamental Principles	2
	Fluid flow-mention of fluid properties such as viscosity, surface tension of fluid, and hydrostatic infusing fluid flow, Bernoulli's Theorem, flow of liquids in pipes, laminar and turbulent flow;	3
	Heat transfer-mention of different modes of heat transfer e.g. conduction, convection and radiation;	2
	Mass transfer and molecular diffusion in liquids, mass transfer in turbulent and laminar flow, interfacial mass transfer	3
	Refrigeration, air condition and humidification; hygrometry, humidification and dehumidification;	2
	Mixing : A) liquid-liquid mixing, B) Mixing small quantities of solids in liquids, C) Mixing large quantities of solids in liquids, perfect mixing and random mixing, degree of mixing, mechanism of mixing and demixing, rate of	5

	mixing, impellers and propeller mixers, baffles in tanks, trough mixers, mixers, sigma and ribbon blenders, paddle mixers, double cone blender, cube mixers, planetary mixers,	
	Emulsification and Homogenization: Process and equipment used and equipment selection for, including colloid mills, Silverson type homogenizer.	5
	Filtration and clarification- factors influencing rate of filtration, filter media and filter aids, Nutsch filter, plate and frame filter, sparkler, leaf filters, rotary vacuum filters, sintered glass and membrane filters-selection of filters,	4
	Filtration of air, primary filters and HEPA filters and their evaluation;	2
	Centrifugation- objective and requirements – hydroextractors.	2
	• Introduction To Chemical Engineering Walter L. Badger, Julius T. Banchero International Student Edn. McGraw Hill Book Company • Perry's Chemical Engineer's Handbook Perry Robert H. Green Don W.7th edition , 1997 McGraw Hill • Tutorial Pharmacy J.W. Cooper, C. Gunn 4th edition, 1950, Sir Isaac Pitman • Introduction To Pharmaceutical Engg. A.R. Paradkar 6th edition, 2004 , Nirali Prakashan	
3.	**CHT 1101-Inorganic Chemistry (50 marks) 3hr./week**	
	Periodic Table, s,p,d and f elements and their general properties, correlations among various properties.	2
	Main group Chemistry: Hydrogen, Chemistry of Group IA, II B and Group IIIB to VIIB elements and noble gases.	8
	Chemical Bonding: Valence Bond theory and Molecular orbital theory	2
	Coordination Chemistry: Nomenclature, Werner theory, VSEPR, crystal field theory, electronic and magnetic properties of the complexes.	8
	Organometallics: Metal Ligand concept, , types of ligands, Effective atomic number rule reactions using organometallic compounds like addition, insertion, migration. Concepts of sigma bond and pi bond formation. Application of organometallic complexes in hydrogenation, hydroformylation, carbonylation etc.	10
	• Concise Inorganic Chemistry, J.D. Lee, Wiley India Edition • Basic Inroganic Chemistry, F.A. Cotton and G. Wilkinson, John Wiley and Sons	
4.	**CHT 1201-Organic Chemistry-I (100 marks) 4hr./week**	
	Nomenclature of organic compounds	3
	Mechanisms of organic reactions: Types of Organic Reaction, Reactive intermediates; their generation, structure, stability and general reactions.	8
	Stereochemistry: Elements of symmetry, stereochemistry of compounds containing one and two carbon atoms. Racemates and their resolution, conformation of cyclic and acyclic systems, E and Z isomers of olefins, Idea of asymmetric synthesis.	8
	Chemistry of alkanes, cycloalkanes, alkenes and alkynes: Alkanes from	7

	petroleum, methods of synthesis. Properties, General reactions, oligomerization and polymerization of olefins, acidity of terminal alkynes, alkenes as fuels.	
	Aromaticity and Aromatic hydrocarbons: Huckel's theory of Aromaticity and monocyclic carbocyclic aromatic species, BTX, Aromatic hydrocarbons. Fridel-Craft alkylation. General reaction of aromatic hydrocarbons.	7
	Aliphatic and aromatic halides: Methods of preparation, properties, General reactions, SN1,SN2 reactions, Aromatic nucleophilic reactions.	12
	• Organic Chemistry, J. McMurry, Brooks/Cole • Organic Chemistry, T.W.G. Solomons, C.B. Fryhle, John Wiley and Sons Inc., • Organic Chemistry, L.G. Wade Jr, Pearson Education • StereoChemistry of Carbon compounds, E.L. Eliel, Mcgraw-Hill • Organic Chemistry, Paula Y. Bruice, Pearson Education	
5.	**MAT 1201– Mathematics-I (50 marks) 3hr./week**	
	Matrices & Determinants: Types of matrices, transpose of a matrix , inverse of a matrix, determinant of a matrix and its properties, elementary row and column operations on matrices, rank of a matrix, Solution of system of linear equations, gauss elimination method eigenvalues and eigenvectors of a matrix, Cayley- Hamilton theorem and its applications.	8
	Differential calculus: Successive derivates, Leibitz's rule for nth derivative-Lagrange's and Rolle's mean value theorems, Taylor's and Maclaurin's series expansions, functions of two or three variables , Partial Differentiation, Euler formula and its applications, Local /absolute maxima and minima and its applications to least square problems. Notion of improper integral and its convergence. Introduction to Beta-Gamma functions, Curve Tracing	10
	Integral Calculus: Reduction formulae; properties of integrals, determination of: length of the curve, area of a bounded region, surface area of surface and volume of solids, double and triple integrals, change of variables, applications to area, volume, centre of gravity and moment of inertia etc	8
	Probability Distributions: Discrete and continuous random variables, Probability distribution functions, expectation of random variables, mean, variance and moments of random variables, moment generating function.	4
	• Advanced Engineering Mathematics R. K. Jain, S. R. K. Iyengar 3rd edition, 2007 , Narosa • Calculus G. B. Thomas, R. L. Finney 9th edition, 2004 Pearson Education • Elements Of Applied Mathematics P. N. Wartikar & J. N. Wartikar 6th edition, 1977 Pune idyarthi Graha • Advanced Engineering Mathematics Erwin Kreyszig 9th edition, 2005 Wiley International • A First Course In Probability Sheldon Ross 6th edition, 2002 Prentice Hall	
6.	**PHT 1101– Pharmaceutics-I (50 marks) 3hr./week**	
	History of Pharmaceutics: Events leading to the formation of pharmaceutical	2

	society of Great Britain,	
	Development of profession of pharmacy & pharmaceutical industry in India	2
	Origin & Development of the pharmacopoeia – IP/BP/USP.	3
	Introduction to dosage form & routes of administration	4
	Dosage form design, Biopharmaceutical consideration	5
	Introduction to GMP	4
	Alternate system of medicine Brief introduction to Ayurvedic & Homeopathic formulations.	2
	GALENICALS: Introduction, size reduction, General properties of drug constituents – solvents used in extraction of drugs, processes used for extraction (infusion, decoction, maceration, & modifications, percolation, hot extraction & modifications). Equipments used for large scale extractions. Study of official extracts	8
	• Pharmaceutical Dosage Form And Drug Delivery Systems Howard C. Ansel, Nicholas G. opovich, Lord V. Alien 6th edition, 1995, B.I.Waverly Pvt.Ltd.,New Delhi • Remington-The Science And Practice Of Pharmacy (Vol.1& 2) David B.Troy 21st edition, 2006 Lippincott Williams & Wilkins • Tutorial Pharmacy J.W. Cooper, Colin Gunn 4th edition, 1950 Sir Isaac Pitman & Sons Ltd.,London • Pharmaceutics: The Science Of Dosage Form Design Michael E. Aulton edition,1998 Churchill-Livingstone • Dispensing For Pharmaceutical Students Cooper & Gunn's Revised By S.J.Carter 12th edition, 1975 Cbs Publishers & Distributers • Physical Pharmacy-Physical Chemical Principles In Pharmaceutical Sciences Alfred N.Martin,James Swarbrick,Arthur Cammarata 2nd edition,1969 Lea & Febiger,Philadelphia • Theory & Practice Of Industrial Pharmacy Leon Lachman,Herbert A.Lieberman & Joseph anig 2nd edition, 1976 , 3rd edition,1987 Lea & Febiger, Philadelphia • Prescription Pharmacy Goseph. B. Sprowls 2nd edition,1970 • Bentley's Textbook Of Pharmaceutics Bentley 8th edition, 1977 E. A. Rawlins • Introduction Of Pharmaceutical Dosage Forms Howard Ansel 3rd edition, 1981 Lea & Febiger • Pharmacopoeias: Indian Pharmacopoeia, British Pharmacopoeia, United States Pharmacopoeia, all editions	
7.	**BSP 1201– Microbiology Laboratory (50 marks) 4hr./week**	
	Study of microscope	
	Study of common laboratory equipments: autoclave, incubator, hot air oven etc.	
	Gram Staining	
	Monochrome staining	
	Negative staining	

	Cell Wall Staining	
	Spore Staining	
	Capsule Staining	
	Motility by hanging drop technique	
	Preparation and sterilization of nutrient broth, agar, slants, stab etc.	
	Inoculation techniques: Colony characteristics, Growth patterns in broth, slant-pour & streak plate technique.	
	Total count by Haemocytometer Growth by optical density+	
	Total plate count, TDP, TDT	
	Study of yeast- Aspergillus, Penicillium with respect to morphology	
	Studies as prepared sides – malarial parasite in blood smear, intestinal amoeba in stools.	
	• Books Recommended: Will be recommended by teacher	
8.	**CHP 1102– Inorganic Chemistry Laboratory (50 marks) 4hr./week**	
	Volumetric Analysis : Preparation and Standardisation of Volumetric solutions. Acid base reactions, titrations of a mixture of (a) hydrochloric and acetic acid (b)Sulfuric and phosphoric acid (c) carbonate and bicarbonate. Oxidation - reduction titrations involving permanganate, dichromate, ceric sulfate, iodine (tri-iodide) potassium bromate. Precipitation titration : Mohr's and Volhard's titrations. Complexiметric titrations involving EDTA : Determination of hardness of water. Determination of Manganese in pyrolusite. Gravimetric analysis : Gravimetric determination of Fe, Ni, $SO4^{-2}$ and Cl^{-}. Analysis of a Fe-Ni alloy. Suitable number of experiments from the above list will be performed.	
9.	**CHP 1202 – Organic Chemistry Laboratory-I (50 marks) 4hr./week**	
	Identification of an organic compound through elemental analysis, group detection, physical constants (m.p and b.p) and derivatisation. Estimation of selected organic compounds like: aniline/phenol, formaldehyde/acetone, glucose, glycerol. Neutral equivalents of acids and bases ,SAP value of an oil.	

Semester II

Sr. No	Topics	Hrs
1.	**CET 1802– Pharmaceutical Engineering-II (50 marks) 3hr./week**	
	Fluidization: Particulate fluidization, aggregate fluidization-	3
	Separation by mass transfer: Solid-liquid extraction and liquid extraction, equipment and methods of operation- distillation, batch fractionation, vacuum and still distillation, azeotropic and extractive distillation, fractional distillation and fractionating columns; Recovery of solvents.	6
	Energy and mass transfers: Crystallisation-crystal shapes and habits, crystal growth, crystallisation in melts, nucleation, crystallisation from solutions, rate of crystallisation,	5
	.Energy effect in the process, size of crystal, different crystallisers, principles underlying the design and operations;	4
	Theories of Absorption and adsorption, Absorption of gases in liquids, Adsorption of liquids on carriers	6
	Drying: Fluid bed dryers, Microwave dryers, Freeze dryers, Spray dryers, tray dryer, tunnel dryer, turbo dryer	6
	• Introduction to Chemical Engineering Walter L.Badger, Julius T. Banchero Internat- ional Student Edi. McGraw Hill Book Company • Perry's Chemical Engineer's Handbook Perry Robert H.Green Don W.7th edition, 1997McGraw ill ook Company • Tutorial Pharmacy J.W. Cooper, Colin Gunn 4th edition, 1950 Sir Isaac Pitman & Sons, London • Introduction to Pharmaceutical Engineering A.R. Paradkar 6th edition, 2004 Nirali Prakashan	
2.	**CHT 1203– Organic Chemistry-II (100 marks) 4hr./week**	
	Chemistry of Hydroxy derivatives of aliphatic and aromatic compounds: Methods of preparation, Properties, General reaction, Acidity of phenol.	8
	Aldehydes and ketones: Methods of preparation. Fridel-Craft acylations and related reactions, properties and reactivity, general reactions.	12
	Carboxylic acids and their Derivatives: Carboxylic acids, esters, amides, acid chlorides and anhydrides Methods of preparation, Properties, Acidity of carboxylic acids, General reaction of their compounds. Interconversion.	7
	Amines: Methods of preparation of primary, secondary and tertiary amines. properties, Basicities and general reactions.	5
	Ethers, epoxides and sulphur acids: Methods of preparation, General reaction, Acidity of sulphur acids. EO condensates.	4

	Heterocyclic chemistry: Comparison with carbocyclic compounds, methods of Preparation, Regenerated compounds Pyrrole, Furan, Thiophene, Pyridine, Quinoline and Isoquinoline. Retrosynthetic approach, characteristic properties and Reactions	9
	• Organic Chemistry, J. McMurry, Brooks/Cole • Organic Chemistry, T.W.G. Solomons, C.B. Fryhle, John Wiley and Sons Inc. • Organic Chemistry, L.G. Wade Jr, Pearson Education • Organic Chemistry, Paula Y. Bruice, Pearson Education	
3.	**MAT 1202-Mathematics-II (50 marks) 3hr./week**	
	Binomial, Poisson and Geometric distributions, Normal, uniform and Gamma- beta distribution functions, chi-square distribution, F-distribution, Joint distributions, notion of covariance.	4
	Sampling distribution, Point and interval estimations of mean, variance and proportion of single and multiple samples.	5
	Hypothesis testing: Inferences concerning mean, variance and proportions, Chi- square test, goodness of fit.	5
	Regression and Correlation: Linear non linear regression, Correlation, multilinear regression.	6
	Design of experiments: One-way and two way ANOVA tests.	6
	Non Parametric tests: Sign test, Rank sum test, Wilcoxon and Kruskal-Vallis test.	4
	• A First Course In Probability Sheldon Ross 6th edition, 2002 Prentice Hall • Miller & Freund's Probability And Statistics For Engineers Richard Johnson, Irwin Miller, John Freund 7th edition, 2005 Pearson Education • Pharmaceutical Statistics: Practical And Clinical Applications Sanford Bolton, Charles Bon 4th edition, 2004 Marcel Dekker • Essential Statistics For The Pharmaceutical Sciences: Philip Rowe1st edition, 2007 John Wiley Sons Ltd • Pharmaceutical Statistics David Jones1st edition, 2002 Pharmaceutical Press UK • Applied Statistics And Probability For Engineers Douglas C M.,Alasdair G M Nairn, G. Runger 4th edition, 2006 Wilely • Statistics Methods S. P. Gupta 2nd edition,1969 S. Chand & Co.	
4.	**PHT 1102-Pharmaceutics-II (50 marks) 3hr./week**	
	Monophasic liquid orals: Preformulation considerations	2
	Principles of Solubilization and Taste masking	3
	Formulation considerations in the development of Monophasic liquid oral dosage forms and quality control of : aromatic waters, solutions, syrups, elixirs, linctuses, drops, glycerites, paints, lotions, liniments, sprays. examples of official preparations belonging to this class.	10
	Large scale manufacture and packaging	2
	Biphasic disperse systems: Suspensions: Preformulation considerations and	4

