

SULTAN-UL-ULOOM COLLEGE OF PHARMACY 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 Credits			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 Credits			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		Professional Elective – I	3	1	0	4
	PS505	I. Generic Product Development				
	PS506	II. Social and Preventive Pharmacy				
	PS507	III. Pharmaceutical Regulatory Sciences				
	PS508	IV. Pharmaceutical Management and Marketing				
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 Credits			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		Professional Elective – II	3	1		4
	PS605	I. Medical Devices				
	PS606	II. Clinical Research and NDCT Regulations				
	PS607	III. Pharmaceutical Bioanalysis				
	PS608	IV. Cosmetics and Cosmeceuticals				
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 Credits			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		Professional Elective - III	3	1	-	4
	PS705	I. Biosimilars				
	PS706	II. Drug Store and Business Management				
	PS707	III. QbD in Pharmaceutical Sciences				
	PS708	IV. Pharmaceutical Supply Chain Management				
6	PS709	Instrumental Methods of Analysis Lab	-	-	4	2
7	PS710	Practice School	-	-	4	2
		Total Credits	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		Professional Elective - IV	3	1	-	4
	PS804	I. Pharma Marketing Management				
	PS805	II. Nano Technology				
	PS806	III. Good Practices in Pharmaceutical Sciences				
	PS807	IV. Pharmaceutical Project Management				
5	PC808	Novel Drug Delivery System Lab	-	-	4	2
6		Project Work	-	-	6	3
		Total Credits	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

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

- CO 1. Explain the history and development of pharmacy in India, various pharmacopoeias, and basic concepts of prescriptions, dosage forms, and posology.
- CO 2. Perform basic pharmaceutical calculations and describe the formulation and classification of powders and liquid dosage forms.
- CO 3. Describe the preparation, classification, and stability aspects of monophasic and biphasic liquid dosage forms such as syrups, suspensions, and emulsions.
- CO 4. Explain the formulation, preparation, and evaluation of suppositories and identify different types of pharmaceutical incompatibilities.
- CO 5. Describe the formulation, preparation, and evaluation of semisolid dosage forms such as ointments, creams, pastes, and gels.

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**10 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

- CO 1. Explain the principles of pharmaceutical analysis, types of analytical techniques, sources of errors, and perform limit tests for impurities in pharmaceuticals.
- CO 2. Describe acid-base chemistry, buffer systems, isotonicity, and the physiological role of electrolytes used in replacement therapy.
- CO 3. Apply various titrimetric methods such as acid-base, non-aqueous, precipitation, complexometric, and redox titrations for quantitative analysis of pharmaceutical substances.
- CO 4. Describe the pharmaceutical importance, preparation, and uses of gastrointestinal agents, antimicrobials, and radiopharmaceuticals with safety considerations.
- CO 5. Explain the preparation, uses, and therapeutic roles of miscellaneous compounds such as expectorants, emetics, haematinics, antidotes, and astringents.

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 bowel 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: Upon completion of the course the students shall be able to

- CO 1. Explain the fundamentals of organic chemistry, including carbon's versatility, classification, nomenclature, reaction types, reactive intermediates, and hybridization.
- CO 2. Describe the preparation, reactions, and mechanisms of aliphatic hydrocarbons such as alkanes, cycloalkanes, alkenes, and conjugated dienes with pharmaceutical relevance.
- CO 3. Explain the mechanisms of nucleophilic substitution and elimination reactions in alkyl halides and their pharmaceutical applications.
- CO 4. Describe the structure, aromaticity, and electrophilic substitution reactions of benzene and substituted benzene derivatives.
- CO 5. Explain the preparation, reactions, and pharmaceutical importance of carbonyl compounds such as aldehydes and ketones.

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

- Methods of preparation of alkenes by dehydration of alcohols, dehydrohalogenation of alkyl halides, dehalogenation of vicinal dihalides and Wittig reaction
- 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**

- 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
- 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
- Zaitsev's Rule (Saytzeff's) with examples. Difference between E1 and E2 reactions. Substitution Vs Elimination reactions
- Pharmaceutical applications of alkyl halides (Chloroform, Iodoform, Trichloroethylene)

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

- IUPAC system of nomenclature for mono and di substituted benzene derivatives
- Structure of benzene, molecular orbital picture, resonance in benzene and aromaticity including Huckel's rule
- Electrophilic aromatic substitution reactions of benzene which includes nitration, halogenation, Friedel-Crafts alkylation and its limitations, Friedel-Crafts acylation, sulphonation and desulfonation reaction
- 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):

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

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

- CO 1. Explain the process, importance, and barriers of communication, and understand factors influencing perception.
- CO 2. Describe the elements, types, and styles of communication with examples of effective interpersonal interaction.
- CO 3. Demonstrate active listening and effective written communication skills suited to different contexts and audiences.
- CO 4. Develop interview and presentation skills, including planning, structuring, and delivering presentations confidently.
- CO 5. Participate effectively in group discussions by applying appropriate communication strategies and etiquette.

