JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
BACHELOR OF PHARMACY
COURSE STRUCTURE AND SYLLABUS

Effective from Academic Year 2025-26 Admitted Batch

I Year I semester

S.No	Course Code	Subject	L	T	P	Credits
1	PS101	General Pharmacy	3	1	0	4
2	PS102	Pharmaceutical Inorganic and Analytical chemistry	3	1	0	4
3	PS103	Pharmaceutical Organic Chemistry-I	3	1	0	4
4	HS104	Communication skills	2	0	0	2
5	BS105/BS106	Remedial Biology# / Remedial Mathematics$	2#/3$	0	0	2#/3$
6	PS107	General Pharmacy Lab	0	0	4	2
7	PS108	Pharmaceutical Inorganic and Analytical chemistry Lab	0	0	4	2
8	PS109	Pharmaceutical Organic Chemistry-I Lab	0	0	4	2
9	HS110	Communication skills Lab	0	0	2	1
10	BS111	Remedial Biology Lab	0	0	2#	1#
		Total	**13#/14$**	**03**	**16#/14$**	**24#/24$**

#Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB) course.

$Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM) course.

I Year II semester

S.No.	Course Code	Subject	L	T	P	Credits
1	PS201	Human Anatomy, Physiology and Pathophysiology- I	3	1	0	4
2	PS202	Pharmaceutical Organic Chemistry-II	3	1	0	4
3	BS203	Pharmaceutical Biochemistry	3	1	0	4
4	CS204	Computer Applications in Pharmacy	3	0	0	3
5	PS205	Human Anatomy, Physiology and Pathophysiology- I Lab	0	0	4	2
6	PS206	Pharmaceutical Organic Chemistry-II Lab	0	0	4	2
7	BS207	Pharmaceutical Biochemistry Lab	0	0	4	2
8	CS208	Computer Applications in Pharmacy Lab	0	0	2	1
		Total	**12**	**03**	**14**	**22**

II YEAR I SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	PS301	Human Anatomy, Physiology and Pathophysiology- II	3	1	0	4
2	PC302	Physical Pharmaceutics-I	3	1	0	4
3	BS303	Pharmaceutical Microbiology	3	1	0	4
4	PC304	Pharmaceutical Engineering	3	1	0	4
5	PS305	Pharmacognosy	3	1	0	4
5	PS306	Human Anatomy, Physiology and Pathophysiology- II lab	0	0	4	2
6	PC307	Physical Pharmaceutics-I Lab	0	0	4	2
7	BS308	Pharmaceutical Microbiology Lab	0	0	4	2
8	PC309	Pharmaceutical Engineering Lab	0	0	4	2
		Total Credits	**15**	**05**	**16**	**28**

II YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	PS401	Medicinal Chemistry-I	3	1	0	4
2	PC402	Physical Pharmaceutics-II	3	1	0	4
3	PC403	Pharmacology-I	3	1	0	4
4	PS404	Pharmacognosy and Phytochemistry	3	1	0	4
5	PS405	Pharmaceutical Jurisprudence	3	1	0	4
6	PS406	Medicinal Chemistry-I Lab	0	0	4	2
7	PC407	Physical Pharmaceutics-II Lab	0	0	4	2
8	PC408	Pharmacology-I Lab	0	0	4	2
9	PS409	Pharmacognosy and Phytochemistry Lab	0	0	4	2
10	*VA400/ VA401	Gender Sensitization/ Human Values and Professional Ethics	1	0	0	0.5+0.5
		Total Credits	**16**	**05**	**16**	**29**

***Note: For the courses Gender Sensitization/ Human Values and Professional Ethics** - one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization is conducted this week, then a one-hour class for Human Values and Professional Ethics will be conducted in the following week.

III Year I Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1	PS501	Medicinal Chemistry-II	3	1	0	4
2	PS502	Pharmacology-II	3	1	0	4
3	PC503	Industrial Pharmacy- I	3	1	0	4
4	PS504	Herbal Drug Technology	3	1	0	4
5	 PS505 PS506 PS507 PS508	**Professional Elective – I** I. Generic Product Development II. Social and Preventive Pharmacy III. Pharmaceutical Regulatory Sciences IV. Pharmaceutical Management and Marketing	3	1	0	4
6	PS509	Pharmacology-II Lab	0	0	4	2
7	PC510	Industrial Pharmacy- I Lab	0	0	4	2
8	PS511	Herbal Drug Technology Lab	0	0	4	2
9	VA500	Environmental science	1	0	0	1
		Total	**16**	**05**	**12**	**27**

III Year II Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1	PS601	Medicinal Chemistry- III	3	1	0	4
2	PC602	Pharmacology- III	3	1	0	4
3	PC603	AI/ML in Pharmaceutical Sciences	3	1	0	4
4	PC604	Biopharmaceutics and Pharmacokinetics	3	1	0	4
5	 PS605 PS606 PS607 PS608	**Professional Elective – II** I. Medical Devices II. Clinical Research and NDCT Regulations III. Pharmaceutical Bioanalysis IV. Cosmetics and Cosmeceuticals	3	1		4
6	PC609	Medicinal Chemistry – II Lab	0	0	4	2
7	PC610	Biopharmaceutics and Pharmacokinetics Lab	0	0	4	2
8	PS611	Industrial Training	0	0	4	2
9	VA600	Indian Knowledge System	1	0	0	1
		Total	**16**	**05**	**12**	**27**

IV Year I Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	PS701	Instrumental Methods of Analysis	3	1	-	4
2	PC702	Industrial Pharmacy-II	3	1	-	4
3	PC703	Pharmacy Practice	3	1	-	4
4	PC704	Pharmacovigilance and Materiovigilance	3	1	-	4
5	 PS705 PS706 PS707 PS708	**Professional Elective - III** I. Biosimilars II. Drug Store and Business Management III. QbD in Pharmaceutical Sciences IV. Pharmaceutical Supply Chain Management	3	1	-	4
6	PS709	Instrumental Methods of Analysis Lab	-	-	4	2
7	PS710	Practice School	-	-	4	2
		Total	**15**	**5**	**08**	**24**

IV Year II Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	PS801	Biostatistics and Research Methodology	3	1	-	4
2	PS802	Pharmaceutical Quality Control and Quality Assurance	3	1	-	4
3	PC803	Novel Drug Delivery System	3	1	-	4
4	 PS804 PS805 PS806 PS807	**Professional Elective - IV** I. Pharma Marketing Management II. Nano Technology III. Good Practices in Pharmaceutical Sciences IV. Pharmaceutical Project Management	3	1	-	4
5	PC808	Novel Drug Delivery System Lab	-	-	4	2
6		Project Work	-	-	6	3
		Total	**12**	**4**	**10**	**21**

Note: VA400/ VA401, VA500 and VA600 are Value Added Courses and should be treated like any other THEORY COURSE, in terms of Attendance Requirements, Evaluation Pattern and Grading System.

Total Credits for B. Pharmacy course is 202.

PS101: GENERAL PHARMACY (Theory)

B. Pharm. I Year I Sem **L T P C**
3 1 0 4

Scope: This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Course Objectives: Upon completion of this course the student should be able to:

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Preparation of various conventional dosage forms

UNIT – I **10 Hours**

Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry, and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.
Dosage forms: Introduction to dosage forms, classification and definitions
Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription. **Posology:** Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

UNIT – II **10 Hours**

Pharmaceutical calculations: Weights and measures–Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.
Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.
Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Definition and Classification of Solubility.

UNIT – III **08 Hours**

Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
Biphasic liquids:
Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

UNIT – IV **08 Hours**

Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.
Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

UNIV – V **07 Hours**

Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms

TEXT BOOKS: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.
13. Tripathi Dulal Krishna, Pharmaceutics: Basic Principles and Formulations, Pharma Med Press

PS102: PHARMACEUTICAL INORGANIC AND ANALYTICAL CHEMISTRY (Theory)

B. Pharm. I Year I Sem

L	T	P	C
3	1	0	4

Course Objectives:

1. Understand the pharmaceutical importance of inorganic compounds
2. Comprehend the principles of volumetric analysis
3. Develop practical skills in performing and interpreting limit tests and analytical tests.
4. Emphasize the importance of radiopharmaceuticals in Pharmacy
5. Analyze inorganic compounds products by different volumetric methods

Course Outcomes: Upon completion of the course the students shall be able to:

1. Describe and differentiate various analytical techniques used in pharmaceutical analysis, including titrimetric methods, and their specific applications in quality assessment.
2. Identify sources and types of errors in pharmaceutical analysis, and apply strategies to minimize these errors, demonstrating knowledge of accuracy, precision, and significant figures.
3. Understand the role of Pharmacopoeias in pharmaceutical regulation, including methods for identifying and testing impurities in pharmaceutical products.
4. Apply concepts of acid-base chemistry and buffer systems to pharmaceutical formulations, with a focus on calculations related to pH and isotonicity for IV fluids and ophthalmic solutions.
5. Explain the principles and applications of various titrimetric methods, including the preparation and standardization of titrants and interpret the results to quantify analytes.
6. Analyze the properties, mechanisms, and therapeutic uses of gastrointestinal agents, radiopharmaceuticals, expectorants, antidotes, and other pharmaceutical compounds, illustrating their roles in therapy and safety considerations.

Course Contents: For compounds marked with an asterisk (*), study the general methods of preparation, properties, assay procedures, and medicinal uses. For compounds without an asterisk, study their medicinal uses.

UNIT-I **07 hours**

1. Introduction to pharmaceutical analysis: Different techniques of analysis, Methods of expressing strength of solutions, Primary and secondary standards with examples.
2. Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.
3. Pharmacopoeia: Definition, types, contents and regulatory importance. Sources and types of impurities in Pharmaceuticals, limit tests for chloride, sulphate, iron, arsenic, lead, heavy metals, and modified limit test for chloride and sulphate.

UNIT-II **08 hours**

1. Acid-Base Chemistry and Buffer Systems in Pharmacy: Definition of acids, bases, buffers, pH Scale and its significance, Buffer equation, calculation of pH for Buffer solution. isotonicity and its application in IV Fluids and Ophthalmic Solutions.
2. Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium chloride and Oral Rehydration Salt (ORS), Physiological acid base balance.