	Physicochemical principles underlying the formulation of suspensions including principles of wetting, Zeta potential etc.	
	Formulation considerations in the development of suspensions for internal and external use and quality control - examples of official preparations belonging to this class.	5
	Large scale manufacturing, packaging	3
	Layout design of liquid section.	1
	• Pharmaceutical Dosage Form And Drug Delivery Systems Howard C. Ansel,Nicholas G. opovich, Lord V. Alien 6th edition, 1995, B.I.Waverly Pvt.Ltd.,New Delhi • Remington-The Science And Practice Of Pharmacy (Vol.1& 2) David B.Troy 21st edition, 2006 Lippincott Williams & Wilkins • Tutorial Pharmacy J.W. Cooper, Colin Gunn 4th edition, 1950 Sir Isaac Pitman & Sons Ltd., London • Pharmaceutics: The Science Of Dosage Form Design Michael E. Aulton 1998 Churchill- ivingstone • Dispensing For Pharmaceutical Students Cooper & Gunn's Revised By S.J.Carter 12th edition, 1975 Cbs Publishers & Distributers • Physical Pharmacy-Physical Chemical Principles In Pharmaceutical Sciences Alfred Martin, James Swarbrick,Arthur Cammarata 2nd edition, 1969 Lea & Febiger,Philadelphia • Theory & Practice Of Industrial Pharmacy Leon Lachman,Herbert A.Lieberman & Joseph Kanig 2nd edition, 1976 3rd edition, 1987 Lea & Febiger, Philadelphia • Prescription Pharmacy Goseph. B. Sprowls 2nd edition, 1970 • Bentley's Textbook Of Pharmaceutics Bentley 8th edition, 1977 E. A. Rawlins • Introduction Of Pharmaceutical Dosage Forms Howard Ansel 3rd edition,1981 Lea & Febiger • Pharmacopoeias: Indian Pharmacopoeia, British Pharmacopoeia, United States Pharmacopoeia	
5.	**PHT 1201– Anatomy, Physiology & Pathophysiology-I (100 marks) 4hr./week**	
	Structural Organization of human body, structure of human cell, cell membrane, membrane potential, Intracellular messengers: cyclic AMP, Adenyl cyclase, protein kinase, Phosphodiasterse, Cell injury and Inflammation, Physiology of pain.	5
	Blood and Lymphatic system Elements of blood, properties of blood, haemopoesis, clotting of blood, significance of Rh, factor clotting disorders, anemia. Anatomy- Physiology and Importance of Lymphatic system Immunity – Cell mediated/humoral/Active/Passive Diseases- AIDS, allergy, Myasthemis gravis, SLE,	12
	Respiratory system: Anatomy – Physiology	6

	Exchange of gases, mechanism of respiration at lung and tissue level, Respiratory volumes, Neural and chemical regulation of respiration, O_2, CO_2 carriage, hypoxia. Diseases: COPD, Asthma, pneumonia, emphysema, pulmonary embolism, acute respiratory failure.	
	Muscular system: Anatomy-Physiology of smooth and skeletal muscles Physiology of NMJ, Skeletal muscles contraction, energy metabolism, types of contraction of muscles. Definition: Myasthemis gravis, tetanus, spasticity.	8
	Reproductive System: Anatomy- Physiology of male and female reproductive system, Menstruation, oocytogenesis, spermatogenesis.	4
	Endocrine system: Anatomy- Physiology of pituitary, thyroid, parathyroid, adrenal, pancreas, testis, ovaries, control of hormone secretion. Diseases associated with hypo-hypersecretion of hormones. Pathophysiology of Diabetes Mellitus	10
	• Ross and Wilson's Anatomy and Physiology in Health and Illness Anne Waugh and Allison Grant 10th edition, 2006 Churchill Livingstone, London, • Principles of Anatomy and Physiology Gerald J.Tortora and Sandra et.al 10th edition, 2003 John Wiley and Sons Inc, New York, USA. • Textbook of Medical Physiology Arthur C.Guyton and John E.Hall 10th edition, 2000 W.B.Saunders Company, • Illustrated Physiology B.R.Mackenna and R.Callander 6th Churchill Livingstone, New York, London	
6.	**CHP 1204 – Organic Chemistry Laboratory-II (50 marks) 4hr./week**	
	Synthesis of several organic compounds such as acetanilide, m-dinitrobenzene, methyl salicylate, benzamide, o-chlorobenzoic acid, tribromophenol, p-nitrobenzoic acid, azo dye, etc. to demonstrate the various unit processes like oxidation , reduction, alkylation chlorination, nitration, etc. Seperation and purification of binary mixtures of the type : water soluble-water insoluble, both water soluble, liquid-liquid by distillation, dissociation –extraction , crystalisation, etc.	
7.	**CHP 1801-Pharmaceutical Engineering Laboratory (50 marks) 4hr./week**	
	Examples of topics covered in theory	
8.	**PHP 1101 – Pharmaceutics Laboratory – I (50 marks) 4hr./week**	
	At least one representative example of each formulation type included in theory (Preparation and evaluation, WITH STRESS ON OFFICIAL FORMULATIONS)	

9.	**PHP 1201–Anatomy, Physiology & Pathophysiology-Laboratory (50 marks) 4hr./week**	
	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) 8. Measurement of blood pressure	
	Study of human skeleton	
	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	
	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) Electrocardiagram (ECG) in diagnosis of cardiac arrhythmia 3) Liver Function tests- - Serum Bilirubin, Serum glutamate oxaloacetate transaminase (SGOT), Serum glutamate pyruvate transaminase (SGPT) - Urine Bilirubin, Urine Urobilinogen Kidney Function Tests Serum Creatinine, Serum Urea, Uric acid, Serum Urea, Nitrogen BUN) Blood Glucose Serum Cholesterol/Triglycerides Serum Alkaline phosphate (ALT) Serum acid phosphatase (APT) Serum Lipase, Serum Amylase, Serum Calcium Serum Lactate dehydrogenase (LDH) Thyroid Function tests- T3, T4 Diagnostic tests for infectious diseases like - Malaria, Tuberculosis, Dengue, Leptospirosis	
	• Textbook Of Medical Laboratory Technology Praful B. Godkar 2nd edition, 2006 Bhalani Publishing House, Mumbai • A Textbook Of Practical Physiology V.G. Ranade, P.N. Joshi And Shalini Pradhan 3rd edition, 1982 P.V.G. Prakashan, Pune-30	

Detailed Syllabus for Second Year B. Pharm

Semester III

Sr. No.	Topics	Hrs
1.	**BST 1301 – Biochemistry-I (100 marks) 4hr./week**	
	Introduction to macromolecules : definition , types, classification , role in cell metabolism (Digestion of food and absorption of monosaccharides, amino acids and fatty acids into circulation. Fate of absorbed nutrients and relationship with regard to immediate use, storage, re-release and interconversion. Role of different organs in these processes especially liver, kidney, muscle, adipose tissue, brain and RBCs.)	**15**
	Carbohydrates	
	Lipids	
	Proteins and amino acids	
	Nucleic acids	
	Enzymes	
	Vitamins and coenzymes	
	Study of carbohydrates	**5**
	Carbohydrates: Fundamentals of chemistry of carbohydrates, concept of ring structures and straight chain structure of common carbohydrates glucose, fructose, galactose, Lactose, maltose, sucrose, polysaccharides, starch, glycogen, cellulose, mucopolysaccharides lipopolysaccharides like hyalurouic acid heparin.	
	Qualitative tests / colour reaction.	
	Selected reaction: With phenyl hydrazine, alkali – oxidation reduction with practical significance	
	Carbohydrate metabolism: Discussion of glycolysis, reversal of glycolysis, glycogen synthesis and breakdown,	
	TCA, gluconeogenesis,	
	pentose- phosphate. Pathway	
	NADH/NAD+ shuttles, with respect to the location, intermediates, enzymes, energy yield, and regulation. Examples of drugs relaed to carbohydrate metabolism modulation	
	Study of lipids	**3**
	Fatty aids, waxes, phospholipids, sphingolipids, terpenoids. With are representative structure and significance. Lipoproteins	
	Functions & comparative distribution of lipids. Lipid metabolism: Discussion of the oxidation and biosynthesis of saturated and unsaturated fats with respect to location, intermediates, enzymes, energy yields or requirements, and	

	regulation,	
	Rancidity, sap value, Iodine value & hydrogenating	
	β oxidation of fatty acids, Oxidation of unsaturated fatty acids,	
	Biosynthesis of cholesterol functions of cholesterol & significance.	
	formation of ketone bodies, acetate mevalonate pathway,. Examples of drugs that are related to lipid metabolism modulation	
	Role of water in cell metabolism	**2**
	Buffers	
	pH	
	Study of proteins and amino acids	**10**
	Proteins & Amino acids: Structure of protein: types of proteins globular, fibrous (helix & placated sheet) Amino acids: Structures, pK – isoelectric point, Essential & non-essential AA: Colour reaction of A.A: Protein Metabolism: Transamination , Deamination & urea cycle, & Decarboxylation of A.A : SGOT / SGPT	
	Protein Biosynthesis: central dogma., Conceptual introduction to DNA transcription and RNA translation, differences between prokaryote and eukaryotes, concepts of introns and exons and intron splicing, concept of posttranslational modifications (examples of gylcosylated proteins, conjugated proteins, insulin). Examples of protein synthesis inhibitors used and drugs.	
	Solid phase peptide synthesis, Edman reaction based protein sequencing and its automation	
	Vitamins & Co-enzymes:	
	Struthers & function of Nicotinamide, nicotinic acid, riboflavin, lipoic acid, biotin, thiamine, B6, folic acid, B12, pantothenic acid, ascorbic acid, vitamins A, D, K, and E.	
	Study of Enzymes:	**10**
	Enzyme kinetics: Classification of enzymes. Effects of enzyme concentration, substrate concentration, temperature, pH on enzyme reactions. General mechanisms of enzyme catalysis – acid base cataltysis, oxidation-reductions, proximity effects, transition state theory, etc. Michaelis – Menten equation and meanings of Km and Vmax, Lineweaver Burke method.	
	Activators & inhibitors of enzymes Enzyme inhibition – competitive, non-competitive and uncompetitive reversible inhibition of enzymes. Effect of these inhibitors on Km and Vmax and Identification of inhibition patterns via LWB plots. Examples of drugs that are enzyme inhibitors.	
	Enzyme induction & lysozyme.	
2.	**PHT 1103– Physical Pharmacy (100 marks) 4hr./week**	
	State of matter: Gases: Ideal and Nonideal gases, van der Waals equation, critical phenomenon, determination of gas constants, liquefaction	4

	Thermodynamics: first law, second law, third law, thermochemistry, free energy function and its applications, chemical potential, Clausius-Clapeyron equation, free energy and equilibrium, the van't Hoff equation	4
	Physical properties of Drug Molecules: Dipole moment and its determination, refractive index and molar refraction, viscosity.	3
	Solutions of Nonelectrolytes: Units for expressing concentration and calculations involving the same, ideal and real solutions, Raoult's law, Henry's law	4
	Colligative properties, elevation of b.p., depression of freezing point, osmotic pressure, molecular weight determination based on colligative properties, molecular weight by steam distillation.	4
	Solution of electrolytes: Properties of solutions of electrolytes, Arrhenies theory of electrolytic dissociation, theory of strong electrolytes, coefficients for expressing colligative properties.	4
	Ionic Equilibria and buffers: Modern theories of acids and bases, Acid-Base equilibria, Sorensen's pH scale, calculation of pH, effect of pH on ionization of weak acid and weak bases, calculation of fraction unionized; The buffers in pharmaceutical and biological systems, buffered solutions, methods of adjusting pH;	3
	Electromotive force and Oxidation-Reduction: Electrochemical cells, Nernst equation, Types of electrodes, electrode, electrode potential, redox potential, concentration cell, measurement of pH;	4
	Solubility: Solubility of gases in liquids, solubility of oxygen in blood, solubility of anaesthetic gases in blood, solubility of volatile anaesthetics in oil, miscible liquids, partial miscibility, solubility of solids in liquids, ideal solubility, solubility parameters and prediction of solubility in regular solutions, partition phenomena, partitioning of weak electrolytes;	3
	Complexation: Organic molecular complexes, inclusion compounds, methods of analysis, protein binding, Scatchard plot	3
	Chemical kinetics: Molecularity and order of a reaction, specific reaction rate constant, zero order, first order and second order reactions, methods to determine order of a reaction, Energy of activation, photochemical reactions and quantum yield.	1
	Catalysis: Positive, negative catalyst, autocatalysis. Homogenous and heterogenous catalysis;	1
	Interfacial phenomena: Surface tension (Surface free energy), Young equation, Kelvin equation, measurement of surface and interfacial tension, wetting and contact angle, spreading of liquids on liquids and on solids, Surface activity and soluble monolayers, Gibb's Duhem equation, insoluble monolayers and the film balance.	4
	Adsorption at solid surfaces, Freundlich and Langmuir treatment to Type-I adsorption isotherm, electrical properties of interfaces-Nernst and Zeta potential.	3
	• Physical Pharmacy-Physical Chemical Principles in Pharmaceutical	

