SYLLABUS COPY FOR SECOND YEAR B. PHARM

SEMESTER III

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY – III 3Hrs/ week

S. No.	Topics	Hours
1.	**Nervous System** Anatomy and physiology of : - Central Nervous System (CNS) - Peripheral Nervous System (PNS) - Autonomic Nervous System (ANS) - Properties of Neurons, Neurotransmitter and neurotransmission - Cranial and spinal nerves - Sensory and Motor pathways	9
2.	**Definition and Etiology of following diseases in detail** - Epilepsy - Parkinsonism - Alzheimer's Disease - Cerebral Hypoxia - Stroke (Cerebrovascular disease) - Anxiety & Depression - Mania and Schizophrenia	7
3.	**Structure and Function of following sensory organs** - Eye - Ear - Tongue - Nose - Skin	6
4.	**Digestive System** - Parts of digestive system. Their structure and functions - Digestion and absorption of carbohydrates, proteins and fats - Phases of gastric secretion	8
5.	**Definition and Etiology of following diseases in detail** - Peptic ulceration - Zollinger – Ellison's Syndrome - Inflammatory Bowel Disease (Ulcerative colitis, Crohn's disease) - Cholecystitis & Cholelithiasis - Jaundice - Hepatitis - Pancreatitis - Achalasia - Reflux esophagitis	6

Reference Books:

1. Ross & Wilson Anatomy & Physiology in health & Illness. 10th Edition. Anne Waugh, Allison Grant, Churchill Livingstone Elsevier, 2006
2. Tortora & Grabowaski Principles of Anatomy & Physiology. 11th Edition, J Wiley & Sons. 2007
3. Guyton & Hall Textbook of Medical Physiology, 10th Edition. Harcourt Singapore. 2001
4. B. R. Mackenna & R. Callander Illustrated Physiology. 6th Edition. NY Churchill Livingstone. 1997
5. Kplan, Jack, Opheim, Toivola Lyon, Clinical Chemistry: Interpretation & Techniques, 4th Edition, Williams & Williams, London 1995.
6. Praful B. Godkar, Darshan P. Godkar Textbook of Medical Laboratory Technology, 2nd Edition Bhalani Mumbai. 2006
7. P.C. Dandiya & P. K. Sharma Bio-Chemistry & Clinical Pathology (Theory & Practical).
8. Russel J. Greene & Norman D. Harris Pathology & Therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice, 2nd Edition, Pharmpress NY. 2000
9. Ranade & Joshi Manual of Practical Physiology, Pune Vidyarthi Gruha Prakashan.
10. Eric Herfindal, Dick Gourley. Text Book of Therapeutics: Drug and Diseases Management, 7th Edition, Lippincott Williams & Wilkins, A Wolters Kluvers Company.
11. Cotran, Kumar and Colins, Robins-Pathologic Basis of diseases, 6th Edition, WB Sauders Company.
12. The Merck Manual of Medical Information, Home Edition. Merck Research Laboratories, Division of Merek & Co Inc. White House Station. N. J. 1997.

ORGANIC CHEMISTRY – III 3 hrs/ week

S. No.	Topic	Hours
1.	**Stereochemistry** Optical isomerism; representation of molecules by Fisher, Newman and Sawhorse projection formulae R, S and D, L notations, diastereomers and resolution of racemic mixtures. Geometrical isomerism E and Z nomenclature. Conformers of ethane, n-butane and cyclohexanes (mono and disubstituted cyclohexanes to be discussed). aspects of stability and optical activity.	16
2.	**Name reactions** Aldol condensation, Nitroaldol Claisen Condensation Michael addition, Dieckmann's cyclisation, Stobbe, Reformatsky, Knoevenagel, Perkin, Cannizaro, Beckmann, Lossen, Curtius, Bayer-Villeger, Favorskii, Hoffman, Wolff, Schmidt, Wittig, Benzilic acid rearrangement, Sommolet, Stevens, Pinacol. Problems based on the transformations to be solved	20

Reference Books:

1. Stereochemistry of Carbon Compounds. E. L. Eliel. Tata McGraw-Hill Publishing Co. Ltd. 1986.
2. Stereochemistry, Conformation and Mechanisms. P. S Kalsi. 4th Ed., New Age International Publishers 2001.
3. Strategic Applications of Named reactions in Organic Synthesis. L. Kurti and B. Czako, Elsevier Science & Technology Books. March 2005.
4. Organic Chemistry, S. H. Pine. 5th Ed., Tata McGraw Hill Publishing Co. Ltd., 2007.
5. Principles of Organic Synthesis. R. O. Norman. 2nd Ed., Chapman and Hall. 1978.
6. Organic Chemistry, John McMurry, 5th Ed. Brooks/ Cole, Thomson Learning, 1999.
7. Organic Chemistry, Francis Carey, 5th Ed., McGraw Hill.