UNIT-III **14 hours**

Principles and applications of the following titrimetric methods of analysis:

1. Acid base titrations: Theories of acid base indicators, classification of acid base titrations. Preparation and standardization of titrants viz. hydrochloric acid and sodium hydroxide. Theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves.
2. Non-aqueous titrations: Types of solvents used, acidimetric and alkalimetric titration using non aqueous solvents. Preparation and standardization of acidic and basic titrants. Estimation of weakly acidic and basic

substances using non- aqueous titrants.
3. Precipitation titrations and gravimetry: Mohr's method, Volhard's, Modified Volhard's, Fajans method. Estimation of barium sulphate by gravimetry.
4. Complexometric titrations: Classification, metal ion indicators, masking and demasking reagents, preparation and standardization of disodium EDTA. Estimation of Magnesium sulphate and Calcium gluconate*.
5. Redox titrations: Concepts of oxidation and reduction, Types of redox titrations viz. Permanganometry, Cerimetry, Iodimetry, Iodometry and titrations with potassium iodate.

UNIT-IV **10 hours**

1. Gastro intestinal agents
a. Acidifiers: Sodium acid phosphate and Dilute Hydrochloric acid
b. Antacids: Ideal properties of antacids, combinations of antacids, Sodium bicarbonate*, Aluminium hydroxide gel*
c. Agents promote bowl movements: Magnesium hydroxide, Sodium orthophosphate, Sodium Potassium tartrate
d. Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations
2. Radiopharmaceuticals: Basics of radioactivity, applications of radioisotopes of Sodium Iodide I 131, Technetium-99m, Cobalt-60, Phosphorus-32 including safe handling, storage, and disposal of radiopharmaceuticals, adhering to regulatory guidelines for safety.

UNIT-V **06 hours**

Miscellaneous Compounds
1. Expectorants: Potassium iodide, Ammonium chloride*.
2. Emetics: Copper sulphate*, Sodium potassium tartrate
3. Haematinics: Ferrous sulphate*, Ferrous gluconate
4. Poison and Antidote: Definition, classification of antidotes, Sodium thiosulphate, Activated charcoal, Sodium nitrite
5. Astringents: Zinc Sulphate, Aluminium sulphate

TEXT BOOKS (Latest editions)

1. Vogel's Text Book of Quantitative Chemical Analysis. Pearson Education Limited, Essex, England
2. Block JH. Inorganic, Medicinal and Pharmaceutical Chemistry. Philadelphia: Lea & Febige.
3. Beckett AH, Stenlake JB. Practical Pharmaceutical Chemistry. Part I & II London: Stahlone Press, University of London.
4. Indian Pharmacopoeia. Indian Pharmacopoeia Commission, Ghaziabad.

PS103: PHARMACEUTICAL ORGANIC CHEMISTRY - I (Theory)

B. Pharm. I Year I Sem **L T P C**
3 1 0 4

Course Objectives

This course provides a comprehensive introduction to the fundamental principles of organic chemistry. It focuses on the classification and systematic nomenclature of simple organic compounds, the nature and role of reaction intermediates, and the methods of synthesis. Emphasis is placed on understanding key chemical reactions and the mechanisms underlying them.

1. To enable students to demonstrate a clear understanding of foundational organic chemistry concepts.
2. To equip students with the skills to systematically name organic compounds following IUPAC nomenclature.
3. To help students accurately classify various types of organic compounds based on structural features and functional groups.
4. To develop students' abilities in synthesizing simple organic compounds using established laboratory methods.
5. To provide a solid understanding of organic reaction mechanisms, enhancing analytical and problem-solving skills in chemical transformations.

Course Outcomes

1. To outline the classification, structure, and IUPAC nomenclature of aliphatic organic compounds, benzene, and its derivatives.
2. To describe the fundamental chemical reactions and reaction mechanisms of organic compounds.
3. To illustrate the methods of preparation for various classes of organic compounds using standard laboratory procedures.
4. To analyze the kinetics, reactivity, and stereochemical aspects of chemical reactions involving alkyl halides and carbonyl compounds.
5. To evaluate the mechanisms of electrophilic aromatic substitution reactions of benzene and its derivatives, considering the influence of substituents on reactivity and orientation.

UNIT-I: Basics of organic chemistry **12 hours**

1. Introduction to organic chemistry including versatility of carbon like tetravalency, catenation and atomic size of carbon
2. Classification and nomenclature of aliphatic organic compounds (IUPAC)
3. Definition and types of basic organic chemical reactions such as addition, elimination, substitution and rearrangement reactions, each illustrated with an example
4. Definition types and stability of reactive intermediates with examples (Free radicals, carbocations and carbanions)
5. Electron displacement effects and their importance (Electromeric, Inductive, Mesomeric and Hyper conjugative effect)
6. Definition and types of hybridization and its significance in alkanes, alkenes and alkynes

UNIT-II: Chemistry of aliphatic hydrocarbons (alkanes, cycloalkanes, alkenes and conjugated dienes) **10 hours**

1. **Alkanes**
   a. Methods of preparation of alkanes by Wurtz reaction, Kolbe's Reaction, Clemmensen reduction and Wolf-Kishner reduction
   b. Study of chemical reactions of alkanes: Mechanism of Free radical substitution of alkanes exemplified with halogenation. Pharmaceutical applications of alkanes (Liquid paraffin, soft paraffin, hard paraffin)
2. **Cycloalkanes**
   Study of Baeyer's strain theory and its limitations, Coulson-Moffitt's modification and Sachse - Mohr's theory.
3. **Alkenes**

a. Methods of preparation of alkenes by dehydration of alcohols, dehydrohalogenation of alkyl halides, dehalogenation of vicinal dihalides and Wittig reaction
b. Chemical reactions of alkenes: Study of mechanism of electrophilic addition reaction exemplified with addition of hydrogen halides and water to alkenes (Markovnikoff's rule and anti-Markovnikoff's rule) and ozonolysis

4. Conjugated dienes

Study of stability of conjugated dienes. Study of mechanism of Diel-Alder reaction, electrophilic addition and free radical addition reactions of 1,3-butadiene with bromine and hydrogen bromide (1,2 and 1,4 addition reactions).

UNIT-III: Chemistry of alkyl halides 8 hours

1. Study of mechanism of nucleophilic substitution reactions of alkyl halides (SN1 and SN2 reactions with evidences including-kinetics, substrate structure, solvent effect and stereochemistry). Difference between SN1 and SN2 reactions
2. Mechanism of dehydrohalogenation of alkyl halides (E1 and E2 reactions with evidences including kinetics, solvent effect, substrate structure and stereochemistry. Differences between E1 and E2 reactions
3. Zaitsev's Rule (Saytzeff's) with examples. Difference between E1 and E2 reactions. Substitution Vs Elimination reactions
4. Pharmaceutical applications of alkyl halides (Chloroform, Iodoform, Tricholoroethylene)

UNIT-IV: Chemistry of benzene and its derivatives 10 hours

1. IUPAC system of nomenclature for mono and di substituted benzene derivatives
2. Structure of benzene, molecular orbital picture, resonance in benzene and aromaticity including Huckel's rule
3. Electrophilic aromatic substitution reactions of benzene which includes nitration, halogenation, Friedel-Crafts alkylation and its limitations, Friedel-Crafts acylation, sulphonation and desulfonation reaction
4. Effect of substituents on reactivity and orientation of mono substituted benzene derivatives towards electrophilic aromatic substitution reaction

UNIT-V: Chemistry of carbonyl compounds (Aldehydes and Ketones) 05 hours

Methods to prepare carbonyl compounds by oxidation of alcohols, Reimer-Tiemann reaction and Friedel-Crafts acylation reaction

Study of mechanism of nucleophilic addition reaction which includes Aldol condensation, Crossed-aldol condensation, Cannizzaro reaction, Crossed-Cannizzaro reaction, Benzoin condensation and Perkin condensation, oxidation and reduction reactions of carbonyl compounds. Pharmaceutical applications of carbonyl compounds (Chloral, Paraldehyde, Ketoprofen)

TEXT BOOKS (Latest editions):

1. Organic Chemistry, by Robert Thornton Morrison, Robert Neilson Boyd and Saibal Kanti Bhattacharjee, Pearson Education India, 7th edition, 2010 (ISBN 9788131704813).
2. Organic Chemistry, Vol. 1, by IL FINAR, Pearson Books, 6th Edition, 2002, (ISBN-13. 978-8177585421).
3. A Text Book of Organic Chemistry, by B S Bahl and Arun Bahl,S Chand and Company, 22nd Edition, 2017, (ISBN 9352531965).
4. Principles of Pharmaceutical Organic Chemisty, by Rama Rao Nadendla, PharmMed Press, 2nd edition, 2018, (ISBN 978-93-5230-197-3).
5. Text Book of Organic Chemistry, by Sony PL and Chawla HM, Sultan Chand and Sons, 16th edition, 2007, (ISBN 9788180547676).

HS104: COMMUNICATION SKILLS (Theory)

B. Pharm. I Year I Sem **L T P C**
2 0 0 2

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Course Objectives: Upon completion of the course the student shall be able to

- Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
- Communicate effectively (Verbal and Non-Verbal)
- Effectively manage the team as a team player
- Develop interview skills
- Develop Leadership qualities and essentials

UNIT – I **07 Hours**

Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context
Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

UNIT – II **07 Hours**

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication, Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style

UNIT – III **07 Hours**

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations
Effective Written Communication: Introduction, When and When Not to Use Written Communication
- Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication
Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT – IV **05 Hours**

Interview Skills: Purpose of an interview, Do's and Dont's of an interview
Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

UNIT – V **04 Hours**

Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion

TEXT BOOKS: (Latest Editions)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1st Edition, Oxford Press, 2011
3. Organizational Behaviour, Stephen. P. Robbins, 1st Edition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1st Edition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, GopalaSwamy Ramesh,

5th Edition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green Hall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konarnira, 2nd Edition, New arrivals – PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1st Edition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning India pvt. ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1st Edition, McGraw Hill Education, 2011
11. Effective communication, John Adair, 4th Edition, Pan Mac Millan, 2009
12. Bringing out the best in people, Aubrey Daniels, 2nd Edition, McGraw Hill, 1999
13. Rao Bhaskara, Communication Skills, BS Publications

BS105: REMEDIAL BIOLOGY (Theory)

B. Pharm. I Year I Sem

L	T	P	C
2	0	0	2

Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Course Objectives: Upon completion of the course, the student shall be able to know the classification and salient features of five kingdoms of life understand the basic components of anatomy & physiology of plant understand the basic components of animal kingdom

UNIT – I

Living world:

- Definition and characters of living organisms
- Diversity in the living world
- Binomial nomenclature
- Five kingdoms of life and basis of classification. Salient features of monera, potista, fungi, animalia and plantae, virus.