	Sciences Alfred N. Martin, James Swarbrick, Arthur Cammarata 2ndedition, 1969 Lea & Febiger, Philadelphia • Tutorial Pharmacy J.W. Cooper, Colin Gunn 4th edition, 1950 Sir Isaac Pitman & Sons Ltd.,London • Essentials of Physical Chemistry Bahl B.S. 23rd edition, S. Chand & Sompany • Remington's-The Science and Practice of Pharmacy(vol.1 & 2) David B. Troy 21stedition, 2006 Lippincott Williams & Wilkins	
3.	**PHT 1104- Dispensing Pharmacy (50 marks) 3hr./week**	
	Definition of Dispensing & Prescription, Parts of prescription, types of prescription, procedure, dispensing the prescription, refilled prescription, prescription pricing, and recording of prescription.	2
	Calculations: Involved in compounding and Dispensing: Weight and measures, % calculations dilutions and concentrations, isotonic solutions HLB values.	6
	Posology, imperial system Latin teems and abbreviations	2
	Basic principles in dispensing: Types of dosage forms, formulation, storage, containers and closures for products, labeling of dispensed products	4
	Products included are: solutions (oral external use, body cavities) suspensions & emulsions Ointments, creams, gels, pastes, Suppository & pessaries Powders & Granules, Lozenges, pastilles, pills, Tablets, capsules, Tables triturates.	10
	Prescription Accessories	1
	Dispensing of Proprietary	1
	Incompatibilities	4
	• Cooper & Gunn's Dispensing For Pharmaceutical Students Revised By S.J.Carter 12th edition, 1987 CBS Publishers & Distributors • Husa's Pharmaceutical Dispensing Eric W.Martin 5thedition,1971 Mack Publishing Company • The Art,Science & Technology Of Pharmaceutical Compounding Loyd V Allen 2ndedition, 2002 American Pharmaceutical Association • Pharmaceutical Calculations Mitchell J.Skotlosa, Howard C.Ansel 8th edition, 1986 Lea & Febiger • American Pharmacy: Textbook Of Pharmaceutical Principles, Processes & Preparations Rufus Lyman 4th, edition, 1955 J.B.Lippincott Company • Pharmaceutical Practice Diana M. Collett, & Michael E. Aulton 1998, Churchill London • Pharmaceutical Practice A.J. Winfield & R.M.E. Richards 2nd edition, 1998 Churchill Liningston	
4.	**PHT 1202- Anatomy, Physiology & Pathophysiology-II (100 marks) 4hr./week**	
	Nervous System/sense organs. Anatomy-Physiology of CNS (Central N.S), PNS (Peripheral NS) and ANS (Autonomic NS) Neurotransmitters, Neurotransmission, Sensory- Motor pathways	12

	Cranial – Spinal Nervous Blood –Brain Barrier, Blood flow to brain Diseases – Parkinsonism, Alzheimer's, epilepsy, Sense organs: Anatomy and Physiology Physiology of sensations (special)	
	Digestive System|: Anatomy-Physiology including liver, pancreas Diseases: Peptic Ulcers, hepatitis	9
	Cardiovascular System: Anatomy – Physiology Structure and conducting systems of heart. Generation of action potential in SA node and its conduction/ Action potential in cardiac muscle. Cardiac cycle, ECG, (P-QRS-T) Blood pressure-factors modifying blood pressure Baroreceptors, Chemoreceptors, Vasomotor centre, humoral and neuronal regulation of Blood pressure and Circulation Diseases: Hypertension, CCF, Arrhythmia, angina pectoris, IHD, arteriosclerosis.	12
	Urinary System: Anatomy – Physiology Function of kidneys and formation of urine. Maintainence of acid- base and electrolyte balance, Renin-angiotensin system. Formation of body finds – Buffers of body, Respiratory and Metabolic acidosis and alkalosis. Urine analysis- Volume, colour, odour, specific gravity, normal and abnormal constituents with associated diseases. Diseases: Acute and Chronic renal failure, Glomerulonephritis	12
	• Ross and Wilson's Anatomy and Physiology in Health and Illness , Anne Waugh and Allison Grant 10th edition, 2006, Churchill Livingstone, London • Principles of Anatomy and Physiology, Gerald J. Tortora and Sandra et.al 10th edition, 2003 John Wiley and Sons Inc, New York, USA. • Textbook of Medical Physiology, Arthur C. Guyton and John E. Hall 10th edition, 2000, W.B.Saunders Company, Pensylvania, U.S.A. • Illustrated Physiology B. R. Mackenna and R. Callander 6th edition, Churchill Livingstone, New York, London	
5.	**PHT 1301– Pharmaceutical Analysis-I (50 marks) 3hr./week**	
	Introduction: a. Significance of quantitative analysis in quality control, different techniques of analysis, preliminaries and definitions, types of errors, selection of sample, precision and accuracy. b. Fundamentals of volumetric analysis, methods of expressing concentrations, primary and secondary standards. Calculation of equivalent weight and stoichiometry.	3
	Aqueous Acid-Base titrations: a. Law of mass action, hydrolysis of salts, neutralization curves, and theory of indicators, choice of indicators, mixed indicator. b. Application** in assay of Benzoic acid, Boric acid, Aspirin.	4 3
	Non-Aqueous titrations:	3

	a. Types of solvents, end point detection, b. Application** in assay of Sodium acetate, Sodium benzoate, Norfloxacin tablet.	
	Oxidation-Reduction titrations: a. Theory of redox titration, measurement of electrode potential, oxidation-reduction curves, redox Indicators. Titrations involving b. Potassium permanganate, potassium dichromate, potassium bromate, potassium iodate, cerium (IV) sulfate, Iodine (Iodimetry and Iodometry), titanous chloride. c. Applications** in assay of Ferrous sulfate, Ascorbic acid, Isoniazide, Hydrogen peroxide.	5
	Complexometric Titrations: a. Theory, formation of complex and its stability, titration curves, metallochrome indicators, types of EDTA titrations, b. Application** in assay of Magnesium sulfate, Lead nitrate and calcium gluconate.	3
	Argentometric Titrations: a. Theory, factors affecting solubility of a precipitate, titration methods- Mohr's, Volhard's, Gay lussac, and Fajan's method, indicators. b. Applications** in assay of Potassium chloride, Sodium chloride and Ammonium chloride.	3
	Miscellaneous methods of analysis:** a. Diazotisation titrations, b. Kjeldahl's method of nitrogen determination c. Oxygen flask combustion method.	3
	Gravimetric analysis: a. Precipitation techniques, solubility products, colloidal state, supersaturation, co-precipitation, post precipitation, digestion, filtration, ignition, weighing and calculation. b. Application** in assay of Alum by oxime reagent, Calcium as calcium oxalate and magnesium as magnesium pyrophosphate.	3
	****Applications should cover all different techniques and methods and may also include other compounds to which the techniques are applicable.**	
	• Vogel's Textbook of Quantitative Inorganic Analysis Bassett J, Denny R C, Jeffery G H, Mendharn J, 7th edition, 1998 ELBS/Longman, London. • Statistical Quality control 6. Instrumental methods of Analysis- Ewing. Grant 6th edition, 1988 McGraw Hill • A Textbook of Pharmaceutical Analysis, Connors K A 3rd edition ,1982 Wiley Interscience, New • Practical Pharmaceutical Chemistry Vol. IBeckett A. H. and Stenlake J B, 4th edition, 1988 . The Anthlone Press of University of London. • Analytical Chemistry an Introduction, Skoog/ West/Holler 4th edition ,	

	1986 CBS Publications, Japan • The Quantitative Analysis of Drug Garrat 3rd edition, 2005 Toppan & Co. • Analytical Chemistry Gary Christian-3rd edition, 1971 John Wiley • IP, BP, USP, EP and International Pharmacopoeia. Current Editions	
6.	**BSP 1301– Biochemistry Laboratory (50 marks) 4hr./week**	
	Qualitative tests for Carbohydrates.	
	Quantitative test for Carbohydrates Lane Eynon's Method Willstatters Method DNS Method Folin- Wu Method (Blood Sugar)	
	Qualitative tests for Amino acids, Proteins and Precipitation of proteins	
	Quantitative tests for Proteins Folin Lowery Method Biuret Method	
	Enzymes Activity of Salivary Amylase Study of factors affecting rate of an enzymatic reactions: Determination of Optimum pH, Temperature, K_M, $V_{Max.}$	
	Vitamins; Quantitative determination of Vitamin C	
	Lipids; Determination of acid value and iodine value of lipids.	
	Estimation of RNA and Blood Cholesterol.	
	Tutorials	
	• An Introduction to Practical Biochemistry David T. Plummer. 2nd edition, 1978 McGraw Hill Book Co.,	
7.	**PHP 1103– Physical Pharmacy Laboratory (50 marks) 4hr./week**	
	Kinetics: Experiments to determine order of reaction- First order Reaction a) degree of hydrolysis b) relative strength of two acids c) equal fraction method;	
	Second order reaction a) a=b b) equal fraction method c) Oswald's dilution method;	
	Energy of activation and determination of shelf life;	
	Kinetics of inversion of cane sugar, Molecular Weight; 1. F.P. Method, 2. B.P. Method, 3. Rast camphor method 4. Molecular weight of polymer by viscosity method, 5. Brookfield viscometer (Demonostration). 6. Victor Meyer method.	
	Suface Tension: 1. Using stalagmometer 2. Critical micelle concentration of a	

	surfactant; HLB: Determination of HLB of glyceryl monostearate;	
	Conductivity: 1. Normality of an acid by conductometric titration, 2. Dissolution constant of an acid (verification of Ostwald's dilution (w), 3. Solubility of a sparingly soluble salt; pH meter.	
	1. Potentiometric titration, 2. Dissolution constant of a weak acid, 3. To determine buffer capacity at various stages of titrations of a weak acid against strong base and hence to determine pKa of the acid;	
	Adsorption: adsorption of acetic acid on activated charcoal and determination of specific surface area of charcoal; Partition; partition coefficient of lodine between carbontetrachloride and water, partition coefficient of benzoic acid between water and benzene;	
	Chromatography – paper chromatography (aqueous phase only), Rf value; Critical solution temperature phenol water system; Heat of solution – by solubility method; Heat of neutralisation – using a thermosflask.	
8.	**PHP 1104– Dispensing Pharmacy Laboratory (50 marks) 4hr./week**	
	At least one representative example of each formulation type included in theory	

Semester IV

Sr. No.	Topics	Hrs
1.	**HUT 1101– Psychology and Sociology (50 marks) 3hr./week**	
	Psychology NOTE: All relevant topics can be dealt with special reference to the Pharmaceutical Industry	
	Definition of Psychology, sub fields of Psychology; Industrial Psychology: definition, nature and scope, history, premices, development, and hurdles;	5
	Personnel Selection: occupational information, individual differences, personnel specifications -its types. and objectives; Methods of job analysis; Uses of job analysis; Types of personnel actions: Selection techniques : Application blanks, reference, interview; Psychological Tests: Intelligence (Otis, Standford-Binet, Weehster adult Intelligence test, Multifactor tests) aptitude (DAT), personality (Rorschaeh, TAT and MMPI);	5
	Personnel Development : Motivation – theories of motivation (Marlowe, Vroom) motivation and organization ; Incentives – financial and non-financial job satisfaction, Herberg's two factor theory, factors affecting satisfaction; Morale and Monotony; Definition and nature of Leadership, functions of leaders, trait theory of leadership – Managerial grid, Field less Contingency	5

	Model; Accident Prevention and Safety Measures.	
	Sociology	
	Introduction to Sociology: What is Sociology? the relevance of Sociology to industry; Personality and social behavior, social adjustment of workers, definition and levels of communication, improving communication in organization;	5
	Industrial Democracy: What is Industrial Democracy? worker participation in management; Trade unions: History of labour movement in India, problems of trade unions in India, collective bargaining, industrial disputes, its causes and methods to resolve;	5
	Science, Technology, Industry and society: Impact of science & technology on industry and society, the role of industry in national development, cottage, small and large scale industries, problems of industrialization with special reference to the pharmaceutical industry .	5
	• Books Recommended: Will be recommended by the teacher	
2.	**PHT 1105– Pharmaceutics-III (100 marks) 4hr./week**	
	Biphasic disperse systems: Emulsions: Preformulation considerations and theories of emulsion formation	1
	Formulation considerations in the development of emulsions for internal and external use and quality control, emulsifying agents - examples of official preparations belonging to this class.	3
	Large scale manufacturing, packaging of emulsions	1
	Semi solid dosage forms: Introduction to the anatomy of skin- percutaneous absorption and penetration,	2
	Ointments different bases,factors influencing the choice of base,- processing of ointments and creams and quality control	4
	Formulation and evaluation of pastes, gels, poultice	1
	Large scale manufacturing, packagingof semisolid dosages including ointments creams and gels	1
	Introduction to Multiple emulsions,submicron emulsions, microemulsions	1
	Aerosols: Components, manufacture and evaluation.	3
	Suppositories: Rectal Delivery- Physico-chemical factorsaffectingrectalabsorption, advantages, limitations,Formulation of suppositories and pessaries, suppository bases, evaluation, packaging, and manufacture	4
	Preformulation considerations in design of tablets, advantages of tablets	1
	Granulation: Need for granulation, Methods and equipment, Direct compression, Advances in granulation equipment	3
	Single stroke and Rotary Tablet Machines, physics of tablet compression, tablet Tooling	2
	Formulation of tablets: Excipients in tabletting	3
	Quality control of tablets	2
	Types of tablets: effervescent, lozenges, chewable, buccal and sublingual, dispersible, orodispersible , solubleincluding various processing problems	3