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

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

- CO 1. Describe the living world, classification, nomenclature and their salient features.
- CO 2. Understand morphology of different parts of flowering plants, general anatomy of root, stem and leaf.
- CO 3. Comprehend the key concepts in plant physiology.
- CO 4. Develop a deeper understanding of cell division, animal tissues and distinguish the vertebrates: Pisces, Reptiles and Aves.
- CO 5. Enhance comprehension on organization of mammals and poisonous animals.

UNIT – I**05 Hours****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, protista, fungi, animalia and plantae, virus.

UNIT –II**07 Hours**

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**Plant Physiology****07 Hours**

Plants and Mineral Nutrition: Essential minerals, 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**06 Hours****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**05 Hours**

General Organization of Mammals
Study of Poisonous Animals

TEXT BOOKS: (Latest Editions)

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

REFERENCE BOOKS: (Latest Editions)

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. Ananthkrishnan.
5. A manual for pharmaceutical biology practical, S.B. Gokhale and C. K. Kokate

SUCP

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

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

- CO 1. Understand and apply the fundamentals of trigonometry, including measurement of angles and trigonometric identities, to solve problems in pharmaceutical sciences.
- CO 2. Utilize matrix operations and determinants for solving simultaneous equations and modeling data in pharmaceutical research, quality control, and process optimization.
- CO 3. Interpret and apply logarithmic principles, including pH and concentration calculations, to analyze chemical equilibria and dosage formulations in pharmaceutical applications.
- CO 4. Apply the principles of differentiation to analyze rate processes, including reaction kinetics, drug release profiles, and changes in formulation parameters over time
- CO 5. Apply integration techniques to evaluate cumulative effects in pharmacokinetics, including drug absorption, area under the curve (AUC), and dosage optimization, in pharmaceutical manufacturing.

UNIT – I**09 Hours**

Trigonometry: Measurement of angles, Trigonometric identities.

UNIT – II**09 Hours**

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**09 Hours**

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**09 Hours**

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**09 Hours**

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

TEXT BOOKS: (Latest Editions)

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

REFERENCE BOOKS: (Latest Editions)

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

PS 107: GENERAL PHARMACY (Practical)**B. Pharm. I Year I Sem**

L	T	P	C
0	0	4	2

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

- CO 1. Prepare and evaluate liquid dosage forms such as syrups, elixirs, and linctus.
- CO 2. Formulate and assess solutions, suspensions, and emulsions for stability and quality.
- CO 3. Prepare and evaluate powders, granules, and effervescent formulations.
- CO 4. Formulate and analyze suppositories and semisolid dosage forms including ointments, gels, and creams.
- CO 5. Prepare and evaluate oral care formulations such as gargles and mouthwashes.

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: (Latest Editions)

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

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

- CO 1. Perform limit tests for various inorganic substances such as chloride, sulphate, iron, lead, and arsenic as per Indian Pharmacopoeia.
- CO 2. Prepare common inorganic pharmaceuticals including aluminium hydroxide, potash alum, ferrous sulphate, and magnesium sulphate.
- CO 3. Evaluate the purity and quality of inorganic compounds through tests like swelling power, acid neutralizing capacity, and iodine content determination.
- CO 4. Conduct quantitative assays of inorganic compounds using standard titration methods including acid-base, cerimetry, iodometry, complexometry, permanganometry, and NAT
- CO 5. Standardize titrants and interpret assay results to ensure accuracy and reliability in the analysis of inorganic pharmaceutical compounds.

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

- CO 1. Perform systematic qualitative analysis of unknown organic compounds using preliminary, solubility, and elemental tests.
- CO 2. Identify functional groups in organic compounds through standard qualitative tests.
- CO 3. Prepare derivatives and confirm the identity of unknown compounds using melting point or boiling point determination.
- CO 4. Construct molecular models to understand molecular shapes, bonding, and structural concepts.
- CO 5. Purify organic compounds using crystallization techniques and evaluate their effectiveness.

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: (Latest Editions)

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

- CO 1. Develop basic communication skills through conversations, asking questions, and social interactions.
- CO 2. Improve pronunciation of consonant and vowel sounds for clear and effective speech.
- CO 3. Enhance listening comprehension and understanding of direct and indirect speech.
- CO 4. Apply effective writing skills in various contexts, including emails and formal communication.
- CO 5. Demonstrate confidence in interviews and presentations using proper communication techniques.

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: (Latest Editions)

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

- CO 1. Demonstrate basic biological laboratory skills, including microscope handling, section cutting, staining, and slide preparation.
- CO 2. Identify the structure and inclusions of cells, stems, roots, and leaves through microscopic observation.
- CO 3. Recognize and differentiate various plant tissues based on their microscopic characteristics.
- CO 4. Classify and study representative species of Pisces, Reptiles, Aves, and Mammals.
- CO 5. Identify common poisonous animals and understand their distinguishing features.

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: (Latest Editions)

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

- CO 1. Explain the structure and function of cells and tissues, and the basic principles of cell injury and adaptation.
- CO 2. Describe the anatomy and physiology of the skeletal and muscular systems, including joint movements and related disorders.
- CO 3. Explain the composition and functions of blood and lymph, mechanisms of inflammation, and related pathophysiology.
- CO 4. Describe the structure, functions, and regulation of the cardiovascular system, including ECG and common cardiac disorders.
- CO 5. Explain the anatomy and physiology of the digestive and respiratory systems, including mechanisms of digestion, respiration, and common disorders.