UNIT –II

Morphology of Flowering plants: Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.

General Anatomy of Root, stem, leaf of monocotyledons & dicotyledons.

UNIT – III

Plants and Mineral Nutrition: Essential mineral, macro and micronutrients, nitrogen metabolism, nitrogen cycle, biological nitrogen fixation.

Photosynthesis: Autotrophic nutrition, photosynthesis, photosynthetic pigments, factors affecting photosynthesis.

Plant Respiration: Respiration, glycolysis, fermentation (anaerobic).

Plant Growth and Development: Phases and rate of plant growth, condition of growth, introduction to plant growth regulators

UNIT – IV

Animal Kingdom:

Cell - The unit of life: Structure and functions of cell and cell organelles. Cell division.

Tissues: Definition, types of tissues, location and functions.

Study of types of: Pisces, Reptiles & Aves.

UNIT-V

General Organization of Mammals

Study of Poisonous Animals

TEXT BOOKS:

1. Text book of Biology, S. B. Gokhale
2. A Text book of Biology, Dr. Thulajappa and Dr. Seetaram.

REFERENCE BOOKS:

1. Text book of Biology, B.V. Sreenivasa Naidu
2. A Text book of Biology, Naidu and Murthy
3. Botany for Degree students, A.C. Dutta.
4. Outlines of Zoology, M. Ekambaranathaayyer and T. N. Ananthakrishnan.
5. A manual for pharmaceutical biology practical, S.B. Gokhale and C. K. Kokate

BS106: REMEDIAL MATHEMATICS (Theory)

B. Pharm. I Year I Sem

L	T	P	C
3	0	0	3

Scope: This is an introductory course in mathematics. This subject deals with the introduction to trigonometry, logarithms, matrices and determinants, calculus and differential equations.

Course Objectives: Upon completion of the course the student shall be able to:-

- Know the theory and their application in Pharmacy
- Solve the different types of problems by applying theory
- Appreciate the important application of mathematics in Pharmacy

UNIT – I

Trigonometry: Measurement of angles, Trigonometric identities.

UNIT – II

Matrices and Determinant: Introduction matrices, Types of matrices, operation on matrices, transpose of a matrix, matrix multiplication, determinants, singular and non singular matrices, inverse of a matrix.

UNIT- III

Logarithms: Introduction, definition, theorems/properties of logarithms, common logarithms, characteristic and mantissa, worked examples, simple applications of pH value related problems and antilogarithms

UNIT – IV

Differentiation: Introductions, properties of derivatives, finding derivative of a function using standard derivatives, derivative of the sum or difference of two functions, derivative of the product of two functions (addition, subtraction and multiplication by using standard formulae).

UNIT - V

Integration: Introduction, definition, standard formulae, simple problems.

TEXT BOOKS: (LATEST EDITION)

1. Intermediate telugu academy mathematics text book
2. A Text Book of Remedial Mathematics, P. Seshagiri Rao, Pharmamed Press.

REFERENCE BOOKS:

1. Differential Calculus, Shanthinarayan
2. Integral Calculus, Shanthinarayan
3. Higher Engineering Mathematics, Dr. B.S. Grewal

PS107: PHARMACEUTICS (Practical)

B. Pharm. I Year I Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. **Syrups**
   a) Syrup IP
   b) Paracetamol pediatric syrup

2. **Elixirs**
   a) Piperazine citrate elixir
   b) Paracetamol pediatric elixir

3. **Linctus** a) Simple Linctus BPC

4. **Solutions**
   a) Strong solution of ammonium acetate
   b) Cresol with soap solution

5. **Suspensions**
   a) Calamine lotion
   b) Magnesium Hydroxide mixture

5. **Emulsions**
   a) Turpentine Liniment
   b) Liquid paraffin emulsion

6. **Powders and Granules**
   a) ORS powder (WHO)
   b) Effervescent granules c) Dusting powder

7. **Suppositories**
   a) Glycero gelatin suppository
   b) Soap glycerin suppository

8. **Semisolids**
   a) Sulphur ointment
   b) Non-staining iodine ointment with methyl salicylate
   c) Bentonite gel
   d) Preparation of Creams

9. **Gargles and Mouthwashes**
   a) Potassium chlorate gargle
   b) Chlorhexidine mouthwash

REFERENCE BOOKS:

1. Pharmaceutics-I (General Pharmacy) A Practical Manual by Mishra Vijay, Pharmamed Press
2. Pharmaceutics: A Practical Manual for B PHARM & PHARM D Courses, Abraham Sindhu by Pharmamed Press.

PS108: PHARMACEUTICAL INORGANIC AND ANALYTICAL CHEMISTRY (Practical)

B. Pharm. I Year I Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Limit tests
   a. Limit test and modified limit test for Chloride as per Indian Pharmacopoeia
   b. Limit test and modified limit test for sulphate as per Indian Pharmacopoeia
   c. Limit test for Iron
   d. Limit test for Lead
   e. Limit test for arsenic
2. Preparation of inorganic pharmaceuticals
   a. Preparation of Aluminium hydroxide
   b. Preparation of potash alum
   c. Preparation of ferrous sulphate
   d. Preparation of Magnesium sulphate from magnesium hydroxide or magnesium carbonate
3. Test for Purity
   a. Assessment of swelling power of bentonite as per Indian Pharmacopoeia
   b. Evaluation of acid neutralizing capacity of aluminium hydroxide gel
   c. Determination of potassium iodate and iodine in potassium Iodide
4. Assay of the following inorganic compounds including standardization of titrant
   a. Assay of ammonium chloride by acid base titration
   b. Assay of Ferrous sulphate by Cerimetry
   c. Assay of Copper sulphate by Iodometry
   d. Assay of Calcium gluconate by Complexometry
   e. Assay of Hydrogen peroxide by Permanganometry
   f. Assay of Sodium benzoate by non-aqueous titration
   g. Assay of Sodium Chloride by precipitation titration (Modified Volhard’s method)

REFERENCE BOOKS (LATEST EDITIONS):

1. Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press, Oxford, UK
2. Vogel's Text Book of Quantitative Chemical Analysis. Pearson Education Limited, Essex, England
3. Block JH. Inorganic, Medicinal and Pharmaceutical Chemistry. Philadelphia: Lea & Febige.
4. Beckett AH, Stenlake JB. Practical Pharmaceutical Chemistry. Part I & II London: Stahlone Press, University of London.
5. Kennedy JH. Analytical Chemistry: Principles. Saunders College Publishing. New York.
6. Schroff ML. Inorganic Pharmaceutical Chemistry: Oxford Book Company. Delhi
7. Indian Pharmacopoeia. Indian Pharmacopoeia Commission, Ghaziabad.

PS109: PHARMACEUTICAL ORGANIC CHEMISTRY (Practical)

B. Pharm. I Year I Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Systematic qualitative analysis of minimum of five water-insoluble or water-immiscible unknown organic compounds from different chemical classes:
    a. Preliminary tests: Color, odour, test for aromaticity, test for saturation/unsaturation etc.
    b. Solubility tests
    c. Detection of elements such as nitrogen, sulphur and halogens by Lassaigne's test
    d. Functional group tests such as phenols, amides, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, aromatic and halogenated hydrocarbons and nitro compounds.
    e. Preparation of the derivatives and confirmation of the unknown organic compound by melting point/ boiling point.
2. Building Molecular Models:
   Students will use **ball-and-stick models** to create structures of molecules and understand their shapes and bonding.
3. Crystallization Method
   Students will learn how to **purify three organic compounds** using the **crystallization technique.**

REFERENCE BOOKS:

1. Text Book of Organic Chemistry, by Sony PL and Chawla HM, Sultan Chand and Sons, 16th edition, 2007, (ISBN 9788180547676).
2. Practical Organic Chemistry, by Mann and Saunders, Pearson Education India, 4th Edition, 2009, (ISBN 13. 978-8131727102).
3. Advanced Practical Organic Chemistry, by N.K. Vishnoi, Vikas Publishing, 3rd Edition, 2010, (ISBN 13: 978-8125931287).
4. Introduction to Organic Laboratory Techniues: A Small Scale Approach, by Donald L. Pavia, Gary M. Lampman, George S. Kriz, Brooks/Cole, 3rd Edition, 2010, (ISBN 978- 0538733281).
5. Vogel's Text Book of Practical organic Chemistry, by B S Furniss, Pearson India, 5th edition, 2003, (ISBN-10. 9788177589573).

HS110: COMMUNICATION SKILLS (Practical)

B. Pharm. I Year I Sem

L	T	P	C
0	0	2	1

List of Experiments:
The following learning modules are to be conducted using wordsworth® English language lab software

Basic communication covering the following topics
Meeting People Asking Questions Making Friends What did you do? Do's and Dont's

Pronunciations covering the following topics Pronunciation (Consonant Sounds) Pronunciation and Nouns
Pronunciation (Vowel Sounds)

Advanced Learning
Listening Comprehension / Direct and Indirect Speech Figures of Speech
Effective Communication Writing Skills
Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills

REFERENCE BOOK:

1. Successful Career Soft Skills and Business English Personality Development and Career Path by Varanasi Bhaskara Rao, Y. Kameswari

BS111: REMEDIAL BIOLOGY (Practical)

B. Pharm. I Year I Sem

L	T	P	C
0	0	2	1

List of Experiments:

1. Introduction to experiments in biology
   a) Study of Microscope
   b) Section cutting techniques
   c) Mounting and staining
   d) Permanent slide preparation
2. Study of cell and its inclusions
3. Study of stem and root
4. Leaf and its modifications
5. Microscopic study and identification of tissues
6. Study of types of Pisces
7. Study of types of Reptiles
8. Study of types of Aves
9. Study of types of Mammals
10. Study of types of Poisonous animals

REFERENCE BOOKS:

1. A Manual of pharmaceutical biology practical, S.B. Gokhale, C.K. Kokate and S.P. Shrivastava.
2. Biology practical manual according to National core curriculum. Biology forum of Karnataka, Prof. M. J. H. Shafi.