	Problems in tabletting	1
	Capsules: Advantages and limitations of Hard gelatin and soft gelatin capsules: Gelatin extraction and manufacture of Hard gelatin capsules	1
	Equipment for filling hard gelatin capsules, formulation considerations and quality control Manufacture, formulation considerations and quality control of soft gelatin Capsules	4
	Packaging machinery and materials for tablets and capsules	1
	Layout design of tabletting section and capsule section	1
	Drying and mixing of powders: equipment and theory, Psychrometry	2
	• Theory & Practice Of Industrial Pharmacy L. Lachman, Herbert A.Lieberman & J. Kanig 3rdedition, 1987 Lea & Febiger, Philadelphia • Pharmaceutical Dosage Form: Dispersed Systems (Vol.1 &2) Herbert A. Lieberman, Martin A.Rieger,G.S.Bank er 2nd edition, 1993 Marcel Dekker Inc. • Modern Pharmaceutics Gilbert S.Banker, C.T. Rhodes 2nd edition, 1990 Marcel Dekker Inc. • Cooper & Gunn's Dispensing For Pharmaceutical Students Revised By S.J.Carter 12th edition, 1987 Cbs Publishers & Distributers • Pharmaceutics: The Science Of Dosage Form Design Michael E.Aulton 2nd edition, 1998 • Churchill-Livingstone • Pharmaceutical Dosage Forms:Tablets (Vol 1-3) Herbert A.Lieberman,Leon Lachman & Joseph B.Schwartz 2nd edition, 1989 Marcel Dekker Inc.,New York • Remington-The Science And Practice Of Pharmacy(Vol.1 & 2) David B.Troy 21st edition, 2006 Lippincott Williams & Wilkins • Pharmaceutics:The Science Of Dosage Form Design Michael E.Aulton 1st edition, 1988 Churchill-Livingstone • Pharmaceutical Production Facilities:Design & Applications Graham C.Cole 1st edition,1990 Ellis Horwood	
3.	**PHT 1203– Pharmacology- I (100 marks) 4hr./week**	
	General Principle of pharmacology: Routes of administration with special reference to their advantages and disadvantages. Drug ADME	4
	Mechanism of drug action: Brief introduction of physiological receptors-structural and functional families, cytoplasmic second messengers, drug receptor interaction, dose response relationship, drug antagonism	5
	Factors modifying the actions of drugs; Drug toxicity in humans-toxic effects of drugs on different systems, organs and tissue. Drugs used in the disorders of gastro- intestinal tract: Emetics and antiemetics and prokinetic drugs. Purgatives and antidiarrheals, antispasmodics, Drugs used in the	6

	treatment of hyperacidity and peptic ulceration and anti-inflammatory bowel disease.	
	Miscellaneous: Histamines and antihistaminics, 5-HT and antagonists, kinins, eicosanoids, cytokines, PAF, oxytocis, local anesthetics, antidiabetic agents, antithyroid agents, oral contraceptive.	6
	Druga affecting blood and blood forming organs: Drugs effective in various types of anemias, anticoagulants, antithromobotics, throbolytics.	4
	Local anaesthetics	2
	Antidiabetic and Antithyroid agents	2
	Chemotherapy Basic concepts and general principles; Antibiotics and Principles of antibacterial , Chemotherapy Sulfonamides – Trimethoprim, Quinolones and fluroquinolones , Penicillins and Cephalosporins; Macrolides, Tetracyclines, Chloramphenicols, Antifungal agents, Antiviral agents, Anticancer agents, Chemotherapy of Parasitic diseases, Amoebiasis, Antimalarial, Anthelmentics, Chemotherapy of Tuberculosis/Leprosy	16
	• Essentials of Pharmacotherapeutics F.S.K.Barar 1st Edition 2004 S.Chand and Company Ltd,New Delhi • Essentials of medical Pharmacology Tripathi K.D., 6th Edition, 2008 Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi • Pharmacology H.P.Rang, M.M.Dale,J.M.Ritter 5th Edition, 2003 Churchill Livingstone; Edinburgh • Pharmacology and Pharmacotherapeutics R.S.Satoskar, S.D.Bhandarkar 15th Edition, 1997 Popular Prakashan,	
4.	**PHT 1302- Pharmaceutical Analysis-II (100 marks) 4hr./week**	
	Introduction: Pharmacopoeial monograph, literature collection, data handling and expression of analytical results – documentation and record keeping	5
	a. Standardization of finished products and their characteristics; b. Official methods of control – Pharmacopoeia and other compendia, c. monographs and their criteria with reference to the drugs and pharmaceutical aids	7
	Melting point, congealing point as per I.P	3
	Discussions: On analysis of gases – oxygen, mercury, Nitrogen determination, Halogen determination;	5
	Principles and theory of aquametry.	3
	Solvent extraction-basic principles, classification, mechanism of extraction, equilibria, techniques and applications,	3
	Absorption spectroscopy: Introduction to interaction between electromagnetic – radiation and matter ,absorption of radiation by molecules, quantitative uses of absorption spectroscopy – Beer and Lambert's law and its derivation, limitation. Application of Beer's law to single component analysis and multi component systems, measurement of equilibrium constant and rate constants by spectroscopy,	5
	Molecular structure and electronic spectra – theory of electronic	1

	transitions and electronic spectra, spectra of isolated chromophores – auxochromes, bathochronic shifts and hyposochromic shift; Hyperchromisms and hypochromism, conjugated chromophores and aromatic molecules; Effect of solvent on absorption spectra;	
	Molecular structure and infra red spectra, vibrational transition, frequency – structure correlations, various regions of IR bands – hydrogen stretching, C-C stretching, C=C stretching and bending effect of hydrogen bonding: Measurement of absorption spectra;	2
	Instrumentation- discussions of light sources, frequency selector, intensity control, detectors, samples preparation, ray diagrams of typical UV-Visible (double beam) and I.R. spectrophotometers;	4
	Fluorescence Spectroscopy; Theory of fluorescence phenomenon – origin of fluorescence and phosphorescence multiplicities, singlet and triplet states; Excitation and fluorescence spectra; Molecular structure and fluorescents; Quantitative fluorescence analysis; Practical fluorescence analysis, Application of fluorescence analysis to drug; Instrumentation;	3
	Refractometry; theory, instrumentation and application.	2
	Polarimetry. theory, instrumentation and application.	2
	Books Recommended: As under Pharmaceutical Analysis –I and additional as follows • Pharmaceutical Analysis- Higuchi & Brochmann- Hanssen- 1961 Interscience • Analytical Profiles Of Drug Substances Florey- 1990 Academic Press • Pharmaceutical Drug Analysis Ashutosh Kar.2001 • Calculation Of Analytical Chemistry Hamilton, Simpson And Ellis- 5th edition, 1954 McGraw Hill • Calculation Of Analytical Chemistry Hamilton, Simpson And Ellis- 5th edition, 1954 McGraw Hill	
5.	**PHT 1401- Pharmaceutical and Medicinal Chemistry –I (50 marks) 3hr./week**	
	Introduction - study of monographs of official compounds in IP; Water – detail study of water as universal pharmaceutical vehicle.	3
	Sources of contamination in pharmaceutical compounds (which are official in pharmacopeias).	2
	Limit tests prescribed – e.g. chloride, sulphate, arsenic, lead, iron, nitrate, alkali & alkaline earth metals	3
	Limits of – insoluble matter, soluble matter, nonvolatile matter, volatile matter, residue on ignition & ash value.	2
	Study of – major intracellular electrolytes & irons: chloride, phosphates, bicarbonate, Na, K, Ca, Mg (including their general, physiological properties and uses such as infusion fluids	3
	Study of essential and trace ions: Fe, Zn, Mn, Se, S and I- official compounds and Uses	1
	Study of Gastrointestinal Agents: antacids, protectives and adsorbants, saline cathartics-official compounds	5

	Study of Topical Agents: protectives, antimicrobials and astringents-official Compounds	5
	Study of Important Inorganic Gases: oxygen, nitrogen, nitrous oxide, carbondioxide, helium and ammonia	3
	Study of Expectorants	1
	Study of Inorganic Compounds: talc, barium sulphate, and other pharmaceutical aids.	2
	• Inorganic, Medicinal and Pharmaceutical Chemistry J. H. Block, E. B. Roche 1986 • IP, BP,USP -Current- • Concise Inorganic Chemistry J. D. Lee, 5th edition, 1996 Oxford Blackwell • Bentley & Driver's Text Book of Pharmaceutical Chemistry L. M. Atherden, 8th edition, 1989 Oxford Medical Publications. • Remington's-The Science and Practice of Pharmacy(vol.1 & 2) David B. Troy 21st edition , 2006 Lippincott Williams & Wilkins	
6.	**PHP 1105– Pharmaceutics Laboratory- II (50 marks) 4hr./week**	
	At least one representative example of each formulation type included in theory of Pharmaceutics IV and V(Preparation and evaluation, **with stress on official formulations)**	
7.	**PHP 1202 – Pharmacology Laboratory-I (50 marks) 4hr./week**	
	Studies of commonly used instruments, common and standard technique used and animal handling in experimental pharmacology.	
	Study of different routes of administration of drugs in mice/rats.[DEMO]	
	Effect of autonomic drugs on rabbit's eye. [DEMO]	
	Effect of various agonists and antagonists and their characterization using suitable isolated preparations.	
	• Prakashan, New Delhi • Practicals in Pharmacology R.K.Goyal, 6th edition, 2006- 2007 B.S.Shah Prakashan, Ahmedabad • Selected Topics in Experimental Pharmacology U.K.Seth, N.K.Dadkar, Usha G.Kamat,1st edition, 1972 Kothari Book Depot Mumbai • Fundamentals of Experimental Pharmacology Ghosh M.N. 3rd edition, 2005 Hilton and Co, Kolkata	
8.	**PHP 1301- Pharmaceutical Analysis Laboratory-I (50 marks) 4hr./week**	
	The students should be introducing to the main Analytical tools through demonstration. They should have a clear understanding of a typical analytical balance, weights, care and use of balance, methods of weighing and errors of weighing. The students should also be acquainted with the general apparatus required in various analytical procedures.	
	Standardization of analytical weights and calibration of balances and volumetric apparatus.	

	Perform following assays as per IP including preparation and standardization of titrants. Such as 0.1 N HCL, 0.1 N NaOH, 0.1 N KMnO4, 0.1 N Na2S203, 0.1 N AgNO3, 0.1N HClO4, 0.05 M disodium EDTA, 0.1 N CH3ONa, 0.1 N Iodine, 0.1 N Oxalic acid	
	Hydrogen ion concentration, pH, and potentiometric titrations	
	Acid-base titrations**: Benzoic acid, Boric acid, Aspirin, Determination of total alkalinity and sodium carbonate of sodium hydroxide	
	Non-Aqueous titrations**: Sodium acetate, Sodium benzoate, Norfloxacin tablet. assay of pyridoxine HCI	
	Oxidation-Reduction titrations**: assay of sodium nitrite Ferrous sulfate, Ascorbic acid, Isoniazide, Hydrogen Peroxide. assay of iodine solution, determination of percentage of ascorbic acid	
	Complexometric titrations**: Magnesium sulfate, Lead nitrate, calcium gluconate, Ca & Mg in a mixture, AI & Zn in a mixture ,assay of aluminium hydroxide gel	
	Argentometric titrations**: Potassium chloride, Sodium chloride and Ammonium chloride.	
	Gravimetric analysis**: Alum by oxime reagent, Calcium as calcium oxalate and magnesium as magnesium pyrophosphate.	
	Miscellaneous methods of analysis:** Estimation by Kjeldahl's method, sodium nitrite titration, hydroxyl value, acid value, iodine value, saponification value, ester value	
	Physicochemical Methods** – specific gravity and density, solubility, viscosity, melting, congealing, and boiling temperatures.	
	**Applications may also include other compounds to which the techniques are applicable.	
	Books recommended under Pharmaceutical Analysis-II And in addition the following • Instrumental Methods Of Analysis Ewing.4th edition, 1975 McGraw Hill New York • Text Book Of Practical Organic Chemistry – Vogel 5th ,edition, 1989 Longman Scientific	

Detailed Syllabus for Third Year B. Pharm

Semester V

Sr. No.	Topics	Hrs
1.	**BST 1202 – Molecular Biology & Biotechnology (50 marks) 3hr./week**	
	Defintition of biotechnology, the different aspects of biotechnology,	2
	Recombinant DNA technology:	10
	Introduction to the concept, introduction to prokaryotic and eukaryotic cell systems and their DNA organization, plasmids, restriction enzymes, methods to prepare cDNA molecules (plasmids and phages),..	
	methods for introduction of DNA into cells, selection methods	
	Differences between cloning and expression. Properties of cloning and expression vectors & cloning and expression systems	
	Examples of production of insulin and human growth hormone	
	Fermentation Technology: or white biotechnology	10
	Introduction to industrial fermentations, factors affecting fermentation processes or fermenter designs, typical fermentation types – batch, continuous, fed-batch, aerobic, anaerobic, pure culture, mixed culture etc.	
	Typical fermenter designs and explanation of design characteristics with emphasis on automation for process control..	
	Types of products produced and microorganisms used , strain improvement	
	Examples of one or two commercial production protocols – penicillin and dextran	
	Immobilizaton of cells/enzymes: Definition of immobilization, advantages and limits, different approaches to cell/enzyme immobilization with examples of adsorption, covalent coupling and matrix/polymer based systems	
	Agriculture biotechnology : green biotechnology	4
	Introduction , Tissue culture techniques : plant and animals	
	Marine biotechnology : blue biotechnology	4
	Introduction fish or pearl culturing ,algal culturing for medicinal purposes	
	• Books Recommended: As recommended by the Teacher	
2.	**BST 1302– Biochemistry II (50 marks) 3hr./week**	
	Biochemical Energetics	15
	Concept of free energy, standard free energy vs transformed free energy vs free energy for a reaction. Relationship of standard free energy to reaction equilibrium constant, concepts of enthalpy and entropy, introduction to first and second law of thermodynamics. Standard free energy changes of some important biological rections.	
	Concept of oxidation – reduction reactions, standard electrode potential, transformed standard electrode potential, standard electrode potentials of some	

	biological important redox couples.	
	Concept of high energy phosphate bond and ATP as a carrier of energy. Concept of oxidation states of carbon in different compounds. Introduction to the terms metabolism, anabolism and catabolism.	
	Electron transport chain: Components of the ETC, oxidative phosphorylation vs substrate level phosphorylation, comparison of this with photosynthesis and photophosphorylation, absorption of light by chlorophyll and energy conservation. Discussion or proton motive force and generation of ATP by use of proton gradients. Examples of some toxins that interfere with ETC.	
	Study of nucleic acids	15
	Nucleic acid metabolism: Discussion of biosynthesis of purines and pyridines with respect to location, intermediates, enzymes, cofactors, and regulation. Salvage pathways for nucleic acids. Examples of drugs interfering with these pathways.	
	Conceptual introduction to DNA replication. Types and models Conceptual explanation of replication of circular and linear chromosomes.	
	Idea of genetic code. And mutation	
	Error correction during DNA replication. Examples of drugs that are used due to role in interaction with DNA or interfering with DNA replication.	
	Solid phase DNA synthesis, DNA sequencing (Maxim-Gilbert method, Sanger dideoxy method and automation of DNA sequencing)	
3.	**HUT 1201- Pharmaceutical Management (100 marks) 4hr./week**	
	Historical perspective; Business management thought -concept, functions, advantages and limitations	3
	Principles of organizations -authority, performance, productivity	8
	Techniques of communication, direction, participation, delegation, decision making, control tools (PERT, CPM), systems, policies, procedures, methods to operate organization	8
	Skills like leadership, motivation, business forecasting, conflict resolution, creativity and innovation.	3
	Sales & Marketing Management: Marketing Management Concepts, behavior of doctors, retailers and customers; Marketing research;	4
	Advertising and sales promotion; Pricing; Distribution; Selling; Sales management; Retail management; Product management;	3
	Legal frame work of industry; Budges; Human resource planning & audit; New product management;	4
	Sales forecasting; Medium planning; Budgeting; Operations management: Production planning & control systems; Materials management systems; Quality management systems; Financial planning and control systems; Inventory & third party	12
	money management; Labour laws; Project Management. Taxation; Direct taxes - Income tax, corporate tax; Indirect taxes -excise duty, sales tax and octroi;.	