PHARMACEUTICAL ANALYSIS II 3hrs/ week

S. No.	Topic	Hours
1.	**Types of errors** Concepts of errors: Mean, median, standard deviation, relative standard deviation, Absolute and relative errors, precision, accuracy, significant figures. Determinate and indeterminate errors and the ways to minimize them. Variables in analytical chemistry and scope of pharmaceutical analysis.	3
2.	**Solvent extraction** Principle, factors affecting liquid-liquid extraction (Solvent method of extraction stripping and pH effect, salting out effect. etc). Soxhlet extractions, Multiple extractions, applications (alkaloids, sodium benzoate, pilocarpine nitrate, any one nasal drops)	6
3.	**Refractometry** Snell's Law, Definitions of specific and molar refraction, factors affecting measurement of refractive index (pressure, wavelength, temperature), Principle (Grazing angle of incidence, Critical angle of refraction). different types of refractometers (Abbes, pulfrich, Dipping type) with construction and working of Abbes refractometer in detail. Applications.	4
4.	**Polarimetry** Introduction to electromagnetic properties of lightwaves. monochromatic radiation, production of linearly polarized light, definitions – circular birefringence, left and right circularly polarized light, optical rotatory dispersion, molecular ellipticity, circular dichroism, Instrumentation: Light source, polarizer, sample cell, analyser, Anisotropic crystals, Nicol's prism, Determination of optical activity (Half shade effect), Applications.	6
5.	**Principales of Gravimetric Analysis** Theory: Mass as measurement signal and precipitation equilibria, Unit	6

	operations in gravimetric analysis, Organic and Inorganic precipitants factors affecting gravimetric analysis, Calculations-Gravimetric factor Applications: Assay of Nickel by dimethylglyoxime and assay of aluminum by oxine reagent of Ba^{+2} $BaSO_4$	
6.	**Miscellaneous-** **Oxygen flask combustion method-** (I.P. apparatus, analysis of organically bound halogens, sulphur and phosphorus, assay of di-iodohydroxy quinoline) **Aquametry-** Different types of water present in a sample, analysis of water by Karl Fischer titrations – preparation of KFR reagent as per I.P. standardization of KPR as per I.P. Stability of KFR, application for Ampicillin trihydrate) **Kjeldahl's method-** (Apparatus, methods of digestion of sample application-anyone from I.P.).	3 4 3

Reference Books:

1. Vogel textbook of Practical Organic Chemistry- 4th edition, 1984, Elbs & Longmans, London.
2. Beckett & Stenlake-Practical Pharmaceutical Chemistry, 4th edition, 1988. CBS Publishers & Distributors, India.
3. Gary Christian-Analytical Chemistry, 4th edition, 1986, John Wiley & Sons. New York.
4. Takeau Higuchi and Finar Brochmann Hanssen-Pharmaceutical Analysis, 1st edition, 1997, CBS Publishers & Distributors.
5. MEITES H.B. of Analytical Chemistry, 1st edition, 1963, Mc Graw Hill Book Company, New York
6. Grant, Eugene, L. Leavenworth, Richard S. Statistical Quality Control, 4th edition, 1972, Mc Graw Hill Kogakasha Limit, Tokyo.
7. I.P., U.S., P., B.P., European Pharmacopoeia.

BIOCHEMISTRY I — 3 hrs/ week

S. No.	Topic	Hours
1.	**Carbohydrates** Definition, biological roles, aldoses and ketoses, trioses to hexoses, D-L notation, Fischer and Haworth projection formulae (glucose as example), Monosaccharides ranging from trioses to hexoses (Fisher projection, names and abbreviations of common sugars), Reactions of carbohydrates – optical properties, oxidation, reduction, hemiacetal/ hemiketal formation, acetate/ ketal formation, glycosides, acid catalyzed rearrangement, base catalyzed rearrangement, hydrazone formation, mutarotation, anomeric carbon. Disaccharides and polysaccharides – introduction to structures of simple compounds and their biological role (sucrose, maltose, lactose, cellulose, starch, amylose). Unusual sugars like glucose amine, muramic acid etc.	10

2.	**Proteins** Definition, biological roles, amino acids – types, structures, names, three letter abbreviations, one letter codes, unusual amino acids. Reactions of amino acids, acid base behavior, isoelectric pH, optical activity, N-acylation, ninhydrin reaction, reaction with flurodinitro benzene. Dansyl chloride reaction. Edman reaction, Schiff base formation, esterification, side chain reactions, Peptides and proteins, peptide bond and its special properties, introduction to primary, secondary, tertiary and quaternary protein structure and their features in brief.	10
3.	**Nucleic acids** Definition of DNA and RNA, nitrogenous bases, nucleosides, nucleotides, structure of DNA, shorthand notation of DNA polymers, melting and annealing of DNA, brief introduction to semiconservative replication and information flow via mRNA to proteins. Types of RNA-mRNA, tRNA and rRNA – their structure and their biological role.	6
4.	**Lipids** Definition, biological roles, fatty acids – saturated, unsaturated, shorthand notation, common fatty acids, Properties of fatty acids – physical properties, formation of esters, triacylglycerols, fats vs oils, acid value, iodine value, ester value, rancidity, hydrolysis of fats, hydrogenation of oils, compound lipids – phospholipids, sphingolipids, glycolipids, Structure and biological roles of some common compound lipids. Introduction to terpenoids – fat soluble vitamins and cholesterol.	6
5.	**Vitamins** Detailed description of the mechanisms involved in the biochemical roles of vitamins A, D, E, K, B1, B2, Niacinamide, B6, biotin, folic acid, ascorbic acid, lipoic acid, inositol and pantothenic acid, Biological role of B12 (without structure).	4

Reference Books:

1. Lehninger, Principles of Biochemistry, 4th Ed., Eds. Nelson D. L. and Cox M.M. Replika Press Pvt. Ltd., India, 2007.
2. Biochemistry, Stryer L., 3rd Ed., W.H. Freeman & Co. 1988.
3. Harper's Biochemistry, 25th Ed., Eds. Murray R.K., Granner D.K., Mayes P.A. and Rodwell V.W. Appleton and Lange, USA, 2000.
4. Outlines of Biochemistry, 5th Ed., Eds. Conn. E. Stumpf P.K., Bruening G and Doi Roy H., John Wiley & Sons, USA, 1987.
5. Textbook of Biochemistry with Clinical Correlations, 5th Ed., Ed. Devilin T.M., Wiley Liss, USA, 2002.