PS201: HUMAN ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-I (Theory)

B. Pharm. I Year II Sem

L	T	P	C
3	1	0	4

Course Objectives:

1. To understand the structural and functional organization of human anatomy, physiology and pathophysiology at different levels including subcellular, cellular, tissue and organ systems.
2. To explain the physiological mechanisms and normal functioning of major body systems and relevant neurological and biochemical control mechanisms.
3. To familiarize the learners with the pathological changes leading to diseases and disorders.
4. Correlate anatomical and physiological concepts with pathophysiology in brief about diseases associated with various organ systems.
5. To familiarize learners with the anatomical and medical terminology and develop analytical skills to understand the disease mechanisms.

Course Outcomes: Upon completion of this course the student should be able to

1. Explain the gross morphology, structures and functions of various organs and organ systems of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Describe the etiology and pathogenesis of the selected disease conditions.
4. Know the signs and symptoms, risk factors, diagnosis, prevention and complications of the diseases.
5. Understand coordinated working pattern of different organs of each system

UNIT - I **10 Hours**

a) Introduction to human body
Definition and scope of anatomy, physiology and pathophysiology. Levels of structural organization and body systems, homeostasis, basic anatomical terminology and anatomical positions.

b) Cellular level of organization
Structure and functions of cell, transport across cell membrane, cell division, cell junctions.

c) Basic principles of cell injury and adaptation: Causes of cellular injury and pathogenesis (cell membrane damage, mitochondrial damage, ribosomal damage, nuclear damage). Morphology of cell injury – adaptive changes (atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia).

d) Tissue level of organization
Classification of tissues: structure, location and functions of epithelial, muscular, nervous and connective tissues.

UNIT - II **10 Hours**

Skeletal system: Divisions of skeletal system, types of bones, structural features and functions of bones of axial and appendicular skeletal system.

Joints: Structural and functional classification, types of joint movements and their articulations.

Pathophysiology in brief about the diseases of bones and joints: Rheumatoid arthritis, osteoarthritis, osteoporosis and gout.

Organization of skeletal muscles: names and locations of major skeletal muscles, physiology of muscle contraction, neuromuscular junction.

UNIT-III **10 Hours**

Body fluids and Blood

Body fluids, composition and functions of blood, hemopoiesis, formation of haemoglobin, mechanisms of coagulation, blood grouping, Rh factors, transfusion, reticuloendothelial system, pathophysiology in brief about blood related disorders like anaemia, leukaemia, haemophilia, coagulopathy.

Lymphatic system

Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system, pathophysiology in brief about lymphadenopathy and lymphomas.

Basic mechanism involved in the process of inflammation and repair: Introduction, clinical signs, types, mechanism and mediators of inflammation.

UNIT-IV **07 Hours**

Cardiovascular system

Vascular system: Types of blood vessels and their structure and functions, blood circulation.

Heart: Anatomy of heart, elements of conduction system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure and pulse.

Study of electrocardiogram.

Pathophysiology in brief about hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis), cardiac arrest, rheumatic heart disease, cardiac arrhythmia.

UNIT-V **08 Hours**

Digestive system: Anatomy of gastro intestinal tract (GIT) with special reference to anatomy and functions of stomach (acid production, regulation of acid through parasympathetic nervous system and role of pepsin in protein digestion), small intestine, large intestine, anatomy and functions of salivary glands, pancreas, liver and gall bladder, movements of GIT, digestion and absorption of nutrients.

Pathophysiology in brief about peptic ulcer, pancreatitis, inflammatory bowel disease, gastritis, hepatitis, fatty liver and cirrhosis.

Respiratory system: Anatomy and physiology of respiratory system, mechanism and regulation of respiration Lung volumes and capacity, transport of respiratory gases, artificial respiration, and cardiopulmonary resuscitation (CPR) methods.

Common cold, cough, bronchitis, asthma, COPD and pneumonia.

TEXT BOOKS:

1. Ross and Wilson Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
2. Principles of Anatomy and Physiology by Tortora, Grabowski. Palmetto, GA, U.S.A.
3. Essential of Medical Physiology, Sembulingam and Prema Sembulingam, Jaypee Publications.
4. Textbook of pathology by Harsh Mohan – Jaypee publisher.

REFERENCE BOOKS:

1. Human Physiology (vol 1 and 2) by Dr. C. C. Chatterjee, Academic Publishers Kolkata
2. Textbook of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Pathophysiology - Concepts of Altered Health Science By Carol Matson Porth (Lippincott Williams &Wilkins.
4. Roger Walker and Cate Whittlesea, Clinical Pharmacy and Therapeutics, Churchill Churchill Livingstone (Elsevier) Publication.

PS202: PHARMACEUTICAL ORGANIC CHEMISTRY -II (Theory)

B. Pharm. I Year II Sem

L	T	P	C
3	1	0	4

Course Objectives:

This course focuses on the fundamental principles and synthetic strategies involved in the preparation and chemical reactions of various classes of organic compounds. The main objectives are to:

1. Enable students to apply IUPAC rules for naming organic and heterocyclic compounds accurately.
2. Develop students' ability to synthesize aromatic, polynuclear aromatic, and heterocyclic compounds using general methods of preparation.
3. Introduce and explain the concepts of stereoisomerism and their pharmaceutical significance.
4. Equip students with knowledge of organic reaction mechanisms and their applications in drug synthesis.

Course Outcomes:

1. To recall and outline methods for the preparation and chemical reactions of various organic compounds.
2. To explain the acidity and basicity of organic compounds and recognize the medicinal relevance of polynuclear hydrocarbons and heterocyclic compounds.
3. To illustrate the concepts of stereoisomerism with appropriate examples.
4. To classify, name, and interpret the structures of heterocyclic compounds.
5. To describe and analyze the synthesis, chemical behavior, and applications of heterocyclic and polynuclear hydrocarbon compounds.

UNIT-I:

Chemistry of Carboxylic acids, Phenols, Amines and Polynuclear Aromatic hydrocarbons 15 Hours

1. **Aliphatic and aromatic carboxylic acids**
   a. Methods to prepare carboxylic acids (Oxidation of alcohols, carbonation of Grignard reagent, Kolbe-Schmidt reaction)
   b. Study of acidity of carboxylic acids and effect of substituents on acidity
   c. Study of chemical reactions of carboxylic acids [Mechanism of nucleophilic acyl substitution, Decarboxylation and Hell-Volhard-Zelinsky reaction]. Pharmaceutical applications of aromatic carboxylic acids (Benzoic acid, Salicylic acid, Acetyl Salicylic acid)
2. **Aliphatic and aromatic amines**
   a. Methods to prepare amines (Reduction of nitro compound, reduction of nitriles and Hofmann degradation of amides)
   b. Study of basicity of amines and effect of substituents on basicity
   c. Study of mechanism and synthetic applications of diazonium salts including Sandmeyer's and azo-dye coupling reaction
3. **Alcohols and Phenols**
   a. Classification of alcohols, methods to prepare alcohols (oxymercuration - demercuration, reduction of carbonyl compounds)
   b. Acidity of alcohols
   c. Definition of phenols, method to prepare phenols by cumene process. Comparison of the acidity of phenol vs alcohol
   d. Study of mechanism of chemical reactions of phenols (Reimer-Tiemann reaction, halogenation and nitration of phenols). Pharmaceutical applications of alcohols and phenols (Glycerine, Thymol, Paracetamol)
4. **Chemistry of polynuclear hydrocarbons:**

Definition, and classification of polynuclear aromatic hydrocarbons, Study of synthesis (Haworth synthesis) and mechanism of electrophilic aromatic substitution reactions of naphthalene, phenanthrene and anthracene and medicinal uses of drugs containing Naphthalene (Propranolol, Naphazoline) and Phenanthrene (Morphine, Codeine).

UNIT II: Optical isomerism **07 hours**

1. Definition of stereoisomerism and types of stereoisomerism with examples
2. Definition with examples for optical activity, origin of chirality, elements of symmetry, chiral and achiral molecules, enantiomerism, diastereoisomerism and meso compounds
3. Study of configuration including D & L system, sequence rules, R & S system. Medicinal importance of optical isomers with examples
4. Racemic mixture and resolution of racemic mixtures

UNIT III: Geometrical isomerism: **06 hours**

1. Nomenclature of geometrical isomers (Cis & Trans, E & Z, Syn & Anti system)
2. Conformational isomerism and its analysis in ethane, butane and cyclohexane
3. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity in biphenyl compounds

UNIT IV: Chemistry of five membered heterocycles **10 hours**

1. IUPAC nomenclature and classification of heterocyclic compounds as per the Hansch- Widman system
2. Relative aromaticity and reactivity of pyrrole, furan and thiophene
   Study of synthesis of pyrrole (Paal – Knorr synthesis), furan (Feist- Bénary reaction), thiophene (Hinsberg synthesis) and Mechanism of Electrophilic substitution reactions of pyrrole, furan and thiophene
3. Medicinal uses of drugs containing pyrrole (Ethosuximide, procyclidine), furan (Furosemide, Nitrofurazone) and thiophene (Cephaloridine, Clopidogrel)

UNIT V Chemistry of other heterocycles: **7 hours**

1. Study of nomenclature of fused heterocyclic compounds, synthesis for pyrazole (Knorr synthesis), imidazoe (Debus-Radziszewski reaction), pyridine (The Hantzsch synthesis), quinoline (The Skraup synthesis) and Electrophilic aromatic substitution reactions of pyrazole and imidazole
2. Chemical structures of Indole, pyrimidine, benzimidazole, purine, azepine, pyrazole, oxazole, Phenothiazine, benztriazole, quinoxaline
3. Basicity of imidazole, pyridine and quinolone
4. Medicinal uses of any two drugs containing pyrazole (Sildenafil, Celecoxib), imidazole (Metronidazole, Pilocarpine), pyridine (Isoniazid, Chlorpheniramine), quinoline (Chloroquine, Ciprofloxacin), indole (Indomethacin, Reserpine), benzimidazole (Albendazole, Mebendazole) pyrimidine (Fluorouracil, Sulphadiazine), purine (Mercaptopurine, Thioguanine), azepine (Diazepam, Loxapine) heterocycles

TEXT BOOKS:

1. Organic Chemistry, by Robert Thornton Morrison, Robert Neilson Boyd and Saibal Kanti Bhattacharjee, Pearson Education India, 7th edition, 2010, (ISBN 9788131704813).
2. Organic Chemistry, Vol. 1, by IL FINAR, Pearson Books, 6th Edition, 1 January 2002, (ISBN-13. 978-8177585421).
3. Organic Chemistry, Stereochemistry and Natural Products, Vol. 2, by IL FINAR, 6th Edition, 1 January 2002, Pearson Books, (ISBN-13. 978-8177585421).
4. Pharmaceutical Organic Chemistry (Part-1 Heterocyclic and Natural Products), by Rama Rao Nadendla, Vallabh Publications, 2nd Edition, 2018.
5. Heterocyclic Chemistry, By Thomas L Gilchrist, Prentice Hall Publication, 3rd Edition, 1997, (ISBN-13. 978-0582278431).
6. Principles of Pharmaceutical Organic Chemisty, by Rama Rao Nadendla, PharmMed Press, 2nd Edition, 2018, (ISBN 978-93-5230-197-3).