	Books Recommended: As recommended by the Teacher	
4.	**PHT 1106- Cosmeticology (50 marks) 3hr./week**	
	Definition of cosmetics; historical background, classification of cosmetics and primary functions	1
	Structure of skin, hair, nails, tooth and skin appendages and interactions with cosmetics	2
	Microbial contamination in cosmetics; Perfumes, colours and other raw material used in cosmetics- a brief review	2
	Toxicology of cosmetics- irritation and sensitization reactions to cosmetics, tests to predict such reactions	2
	Study of following Skin cosmetics with respect to raw materials, formulations,	5
	processing equipment and quality control: skin creams and lotions- cold creams, vanishing creams, bleach creams, acne creams, hand and body creams and lotions (barrier preparations), emollient creams, sunscreen products- sun tan and anti sunburn products, insect repellants, face powder, lipstick, rouge, face packs- cleansing preparations- moisturizers, bath oils	
	Study of following Hair care cosmetics with respect to raw materials, formulations, processing equipment and quality control: shampoos, women's hair dressings, men's hair dressings, hair tonics, hair conditioners, hair rinses, hair colorants, hair waving and straightening preparations, depilatories, shaving preparations and aids (after shave solution/ lotion/ cream), anti-lice preparations;	5
	Study of following Nail products with respect to raw materials, formulations, processing equipment and quality control: pedicure and manicure preparations (nail polish, nail paint removers, cuticle removers, nail whiteners etc);	4
	Study of following Dental care products with respect to raw materials, formulations, processing equipment and quality control: toothpaste, tooth powder, mouth washes and denture cleansers;	2
	Study of following Eye makeup products with respect to raw materials, formulations, processing equipment and quality control: eye shadow, eye liner, mascara etc	2
	Baby cosmetics;	2
	Herbal cosmetics	3
	• Harry's Cosmeticology Rieger 8th edition, 2000 Leonard Hill Book & Intertext Publisher,London • Cosmetic Science(Vol 2) M.M. Breuer 1978 Academic Press, London • Cosmetics: Formulation, Manufacturing & Quality Control P.P. Sharma 1998Vandana Publications,New Delhi • A Formulary Of Cosmetic Preparations Michael & Irene Ash 1st edition, 1977 George Godwin Ltd., London • Drugs & Cosmetics Act 1940 Vijay Malik 16th edition, 1997 Eastern Book Company	

5.	**PHT 1402– Pharmaceutical & Medicinal Chemistry–II (100 marks) 3hr./week**	
	Chemotherapeutic agents: Study of the following classes of drugs with respect to their classification, chemical nomenclature, structure including stereochemistry, generic names, chemistry, physicochemical properties, SAR, metabolism, molecular mechanism of action and synthesis and introduction to rational development, if any.	
	Antibacterial agents – a) Antibiotics: beta-lactam antibiotics including-penicillin, cephalosporins, carbapenems, monobactams. b) Tetracyclincs and glycylcyclins.	 4 1
	c) Marcolides and ketolides. d) Aminoglcosides. e) Miscellaneous including chloramphenicol, vancomycin, bacitracin etc. f) Sulfonamides and DHFR inhibitors: g) Quinolones h) Oxazolidinediones and other miscellaneous agents.	1 1 1 2 1 1
	Anitparasitic agents- a) Antiamoebics, b) Antimalarials, c) Anthelmintics d) Miscellaneous including drugs versus Trypanosomiasis, leishmaniasis, scabies, filaria etc	5
	Antifungal agents- a) Azoles, b) Polyene antibiotics and Miscellaneous including Allyl amines, Tolnaftate, griseofulvin etc.	 1 1
	Antimycobacterial agents- a) Antitubercular agents b) Antileprotic agents Drugs versus MAC	 1 1
	Anticancer agents – a) DNA alkylating agent b) Nitrosoureas Procarbazines, Triazines and misc. Organoplatinum agents c) Antibiotics d) Antimetabolites including DNA polymerase inhibitors, Pyrimidine and purine antagonists and misc. agents. e) Mitosis inhibitors and other misc. anticancer agents.	 1 1 1 1 1
	Antiviral agents – a) General aspects b) Agents interfering with nucleic acid replication including those with modification with bases sugars and phosphate. c) Amantidine and its analogs, interferon and its inductors. Nuraminidase inhibitors	 1 1 1

	d) Antiretroviral drugs including NRTI, NNRTI and protease inhibitors.	1
	Study of the following classes of drugs with respect to their classification, chemical nomenclature, structure including stereochemistry, generic names, chemistry, physicochemical properties, SAR, metabolism, molecular mechanism of action and synthesis and introduction to rational development, if any.	
	a) Non Steroidal Anti-inflammatory Agents: i) Antipyretic analgesics ii) Salicylates iii) Aryl alkanoic acids iv) N-aryl anthranillic acids v) Oxicams vi) Selective COX-2 inhibiotrs b) Antihistaminic agents: i) H_1 antagonists- Classical antagonists & Non-sedative H_1 antagonists c) Antiulcer agents: ii) H_2 antagonists iii) Proton Pump inhibitors iv) Others	 1 1 3 1 1 1 4 1 1 1
	• Foye's Principles Of Medicinal Chemistry W. O. Foye 6th edition, 2008 Lippincott Williams & Wilkins • Textbook Of Medicinal And Pharmaceutical Chemistry Wilson And Gisvold 11th edition, 2004 Lippincott Williams & Wilkins –Philadelphia • Burger's Medicinal Chemistry & Drug Discovery(Vol. 1- 6) A. Burger And M.E. Wolff; 6th edition, 2003 John Wiley & Sons-New Jersey • Remington's The Science And Practice Of Pharmacy 21st edition, 2006 Lipincott, William And Wilkins • Pharmaceutical Substances: Synthesis, Patents, Applications (N-Z) Kleemann 4th edition, 2001 Georg Thieme Verlag-Stuttgart. Thieme • **Synthesis Of Drugs: A Synthon Approach Vol-1 R. P. Iyer, M. S. Degani 2nd edition, 2008 Sevak Publications Pvt. Ltd.** • **The Organic Chemistry of Drug Synthesis Vol. 1-6 Daniel Lednicer 1999** John Wiley & Sons INC • The Organic Chemistry of Drug Design And Drug Action. R. B. Silverman 2nd edition, 2004 Elsevier Publication	
6.	**BSP 1202– Molecular Biology & Biotechnology Laboratory (50 marks) 4hr./week**	
	Sterility testing Aqueous and oily injectables, Powders, Eye drops and Ointments	
	Microbial assay of antibiotics	
	Microbial Limit test on Starch, gelatin, talc and lactose of pharmaceutical grade.	
	Special Biochemical Tests: Sugar fermentation, hydrolysis of gelatin, starch	

	and urea, Nitrate reduction, Coagulase test, Oxidase test, Catalase test, IMIVC test	
	Observation of Pathogens on Selective media: McConkey, Vogel- Johnson, and Cetrimide agar.	
	Air and Water analysis	
	Demonstrations: Alcohol production by Yeast Lactic acid fermentation in milk Widal test	
	Enzyme Production Ammonium Sulphate Precipitation Demonstrations: Immobilization of enzymes Electrophoresis Isolation and Extraction of DNA & RNA.	
	• Books Recommended: As recommended by Teacher	
7.	**PHP 1106– Cosmeticology Laboratory (50 marks) 4hr./week**	
	Definition of cosmetics; historical background, classification of cosmetics and primary functions	
	Structure of skin, hair, nails, tooth and skin appendages and interactions with cosmetics	
	Microbial contamination in cosmetics; Perfumes, colours and other raw material used in cosmetics- a brief review	
	Toxicology of cosmetics- irritation and sensitization reactions to cosmetics, tests to predict such reactions	
	Study of following Skin cosmetics with respect to raw materials, formulations, processing equipment and quality control: skin creams and lotions- cold creams, vanishing creams, bleach creams, acne creams, hand and body creams and lotions (barrier preparations), emollient creams, sunscreen products- sun tan and anti sunburn products, insect repellants, face powder, lipstick, rouge, face packs- cleansing preparations- moisturizers, bath oils	
	Study of following Hair care cosmetics with respect to raw materials, formulations, processing equipment and quality control: shampoos, women's hair dressings, men's hair dressings, hair tonics, hair conditioners, hair rinses, hair colorants, hair waving and straightening preparations, depilatories, shaving preparations and aids (after shave solution/ lotion/ cream), anti-lice preparations;	
	Study of following Nail products with respect to raw materials, formulations, processing equipment and quality control: pedicure and manicure preparations (nail polish, nail paint removers, cuticle removers, nail whiteners etc);	
	Study of following Dental care products with respect to raw materials,	

	formulations, processing equipment and quality control: toothpaste, tooth powder, mouth washes and denture cleansers;	
	Study of following Eye makeup products with respect to raw materials, formulations, processing equipment and quality control: eye shadow, eye liner, mascara etc	
	Baby cosmetics;	
	Herbal cosmetics	
	Schedule S of Drug and Cosmetics Act in relation to cosmetic manufacture-hygiene pollution control-ecological concern.	
	• Harry's Cosmeticology Rieger 8thedition, 2000 Leonard Hill Book & Intertext Publisher,London • Cosmetic Science(Vol 2) M.M. Breuer 1978 Academic Press, London • Cosmetics: Formulation, Manufacturing & Quality Control P.P. Sharma 1998 Vandana Publications, New Delhi • A Formulary Of Cosmetic Preparations Michael & Irene Ash 1st edition, 1977 George Godwin Ltd.,London • Drugs & Cosmetics Act 1940 Vijay Malik 16th edition, 1997 Eastern Book Company	
8.	**PHP 1401– Pharmaceutical & Medicinal Chemistry Laboratory-I (50 marks) 4hr./week**	
	Functional group transformation: Minimum one exercise to be given for each of the preceding types of transformations, if possible leading to synthesis of drugs or drug intermediates	
	Esterification (synthesis of acetyl salicylic acid)	
	Hydrolysis	
	Amide formation (acetylation, benzoylation),	
	Diazotization and coupling	
	Bromination	
	Nitration and Sulfonation in aromatic rings	
	Simple oxidation and reduction reactions	
	Synthesis of Heterocycles (e.g. Hydantoin, Benzimidazole)	
	Aliphatic substitution reactions	
	Clasien / aldol condensation	
	• Vogel's A Text book of Practical Organic Chemistry A. Vogel 3rd edition, 1962 Longman group limited, London • Advanced Practical Organic Chemistry J. Leonard, trvor P. Toube, B. Lygo, G. Proctor 2nd edition, 1990 Stanley Thornes • Practical Organic Synthesis: A Student's Guide Reinhart Keese, Martin P. Brändle	

Semester VI

Sr. No.	Topics	Hrs
9	**PHT 1107– Hospital Pharmacy and Drug Store Management (50 marks) 3hr./week**	
	Hospital Pharmacy	
	HOSPITAL: Classification, Organization, Administration & Functions	1
	Hospital Pharmcy: History, Development, Duties & responsibilities of Pharmacist	1
	PHARMACY & THERAPEUTIC COMMITTEE	1
	HOSPITAL FORMULARY	1
	PURCHASE: Procedure, Storage, Inventory Control.	1
	DISPENSIGN OF CONTROLLED SUBSTANCES	1
	BULK COMPOUNDING: Large volume parentrals total parentral Nutrition, Intravenous additives.	1
	CENTRAL STERILE SERVICE: Advantages, Plan, Location, Activities management	1
	STERILISATION & DISPOSAL OF SURGICAL MATERIALS: Rubber gloves, Syringes, Needles, Catheters, Surgical Instruments, Powders, etc.	1
	MEDICAL GASES: Different gases &their uses, Color coding of Cylinders & Care of Cylinders	2
	HEALTH ACCESSORIES: Wheel chairs, Canes, Crutches, Bed panes, Syringes, Needles etc.	1
	CLINICAL APPLICATIONS OF RADIOPHARMACEUTICALS: Therapeutic & Diagnostic radiopharmaceuticals.	1
	APPLICATION OF COMPUTERS: In maintenance of Records, Inventory control, Medication monitoring, Drug information, etc. (Current)	1
	HEALTH INSURANCE (Current)	1
	Drug Store Management	
	Introduction to Retail (Community) Pharmacy as a Career. 1. Retail Pharmacy Origin and Concept 2. Pharmacy as Profession 3. Role of Retail (Community) Pharmacist	1
	Retailing: Single Store (Model Pharmacy), Departmental Stores, Malls, Chain Stores, Co-operative Pharmacy and Internet Pharmacy	2
	Forms of Business Organizations- Sole Proprietorship, Partnership, and Corporate Structure including Co-operative Societies	2
	Building of a Model Pharmacy	3
	Stocking / Inventory Control and Recordkeeping	2
	Sales Promotion Methods	1
	Banking and finance	2