PHARMACEUTICS – III 3 hrs/ week

S. No.	Topic	Hours

1.	Biphasic Dispersed Systems: Physicochemical principles thermodynamic, instability of dispersed systems • Suspensions – definition, advantage & disadvantage, desirable features, Theoretical (Preformulation) aspects wetting phenomena, particle – particle reactions, DLVO theory, flocculated and deflocculated systems, Schulze Hardy Rule, Sedimentation in suspensions, Crystal Factors, Rheology. Preparation of suspension – Precipitation methods and Dispersion method, Formulation Additives, Large Scale manufacture with equipments Q.C. tests including stress testing, layout, Example formulations – official preparations. • Emulsions – Definition, advantage and Disadvantage, Theoretical aspects – interfacial tension, need for emulsion. Theories of emulsification. Droplet stabilization, Mechanism of emulsifier's, selection of emulsifiers – HLB, Davis method, PIT method, cloud point determination, classification of emulsifiers with examples, other additives. Rheology aspects, Manufacturing – large scale with equipments, Packaging, stability of emulsion, Q.C. tests & stress tests, layout Examples – Official preparations.	12 8
2.	**Semisolids** • Introduction • Introduction to anatomy of Skin. • Function of Skin • Percutaneous absorption and Penetration. • Factors influencing. • Methods used to evaluate percutaneous absorption. • Permeation enhancers. • Ointments, Ointment Bases, Pastes, Gels, Poultice. • Selection of bases – Large scale manufacturing and processing with equipments. • Q.C. testing, Examples of Preparation.	10
3.	**Suppositories** • Definition, advantage & disadvantage, desirable features • Anatomy of Rectum in brief & rectal absorption • Suppository bases – Features desired, Classification and selection, Special Bases. • Manufacturing and Packaging, Q,C, tests • Example – formulations	6

Reference Books:

1. Lachman Leon, Lieberman Herbert A. Kanig Joseph L., "The Theory and Practice of Industrial Pharmacy", 3rd Edition 1987, Varghese Publishing House, Mumbai.
2. Lieberman Herbert A., Rieger, "Pharmaceutical Dosage Forms – Dispersed Systems". Volume 1/ 2/ 3, 2nd Edition, 2005, Marcel Dekker Inc. New York.

3. Remington, The Science and practice of Pharmacy, 21st ed., Volume I & II B. L. Publications Pvt. Ltd., 2005.
4. Martin A. Physical Pharmacy, 4th Ed., Lea & Febiger, Philadelphia, London, 2006.
5. M.E. Aulton, Ed. Pharmaceutics – The Science of Dosage Form Design, Churchill Livingstone Medical Division of Longman Group, U.K. Ltd., 2002.

PHARMACEUTICAL ENGINEERING - II

- Only principles and equipments to be covered.
- No mathematical derivations and numerical problems

S. No.	Topic	Hours
1.	**Fluidization** • Theory of fluidization	2
2.	**Extraction:** Solid-Liquid & Liquid-Liquid Extraction • Mechanism and method of extraction process and factors affecting extraction process. • Equipments employed in solid-liquid extraction-Soxhlet extractor, Open tank, Agitated tank, Vortical or Turbo extractor, extraction battery and Robert diffusion battery, Rotocel extractor, Bollman extractor, Bonotto extractor, Screw extractor and Hilderbrandt extractor. • Equipments employed for Liquid-Liquid extraction-Mixer settler, Spray columns, Packed Columns, Agitated columns, Podbielniak extractor.	6
3.	**Distillation:** • Vapor-Liquid equilibrium • Distillation methods Equilibrium distillation Simple Distillation Fractional distillation – Theory of batch fractionation, Columns (only construction and working)-Plate columns-bubble cap, sieve plate column, Packed columns, Concept of plate efficiency and HETP (no detailed theories and derivations) Distillation under reduced pressure – Theory of molecular distillation and equipments Falling film and centrifugal molecular distillation still, applications Azeotropic and Extractive distillation- Theory of azeotropic and extractive distillation, applications such as dehydration of alcohol. Steam distillation- Theory of steam distillation and applications of steam distillation such as methods of separation of Volatile constituents and preparation of aromatic water, purification of high boiling liquids.	6
4.	**Crystallization:** • Crystal forms and crystal habits • Theory of crystallization-Supersaturation-Mier's Theory of	5

	supersaturation, Nucleation, Crystal growth • Crystallizers- Classification, Tank crystallizers, Agitated tank crystallizers, Swenson Walker crystallizer, Vacuum crystallizer and its modifications such as circulating magma and DTB crystallizer, Krystal or Oslo crystallizer. • Caking of crystals.	
5.	**Evaporation:** • Heat transfer process in boiling liquids in evaporators • Evaporators-Pan evaporators, Horizontal tube evaporator, short tube vertical evaporator, Falling film evaporator Forced circulation evaporator. Wiped film evaporator, Evaporator accessories-condensers, vacuum pumps, expansion and bucket traps, Entertainment separators, Vapor recompression. Scale information.	6
6.	**Drying:** • Mechanism and theory of drying • Dryer-tray dryer, vacuum tray dryer, tunnel dryer, Rotary drum dryer, Spray dryer, Freeze dryer, Fluidised bed dryer	4
7.	**Pollution from Pharmaceutical Industry:** Air pollution and preservation - • Wet scrubber, dust collector. Water pollution- • Bulk drug manufacture- dirty water, acids and alkalis, dissolved salts, organic chemicals. • Formulation manufacturing- sterile product, liquid dosage forms, solid dosage form, fermentation products, radiological products. • Waste treatment processes- segregation, neutralization and pretreatment, dissolved salt removal, preaeration, biological treatment.	
8.	**Industrial hazards and safety:** • Fire Hazards and extinguishers • Chemical hazards and extinguishers • Mechanical and electrical hazards • Accidents- unsafe action and unsafe condition • Prevention of accidents	4

Reference Books:

1. K. Sambhamurthy, Pharmaceutical Engineering, New age international (p) limited publishers, 1998.
2. Dr. A. R. Paradkar, Introduction to Pharmaceutical Engineering, 10th edition, Nirali Prakashan, 2007.
3. James Swarbrick & James C. Boylon, Encyclopedia of Pharmaceutical Technology, Marcel Dekker, INC, New York, 1994.
4. Walter L. Badger & Julius T. Bancherro, Introduction to Chemical Engineering, Mc. Graw Hill Inc., 1955.