BS203: PHARMACEUTCIAL BIOCHEMISTRY (Theory)

B. Pharm. I Year II Sem **L T P C**
3 1 0 4

Scope: Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Course Objectives: Upon completion of course, student shell able to

- Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
- Understand the metabolism of nutrient molecules in physiological and pathological conditions.
- Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

UNIT – I **10 Hours**

Carbohydrate metabolism

Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance
HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency
Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance
Hormonal regulation of blood glucose level and Diabetes mellitus

Biological oxidation

Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate level phosphorylation, Inhibitors ETC and oxidative phosphorylation/Uncouplers

UNIT – II **10 Hours**

Lipid metabolism

â-Oxidation of saturated fatty acid (Palmitic acid)
Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D
Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

UNIT – III **10 Hours**

Amino acid metabolism

General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders
Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia)
Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline
Catabolism of heme; hyperbilirubinemia and jaundice

UNIT – IV **08 Hours**

Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides
Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome
Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis
Genetic code, Translation or Protein synthesis and inhibitors

UNIT – V **07 Hours**

Enzymes

Introduction, properties, nomenclature, and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)
Enzyme inhibitors with examples
Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation
Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions

TEXT BOOKS: **(Latest Editions)**

1. Principles of Biochemistry by Lehninger
2. Algarsamy V. Pharmaceutical Biochemistry, Pharma Med Press.
3. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.
4. Biochemistry by Stryer.
5. Biochemistry by D. Satyanarayan and U. Chakrapani
6. Textbook of Biochemistry by Rama Rao.
7. Textbook of Biochemistry by Deb.
8. Outlines of Biochemistry by Conn and Stumpf
9. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)

CS204: COMPUTER APPLICATIONS IN PHARMACY (Theory)

B. Pharm. I Year II Sem

L	T	P	C
3	0	0	3

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.

Course Objectives: Upon completion of the course the student shall be able to

- know the various types of application of computers in pharmacy
- know the various types of databases
- know the working of MS Office

UNIT – I

Introduction: History of Computers, Parts of a computer – CPU, Input, Output & Storage devices. A brief introduction to General Computer terms and types of Operating Systems.

UNIT –II

Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction, binary multiplication, binary division.

UNIT – III

Web Technologies: HTML, MS Access, Introduction to Database.

UNIT – IV

Introduction to MS Office: **MS-Word, Excel and Power Point.**

MS-Word: Overview of Microsoft Word Interface, Basic Text Formatting, Document Layout and Design, working with Tables, Inserting and Editing Graphics, Mail Merge.

Basics of a Document: Starting a New Document, Home Tab, Cut, Copy, Paste, Format Painter, Find and Replace, Formatting Text and Fill colour.

Editing / Formatting the Document: Using Text Box, My App and store, Header and Footer, Adding Signatures, Objects, Grouping Multiple Objects, Wrapping the Text, Setting up the Page, Page Size, Columns, Page Breakup, Indent spacing, Hyphenation, Printing, Saving & Closing the document.

MS-Excel: Basics, spreadsheets, data types, formulas, formatting, charts, graphs, calculation of statistical parameters using excel.

MS-Power Point: Power point basics, views, slide controls, applied design, page setup, templates, background control, colour screens, transitions and animations, working with texts and working with graphics.

UNIT-V

Applications of Computers in Pharmacy: Drug information storage and retrieval, Pharmacokinetics, Pharmaceutical Analysis, Bulk drugs and Pharmaceuticals Manufactures, Hospital and Clinical Pharmacy, Electronic Prescribing and Discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology, and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System.

TEXT BOOKS: (Latest edition):

1. Introduction to Biostatics and Computer Science – Y.I. Shah, Dr. A.R. Paradkar, M. G. Dhayagude, Nirali Prakashan.
2. Computer Applications in Pharmaceutical Sciences – Syed Mohiuddin, A. Venkateshwar Reddy, Azra Sultana, Ukaaz Publications, Hyderabad.

REFERENCE BOOKS: (Latest edition):

1. Computer Application in Pharmacy – William E. Fassett, Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.

2. Computer Application in Pharmaceutical Research and Development – Sean Ekins, WileyInterscience, A John Willey and Sons, INC., Publication, USA.
3. Bioinformatics (Concept, Skills and Applications) – S.C. Rastogi, CBS Publishers and
4. Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
5. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and
6. Infopath – Cary N. Prague, Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani,
7. New Delhi – 110002.
8. Mohiddin S. D. Computer Applications in Pharmaceutical Sciences, Pharma Med Press.
9. Working in Microsoft Office – Ron Mansfield, Tata Mc Grow Hill Education Pvt. Ltd.

PS205: HUMAN ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-I (Practical)

B. Pharm. I Year II Sem	**L**	**T**	**P**	**C**
	0	**0**	**4**	**2**

List of Experiments:

Practical HAPP allows the verification of physiological processes discussed in theory classes through experiments on living tissues, simulated animal models, charts, models or and models with the help of human volunteers

1. Principle and applications of compound microscopes/phase contrast microscopy.
2. Microscopic study of epithelial, connective, muscular and nervous tissues
3. Identification of axial bones and appendicular bones
4. Estimation of hemoglobin content
5. Determination of bleeding time and clotting time
6. Demonstration of complete blood count by cell analyzer
7. Estimation of white blood cell (WBC) count
8. Estimation of red blood corpuscles (RBC) count
9. Estimation of differential leukocyte (DLC) count
10. Determination of blood groups and erythrocyte sedimentation rate (ESR). Students should study sample hematological test reports.
11. Learning through charts and models – Heart and blood vessels
12. Learning through charts and models – Respiratory system
13. Learning through charts and models – Digestive system
14. Determination of heart rate, pulse rate, respiratory rate and tidal volumes
15. Recording blood pressure and studying the components of ECG.
16. Students may undertake case studies of some of the diseases prescribed in the theory syllabus above.

TEXT BOOKS:

1. Textbook of Human Histology by Inderbir Singh, Jaypee Brother’s medical publishers, New Delhi.
2. Textbook of Practical Physiology by C.L. Ghai, Jaypee
3. Laboratory Manual and Journal of Physiology. Dr. V. G. Ranade, Pune Vidhyarthee Prakashan.
4. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee Brother’s medical publishers, New Delhi.
5. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterjee, Academic Publishers Kolkata

PS206: PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

B. Pharm. I Year II Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Prepare, purify and characterize (by physical constant/TLC/IR) following organic compounds (Minimum of 04 aromatic and any two heterocyclic compounds with different chemical reactions)
   a. Benzanilide/Phenyl benzoate/Acetanilide from aniline/ Phenol by acylation reaction.
   b. 2,4,6-Tribromo aniline from aniline/para bromo acetanilide from Acetanilide by halogenation (Bromination) reaction.
   c. 5-Nitro salicylic acid f r o m salicylic acid / meta di-nitro benzene from nitro benzene by nitration reaction.
   d. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
   e. 1-Phenyl-azo-2-napthol from aniline by diazotization and coupling reactions.
   f. Benzil from benzoin by oxidation reaction.
   g. Synthesis of 3,5-dimethyl pyrazole from acetylacetone.
   h. Synthesis of benzimidazole from ortho phenylene diamine
   i. Synthesis of phenothiazine from diphenyl amine
2. Qualitative analysis of binary mixture of organic compounds (any two) (Acid + Neutral and Base + Neutral)
3. To draw and visualize 3D structures, calculate molecular properties and to draw Chemical reactions using software tools

TEXT BOOKS:

1) Practical Organic Chemistry, by Mann and Saunders, Pearson Education India 4th Edition, 2009, (ISBN: 13. 978-8131727102).
2) Introduction to Organic Laboratory Techniues: A Small Scale Approach, by Donald L. Pavia, Gary M. Lampman, George S. Kriz,Brooks/Cole, Third Edition, 2010, (ISBN: 978- 0538733281).
3) Heterocyclic Chemistry, by Raj K Bansal, New Age International, Fifth Edition, 2020, (8122412122).

BS207: PHARMACEUTICAL BIOCHEMISTRY (Practical)

B. Pharm. I Year II Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
2. Identification tests for Proteins (albumin and Casein)
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4. Qualitative analysis of urine for abnormal constituents
5. Determination of blood creatinine
6. Determination of blood sugar
7. Determination of serum total cholesterol
8. Preparation of buffer solution and measurement of pH
9. Study of enzymatic hydrolysis of starch
10. Determination of Salivary amylase activity
11. Study the effect of Temperature on Salivary amylase activity.
12. Study the effect of substrate concentration on salivary amylase activity.

RECOMMENDED BOOKS (Latest Editions)

1) Biochemistry: A Practical Manual, Bose Sharad Chandra
2) Practical Biochemistry by R.C. Gupta and S. Bhargavan.
3) Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
4) Practical Biochemistry by Harold Varley.

CS208: COMPUTER APPLICATIONS IN PHARMACY (Practical)

B. Pharm. I Year II Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML web page to show personal information.
3 Retrieve the information of a drug and its adverse effects using online tools
4 Creating mailing labels Using Label Wizard, generating label in MS WORD
5 Create a database in MS Access to store the patient information with the required fields Using access
6 Design a form in MS Access to view, add, delete and modify the patient record in the database
1. Generating report and printing the report from patient database
2. Creating invoice table using – MS Access
3. Drug information storage and retrieval using MS Access
4. Creating and working with queries in MS Access
5. Exporting Tables, Queries, Forms and Reports to web pages
6. Exporting Tables, Queries, Forms and Reports to XML pages

PS301: HUMAN ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY- II (Theory)

B. Pharm. II Year I Sem

L	T	P	C
3	1	0	4

Course Objectives:

- To impart fundamental knowledge on the structure and functions of the various organ systems of the human body and the Pathophysiology in brief about various diseases affecting these organ systems.
- To help in understanding both homeostatic mechanisms and the study of various causes of diseases and reactions of the body to such disease producing causes.