	Prevention of Frauds and Risk insurance	2
	• A Text Book Of Hospital Pharmacy S.H. Merchamt & J.S. Quadry 3rdedition, 1989 Mr. S.B. Shah • Hospital & Clinical Pharmacy A.R. Paradkar & S.A.Chunawala 9th edition, 1999 Nirali Publications , Pune • Cooper & Guns. Dispensing For Pharmaceutical Students S.J. Carter 12th edition, 1987 Pitman Books	
10	**PHT 1108–Biopharmaceutics and Pharmacokinetics (50 marks) 3hr./week**	
	Introduction: Definition: absorption, distribution, metabolism, excretion, elimination, first pass effect, enterohepatic cycling, bioavailability, biopharmaceutics, pharmacokinetics and pharmacodynamics	2
	Pharmacokinetics parameters: biological half life, volume of distribution, clearance: renal clearance, nonrenal clearance, additively of clearance, absolute bioavailability relative bioavailability, bioequivalence, and other parameters	2
	Concepts of compartment models: Pharmacokinetics of one compartment model, mathematical treatment to pharmacokinetics upon i.v. bolus dosing, i.v. infusion and first order extra vascular input; Methods of estimation of pharmacokinetic parameters and parameters for bioavailability/ bioequivalence – including method of residuals, excretion rate method, and sigma minus method of estimation of renal clearance, renal clearance, mean residence time; Wagner Nelson method	8
	Multicompartment models: Concepts and examples (excluding derivation or mathematical treatment)	2
	Plasma concentration and therapeutic response and introduction to pharmacodynamics;	2
	Non-linear pharmacokinetics: Non-linearities in absorption distribution, metabolism and elimination, examples of drug showing nonlinear pharmacokinetics	2
	Dosage regimens: Factors affecting dosage regimens, individualization of dosage regiments, therapeutic window, multiple dose pharmacokinetics, fluctuation, accumulation index, steady state concept, time to reach steady state, loading dose, maintenance dose, dose requiring individuation of dosage regimens	2
	Drug absorption: Different mechanism of drug transport, passive transport and pH partition theory, facilitated diffusion, active transport, blood and its drug binding constituents as carriers of drugs in the body; Perfusion limitation and permeability limitation and permeability limitation in drug transport; Physicochemical and physiological factors affecting the absorption of drugs	4
	Distribution: rate of distribution, perfusion limitation and permeability limitation, extent of distribution , plasma and tissue binding of drugs, drugs with small, intermediate and high volume of distribution and their relative plasma and tissue binding	3
	Elimination: Organ clearance concepts, hepatic clearance, hepatic extraction	3

	ratio, blood flow limitation in hepatic clearance, first pas effect; Clinical application : Effect of enzyme induction, enzyme inhibition, blood flow and protein binding on hepatic clearance, bioavailability, steady state plasma concentration and dosage regimens, renal clearance and mechanisms of renal excretion, estimation of renal clearance, factors affecting renal elimination, clinical applications, biliary clearance, enterohepatic circulation and other miscellaneous modes of drug elimination	
	• Biopharmaceutics & Pharmacokinetics-A Treatise D.M. Brahmankar, Sunil B. Jaiswal 1st edition, 1995 Vallabh Prakashan • Biopharmaceutics &Clinical Pharmacokinetics-An Introduction Robert E. Notari 4th edition, 1971 Marcel Dekker Inc. • Clinical Pharmcokinetics- Concepts & Applications Malcolm Rowland Thomas N. Tozer 2nd edition, 1989 Lea & Febiger,Philadelphia • Biopharmaceutics &Clinical Pharmacokinetics Milo Gibaldi 3rd edition, 1984 Lea Febiger, Philadelphia • Pharmacy Review Leon Shargel 1990 Wiley Medical Publication • Principles & Applications of Biopharmaceutics & Pharmacokinetics Dr.H.P.Tipnis Dr.Amrita Bajaj 2004 Career Publication	
11.	**PHT 1204– Pharmacology- II (50 marks) 3hr./week**	
	Drugs acting on CNS: Alcohol: Ethanol, Methanol, Disulfiram General Anaesthetics: History, classification, stages of anaesthesia, preanaesthetic medicine, Basal anaesthetic agents, Neuroleptanalgesia, Latest agents: Sedative, hypnotics, anxiolytics. Anticonvulsants; Antidepressants; Antiparkinsonism. CNS stimulant, Opiod analgesics/NSAIDS.Centrally acting muscle relaxants	18
	Drugs acting on ANS: Cholinergic, anticholinergic agents Adrenergic, adrenergic blocking agents Drugs acting on NMJ; Ganglion Blockers/stimulators	12
	• Essentials of Pharmacotherapeutics F.S.K.Barar 1st Edition 2004 S.Chand and Company Ltd, New Delhi • Essentials of medical Pharmacology Tripathi K.D., 6th Edition, 2008 Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi • Pharmacology H.P.Rang, M.M.Dale,J.M.Ritter 5th Edition, 2003 Churchill Livingstone; Edinburgh • Pharmacology and Pharmacotherapeutics R.S.Satoskar, S.D.Bhandarkar 15th Edition, 1997 Popular Prakashan, Mumbai	
12.	**PHT 1403- Pharmaceutical & Medicinal Chemistry – III (50 marks) 3hr./week**	
	Study of the following classes of drugs with respect to their classification, chemical nomenclature, structure including stereochemistry, generic names, chemistry, physicochemical properties, SAR, metabolism, molecular mechanism of action and synthesis and introduction to rational development, if any.	

	Adrenergic Drugs or drugs affecting adrenergic neurotransmission: a) General aspects of adrenergic receptors and Non-selective adrenergic agonists- nor-epinephrine and epinephrine. b) Selective α_1-adrenergic agonists and α_2-adrenergic agonists c) β_1 and β_2- adrenergic agonists d) Mixed-acting sympathomimetics e) Non-selective and Selective α-adrenergic antagonists f) β-adrenergic antagonists g) Mixed α/β-adrenergic antagonists Ergot alkaloids.	2 1 1 1 1 2 1
	Cardiovascular Drugs: a) Cardiac agents: I. Cardiac glycosides and non-glycosides. II. Antianginal agents: III. Nitrates and nitrites, nitric oxide donors IV. Calcium channel blockers V. Antiarrhythmic drugs: Class I to IV. b) Diuretics: I. Osmotic diuretics II. Carbonic anhydrase inhibitors. III. Thiazide and thiazide like diuretics IV. Loop diuretics V. Aldosterone antagonists VI. Potassium sparing diuretics c) Antihypertensive agents: I. ACE inhibitors II. Ca channels blockers III. Adrenergic blockers IV. Vasodilators V. Misc. d) Antihyperlipidemic agents and cholesterol reducing agents. e) Drugs affecting blood clotting -Anticoagulants: Heparin and oral, Direct thrombin inhibitors, Thrombolytics, antiplatelet drugs and Anitfibrinolytic agents.	2 1 2 2 4 5 2 3
	• Books Recommended: As under Pharmaceutical Medicinal Chemistry –II	
13.	**PHT 1501- Pharmacognosy-I (50 marks) 3hr./week**	
	General Pharmacognosy: Definition, history, indigenous systems of medicine. Source of drugs, organized drugs and unorganized drugs	2
	Scope of Pharmacognosy: Origin, geographical source & habitat, history, cultivation, pest control, preparation for market, identification, chemical constituents, uses, allied drugs, substitutes, adulterants	4
	Plant growth regulators :	1
	Cell cultures as source of drugs	1
	Classification of crude drugs: Alphabetical, biological,	2

	morphological, pharmacological, chemical, chemo-taxonomical	
	Standardization of drugs of natural origin: Organoleptic, microscopic, macroscopic, biological, chemical, spectral, and physical methods. Application of chromatographic techniques in evaluation of herbal drugs. Evaluation of crude drugs, extracts and phytoconstituents	3
	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, stolen, 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.	4
	Unorganised drugs: Dried latex, dried juices, dried extracts, gums and mucilages, resins.	1
	Phytochemistry: General properties, structures, classification, methods of extraction, etc. of Carbohydrates, proteins, enzymes, lipids, volatile oils, glycosides (anthraquinone, cyanogenic, steroidal, triterpenoidal, coumarin, flavonoid, glucosinolate, etc.) tannins, alkaloids.	6
	Biosynthesis : Building blocks, reactions involved in the biosynthesis, biosynthesis of building blocks. (acetate, isopenntenyl pyrophosphate, phenyl propane, etc.,)	3
	Extraction: Methods employed for the extraction of natural products mentioned under phytochemistry. Types of extracts. Methods used for separation of phytoconstituents	2
	Minerals- Kiselghur, Chalk, Talc, and Bentonite	1
	• Books Recommended ; Will be recommended by the teacher	
14.	**IPP 1101– Computer application In Pharmacy (50 marks) 4hr./week**	
	Application of mathematical and statistical packages like (R, Mupad, MatLab, Excel etc) Basic	15
	Applications in Pharmacy of the packages and others	15
15.	**PHP 1203 – Pharmacology Laboratory- II (50 marks) 4hr./week**	
	To record concentration response curve of acetylcholine, gallamine, histamine and oxytocin using suitable isolated preparations.	
	Study of analgesia, anti-inflammatory activity and muscle relaxant activity of drugs using simple experiments. [DEMO]	
	To study the effect of drugs on normal and hypodynamic heart using suitable animals. [Use of CDs and other materials to show experiments] [DEMO]	
	Brief explanation of regulatory toxicity studies.	
	• Hand Book of Experimental Pharmacology, Kulkarni S.K., 3rd edition, 1999 Vallabh Prakashan, New Delhi	

	• Practicals in Pharmacology R.K.Goyal, 6th,edition, 2006- 2007 B.S.Shah Prakashan, Ahmedabad • Selected Topics in Experimental Pharmacology U.K.Seth, N.K.Dadkar, Usha G.Kamat, 1st edition, 1972 Kothari Book Depot Mumbai • Fundamentals of Experimental Pharmacology Ghosh M.N. 3rd edition, 2005 Hilton and Co, Kolkata	
16.	**PHP 1302- Pharmaceutical Analysis Laboratory-II (50 marks) 4hr./week**	
	Atomic absorption spectroscopy (Alkali earth metal determinations) **	
	Absorption spectroscopy (UV, Visible); **	
	Fluorescence spectroscopy (Quinine salt), Quenching phenomenon. **	
	Chromatography (PC, CC, TLC) application to reaction monitoring, purity assessment of drugs, separation of the mixtures.	
	Medicaments in formulations**: Liquid oral, tablet, injectable, aerosol, capsule, ointment, eye drops, suppositories, lozenges, etc. (one each);	
	Multi component analysis for drugs in combination**. eg:Using simultaneous equation method, using iso absorption point method, Using solvent extraction method, Using colorimetric and UV methods.	
	Refractometry** Caibration of Abbe's Refractometer, Estimation of refractive index of natural oils and laboratory solvents , determination of the percentage of glycerin in the unknown by calibration curve.	
	Polarimetry ** Instrument information, Optical rotation of dextrose solution, determination of specific optical rotation of ethambutol,	
	**Applications may also include the compounds to which the techniques are applicable.	
17.	**PHP 1501- Pharmacognosy Laboratory-I (50 marks) 4hr./week**	
	Study of simple and compound microscope, magnification, micrometry, and microscopical drawing using camera lucida, Projection microscope. etc.	
	Studies on morphological features of leaves, roots and rhizomes, stem, flowers, fruits, seeds, barks, woods, etc	
	Studies of plant tissues : palisade, epidermis, cork, parenchyma, collenchyma, sclerenchyma, vascular tissues, secretary organs, spores, etc	
	Studies of stomata (diacytic, paracytic, animocytic , anisocytic, dumb-bell shaped stomata, etc.)	
	Studies of covering and glandular trichomes (minimum of 5 each type).	
	Studies of calcium oxalate crystals (acicular, prism, rosette, sandy, microneedles, crystal sheath, etc.	
	Studies on starches (maize, wheat, rice, potato, etc.).	
	Determination of stomatal number and stomatal index	
	Determination of palisade ratio.	
	Determination of vein-islet and vein termination number	

	Quantitative microscopy using lycopodium spores.	
	Determination of total ash and acid insoluble ash	
	Determination of alcohol and water soluble extractive values	
	Development of thin layer chromatography for two drugs (alkaloids, volatile oils, glycoside, etc	
	Evaluation of volatile oil/fixed oil by R.I	
	Determination of swelling factor (isabgol seed or husk)	
	Determination of moisture content by (Karlfisher method, LOD, etc.)	
18.	**PHP 1701- Seminar (50 marks) 4hr./week**	
	Every student will be assigned a supervisor. The student will select a topic in consultation with the supervisor. The seminar will be submitted in spiral bound form well in advance of presentation. The seminar will be presented by the student as per the schedule put up.	