5. M. E. Aulton, Ed. Pharmaceutics – The Science of Dosage from Design, Churchill Livingstone Medical Division of Lognman Group, UK, Ltd., 2002.
6. S. J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6th edition, CBS Publishers & Distributors, New Delhi, 2005.
7. Robert H. Perry, Don W. Green, Perry's Chemical Engineers Handbook, 7th edition, Don W. Green, James O. Maloney, Mac Graw Hill, 1997.

MATHEMATICS – I 3 hrs/ week

S. No.	Topic	Hours
1.	**Differential Calculus:** Successive Derivative's Lebnitz's rule forth derivative, Lagrange's and Rolle's mean value theorems (Statements only), Taylors and Maclaurin's series (without proof) with application curvature.	5
2.	**Partial Differentiation:** Functions of two or three variables, change of variables, application to errors, maxima and minima.	3
3.	**Integral Calculus:** Integration by parts, properties of definite integrals and reduction formulae; Determination of length of the curve area and volume.	8
4.	**Differential equations:** Formation of differential equations solution of first order and first degree equations, linear differential equation of higher order with constant coefficients, simple application to chemical reactions and biopharmaceutics.	8
5.	**Determinants and Matrices:** Properties of determinants and applications, solution of simultaneous equations with three variables by Crammers method: Type of matrices, inverse of matrices, rank of a matrices, eigen values and eigen vectors, Caley Hamilton theorem. `	7
6.	**Numerical Methods:** Finite difference operator's (delta and E), interpolation of equal intervals-Newton's method and Lagrange method: Numerical integration-Trapezoidal rule, Simpson's 1/3rd and 3/8th rules.	5

Reference Books:

1. Mathematics for pharmacy students (Volume I): Gujar, K. N. Bhavale Ashok 1st Edition, Career publication.
2. Differential Calculus: Nareyan, S. 1st Edition, S. chand Publication.
3. Applied Mathematics – I, Baphana R. M., 3rd Edition, Techmax Publication.
4. Textbook of Applied Mathematics Volume I & II, Wartikar P. N. 7th Edition Pune Vidyarthi Griha Prakashan.
5. Integral Calculus, Shanti Narayan, 1st Editions, S. Chand Publication.
6. A Textbook of matrices, Shantinarayan, 10th Edition, S. Chand Publication.

PHARMACEUTICAL ANALYSIS LABORATORY – II 3 hrs/ week

1. **Preparation and standardization** of 0.05 M EDTA and 0.1 N perchloric acid.

2. **Redox titrations-** assay of sodium nitrite (KMnO4 method). Assay of sodium nitrite, assay of methyl paraben/ propyl paraben, determination of sulphur in sulphur ointment, assay of Lugol's solution, assay of hydrogen peroxide, assay of isoniazid.
3. **Complexometric titrations**- Assay of aluminium hydroxide gel, determination of percentage of calcium and magnesium in a mixture, assay of calcium gluconate powder and injection, assay of zinc. Sulphate powder.
4. **Gravimetric analysis-** Al^{+3} as Al-oxinate, Ba^{+2} as $BaSO_4$, Ni^{+2} as Ni-dimethyl glyoxime.

Demonstration experiments:

1. **Non-aqueous titrations-** assay of pyridoxine hydrochloride, assay of Norfloxacin/ Metronodazole, assay of chlorpromazine hydrochloride.

PHARMACEUTICS LABORATORY – II **3 hrs/ week**

1. **SUSPENSIONS:** (a.) Paediatric Kaolin Mixture B.P. 1980, (b.) Paediatric Chalk Mixture B.P. 1988, (c.) Calamine Lotion I.P.' 66, (d.) Kaolin Poultice I.P.' 66, (e.) Microscopic evaluation, rheology and sedimentation rate studies for any one of the above suspension.
2. **EMULSION:** (a.) Liquid Paraffin Emulsion I.P.' 66, (b.) White Liniment B.P.C., (c.) Turpentine Liniment I.P.' 1966, (d.) Benzyl Benzoate Application I.P.' 66, (e.) Microscopy of any of the above emulsion
3. **OINTMENTS:** (a.) Simple Ointment I.P.' 66, (b.) Sulphur Ointment I.P.' 66 (Microscopic evaluation), (c.) Emulsifying Ointment I.P.' 66, (d.) Benzoic Acid Ointment, Compound B.P.C' 68, (e.) Iodine Ointment, Non-staining B.P.C.' 68, (f.) Iodine Ointment, Non-staining with Methyl Salicylate B.P.C. 1968.
4. **CREAMS:** (a.) Cetrimide Cream B.P. 1993.
5. **GELS:** (a.) Diclofenac Sodium Gel
6. **PASTES:** (a.) Titanium Dioxide Paste.