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: (Latest Editions)

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: (Latest Editions)

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

- CO 1. Explain the chemistry, preparation, reactions, and pharmaceutical applications of carboxylic acids, amines, alcohols, phenols, and polynuclear aromatic hydrocarbons.
- CO 2. Describe optical isomerism, stereochemistry, and the medicinal importance of chiral compounds.
- CO 3. Explain geometrical and conformational isomerism, including atropisomerism and stereochemical analysis of organic compounds.
- CO 4. Discuss the chemistry, synthesis, reactions, and medicinal applications of five-membered heterocyclic compounds such as pyrrole, furan, and thiophene.
- CO 5. Describe the chemistry, synthesis, reactions, and pharmaceutical uses of other heterocycles, including pyrazole, imidazole, pyridine, quinoline, and fused heterocyclic 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), imidazole (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, benzotriazole, quinoxaline
3. Basicity of imidazole, pyridine and quinoline
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: (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 I.L. FINAR, Pearson Books, 6th Edition, 1 January 2002, (ISBN-13. 978-8177585421).
3. Organic Chemistry, Stereochemistry and Natural Products, Vol. 2, by I.L. 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 Chemistry, by Rama Rao Nadendla, PharmMed Press, 2nd Edition, 2018, (ISBN 978-93-5230-197-3).

BS203: PHARMACEUTICAL 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 shall 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.

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

- CO 1. Explain carbohydrate metabolism, biological oxidation, and their regulation, including disorders like diabetes and G6PD deficiency.
- CO 2. Describe lipid metabolism, ketone body formation, cholesterol significance, and related metabolic disorders.
- CO 3. Illustrate amino acid metabolism, including catabolism, biosynthesis of bioactive molecules, and associated metabolic disorders.
- CO 4. Explain nucleic acid metabolism, genetic information transfer, DNA/RNA functions, and protein synthesis.
- CO 5. Describe enzyme properties, kinetics, regulation, inhibition, and their therapeutic and diagnostic applications.

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**

β-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 (Phenylketonuria, Albinism, alpeptonuria, 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

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

- CO 1. Describe the history, components, and basic concepts of computers and operating systems.
- CO 2. Apply different number systems and perform conversions and basic arithmetic operations in binary, octal, decimal, and hexadecimal.
- CO 3. Understand web technologies including HTML and basic database concepts using MS Access.
- CO 4. Demonstrate proficiency in MS Office applications including Word, Excel, and PowerPoint for document creation, data analysis, and presentations.
- CO 5. Explain the applications of computers in pharmacy for information management, clinical practice, and automated healthcare systems.

UNIT – I**08 Hours**

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**08 Hours**

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**07 Hours**

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

UNIT – IV**12 Hours**

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**10 Hours**

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 editions)

1. Introduction to Biostatistics 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 editions)

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

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

- CO 1. Demonstrate the use of microscopes and perform microscopic studies of various tissues.
- CO 2. Identify bones and understand human skeletal anatomy.
- CO 3. Perform hematological tests including hemoglobin estimation, blood counts, blood grouping, and ESR.
- CO 4. Measure physiological parameters such as heart rate, pulse, respiratory rate, tidal volume, blood pressure, and ECG components.
- CO 5. Apply theoretical knowledge through charts, models, and case studies to understand human organ systems and diseases.

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: (Latest Editions)

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

- CO 1. Synthesize and purify aromatic and heterocyclic organic compounds using standard reactions.
- CO 2. Characterize synthesized compounds using physical constants, TLC, and IR spectroscopy.
- CO 3. Perform qualitative analysis of binary mixtures of organic compounds.
- CO 4. Apply chemical knowledge to predict and carry out various organic reactions.
- CO 5. Use software tools to visualize 3D structures, calculate molecular properties, and represent chemical reactions.

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 from 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-naphthol 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: (Latest Editions)

- 1) Practical Organic Chemistry, by Mann and Saunders, Pearson Education India 4th Edition, 2009, (ISBN: 13. 978-8131727102).
- 2) Introduction to Organic Laboratory Techniques: 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**Course Outcomes:** Upon completion of this course the student should be able to

- CO 1. Perform qualitative analysis of carbohydrates, proteins, and urine constituents.
- CO 2. Conduct quantitative estimation of reducing sugars, proteins, blood sugar, creatinine, and cholesterol.
- CO 3. Prepare buffer solutions and measure pH accurately.
- CO 4. Study enzymatic hydrolysis of starch and salivary amylase activity.
- CO 5. Analyze the effects of temperature and substrate concentration on enzyme activity.

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

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

CO 1. Design questionnaires and web pages to collect and display information effectively.

CO 2. Retrieve and manage drug-related information using online tools.

CO 3. Create and manage databases in MS Access to store and manipulate patient and drug information.

CO 4. Generate forms, queries, reports, and invoices for data entry, retrieval, and analysis.

CO 5. Export database objects to web and XML formats for sharing and presentation.

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