Detailed Syllabus for Final Year B. Pharm

Semester- VII

Sr. No.	Topics	Hrs
1.	**PHT 1109– Pharmaceutics- IV (100 marks) 4hr./week**	
	Tablet Coating: Need, advantages, types	1
	Sugar coating: Method, advantages, coating formulation, problems	1
	Film coating : Polymers for coating, properties and selection, Coating formulation development, Evaluation of free films, enteric and non enteric film coating	3
	Equipment for sugar and film coating: Coating pan, Modified coating pans, Fluid bed coating, spray systems,	3
	Quality control of coated tablets: Enteric and non enteric	1
	Problems in coating, Introduction to Aqueous coating	1
	Microencapsulation: Introduction, advantages, applications in dosage forms	1
	Methods of microencapsulation: Physical, Physicochemical and chemical, Phase separation coacervation, Mutiorifice centrifugal process, spray drying and congealing, orifice methods, polymerization techniques	3
	Formulation of microcapsules into dosage forms and evaluation of microcapsules and dosage forms.	1
	Stability testing: Accelerated stability testing and shelf life determination using Arrhenius equation, determination of overages, Degradation kinetics	4

	from dosage forms,	
	Routes of degradation((physical, chemical and microbiological)	1
	Factors affecting stability and methods of stabilization, interactions with containers and closures	1
	Introduction to ICH guidelines	1
	Sterile Products: Introduction to sterile dosage forms, parenteral preparations- types, general requirements,	1
	Containers and closures(glass, plastic, rubber) for parenterals, evaluation and selection,	2
	Routes of parenteral administration, Formulation considerations in the development of a small volume parenterals including solutions, suspensions, emulsions, dry powders, water for injection (preparation and testing)	4
	Manufacture of small volume parenterals in ampoules and vials, Freeze drying of small volume parenterals	3
	Sterilization methods and evaluation using biological indicators	1
	Production facilities, layout of production facilities, Air systems, Filters, HEPA filters,Class considerations, Environment control,	2
	Quality control tests of small volume parenterals	2
	Opthalmics: anatomy and physiology of eye, Factors affecting topical ophthalmic delivery	1
	Ophthalmic solutions, suspensions, ointments, gels, advantages and limitations, Formulation considerations, manufacture and packaging, Quality control of ophthalmics, preservative efficacy test	3
	Contact lens solutions and their formulation and evaluation	1
	Blood products and Plasma substitutes: collection and storage of blood, whole human blood, and products obtained from it, methods used for these and packaging employed for them, quality control of blood and its constituents; Plasma substitutes their properties and quality control	1
	Glandular products: Extraction and isolation of insulin from of pancreas, insulin injections;	1
	Sutures and ligatures	1
	• Theory & Practice Of Industrial Pharmacy L. Lachman, Herbert A.Lieberman & J. Kanig 3rd edition, 1987 Lea & Febiger, Philadelphia • Pharmaceutical Dosage Form: Dispersed Systems (Vol.1 &2) Herbert A. Lieberman, Martin A.Rieger,G.S.Banker 2nd edition, 1993 Marcel Dekker Inc. • Modern Pharmaceutics Gilbert S.Banker, C.T. Rhodes 2nd edition, 1990 Marcel Dekker Inc. • Cooper & Gunn's Dispensing For Pharmaceutical Students Revised By S.J.Carter 12th edition, 1987 Cbs Publishers & Distributers • Pharmaceutics: The Science Of Dosage Form Design Michael E.Aulton 2nd edition, 1998 Churchill-Livingstone • Pharmaceutical Production Facilities:Design & Applications Graham	

	C.Cole 1st , edition, 1990 Ellis Horwood	
2.	**PHT 1205– Pharmacology- III (50 marks) 3hr./week**	
	CVS: Drugs used in the treatment of Hypertension Congestive cardiac failure Arrhythmia Hyperlipidemia Angina Pectoris	6
	Diuretics	4
	Pharmacology of bronchial asthma and cough	3
	Immunomodulators: immunostimulants/suppressants	6
	Principle of toxicology: Heavy metal poisoning, Pesticides, Poisoning, opium poisoning	4
	Use of radioisotopes in medicine	3
	Development of new drug: (Importance of preclinical and clinical studies, phases of clinical trial and placebo)	4
	• 1-4. All Books under Pharmacology –II • The Pharmacological Basis of Therapeutics Goodman and Gilman, 11 edition, 2006 McGraw –Hill Medical Publishing	
3	**PHT 1303- Pharmaceutical Analysis-III (100 marks) 4hr./week**	
	Electrochemical methods: Theory, introduction and application of voltametry, coulometry, polarography, amperometry, introduction to pulse polarography, electrogravimetry	4
	Chromatography: Terminologies, development of chromatogram, dynamic of chromatography, classification (absorption, partition, gas, liquid, exclusion, electrochromatography, ion exchange), thin layer chromatography (TLC), high performance thin layer chromatography (HPTLC), gas liquid chromatography (GLC), and high performance liquid chromatography (HPLC), column chromatography, paper chromatography, ion pair chromatography, details of components of instruments (eg. Rheodyne injector, pumps, etc) and accessories (eg, detectors, integrators autosampler, etc.) Introduction to UPCL, Instrumentation, application, advantages and disadvantages.	8
	Introduction, theory, instruments, and applications of ^{1}H NMR;^{13}C NMR; Mass Spectrometry; Near IR	4
	Problem solving based on UV, IR, NMR, MS of simple molecules and drug substances	4
	Hyphanated techniques: LC-MS; GC-MS	4
	Raw material analysis (RMA), Quality control of pharmaceutical excipient	3
	Packaging material testing (PMT): Packaging material testing, permeability of plastic, testing of foil, bottles, carrions, shipment.	4
	Thermal analysis: Theory, introduction and applications of thermogravimetric analysis (TGA), differential thermal analysis, DSC (Differential Scanning Calorimetry), thermogravimetry – instruments available;	5
	Atomic emission and atomic absorption spectrophotometry: Theory, introduction and application;	4
	Statistics and statistical quality control: Statistics in quality control – definition of terms, normal distribution, T-test, F-test, linear regression,	5

	correlation coefficient, statistical validation of analytical procedures – application to analysis; Methods of statistical analysis as applied to sampling and interpretation of results, regression regression lines – sampling procedures; Statistical quality control charts; Case studies to be included.	
	• Pharmaceutical Analysis- Higuchi & Brochmann- Hanssen- 1961 Interscience • Analytical Profiles Of Drug Substances Florey- 1990 Academic Press • Instrumental Methods Of Analysis Willard, Dean, Merrit And Settle- 6th edition, 1986 Wadsworth • Pharmaceutical Drug Analysis Ashutosh Kar. 2001 • Calculation Of Analytical Chemistry Hamilton, Simpson And Ellis- 5th edition, 1954 McGraw Hill	
4.	**PHT 1404- Pharmaceutical & Medicinal Chemistry – IV (50 marks) 3hr./week**	
	Antidiabetic agents: a) Insulin b) Sulfonylureas c) PPAR-agonists and Misc.	 1 2 1
	Steroids: a) Nomenclature and 3-D structure of steroids. b) Biosynthesis and metabolism of steroids. c) Corticosteroids – Glucocorticoids - systemic topical and inhaled, Mineralocorticoids. d) Male sex steroids and other related agents – Androgens and anabolic steroids, Antiandrogens, androgen biosynthesis inhibitors, Drugs for erectile dysfunction. e) Estrogens- steroidal and non-steroidal, antiestrogens, SERMs. Aromatase inhibitors. Progestins & its inhibitors.	 1 1 3 2 2 1
	Thyroid Agents: a) Thyroid hormone and analogs. b) Antithyroid agents	1
	Introduction to eiconosides	1
	Drugs for calcium homeostasis.	1
	Vitamins and their involvement in metabolism : a) Water soluble vitamins b) Lipid soluble vitamins	2
	Introduction to pharmaceutical biotechnology:	1
	Peptide and protein drugs	2
	Introduction to antisense agents	1
	Introduction to drug discovery: a) Drug discovery from natural products. b) Molecular modeling and drug design-ligand and structure based. c) Enzymes and receptors in drug design. Analog design and prodrugs	 1 2 2 1

	Emerging areas in medicinal chemistry. e.g. drugs based on PDEs and other topics of current interest.	1
5.	**PHT 1502– Pharmacognosy-II (50 marks) 3hr./week**	
	Carbohydrates – Agar, Alginic acid, Acacia, Aloe vera gel, Bael, Chitin, Dextrans, Guar gum, Honey, Inulin, Irish moss, Ispaghula, Pectins, Starches, TKP, Tragacanth**.** Biosynthesis of carbohydrates in brief	4
	Acids - Citrus, Tamarind pulp, **Garcinia, Amla**	1
	Fatty acids and their esters - Almond oil, Arachis, **Castor,** Chaulmoogra oil, Coconut oil, Cotton seed oil, Croton, **Linseed,** Jajoba, Olive oil, **Mustard oil,** Neem, Sesame, Wheatgerm oil, **Fish liver oil,** Cocoa butter, Kokum butter, **Woolfat, Beeswax,** Carnauba wax, lecithin, Spermaceti. Biosynthesis of fatty acids and triglycerides.	4
	Protein sand enzymes - Protein hydrolysate, Gelatin,; Pepsin, Renin, Trypsin, Chymotrypsin, Thrombin, Papain, Ficin, Bromelain, Pancreatin, Hyaluronidase	2
	Peptide toxins : Abrin, Botulinum toxin, Ricin, Bee venom, Snake venom, Scorpion venom	1
	Alkaloids: Derived from Ornithine: Belladonna*, Coca, Datura, Hyoscyamus, Stramonium **Derived from Lysine :Black pepper*, Lobelia** **Derived from Nicotinic acid: Areca, Tobacco** **Derived from Phenylalanine: Ephedra** **Derived from tyrosine and tyramine : Colchicum*, Opium*, Ipecac** **Derived from tryptophan: Cathatharanthus, Cinchona*, Ergot*, Nuxvomica, Rauwolfia** **Derived from anthranilic acid : Vasaka** **Derived from histidine : Pilocarpus** **Purine alkaloids : Cocoa , Coffee, Cola, Tea** **Terpenoid alkaloid : Aconite** **Steroidal alkaloid : Kurchi, Solanum**	18
	Study of fibers (animal, vegetable, mineral, & synthetic) : Cotton, Jute, Flax, Viscose, Cellulosics, Silk, Wool, Asbestos, Glasswool, Nylon, Terylene, Polythene	3
	• Books Recommended ; Will be recommended by the teacher	
6.	**PHT 1601– Pharmaceutical Biotechnology (50 marks) 3hr./week**	
	Medical biotechnology : red biotechnology	10
	Pharmaceutical biotechnology and its role in producing therapeutics and diagnostics and in health care	
	Therapeutic proteins, Nucleic acids (Antisense RNA technique).Animal and plant cell culture: typical media used, typical methods for setting up primary culture, cell strains vs cell lines. Use of plant/animal cell culture for production of pharmaceuticals. Recombinant DNA technology for plant cell culture via use of Agrobacterium species.	

	Genomics in Clinical Diagnostics:	4
	Restriction fragment length polymorphism (RFLP) , Gel electrophoresis techniques (PAGE, SDS-PAGE and agarose gel electrophoresis), immunoblotting, Southern blotting, Northern blotting, Western blotting, PCR and RT PCR, Sanger dideoxy method of sequencing	
	Therapeutic and DiagnosticImmunological techniques	15
	Introduction : Immunity, methods of immunization, principles of serology, antigen antibody reactions, generation of immune response, polyvalent antibodies, hypersensitivity responses. Preparation and characterization of immune sera, and allergenic extracts.	
	Monovalent antibodies or monoclonal antibodies, hybridoma technology, humanization of monoclonal antibodies, application of monoclonals in therapeutics and diagnostics RIA and ELISA diagnostic methods	
	Vaccines: Preparation and standardization of vaccines. Discussion of different types of vaccines, different approaches for vaccine preparation and their quality control parameters	
	Phrmacogenomics	1
7.	**PHP 1109– Pharmaceutics IV and Biopharmaceutics Lab. (50 marks) 4hr./week**	
	At least one representative example of each formulation type included in theory of Pharmaceutics III. (Preparation and evaluation, WITH STRESS ON OFFICIAL FORMULATIONS)	
	Dissolution testing of conventional marketed formulations representing-soluble drug, poorly soluble drug (selection of medium) ; Dissolution testing of sustained released marketed formulation; Bioavailability of an oral formulation in rabbits (demonstration) and calculation of pharmacokinetic parameters. Problem solving sessions with $t_{max,}$ $C_{max,}$ AUC, and other pharmacokinetic parameters.	
8.	**PHP 1303– Pharmaceutical Analysis Laboratory-III (50 marks) 4hr./week**	
	Raw material analysis (RMA), Quality control of pharmaceutical excipient	
	Packaging material testing (PMT): Packaging material testing, permeability of plastic, testing of foil, bottles, carrions, shipment.	
	Thermal analysis: Theory, introduction and applications of thermogravimetric analysis (TGA), differential thermal analysis, DSC (Differential Scanning Calorimetry), thermogravimetry – instruments available;	
	Atomic emission and atomic absorption spectrophotometry: Theory, introduction and application;	
	Statistics and statistical quality control: Statistics in quality control – definition of terms, normal distribution, T-test, F-test, linear regression, correlation coefficient, statistical validation of analytical procedures – application to analysis; Methods of statistical analysis as applied to sampling	

	and interpretation of results, regression regression lines – sampling procedures; Statistical quality control charts; Case studies to be included.	
9.	**PHP 1502– Pharmacognosy Laboratory-II (50 marks) 4hr./week**	
	Detailed histological studies including powder characters of barks: Cinchona and Kurchi	
	Detailed histological studies including powder characters of leaves : datura leaf, vasaka leaf, vinca leaf	
	Detailed histological studies including powder characters of roots : ipecac root, rauwolfia root	
	Detailed histological studies including powder characters of seeds : linseed, nux vomica seed	
	Detailed histological studies including powder characters of ephedra stem	
	Gross identification of drugs containing fixed oils, fats and waxes (10 drugs). Identification of fixed oils by chemical tests.	
	Gross identification of drugs containing carbohydrates (10 drugs). Identification of drugs by chemical tests	
	Gross identification of Alkaloidal drugs (20 drugs).	
	Identification of fibers by chemical tests and microscopy (animal, vegetable, mineral and synthetic fibers)	
	Separation of starch from potato tubers	
	Isolation of mucilage by alcohol precipitation (aloe juice)	
	Preparation of extract by Soxhlet extractor and evaluation of extract by for phytoconstituent by spectrophotometry. (e.g. quinine, strychnine, brucine).	
	Extraction and isolation of piperine from blackpepper	
	• Books recommended; Will be recommended by the teacher	
10.	**PHP 1702 – In plant training report and presentation and Community service (50 marks) 4hr./week**	
	In-Plant Training Evaluation:	
	At the end of Semester – VI students will have to spend 4 weeks in a Pharmaceutical/API manufacturing plant. They will be required to submit a written report on their In-plant training. The report should consist of (i) Major products of the company, (ii) General plant layout, (iv)Equipments for various products with diagrams or pictures (v) Chemistry of processes (in case of API) (no confidential proprietary information may be included), of chemical manufacture) based on Journal papers, Patents, Books, etc (vii) Environmental Control methods with supporting figures or pictures (viii) Standards of compliance (ISO 9000, ISO 14000, OHSAS 18000, USFDA other regulatory agencies, etc) etc.), (xi) comments of the student in terms of GMP compliance and methods to improve if required, Any project assigned to you by the company (title, a short description, results and conclusions: all in less than 500 words) Students will present their work before a panel of teachers in the Institute. The report would carry 50% weightage and the presentation would	

	carry 50% weightage	
	Community Service:	
	Introductory lectures / Project identification / including preliminary and finalization visits**.** This will involve faculty lecture, debate, interaction with students, group / individual projects. (A) Community Teaching and Field work: 2 weeks: Municipal and under-privileged aided schools in the areas of Basic Sciences, and health related aspects; demonstrations to increase science awareness through actual experiments, audiovisuals etc. (B) Submission of report: Students will present their experience before a panel of teachers in the Institute. The report would carry 50% weightage and the presentation would carry 50% weightage	