COMPUTER LABORATOY **4 hrs/ week**

S. No.	Topic	Hours
1.	**Computer Devices** a. Input and Output devices b. Secondary storage units c. Memory ROM and RAM Virtual memory d. ALU, the Control Unit, and CPU e. Classification of Computers – Microcomputers, personal computers, laptop computers, minicomputers, mainframes and supercomputers.	2
2.	**Operating Systems (OS)** a. Purpose of the OS b. Management functions of OS c. Services provided by OS d. Types of OS e. User interfaces – command line and GUI	2

	f. Features of the MS-DOS, Windows and UNIX OSes g. k. Features of the MS-DOS, Windows and UNIX OSes		
3.	**Types of Computer Language** a. Need for interpreter b. Computer Program c. Interpreter d. Compiler e. Classification of Computer Languages – Conventional advantages and limitations f. Very brief introduction to C++ Language.		3
4.	**Introduction to Computer Networks** a. What is a Computer Network b. Networking Basis c. Common types of Networks – LAN, WAN and their variations d. Network topologies – bus, ring, star, mesh e. Network Protocols f. Network components – Computers, communications medium, modem, repeater, hubs, switches, bridges, gateways, routers, and network interface cards.		4
5.	**Algorithms and Flowcharts** a. Algorithm b. Characteristics of algorithm c. Writing algorithms d. Flowcharts and symbols, drawing a flowchart Divide and conquer strategy		2
6.	**Introduction to Data structure** a. Types of data structures b. Arrays c. Structure or records d. Stack e. Queue f. Linked Lists g. Tree		2
7.	**Introduction to DBMS and SQL** a. Features of DBMS b. Introduction to Relational Database Management Systems (DBMS) c. Introduction to Ingres DBMS		2
8.	**General applications of Computers in Pharmaceutical Sciences.**		2
9.	**CONCEPTS OF NETWORKING** Introduction to Networking, Types of Networking (LAN, MAN, WAN, VWAN), Topologies, Requirements for using Networking, Networking Terminologies (Client, Server, Node, Terminals etc.)		4 hrs
10.	**WINDOWS**		
11.	Session - 1	Introduction to Operating System, Features of Operating systems, types of operating systems, Difference between	1

		Dos and Windows Starting and Shutdown of PC, Screen Components, Notepad (File Menu) Notepad Complete with all menus	
12.	Session - 2	WordPad File and Edit Menu WordPad complete with all menus	1
13.	Session - 3	Paint – all tools, Paint – all menus – paint complete	1
14.	Session - 4	Character Map, Control Panel (Date & Time, Keyboard, Mouse, Display) Creation of files and folders, moving files, copying files, Recycle bin, Run, My Documents, My Computer, Finding Files and Folders, doubts clearing.	1
15.	**MS-OFFICE**		
16.	**(A); WORD PROCESSING**		
17.	Session - 1	Introduction to package, language, MS-office and introduction to word; File and Edit Menu; View menu options.	1
18.	Session - 2	Insert menu options; Format font (full), paragraph and change case Format bullets and numbering, columns, bullets and numbering, borders and shading, tabs.	1
19.	Session - 3	Table menu full, Tools – spelling and grammar, thesaurus, mail merge with single field, multiple field and queries options.	1
20.	Session - 4	Macro, autocorrect, letter wizard Envelop and labels, window menu options	1
21.	Session - 5	Drawing toolbar options, Drawing toolbar draw option.	1
(B); EXCEL			
Session - 1		Introduction to screen, components (database, spreadsheet and chart), use of excel, auto fill, fill handle features, calculator with '=' sign, sum and average function	1
Session - 2		Edit menu, View menu, Inset menu	1
Session - 3		Format menu, spelling and grammar, protection, autocorrect, goal seek, macro, options (view and custom lists); Data – sort, forms, subtotals, filters, pivot table.	1
Session - 4		Window menu complete, numeric and date and time functions; Numeric functions: ABS, FACT, COUNT, COUNTBLANK, POWER, MOD, PRODUCT, MIN, MAX, QUOTIENT; Date and time functions: NOW, TODAY, TIME	1
Session - 5		Text functions: LOWER, UPPER, PROPER, MID, REPLACE, LEN, TRIM, CONCATENATE, LEFT, RIGHT; Logical function: AND, OR, NOT, EXACT.	1
(C); POWERPOINT			
		Introduction to PowerPoint, creating presentation with auto content wizard	1

	Creating presentation with design template, custom animation, slide transition, sounds and songs insertion Creating different types of blank presentations Points to be noted while creating PowerPoint presentations 1. No spelling Mistakes 2. Proper Clipart in each slide 3. Proper Slide Transition Effects 4. Proper Text Animation Effects Proper Timings	
INETERNET SYLLABUS		
Session - 1	Theory of Internet, basic requirements to run internet, web site, domain name, sub domain, chatting, email, surfing, Surfing and creating e-mail ID	1
Session - 2	Inbox, compose, sending and receiving greeting cards, text files, images downloading, search engines (google, yahoo, Lycos, khoj etc.) Chatting, yahoo messenger and other things.	1

Reference Books:

1. Basic Electronics and Computer Applications, Rajiv Khanna, New Age International Publishers, 2007.
2. Introduction to Biostatistics 7 Computer Science, Y.I. Shah, A. R. Paradekar, M. G. Dhayagude, Nirali Prakashan, 3rd Ed., 2004.
3. Fundamentals of Computers, V. Rajaraman, Prentice Hall of India Pvt. Ltd., 1986.
4. Schaum's Outline Series. Theory & Problems of "Introduction to Computer Science", by Francis Scheid, McGraw Hill Book Co., 1983.