Course Outcomes: Upon completion of this course the student should be able to

- Explain the gross morphology, structures and functions of various organs and organ systems of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Describe the etiology and pathogenesis of the selected disease states
- Know the signs and symptoms, risk factors and complications of the diseases.
- Understand coordinated working pattern of different organs of each system
- Perform the various experiments related to special senses and nervous system

UNIT-I **08 Hours**

Nervous system: Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, nerve electrophysiology, synapse, neurotransmitters and their receptors and neurohumoral transmission including ion channel opening, signal transduction, second messengers.

UNIT-II **10 Hours**

a) Peripheral nervous system:

Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves.

b) Diseases of Peripheral and Central Nervous System:

Pathophysiology in brief about neurodegenerative diseases (Alzheimer's disease, Parkinson's disease), traumatic injuries (spinal cord injury, brain injury), infections (Meningitis, Encephalitis), vascular disorders (stroke), demyelinating diseases (Multiple sclerosis), and mental health conditions (Depression and Schizophrenia). Pathophysiology in brief about Epilepsy and Migraine. Pathophysiology in brief about peripheral neuropathies.

UNIT-III **10 Hours**

a) Urinary system

Anatomy of urinary tract, kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, renin- angiotensin axis

b) Pathophysiology in brief about glomerulonephritis, acute and chronic renal failure, renal calculi.

Special Senses: Anatomy and physiology of eye, ear, nose, tongue and skin

Definitions and Pathophysiology in brief about - Myopia. Hypermetropia, loss of accommodation, glaucoma, cataract, vertigo, hearing impairment, otitis.

UNIT-IV **10 Hours**

a) Endocrine system:

Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus. Pathophysiology in brief about diabetes, thyroid disorders, pituitary disorders, adrenal disorders.

b) Reproductive system

Anatomy of male and female reproductive system, functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition.

Diseases of sex hormones: PCOD, menstrual disorders, male and female infertility.

UNIT-V **7 Hours**

Pathophysiology in brief about

a) Neoplasms: Classification, etiology, and pathogenesis of cancer.
b) An overview of Mutagenicity and Teratogenicity
c) Infectious diseases**:** Meningitis, typhoid, malaria, leprosy, tuberculosis, dengue chikungunya, COVID-19, amoebiasis, septicaemia etc.
d) Sexually transmitted diseases: AIDs, chlamydia, syphilis, gonorrhea, etc.

TEXT BOOKS:

1. Ross and Wilson Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
2. Principles of Anatomy and Physiology by Tortora, Grabowski. Palmetto, GA, U.S.A.
3. Essential of Medical Physiology, Sembulingam and Prema Sembulingam, Jaypee Publications.
4. Textbook of pathology by Harsh Mohan – Jaypee publisher.

REFERENCE BOOKS:

1. Human Physiology (vol 1 and 2) by Dr. C. C. Chatterjee, Academic Publishers Kolkata
2. Textbook of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Pathophysiology - Concepts of Altered Health Science By Carol Matson Porth (Lippincott Williams &Wilkins)
4. Roger Walker and Cate Whittlesea, Clinical Pharmacy and Therapeutics, Churchill Churchill Livingstone (Elsevier) Publication.

PC302: PHYSICAL PHARMACEUTICS – I (Theory)

B. Pharm. II Year I Sem **L T P C**
3 1 0 4

Course Objectives: The course deals with the various physical, physicochemical properties and principle involved in dosage forms, formulations. Theory and practical components of the subject help the student to get a better insight in to various areas of formulation research and development and stability studies of pharmaceuticals.

Course Outcomes: Upon the completion of the course student shall be able to:

- Understand various physicochemical properties of drug molecules in the designing the dosage form.
- Know the principles of chemical kinetics & to use them in assigning expiry date for formulation.
- Demonstrate use of physicochemical properties in evaluation of dosage forms.
- Appreciate physicochemical properties of drug molecules in formulation research and development.

UNIT – I **10 Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols– inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism. **Physicochemical properties of drug molecules:** Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications

UNIT – II **10 Hours**

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, Solubility enhancements techniques. Dissolution, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions, azeotropic mixtures, fractional distillation. Partially miscible liquids, Critical solution temperature (CST) and applications. Distribution law, its limitations and applications

UNIT - III **10 Hours**

Micromeritics: Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle size by (different methods), counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT – IV **08 Hours**

Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, Crystalline structures.

UNIT – V **07 Hours**

pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination ectrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions. Isotonicity, Colligative properties and determination of tonicity of a system.

REFERENCE BOOKS: (Latest Editions)

1. Physical pharmacy by Alfred Martin
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H. A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume 1-3, Marcel Dekkar Inc.
6. Liberman H. A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical pharmaceutics by Ramasamy C and Manavalan R.
8. Manavalan et. Al, Physical Pharmaceutics, Pharma Med Press

BS303: PHARMACEUTICAL MICROBIOLOGY (Theory)

B. Pharm. II Year I Sem **L T P C**
3 1 0 4

Course Objectives: In the broadest sense, scope of microbiology is the study of all organisms that are invisible to the naked eye- that is the study of microorganisms. Microorganisms are necessary for the production of bread, cheese, beer, antibiotics, vaccines, vitamins, enzymes etc. Microbiology has an impact on medicine, agriculture, food science, ecology, genetics, biochemistry, immunology etc.

Course Outcomes: Upon completion of the subject student shall be able to;

- Understand methods of identification, cultivation and preservation of various microorganisms
- Importance of sterilization in microbiology. and pharmaceutical industry
- Learn sterility testing of pharmaceutical products.
- Microbiological standardization of Pharmaceuticals.
- Understand the cell culture technology and its applications in pharmaceutical industries.

UNIT – I **10 Hours**

Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes. Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

UNIT - II **10 Hours**

Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of Physical, chemical and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipments employed in large scale sterilization. Sterility indicators.

UNIT – III **10 Hours**

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Virus. Classification and mode of action of disinfectants. Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions. Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

UNIT – IV **08 Hours**

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic and testing of antimicrobial activity of a new substance. General aspects-environmental cleanliness.

UNIT – V **07 Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.

REFERENCE BOOKS (Latest edition)

1. Rafi MD, Text book of biochemistry for undergraduates, 3rd edition, Universities press, 2017.
2. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
3. Prescott and Dunn, Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.

4. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
5. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
6. Rose: Industrial Microbiology.
7. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
8. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
9. Peppler: Microbial Technology.
10. I.P., B.P., U.S.P.- latest editions.
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
14. Ananthanarayan and Paniker's textbook of Microbiology tenth edition
15. Ravi Kumar, Pharmaceutical Microbiology: A Comprehensive Approach, 2nd Ed. Pharma Med Press

PC304: PHARMACEUTICAL ENGINEERING (Theory)

B. Pharm. II Year I Sem **L T P C**
3 1 0 4

Course Objectives: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Course Outcomes: Upon completion of the course student shall be able:

- To know various unit operations used in Pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To carry out various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

UNIT – I **10 Hours**

Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.

Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.

Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

UNIT – II **10 Hours**

Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers & Silverson Emulsifier,

Crystallization: Objectives, applications, & theory of crystallization. Solubility curves, principles, construction, working, uses, merits and demerits of Agitated batch crystallizer, Swenson Walker Crystallizer, Krystal crystallizer, Vacuum crystallizer.

UNIT – III **10 Hours**

Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator.

Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

UNIT – IV **08 Hours**

Drying: Objectives, applications & mechanism of drying process, measurements& applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

Distillation: Objectives, applications & types of distillation. principles, construction, working, uses, merits and demerits of (lab scale and industrial scale) Simple distillation, preparation of purified water and water for injection BP by distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation.

UNIT - V **07 Hours**

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta

filter & Cartridge filter, membrane filters and Seitz filter. HEPA filters for controlled pollution. **Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

REFERENCE BOOKS: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latest edition.
3. Unit operation of chemical engineering – Mcabe Smith, Latest edition.
4. Pharmaceutical Engineering DK Tripathi, Pharma Med Press
5. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
6. Remington practice of pharmacy- Martin, Latest edition.
7. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
8. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
9. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.
10. Derle, Essentials of Pharmaceutical Engineering (Unit Operations), 2nd Ed. Pharma Med Press

PS305: PHARMACOGNOSY (Theory)

B. Pharm. II Year I Sem **L T P C**
3 1 0 4

Course Objective: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Course Outcomes: Upon completion of the course, the student shall be able

- to know the techniques in the cultivation and production of crude drugs
- to know the crude drugs, their uses and chemical nature
- know the evaluation techniques for the herbal drugs
- to carry out the microscopic and morphological evaluation of crude drugs

UNIT - I **10 Hours**

Introduction to Pharmacognosy: Definition, history, scope and development of Pharmacognosy

(a) Sources of Drugs – Plants, Animals, Marine & Tissue culture

(b) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo classification of drugs

UNIT – II **10 Hours**

Cultivation, Collection, Processing and storage of drugs of natural origin:

Cultivation and Collection of drugs of natural origin. Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants.

Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT – III

Introduction to primary metabolites and secondary metabolite: **10 Hours**

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs .General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT - IV **08 Hours**

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Traditional Chinese medicine system ,Unani, Siddha, Homeopathy and naturopathy,

Plant Products: Fibers - Cotton, Jute, Hemp Hallucinogens, Teratogens, Natural allergens, Natural pesticides

UNIT - V

Plant tissue culture: Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible

vaccines

REFERENCE BOOKS: (Latest Editions)

1. W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Anatomy of Crude Drugs by M.A. Iyengar
9. SL Deore, Pharmacognosy and Phytochemistry – I, Pharma Med Press

PS306: HUMAN ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY- II (Practical)

B. Pharm. II Year I Sem

L	T	P	C
0	0	4	2

List of Experiments:

Practical HAPP allows the verification of physiological processes discussed in theory Sclasses through experiments on living tissues, simulated animal models, charts, and models with the help of human volunteers.