Semester VIII

Sr. No.	**Topics**	Hrs
1.	**PHT 1110– Pharmaceutics- V (100 marks) 4hr./week**	
	Oral Sustained and Controlled release formulations: Terminologies, Basic Principles & mechanisms of sustained drug release, materials and methods, large- scale manufacture, evaluation and quality control, packaging	3
	Novel Oral DDS: Gastro retentive DDS, Osmotic DDS, Pulsatile DDS , Colonic DDS	10
	Introduction to principles and concepts of transdermal, transmucosal, ocular and targeted delivery	5
	CGMP. and quality assurance	2
	Documentation:	2
	Qualification and Validation; : Types of validation, Product and process validation	4
	Schedule M: Factory Layout, Focus on department layouts, services, etc.	3
	Pilot plant scale up technique – groups responsibilities, facilities, example of scaling up of liquid/solid oral formulations; biobatch preparation	3
	Production Management; Total quality management, materials, inventories, ABC concept, EOQ, Cost controls	3
	IPR: Introduction to Indian Patent law:, Gatt, WTO. TRIPS; Types of patents, Introduction to patents, parts of a patent	3
	NDA and ANDA filing: CDER guidelines	2
	ICH Guidelines	2
	Packaging: Primary packaging materials including glass, plastics, rubber, materials for strip and blister packaging, specifications, testing, selection, compatibility evaluation, advantages and limitations ; secondary and tertiary packaging materials.	3

	• Theory & Practice Of Industrial Pharmacy L. Lachman, Herbert A.Lieberman & J. Kanig 3rd edition, 1987 Lea & Febiger, Philadelphia • Pharmaceutical Dosage Form: Dispersed Systems (Vol.1 &2) Herbert A. Lieberman, Martin A.Rieger,G.S.Banker 2nd edition, 1993 Marcel Dekker Inc. • Modern Pharmaceutics Gilbert S.Banker, C.T. Rhodes 2ndEdition, 1990 Marcel Dekker Inc. • Cooper & Gunn's Dispensing For Pharmaceutical Students Revised By S.J.Carter 12th edition, 1987 Cbs Publishers & Distributers • Pharmaceutics: The Science Of Dosage Form Design Michael E.Aulton 2nd edition, 1998 Churchill-Livingstone • Pharmaceutical Dosage Forms:Tablets (Vol 1-3) Herbert A.Lieberman,Leon Lachman & Joseph B.Schwartz 2nd edition, 1989 Marcel Dekker Inc.,New York • Remington-The Science And Practice Of Pharmacy(Vol.1 & 2) David B.Troy 21st edition,2006 Lippincott Williams & Wilkins • Pharmaceutics:The Science Of Dosage Form Design Michael E.Aulton 1st edition, 1988 Churchill- Livingstone • Pharmaceutical Production Facilities:Design & Applications Graham C.Cole 1st edition, 1990 Ellis Horwood	
2.	**PHT 1111– Forensic Pharmacy (50 marks) 3hr./week**	
	Status of profession of pharmacy in pre and post independence era; reports of Chopra inquiry committee; Health and berker committee and action thereon;	2
	Historical perspectives; an objective study of the following with amendments: Drugs and cosmetic act 1940/ rules 1945-events, commencement-important definitions – drugs technical advisory board and central drug laboratory- their compositions and functions;	8
	Ayurvedic and allopathic drugs, prohibitions – ayurvedic Homeopathic and allopathic medicines in respect of import and export, indigeneous manufacture, sales of distribution;	3
	Drugs consultative committee, its compositions and functions; Inspectors – their powers and duites; Sampling procedures; Inspection enquiry: Investigation and prosecution:	2
	Standards (allopathic drugs/Cosmetics/Ayurvedic drugs); Imported drugs, cosmetics, and indigenously manufactured drugs, and analyst; Licensing authorities and controlling authorities- qualifications, functions and powers; Licenses for different systems of medicines;	2
	Drugs and magic remedies Act 1954- definitions, official's duties prohibitions, penalties; Narcotic Drugs and Psychotropic substances Act 1985- Historical backgrounds of Opium Act and Dangerous Drugs Act, prohibitions and penalties; Preservation of food Adulteration Act 1954 and rules 1955;	4
	Important definitions , central board of food standards central food laboratoty-	1

	compostions and functions; Public analyst –qualifications ,duties; Food inspectors-qualification, powers duties sampling procedures;	
	Drug price control order 1987-historical background –Essential Commodities Act – relevant provisions, Drug prices display Rule 1961-and other relevant orders – applicability to imported drugs and indigenously manufactured drugs, definitions, prices to wholesaler and retailer, MAP-penal provisions;	2
	Pharmacy Act 1948; Poisons Act 1919 and Maharashtra Poisons Rules 1972 and amendment 1976; Medicinal and Toilet preparations (Excise duties) Act 1955; Pharmaceutical committees with details of Chopra, Hathi and Berker committees; Bombay shop and Establishment Act; Insecticides Act 1968 and Rules thereunder- Licensing system; Factories Act – Licensing system-precautions, suggestion under act; Criminal procedure code and Indian penal code- provisions pertaining to different courts, Jurisdiction and power, Punishments available, Types of trials e.g. summary trials; Other procedures-warrants, summons; Provisions governing entry, arrest, search, seizere; Types of offences- bailable, nonbailabel, cognisable and noncognisable;	4
	Consumers protection Act with reference to provisions applicable to drug manufacture and sale;	1
	Patents and laws relating to Intellectual Property Rights.	1
3.	**PHT 1206- Clinical Pharmacy and Drug Interactions (50 marks) 3hr./week**	
	Introduction: History and Scope of Clinical Pharmacy	4
	Concept of Clinical Pharmacy	4
	Role of Clinical Pharmacy in Patient care	4
	Patient Counselling and Communication Skills	4
	Adverse drug reactions	4
	Drug Problems in geriatrics and pediatrics	4
	Drug Interactions: Review of theoretical basis of possible interactions with examples of interactions of clinical significance	6
	• The Science And Practice Of Pharmacy Remington 2005 Lippincott Williams &Wilkins • Clinical Pharmacy And Therapeutics Roger Walker And Clive Edwards. 2nd edition,1999 • Churchill Livingstone, Edinburgh • Drug Interactions: Clinical Significance Of Drug Interactions Hansten P.D., 5th edition,1985 Lea And Febiger, Philadelphia • Elements Of Clinical Pharmacy Dr R.K.Goyal, Dr P.A.Bhatt, Dr M.D.Burande, 2nd edition, 2004-2005 B.S.Shah Prakashan, Ahmedabad • A Handbook Of Clinical Pharmacy A.V.Yadav, B.V.Yadav, T.I.Shaikh 2nd edition, 2004 Nirali Prakashan, Pune	
4.	**PHT 1405- Pharmaceutical & Medicinal Chemistry–V (50**	

	marks) 3hr./week	
	Study of the following classes of drugs with respect to their classification, chemical nomenclature, structure including stereochemistry, generic names, chemistry, physicochemical properties, SAR, metabolism, molecular mechanism of action and synthesis and introduction to rational development, if any.	
	Drugs Affecting the Central Nervous System- a) General introduction to biogenic amines and other biomolecules involved in neurotransmission. b) General anaesthetics: Inhaled general anesthetics and Intravenous general anesthetics. c) Sedatives and hypnotics: Benzpdiazepines, Non-benzodiazepine, Barbiturates, Misc. d) Antiseizure drugs or anticonvulsant agents: Clinical drugs and newer agents e) Antidepressants: Selective norepinephrine reuptake inhibitors (SNRIs),Selective 5-HT reuptake inhiitors (SSRIs), Nonselective reuptake inhibitors (NSRIs), Dopamine and norepinephrine reuptake inhibitors (DNRIs), Serotonin antagonist/reuptake inhibitors (SARIs), nonadrenergic specific serotonergic antidepressants (NaSSAs), monoamine oxidase inhibitors (MAOIs), Mood stabilizers. f) Antipsychotics: phenothiazes, thioxanthines, benzamide, benzapines, benzisoxazole and benzisothiazoles, misc. agents. g) Anxiolytics: Benzodiazapines, Misc agents. h) Hallucinogens, Stimulants and related drugs of abuse or analeptics, xanthines, psychedelics: Non classical Hallucinogens-cannabinoids, classical hallucinogens- Indolealkylamines, phenylalkylamines, Central stimulants-amphetamine related agents, cocaine related agents. i) Drugs used to treat neuromuscular disorder: Antiparkinsonian and spasmolytic agents. j) Drugs affecting serotonergic neurotransmission- drugs for migrane, Irritable Bowel Syndrome, Anitemetic agents.	2 1 3 2 3 2 2 2 1 2
	Cholinergic Drugs or Drugs affecting cholinergic nerutransmission: a) General aspects of cholinergic receptor and acetylcholine b) Acetyl choline mimetics- muscarainic agonist or cholinergic agonists. c) Anticholineesterases d) Drugs for the treatment of Alzheimer's. e) Acetylcholine antagonists muscrinic antagonists. f) Neuromuscular blocking agents.	 1 1 1 1 1 1
	Analgesics: a) Opoid or narcotic analgesics: μ-agonists, other analgesics, mixed agonist/antagonist analgesics, μ-antagonists.	4

	b) Antidiarrheal agents c) Cough suprresants, anti-tussives narcotic and others.	
	• Books Recommended: Same as recommended under Pharmaceutical and Medicinal Chemistry-IV	
5.	**PHT 1503– Pharmacognosy-III (50 marks) 3hr./week**	
	Phenyl propanoids; Peru and Tolu Balsams, **Asafoetida,** Vanilla, Salicin, **Capsicum*, Ginger, Benzoin, Clove, Nutmeg, Cinnamon*, Turmeric**	3
	Coumarins : Psoralea, Tonco	1
	Lignans and lignins : Podophyllum, Phyllanthus,	1
	Flavonoids: Fagopyrum, Orange peel, Soya isoflavone	1
	Terpenoids: Ajowan*, Alpinia, Abelmoschus, Anise,. Amomum, Calamus, **Cardamom,** Caraway, **Citrus oils*, Coriander**, Cummin, Dill, Eucalyptus oil, **Fennel***, Jatamansi, Lemongrass, **Mints*** Palmarosa, Rose, Sandalwood, Saussurea, Star anise,, **Turpentine*,** Wintergreen, Vetiver, **,** Valerian, Jasmine, Artemisia, **Pyrethrum**, **Colophony*,** Matricaria; Taxus, **Myrrh, Shellac, Quassia,** Picrorhiza, Andrographis	9
	Triterpenes : Acacia concinna, **Bacopa,** Colocynth, Gymnema, **Hydrocotyl, Licorice*,** Momordica, Quillaia, Senega, Sapiandus	2
	Cardioactive glycoside : Digitalis*, Nerium, **Strophanthus, Squill,** Thevetia	2
	Steroidal saponin: Agave, **Asparagus, Dioscorea*, Fenugreek ,Guggul,** Smilax	2
	Carotenoids: **Saffron,** Bixa, **-carotene**	1
	Naphthelene derivatives: Plumbago, Alkanna, **Henna**	1
	Anthraquinone: **Aloes,** Andira, **Cascara,** Cochineal, Hypericum, **Rhubarb,** Rubia, **Senna**	2
	Tannins: **Black catechu, Galls*,** Hammamalis, Kinos, **Myrobalans, Pale catechu.**	2
	Polyacetytenes:	
	Cyanophoric glycosides: Almonds, **Wild cherry**	
	Isothiocyanate glycosides: Mustard	
	Sulphur containing compounds: Garlic	1
	Plant Allergens	1
	Aflatoxin, Marine drugs, Poisonous plants	1
	Drugs which are in **bold** are representatives of the class, meant for detailed study. **with * mark are meant for biosynthesis study of major constituent.**	
	• Books recommended; Will be recommended by the teacher	
6.	**PHP 1110- Pharmaceutics Laboratory-V (50 marks) 4hr./week**	
	Accelerated stability testing of at least two pharmaceutical formulations.	
	Oral sustained release matrix tablets – formulation and evaluation	
	Oral multiparticulate sustained release formulation - formulation and evaluation	
	Floating DDS, Pulsatile DDS, Osmotic DDS	

	Demonstration of scaleup of a liquid/solid formulation	
	Documentation of certain standard records related to manufacture and quality control	
	• Books recommended; Will be recommended by the teacher	
7.	**PHP 1402- Pharmaceutical & Medicinal Chemistry Laboratory – II (50 marks) 4hr./week**	
	Experimental determination of pKa and comparison with software generated data	
	Experimental determination of log P values and comparison with software generated data	
	Experimental determination of simple in-vitro activity of analogs	
	Structure property relationship from data of experiments 1,2 and 3	
	Demonstration of pharmacophore development and QSAR	
	Demonstration of structure based drug design	
	Multistep drug synthesis a) acetanilide to sulphanilamide. b) p-nitro toluene to benzocaine	
	Synthesis of analogs e.g. series of esters from suitable carboxylic acids	
	• Books recommended; Will be recommended by the teacher	
8.	**PHP 1503- Pharmacognosy Laboratory-III (50 marks) 4hr./week**	
	Detailed histological studies including powder characters of rhizomes: Ginger and Glycyrrhiza	
	Detailed histological studies including powder characters of fruits : Coriander and Fennel	
	Detailed histological studies including powder characters of leaves : Senna and Digitalis	
	Detailed histological studies including powder characters of Cinnamon bark and Quassia wood	
	Detailed histological studies including powder characters of Clove and Cardamom	
	Gross identification of drugs containing volatile oils (20 drugs)	
	Gross identification of drugs containing steroids and triterpenoiods (10 drugs)	
	Gross identification of anthraquinones, tannins, lignan and coumarin, etc. containing drugs (10 drugs)	
	Evaluation of unorganised drugs mentioned under theory by chemical tests	
	Separation of volatile oil from crude drug (e.g. clove, eucalyptus, etc)	
	Isolation of calcium Sennoside from senna leaves	
	Demonstration of column chromatography and preparative TLC.	
	Preparation of herbarium sheet	
	Visit to medicinal plant garden	
	• Books recommended; Will be recommended by the teacher	
9.	**PHP 1703- Project (100marks) 6hr./week**	
	Project supervisor will be assigned to each student and student will work on a	

	project assigned and a report will be submitted in a bound form. The project will be evaluated by the examiners and hold viva. Marks will be awarded on the basis of project and viva.	