SEMSETER IV

PHARMACOLOGY – I **3 hrs/ week**

S. No.	Topic	Hours
1.	General principles of pharmacology • Introduction to Pharmacology • Routes of drug administration with special reference to their advantages and disadvantages • Drug absorption, distribution, metabolism and excretion. • Factors modifying the actions of drugs. • Drug Toxicity in human - Toxic effects of drugs on different systems, organs & tissues.	13
2.	Mechanism of drug action: a) Brief introduction of physiological receptors - structural and functional families - cytoplasmic second messengers b) drug-receptor interaction - dose-response relationship - drug antagonism	8
3.	Drugs used in the disorders of gastro-intestinal tract • Emetics, antiemetics & prokinetic drugs • Purgatives & antidiarrheals, antispasmodics • Drugs used in the treatment of hyperacidity & peptic ulceration • Inflammatory bowel diseases	8
4.	Drugs used in haematological disorders - Antiplatelet agents - Anticoagulants - Thrombolytic agents - Antianaemic drugs	7

Reference Books:

1. Goodman & Gilman's Pharmacological Basis of Therapeutics Joel G. Hardman, Lee E. Limbird , Alfred Goodman Gillman 11th Edition, The McGraw – Hill Companies Inc., 2001.
2. Satoskar, R. S. Bhandarkar S. D. & Rege N. N. Pharmacology & Therapeutics 20th Edition Popular Prakashan, 2007.
3. Rang & Dale Pharmacology – 5th Edition, Churchill Livingstone 2003.
4. Lippincott's Illustrated Reviews: Pharmacology – Lippincott – Raven 3rd Edition Howland & Nycets Publishers N Y, 2006.
5. Lewis Pharmacology – By Crossland – 5th Edition, Churchill Livingstone.
6. Laurence, D. R. & Bennet Clinical Pharmacology – 9th Edition, Elsevier, N Y, 2006.
7. Kulkarni, S. K. Handbook of Experimental Pharmacology – 3rd Edition Vallabh Prakashan New Delhi, 2005.

8. B. G. Katzung – Basic and Clinical Pharmacology 9th Edition Appleton and Lange publication, 2004.
9. Gosh M. N. – Fundamentals of Experimental Pharmacology, 3rd Edition, Hilton & Company, Calcutta, 2005.

ORGANIC CHEMISTRY – IV 3 hrs/ week

S. No.	Topic	Hours
1.	Introduction to free radical chemistry, stability and structure, generation of free radicals (thermal decomposition, photochemical methods, oxidation-reduction, electrolysis), propagation of free radicals, termination of free radicals, Discussion of Birch reduction, Kolbe electrolysis, Hunsdiecker reaction, Sandmeyer reaction.	6
2.	Peptide Chemistry, Chemistry of the peptide bond, methods of forming peptide bond including solid phase peptide synthesis, amino acid protecting agents.	6
3.	Organometallic chemistry: Introduction organomagnesium, organolithium and some mixed organoboranes.	8
4.	Polymer Chemistry: Introduction to Polymers, polymer characteristics, properties, methods to determine properties.	5
5.	Heterocyclic aromatics- synthesis and reactions of five and six numbered rings with one and two heteroatoms like pyrrole, oxazole, thiophene, furans, imidaxele, pyrazole, thickzole, isoreazole, pyridine, pyrimidine, quinoline and isoquinoline, pyrazine and indole.	12

Reference Books:

1. Organic Chemistry, S. H. Pine, 5th Ed., Tata McGraw Hill Publishing Co. Ltd., 2007.
2. Principles of Organic Synthesis, R. O. Norman, 2nd Ed., Chapman and Hall, 1978.
3. Organic Chemistry, John McMurry, 5th Ed., Brooks/Cole, Thomson Learning, 1999.
4. Organic Chemistry, Francis Carey, 5th Ed. McGraw Hill
5. Organic Chemistry, Vols. 1 and 2, I. L. Finar, 5th Ed., Pearson Education, 2005.
6. Heterocyclic Chemistry, J. A. Joule and K. Mills, 4th Ed., Blackwell Publishing, 2005.

BIOCHEMISTRY II 3 hrs/ week

S. No.	Topic	Hours
1.	Biochemical Energetics: 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 reactions. Concept of oxidation – reduction reactions, standard electrode potential, transformed standard electrode potential, standard	6

	electrode potentials of some biological important redox couples.	
2.	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.	3
3.	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 process especially liver, kidney, muscle, adipose, tissue, brain and rbcs.	3
4.	Carbohydrate metabolism: Discussion of glycolysis, reversal of glycolysis, glycogen synthesis and breakdown, pentose phosphate pathway, TCA cycle, glyoxalate shunt, gluconeogenesis, NADH/ NAD^+ shuttles, with respect to the location, intermediates, enzymes, energy yield and regulation. Examples of drugs related to carbohydrate metabolism modulation.	13
5.	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, formation of ketone bodies, acetate mevalonate pathway, biosynthesis of cholesterol. Examples of drugs that are related to lipid metabolism modulation.	4
6.	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 of proton motive force and generation of ATP by use proton gradients. Examples of some toxins that interfere with ETC.	3
7.	Nucleic acid metabolism: Discussion of biosynthesis of purines and pyridines with respect to location, intermediate, enzymes, cofactors, and regulation, Salvage pathways for nucleic acids. Example of drugs interfering with these pathways.	4

Reference Books:

1. Lehninger, Principles of Biochemistry, 4th Ed., Nelson D. L. and Cox M. M. Replika Press Pvt. Ltd., India, 2007.
2. Biochemistry, Stryer L, 3rd Ed., W. H. Freeman & Co., 1988.
3. Harper's Biochemistry, 25th Ed., Eds. Murray R. K. Granner D. K., Mayes P. A. and Rodwell V. W. Appleton and Lange, USA, 2000.
4. Outlines of Biochemistry, 5th Ed., Eds. Conn E. Stumpf p. K. Bruening G and Doi Roy H., John Wiley & Sons, USA, 1987.
5. Textbook of Biochemistry with Clinical Correlations, 5th Ed., Ed. Devlin T. M. Wiley Liss, USA, 2002.