1. Learning through charts and models – Nervous system
2. To demonstrate the general neurological examination and calculation of GCS Score
3. To record body temperature and demonstrate the reflex activity
4. Understanding EEG as a diagnostic tool
5. Learning through charts, models and open-source digital applications – Special senses.
    - To demonstrate the function of olfactory nerve
    - To examine the different types of taste.
    - To demonstrate the visual acuity
    - To demonstrate the reflex activity
6. Learning through charts and models – Urinary system
7. Learning through charts and models – Endocrine system
8. Learning through charts and models – Reproductive system
9. Recording of body mass index (BMI) and basal metabolic rate (BMR).
10. Study of family planning devices and pregnancy diagnosis test.
11. Understanding the significance of liver function tests with the help of a clinical diagnostic report,
12. Understanding the significance of kidney function tests with the help of a clinical diagnostic report
13. Understanding the significance of lipid profile tests with the help of a clinical diagnostic report
14. Students may undertake case studies of some of the diseases prescribed in the theory syllabus above.

REFERENCE BOOKS:

1. Textbook of Human Histology by Inderbir Singh, Jaypee Brother’s medical publishers, New Delhi.
2. Textbook of Practical Physiology by C.L. Ghai, Jaypee
3. Laboratory Manual and Journal of Physiology. Dr. V. G. Ranade, Pune Vidhyarthee Prakashan.
4. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee Brother’s medical publishers, New Delhi.
5. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterjee, Academic Publishers Kolkata

PC307: PHYSICAL PHARMACEUTICS – I (Practical)

B. Pharm. II Year I Sem

L	T	P	C
0	0	4	2

List of Experiments

1. Determination the solubility of drug at room temperature at different pH conditions
2. Determination of pKa value by Half Neutralization/ Henderson Hassel Balch equation
3. Determination of Partition co- efficient of benzoic acid in benzene and water
4. Determination of Partition co- efficient of Iodine in CCl4 and water
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method
6. Determination of particle size, particle size distribution using sieving method
7. Determination of particle size, particle size distribution using Microscopic method
8. Determination of bulk density, true density and porosity
9. Determine the angle of repose and influence of lubricant on angle of repose
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

REFERENCE BOOKS: (Latest Editions)

1. Experimental pharmaceutics by Eugene, Parott.
2. Pharmaceutical Calculation, D K Tripathi.
3. Laboratory manual of physical pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
4. Mohanta Guru Prasad. Physical Pharmacy Practical text, 3rd Revised Ed., Pharma Med Press

BS308: PHARMACEUTICAL MICROBIOLOGY (Practical)

B. Pharm. II Year I Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test (IMViC reactions)
11. Revision Practical Class

REFERENCE BOOKS (Latest edition)

1. Jyostna, Manual of Practical Microbiology, Pharma Med Press
2. Pharmaceutical Microbiology: A Laboratory manual by Prasad G.Shyam & K.Srisailam,

PC309: PHARMACEUTICAL ENGINEERING (Practical)

B. Pharm. II Year I Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Determination of radiation constant of brass, iron, unpainted and painted glass.
2. Steam distillation – To calculate the efficiency of steam distillation.
3. To determine the overall heat transfer coefficient by heat exchanger.
4. Construction of drying curves (for calcium carbonate and starch).
5. Determination of moisture content and loss on drying.
6. Determination of humidity of air – i) from wet and dry bulb temperatures –use of Dew point method.
7. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
8. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
9. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
10. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
11. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity
12. To study the effect of time on the Rate of Crystallization.
13. To calculate the uniformity Index for given sample by using Double Cone Blender.

REFERENCE BOOKS (Latest edition)

1. Pharmaceutical Engineering: Practical Manual (Unit Operations), Sudhakara Reddy,Pharmamed Press.
2. Remington practice of pharmacy- Martin, Latest edition.

PS401: MEDICINAL CHEMISTRY – I

B. Pharm. II Year II Sem **L T P C**
3 1 0 4

Course Objectives:
This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Course Outcomes: Upon completion of the course the student shall be able to
- understand the chemistry of drugs with respect to their pharmacological activity
- understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
- know the Structural Activity Relationship (SAR) of different class of drugs
- write the chemical synthesis of some drugs

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT – I **10 Hours**

Introduction to Medicinal Chemistry
History and development of medicinal chemistry. Physicochemical properties in relation to biological action (Ionization, Solubility, Partition Coefficient, Hydrogen bonding) Protein binding, Chelation, Bioisosterism, significance of Isomerism in biological activity, Structural modifications in drug discovery. Prodrugs: Basic concepts & application of prodrug design

UNIT – II **10 Hours**

Drugs acting on Autonomic Nervous System
Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.
Sympathomimetic agents: SAR of Sympathomimetic agents
Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.
Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol.
Adrenergic Antagonists:
Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.
Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT – III **10 Hours**

Cholinergic neurotransmitters: Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.
Parasympathomimetic agents: SAR of Parasympathomimetic agents
Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.
Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.
Cholinesterase reactivator: Pralidoxime chloride.
Cholinergic Blocking agents: SAR of cholinolytic agents
Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyaminesulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolatehydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT – IV **08 Hours**

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous:

Amides & imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazeines: SAR of Phenothiazeines Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsantaction

Barbiturates: Phenobarbitone, Methabarbital. **Hydantoins:** Phenytoin, Mephenytoin, Ethotoin **Oxazolidine diones:** Trimethadione, Paramethadione

Succinimides: Phensuximide, Methsuximide,Ethosuximide

Urea and monoacylureas: Phenacemide, Carbamazepine **Benzodiazepines**: Clonazepam

Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V **07 Hours**

DRUGS ACTING ON CENTRAL NERVOUS SYSTEM

General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbitutrates: Methohexital sodium*, Thiamylalsodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride. *

NARCOTIC AND NON-NARCOTIC ANALGESICS

Morphine and related drugs: SAR of Morphine analogues, Morphinesulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride. **Anti-inflammatory agents:** Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

REFERENCE BOOKS (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.

7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Rama Rao Nadendla, Medicinal Chemistry, 2nd Revised Ed. Pharma Med Press

PC402: PHYSICAL PHARMACEUTICS - II

B. Pharm. II Year II Sem **L T P C**
3 1 0 4

Course Objectives: The course deals with the various physical, physicochemical properties and principle involved in dosage forms, formulations. Theory and practical components of the subject help the student to get a better insight in to various areas of formulation research and development and stability studies of pharmaceuticals.

Course Outcomes: Upon the completion of the course student shall be able to

- Understand various physicochemical properties of drug molecules in the designing the dosage form
- Know the principles of chemical kinetics & to use them in assigning expiry date for Formulation
- Demonstrate use of physicochemical properties in evaluation of dosage forms.
- Appreciate physicochemical properties of drug molecules in formulation research and Development

UNIT - I **10 Hours**

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.

UNIT - II **10 Hours**

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatants, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers.

Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus.

UNIT – III **10 Hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation and evaluation of suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Physical stability of emulsions, preservation of emulsions, rheological properties of emulsions, phase equilibria. Formulation and evaluation of emulsions.

UNIT - IV **08 Hours**

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions,
surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilization and its methods, adsorption at solid interface.

UNIT – V **07 Hours**

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes and coacervation.

REFERENCE BOOKS: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume 1-3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.
8. Vidyadhara et al. Physical Pharmaceutics – II, Pharma Med Press.

PC403: PHARMACOLOGY - I

B. Pharm. II Year II Sem **L T P C**
3 1 0 4

Course Objectives: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Course Outcomes: Upon completion of this course the student should be able to

- Understand the pharmacological actions of different categories of drugs
- Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
- Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
- Observe the effect of drugs on animals by simulated experiments
- Appreciate correlation of pharmacology with other bio medical sciences

UNIT – I **08 hours**

1. General Pharmacology

a) Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration.
b) Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.
c) Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination

UNIT – II **10 Hours**

Adverse Drug Reactions and Drug Interactions

a. Agonists, antagonists (competitive and noncompetitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.
b. Adverse drug reactions.
c. Drug interactions (pharmacokinetic and pharmacodynamic)
d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

UNIT – III **10 Hours**

2. Pharmacology of peripheral nervous system

a. Organization and function of ANS.
b. Neurohumoral transmission, co-transmission and classification of neurotransmitters.
c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.
d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
e. Local anesthetic agents.
f. Drugs used in myasthenia gravis and glaucoma

UNIT – IV **10 Hours**

3. Pharmacology of central nervous system - I

a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.
b. General anesthetics and pre-anesthetics**.**
c. Sedatives, hypnotics and centrally acting muscle relaxants.
d. Anti-epileptics

e. Alcohols and disulfiram

UNIT – V **07 Hours**

Pharmacology of central nervous system - II

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti- manics and hallucinogens.
b. Drugs used in Parkinsons disease and Alzheimer's disease.
c. CNS stimulants and nootropics.
d. Opioid analgesics and antagonists
e. Drug addiction, drug abuse, tolerance and dependence.