DISPENSING CHEMISTRY 3 hrs/ week

S. No.	Topic	Hours

1.	Definition of Compounding and Dispensing	1
2.	Prescription and its parts: Different types of prescriptions, prescription pricing, recording of prescription	4
3.	Calculations: various calculations involved in compounding and dispensing such as - weights and measures % calculations, dilutions and concentrations, isotonic solutions, HLB value calculation, posology, imperial system of weights and measures.	8
4.	Basic principles in compounding and dispensing: Types of dosage forms, formulation of dispensed products, storage and stability of products, containers and closures for products. Labeling of dispensed products Preparation of stock solutions; Latin terms and abbreviations.	4
5.	Compounding and Dispensing aspects of solutions (for oral use, external use, for body cavities), suspensions, emulsions and creams, ointments, pastes, gels, suppositories, pessaries, powders, granules, lozenges, pastilles, pills, tablets, capsule, tablet, triturate, etc. Incompatibilities Prepackaging, Dispensing of properties	2 2 2 2 2 3 2 1

Reference Books:

1. Cooper and Gunns Dispensing for Pharmaceutical students Twelfth edition Edited by S.J. Carter Indian edition CBS Publishers, Delhi 1987.
2. Pharmaceutical Practice Edited by D. M. Collett and M.E. Aulton, Churchill Livingstone ELBS edition, 1991.
3. Pharmaceutical Practice Edited by A.J. Winfield and R.M.F. Richards, Second edition Churchill Livingstone, 1998.
4. Pharmaceutical Practice Edited by A.J. Winfield and R.M.E. Richards, Third Edition, Churchill Livingstone, 2004.
5. Husa's Pharmaceutical Dispensing, Edited by Eric Martin, Sixth edition, Mack Publishing Company, 1966.
6. Pharmaceutical Calculations – by H. C. Ansel and M. J. Stoklosa, Lippincott Williams and Wilkins, 2006.
7. Pharmaceutical Calculations – by Bradley, Gustafson and Stoklosa, Third Edition, Lea and Febiger, 1957.

MATHEMATICS – II (FUNDAMENTALS OF STATISTICS) 3 hrs/ week

S. No.	Topic	Hours
1.	**Measures of central tendency:** Arithmetic's mean, median and mode	08
2.	**Measure of dispersion:** Range, quartile deviation mean deviation	18

	and standard deviation, Coefficients of variation, moments, skewness, and kurtesis, moments generating, Probability expectations and variance, binomial, Poisson and Normal distributions, Fitting of curve by the method of least square. { $Y=a+bX$:$Y = a+bX+cX^2$, $Y= aX^h$, $Y= ab^X$, $Y =ac^{bX}$ }	
3.	Sampling distribution for mean and Proportion: Test of hypothesis for specified values of means and proportion for large samples, Testing equality of two means and proportions, Students 't' test for single sample and paired observation. F-Test and analysis of variance, testing of attributes, Chi-square distribution.	10

Reference Books:

1. Fundamentals of statistics: Gupta, S. C. 6th Edition Himalaya publication.
2. Mathematics for pharmacy students (Vol-I), Gujor K. N. Bhavale Ashok Edition, career publication.
3. Measurement, statistics of computation C. Cormich D., 1st Edition, John Wiley & Sons.
4. Biostatistics in pharmaceutical Industry, Buncher, R. C. 1st Edition, Matcel Decker Inc.
5. Vogel's Textbook of Quantitative Chemical Analysis, Mendham, J. R. C. Denney, 6th Edition, Pearson Education Pvt. Ltd.

PSYCHOLOGY AND SOCIOLOGY 3 hrs/ week

Note: All relevant topics can be dealt with special reference to the Pharmaceutical Industry

Psychology

S. No.	Topic	Hours
1.	Nature, Definition of Psychology-Introduction subfields of Psychology, Industrial Psychology, Organizational Behavior – Nature Scope Goals.	2
2.	Personnel Selection Occupational Information-uses Personnel Specifications Job analysis Selection techniques: Application Blanks-Biodata Interviews Psychological tests (Intelligence tests, Aptitude tests, Personality tests)	2
3.	Work Motivation: Theories (Maslow's Herbergs, Vrooms, Equity Theory), Ways to	4

	motivate people in organizations Financial and nonfinancial Incentive, Job satisfaction.	
4.	Leadership-Trail – theory of leader, leadership skills, leadership styles Fielder's contingency model.	4
5.	Team and Team building	2
6.	Accident-causes Accident prevention-safety measures	2 2
7.	Organizational change-Resistance, Overcoming resistance, Continuous and episodic change	2

SOCIOLOGY

S. No.	Topic	Hours
1.	**Concept of:** The relevance of sociology to industry, Social adjustment of workers	3
2.	**Communication-** its levels and types.	3
3.	**Science, technology, industry and society:** Impact, Role, Problems (with special reference to Pharmaceutical Industry)	3
4.	**Sociology of Medicine in India:** an approach. The best of both the world-bringing traditional medicine up-to-date. Who chooses modern medicine and why? Man, medicine and environment. Allopathic medicine in India. Class composition of medical students. Its relevance to Pharmacy – Pharmaceutical Marketing.	6
5.	**Industrial Democracy:** Workers participation in management.	3

Reference Books:

1. Sociology by Anthony Giddnes
2. Industrial Relation by P. B. Mammudity
3. Sociology by Harrambus
4. Sociology Change by Kappu Swami
5. Man, Medicine and Environment-Rene Du Bos (1969)
6. Organizational Behavior-Human Behavior at work –By New Strom and Keith Davis
7. Organizational Behavior –By Suja Nair, Himalaya Publishing Company
8. Industrial Psychology and Sociology –By Milind Wagh, Career Publication
9. Industrial Psychology and Sociology –By B. V. Pathak, Nirali Prakashan

ANATOMY, PHYSIOLOGY AND PATHPHYSIOLOGY – IV 3 hrs/ week

S. No.	Topic	Hours
1.	Cardiovascular System - Functional anatomy of heart - conducting system of heart - cardiac cycle, Electrocardiogram (ECG)	12

	- Functional anatomy of blood vessels - Blood pressure and factors regulating blood pressure - Baroreceptors, chemoreceptors vasomotor center - Humoral and Neuronal Control of Blood Pressure and circulation. - Enterohepatic circulation	
2.	Definition and Etiology of following diseases in detail - Hypertension - Congestive Cardiac Failure - Cardiac Arrhythmia - Angina Pectoris - Ischemic Heart Disease - Arteriosclerosis/ Atherosclerosis - Varicose veins, Hemorrhoids	10
3.	Urinary system: - Anatomy and Physiology of Urinary System - Formation of urine - Water balance, electrolyte balance & acid-base balance	6
4.	Formation of body fluids and fluid compartments.	4
5.	Definition and Etiology of following diseases in detail - Renal failure - Glomerulonephritis - Renal calculi/ Kidney stones - Urinary Tract Infections (UTI)	4

Reference Books:

1. Ross & Wilson Anatomy & Physiology in Health & Illness, 10th Edition, Anne Waugh, Alison Grant, Churchill Livingstone Elsevier, 2006.
2. Tortora & Grabowaski Principles of Anatomy & Physiology, 11th Edition, J. Wiley & Sons, 2007.
3. Guyton & Hall Textbook of medical Physiology, 6th Edition, Harcourt Singapore, 2001.
4. B. R. Mackenna & R. Callander Illustrated Physiology, 6th Edition, N. Y. Churchill Livingstone, 1997.
5. Kaplan, Jack, Opheim, Toivola, Lyon Clinical Chemistry: Interpretation & Techniques, 4th Edition, Williams & Williams London 1995.
6. Praful B. Godkar, Darshan P. Godkar Textbook of Medicinal Laboratory Technology, 2nd Edition, Bhalani Mumbai- 2006.
7. Russel J. Greene & Norman D. Harris Pathology & Therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice, 2nd Edition Pharmapress, N Y, 2000.
8. Ranade & Joshi Manual of Practical Physiology, Pune Vidyarthi Gruha Prakashan.
9. Eric Herfindal, Dick Gourley, Textbook of Therapeutics: Drug and Diseases Management, 7th Edition, Lippincott Williams & Wilkins. A. Wolters Kluvers Company.
10. Cotran, Kumar and Collins, Robins – Pathologic Basis of diseases, 6th Edition, W. B. Saunders Company.
11. The Merck Manual of medical Information, Home Edition, Merck Research Laboratories, Division of Merck & Co. Inc. White House Station, N. J., 1997.

ORGANIC CHEMISTRY LABORATORY II **4 hrs/ week**

Techniques in Organic Chemistry: Quantitative separation of binary organic mixture by physical and chemical methods mixture of different types including compounds with more than one functional group to be given, complete characterization if individual components including physical constants followed by preparation of suitable derivative. Purification techniques solvent selection for recrystallisation, recrystallization techniques, simple distillation, fractional distillation, steam distillation.

DISPENSING PHARMACY LABORATORY 4 hrs/ week

1. Solutions	1. Zinc Chloride & Zinc sulphate mouth wash BPC 2. $KMnO_4$ solution 3. Sodium Bicarbonate Ear Drops BP 4. Pediatric Ferrous Sulphate Solution BP 1988
2. Suspensions	5. Calamine Lotion IP 6. Menthol & Eucalyptus Inhalation
3. Emulsion	7. Arachis Oil Emulsion 8. Calciferol Emulsion 9. Oily Calamine Lotion BP 1980/ Benzoyl Benzoate Application BP 1988/ White liniment
4. Ointment	10. Sulphur ointment BPC/ Calamine & Coal Tar Ointment/ Whitfield's Ointment
5. Paste	11. Zinc & Coal Tar Paste/ Titanium Dioxide paste
6. Gels	12. Lubricating Jelly
7. Cream	13. Medicated Cream
8. Powders	14. Hyoscine HBr Powder 15. Seidlitz Powder 16. Mg Trisilicate Oral Powder BP 1988/ Dusting Powder
9. Granules	17. Effervescent Granuales 18. Isapghul Granuales
10. Tablet triturates	19. Boric Acid/ Riboflavin
11. Capsules	20. Chlordiazepoxide Capsules
12. Pills	21. Compound Rhubarb Pills BPC 1960/ Potassium Permanganate Pills
13. Pastilles	22. Medicated Pastilles
14. Lozenges	23. Brompton Cough, Lozenge/ Bismuth Carbonate Lozenges
15. Suppositories	24. Compound Bismuth Subgallate Suppositories BP 1980
16. Incompatibility	25. Eutectic mixture
17. Prepackaging	

BIOCHEMISTRY LABORATORY – I **4 hrs/ week**

Quantitative test for carbohydrates confirmatory tests by osazone formation

Quantitative estimation of glucose by Willstates and Lane and Eynon method, estimation of sucrose: Simple colour reactions of proteins and amino acids, precipitation reactions of proteins

Determination of acid value, iodine value and sap value of lipids

Enzymes: Ptyline activity of saliva