REFERENCE BOOKS (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
2. A Pharmacology Primer: Theory Applications and Methods, 3rd edition, Terry P. Kenakin, Elsevier
3. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
4. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
5. Basic Knowledge of Pharmacology BY Roland Seifert, Springer
6. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
7. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
8. K.D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
9. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
10. Modern Pharmacology with clinical Applications, by Charles R. Craig& Robert,
11. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
12. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan
13. Ravishankar. K & Kiranmayi G.V.N, Pharmacology: A Comprehensive Approach, Pharma Med Press

PS404: PHARMACOGNOSY AND PHYTOCHEMISTRY

B. Pharm. II Year II Sem **L T P C**
3 1 0 4

Course Objective: The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine

Course Outcomes: Upon completion of the course, the student shall be able

- To know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
- To understand the preparation and development of herbal formulation.
- To understand the herbal drug interactions
- To carryout isolation and identification of phytoconstituents

UNIT - I **07 Hours**

Metabolic pathways and biogenetic studies

- Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
- Study of utilization of radioactive isotopes in the investigation of Biogenetic studies. Pathway Prediction tools, CRISPR/Cas9, Genome editing

UNIT - II **10 Hours**

a. General introduction, general methods of extraction (Maceration, Percolatio, Chromatographic methods) and isolation of alkaloids, glycosides, flavanoids and volatile oils.

b. Biological source, microscopical characters, composition, chemistry, analysis, therapeutic uses and commercial applications of the following secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta, Gingko

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander, Lemon grass

UNIT - III **10 Hours**

General introduction, composition, chemistry & chemical classes, general methods of extraction & analysis, biological sources, therapeutic uses and commercial applications of following secondary metabolites

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony,Boswellia

Glycosides: Senna, Aloes, Bitter Almond, Digitalis, Liquorice

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT - IV **12 Hours**

Isolation, Identification, estimation of phytoconstituents and commercial applications of following

a. Terpenoids: Menthol, Citral and Artemisin,Taxol
b. Glycosides: Glycyrhetinic acid,Rutin, Sennoside and Digoxin.
c. Alkaloids: atropine, Quinine, Reserpine and Caffeine
d. Resins: Podophyllotoxin and Curcumin

UNIT - V **06 Hours**

a. Preparation and Standardization of Ayush Formulations-Aristas and Asawas, Gutika, Avaleha, Ghrita, Churna, Bhasma and Taila

b. Modern methods of extraction (Super critical fluid extraction, counter current extraction, Microwave assisted extraction, ultra sonication assisted extraction

TEXT BOOKS: (Latest Editions)

1. W. C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr. SH. Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H. Pande, Asia Pacific Business press, Inc, New Delhi.
7. A. N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington's Pharmaceutical sciences.
12. Text Boo of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R. C. Dubey.
14. SL Deore, Pharmacognosy and Phytochemistry – II, Pharma Med Press
15. Jalalpure,S.S.Patil,A.K.Text book of Pharmacognosy and Phytochemistryl, Nirali prakashan
16. Kulkarni A. Vishaka, Pharmacognosy and Phytochemistry – II, Pharma Med Press

PS405: PHARMACEUTICAL JURISPRUDENCE

B. Pharm. II Year II Sem **L T P C**
3 1 0 4

Course Objectives: This course is designed to impart basic knowledge on several important legislations related to the profession of pharmacy in India.

Course Outcomes: Upon completion of the course, the student shall be able to understand:
- The Pharmaceutical legislations and their implications in the development and marketing
- Various Indian pharmaceutical Acts and Laws
- The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
- The code of ethics during the pharmaceutical practice

UNIT – I **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the act and rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties.

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs,

Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT – II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs - Wholesale, Retail sale and Restricted license. Offences and penalties

Labeling & Packing of drugs - General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the act and rules - Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors

UNIT – III **10 Hours**

Pharmacy Act - 1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; its constitution and functions, Registration of Pharmacists, Offences and

Penalties

Medicinal and Toilet Preparation Act -1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT – IV **08 Hours**

Study of Salient Features of Drugs and magic remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties.

Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee, Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT – V **07 Hours**

Pharmaceutical Legislations – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee

Code of Pharmaceutical ethics - Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath

Medical Termination of pregnancy act Right to information Act

Introduction to Intellectual Property Rights (IPR)

RECOMMENDED BOOKS: (Latest Edition)

1. Forensic Pharmacy by B. Suresh
2. Text book of Forensic Pharmacy by B.M. Mithal
3. Hand book of drug law-by M. L. Mehra
4. A text book of Forensic Pharmacy by N.K. Jain
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
9. Bare Acts of the said laws published by Government. Reference books (Theory)
10. Kokate C. K. Textbook of Forensic Pharmacy, 2nd Ed. Pharma Med Press

PS406: MEDICINAL CHEMISTRY – I (Practical)

B. Pharm. II Year II Sem

L	T	P	C
0	0	4	2

List of Experiments:

I. Preparation of drugs/ intermediates

1. 1,3-pyrazole
2. 1,3-oxazole
3. Benzimidazole
4. Benztriazole
5. 2,3- diphenyl quinoxaline
6. Phenothiazine
7. Barbiturate

II Assay of drugs

1. Chlorpromazine
2. Phenobarbitone
3. Atropine
4. Ibuprofen
5. Aspirin
6. Furosemide

III Determination of Partition coefficient for any two drugs

RECOMMENDED BOOKS (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. rganic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I. Vogel
11. Raghuprasad, et al., Advanced Medicinal Chemistry – A Laboratory Guide, Pharma Med Press

PC407: PHYSICAL PHARMACEUTICS – II (Practical)

B. Pharm. II Year II Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Determination of surface tension of given liquids by drop count and drop weight method
2. Determination of HLB number of a surfactant by saponification method
3. Determination of Freundlich and Langmuir constants using activated char coal
4. Determination of critical micellar concentration of surfactants
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies
12. Preparation and evaluation of Colloids

RECOMMENDED BOOKS: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Physical Pharmacy Practical text, 3rd Revised Ed.by Mohanta Guru Prasad
5. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

PC408: PHARMACOLOGY – I (Practical)

B. Pharm. II Year II Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos

RECOMMENDED BOOKS (Latest Editions)

1) Essentials of Experimental Pharmacology, General Concepts by Bothra Sunil

PS409: PHARMACOGNOSY AND PHYTOCHEMISTRY – I (Practical)

B. Pharm. II Year II Sem

L	T	P	C
0	0	4	2

List of Experiments:

1. Determination of stomatal number and index
2. Determination of vein islet number, vein islet termination and paliside ratio.
3. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
4. Determination of length and width of Phloem fibres of Cinchona & Cinnamon
5. Determination of number of starch grains by Lycopodium spore method
6. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
7. Exercise involving isolation & detection of active principles
   a. Caffeine - from tea dust.
   b. Diosgenin from Dioscorea
   c. Atropine from Belladonna
   d. Sennosides from Senna
8. Separation of sugars by Paper chromatography
9. TLC of herbal extract
10. Determination of acid value, ester value, Saponification value and iodine lab of fixed oils mentioned in theory.
11. Determination of Ash value
12. Analysis of crude drugs by chemical tests: (i)Tragaccanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil (viii) Asafoetida (ix) Benzoin (x) Colophony (xi) Aloes (xii) Myrrh
13. Determination of alcohol content of Asava and arista

RECOMMENDED BOOKS: (Latest Editions)

1. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
2. Practical Pharmacognosy, T. E. Wallis, Pharmamed Press
3. Anatomy of Crude Drugs by M.A. Iyengar

VA400: GENDER SENSITISATION (8 HOURS)

B. Pharm. II Year II Sem

L	T	P	C
1	0	0	0.5

Course Description

The course on 'Gender Sensitization' offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines - such as literature, history, economics, psychology, sociology, philosophy and media studies - to examine cultural assumptions about sex, gender, and sexuality.

Course Objectives: The course aims:

1. To develop students' sensibility with regard to issues of gender
2. To provide a critical perspective on the socialization
3. To bring awareness on gender-based violence and sexual harassment
4. To educate students about Sustainable Development Goals (SDGs) and their importance
5. To sensitize students about gender-biased language

Course Outcomes: Students will be able to:

1. Develop a better understanding of important issues related to gender
2. Understand various aspects of socialization and gender discrimination
3. Realise the consequences of gender-based violence and sexual harassment
4. Understand the objectives of Sustainable Development Goals (SDGs) and their importance
5. Comprehend and be able to use gender-neutral language

Syllabus

Unit – I Understanding Gender Roles and Relations: Definition of Gender - Exploring Attitudes towards Gender - Transformation in Stereotypical Roles

Unit – II Socialization: Preparing for Womanhood - Growing up Male-Gender Roles and Just Relationships – Matrix - Missing Women-Sex Selection and its Consequences

Unit – III Gender & Labour and Gender-Based Violence: Housework- the Invisible Labor- "*My Mother doesn't Work*." "*Share the Load*."-Unrecognized and Unaccounted work - Types of Gender-based Violence - Sexual Harassment - Domestic Violence

Unit – IV Gender and Culture: Gender Development Issues-Gender, Governance and Sustainable Development Goals (SDGs)

Unit - V Gender and Electronic Media: Gender and Film - Gender and Advertisement- Electronic Media - Gender Sensitive Language

Essential Reading:

The Textbook, "*Towards a World of Equals: A Bilingual Textbook on Gender"* written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu **published by Telugu Akademi, Telangana Government in 2015.**

VA401: HUMAN VALUES AND PROFESSIONAL ETHICS (8 HOURS)

B. Pharm. II Year II Sem

L	T	P	C
1	0	0	0.5

Course Description

The course on '*Human Values and Professional Ethics*' aims to sensitize students to the importance of human values and professional ethics in personal and professional life. It covers fundamental human values, moral principles, and ethical theories, as well as their application in various professional contexts.

Course Objectives: The course aims:

1. To develop students' sensibility with regard to issues of professional ethics
2. To provide a critical perspective on the personality development
3. To bring awareness on professional codes of conduct
4. To educate students about Sustainable Development Goals (SDGs) and their importance
5. To sensitize students about employee rights

Course Outcomes: Students will be able to:

1. Develop a better understanding of important issues related to professional ethics
2. Understand various aspects of personality development
3. Realise the importance of professional codes of conduct
4. To prepare students for possible gaps and fight against unethical practices
5. To sensitise students about employee responsibilities and rights

Syllabus

Unit – I Human Values and Professional Ethics: Morals, Values, Ethics - Work Ethics - Service Learning - Respect For Others- Living Peacefully - Valuing Time

Unit –II Personality Development: Character- Self-Confidence - Empathy - Cooperation

Unit –III Two Models of Professionalism - Professional Etiquette - Engineering Ethics - Professional Codes and Code of Conduct of Institute of Engineers - Global issues in MNCs

Unit –IV Professional Responsibilities: Responsibility in Engineering and Engineering Standards - Ethical Standards Vs Professional Conduct - Zero Tolerance for Culpable Mistakes - Hazards and Risks

Unit – V Employee Rights: Respect for Authority - Conflicts of Interest - Professionals /Engineers as Managers, Advisors, Experts, Witnesses and Consultants - Moral Leadership

Suggesting Reading:

1. R. R. Gaur; R. Sangal; G.P. Bagaria. *Human Values and Professional Ethics.* Excel Books
2. S B George. *Human Values and Professional Ethics,* Vikas Publishing.
3. S K Chakraborthy & D.Chakraborthy. *Human Values and Ethics*, Himalaya.
4. M. Govindarajan, S. Natarajan, & V.S. Senthil kumar: *Engineering Ethics (Includes Human Values),* PHI Learning Pvt. Ltd., New Delhi – 110001