

Second Year B. Pharm.

Credit Based System effective from Academic Year 2012-13

Syllabus Framework,

Scheme of Examination

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Syllabus (Semesters III and IV)

S. Y. B. Pharm.

Syllabus Framework

| No | Semester- III Subject | Credits | Contact hrs/week | Weightage | | Marks |
|----|---|-----------|---------------------|--------------------------------------|--------------------------------|------------|
| | | | | Continuous internal assessment | End Semester Examination | |
| 1 | Organic Chemistry - I | 4 | 4 | 30 | 70 | 100 |
| 2 | Biochemistry-II | 4 | 4 | 30 | 70 | 100 |
| 3 | Dispensing Pharmacy | 3 | 3 | 30 | 70 | 100 |
| 4 | Pharmaceutical Engineering | 3 | 3 | 30 | 70 | 100 |
| 5 | Anatomy, Physiology and Pathophysiology- III | 3 | 3 | 30 | 70 | 100 |
| 6 | Mathematics | 3 | 3 | 30 | 70 | 100 |
| | Total | 20 | 20 | 180 | 420 | 600 |
| | Practicals | | | | | |
| 7 | Organic Chemistry Lab - I | 2 | 4 | 15 | 35 | 50 |
| 8 | Biochemistry Lab | 2 | 4 | 15 | 35 | 50 |
| 9 | Dispensing Lab | 2 | 4 | 15 | 35 | 50 |
| | Total | 6 | 12 | 45 | 105 | 150 |
| | Total Teaching Hrs. | | 32 | | | |
| | Total Credits | 26 | | | | |
| | Total Marks | | | 225 | 525 | 750 |

| No. | Semester IV | | | | | |
|-----|--------------------------------|-----------|-----------|------------|------------|------------|
| 1 | Organic Chemistry-II | 3 | 3 | 30 | 70 | 100 |
| 2 | Pharmaceutical Analysis- I | 3 | 3 | 30 | 70 | 100 |
| 3 | Pharmaceutics -II | 3 | 3 | 30 | 70 | 100 |
| 4 | Microbiology | 3 | 3 | 30 | 70 | 100 |
| 5 | Pharmacology - I | 3 | 3 | 30 | 70 | 100 |
| 6 | Mathematics and Statistics | 3 | 3 | 30 | 70 | 100 |
| | Total | 18 | 18 | 180 | 420 | 600 |
| | Practicals | | | | | |
| 7 | Pharmaceutical Analysis Lab- I | 2 | 4 | 15 | 35 | 50 |
| 8 | Pharmaceutics Lab- II | 2 | 4 | 15 | 35 | 50 |
| 9 | Pharmacology Lab- I | 2 | 4 | 15 | 35 | 50 |
| 10 | Microbiology Lab | 2 | 4 | 15 | 35 | 50 |
| | Total | 8 | 16 | 60 | 140 | 200 |
| | Total Teaching Hrs. | | 34 | | | |
| | Total Credits | 26 | | | | |
| | Total Marks | | | 240 | 560 | 800 |

S. Y. B. Pharm.

Scheme of Examination

| No | Semester- III Subject - Theory | No of papers | End Semester Examination | | | Internal Assessment | | Maximum marks | Minimum marks for passing the subject | |
|-------------------|--|-----------------|--------------------------|------------------|------------------------|------------------------------------|------------------|------------------|---|--|
| | | | Duration (hrs) | Maximum marks | Minimum for passing | Periodic Test Duration (hrs) | Maximum marks | | | Continuous Evaluation Maximum marks |
| 1 | Organic Chemistry - I | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 2 | Biochemistry - II | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 3 | Dispensing Pharmacy | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 4 | Pharmaceutical Engineering | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 5 | Anatomy, Physiology and Pathophysiology - III | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 6 | Mathematics | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| Practicals | | | | | | | | | | |
| 7 | Organic Chemistry Lab - I | 1 | 4 | 35 | 14 | 4 | 8 | 7 | 50 | 20 |
| 8 | Biochemistry Lab | 1 | 4 | 35 | 14 | 4 | 8 | 7 | 50 | 20 |
| 9 | Dispensing Lab | 1 | 4 | 35 | 14 | 4 | 8 | 7 | 50 | 20 |

| No | Semester- IV | No of papers | End Semester Examination | | | Internal Assessment | | | Maximum marks | Minimum marks for passing the subject |
|-------------------------|---------------------------------|--------------|--------------------------|---------------|---------------------|---------------------|---------------|-----------------------|---------------|---------------------------------------|
| | | | Duration (hrs) | Maximum marks | Minimum for passing | Periodic Test | | Continuous Evaluation | | |
| | | | | | | Duration (hrs) | Maximum marks | | | |
| Subject - Theory | | | | | | | | | | |
| 1 | Organic Chemistry-II | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 2 | Pharmaceutical Analysis - I | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 3 | Pharmaceutics - II | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 4 | Microbiology | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 5 | Pharmacology - I | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| 6 | Mathematics and Statistics | 1 | 3 | 70 | 28 | 1 | 15 | 15 | 100 | 40 |
| Practicals | | | | | | | | | | |
| 7 | Pharmaceutical Analysis Lab - I | 1 | 4 | 35 | 14 | 4 | 8 | 7 | 50 | 20 |
| 8 | Pharmaceutics Lab - II | 1 | 4 | 35 | 14 | 4 | 8 | 7 | 50 | 20 |
| 9 | Pharmacology Lab - I | 1 | 4 | 35 | 14 | 4 | 8 | 7 | 50 | 20 |
| 10 | Microbiology Lab | 1 | 4 | 35 | 14 | 4 | 8 | 7 | 50 | 20 |

S. Y. B. Pharm.

Syllabus

Semester III

Organic Chemistry – I

4 hrs/week

| Unit | Topics | Hours |
|------|---|-------|
| 1. | Basic concepts | 11 |
| 1.1 | Electronegativity, Inductive effect, Dipole moment, Polarizability | 1 |
| 1.2 | Resonance in aliphatic and aromatic systems: Rules of resonance, Stability of the resonating structures | 2 |
| 1.3 | Tautomerism (including types of tautomerism), Hyperconjugation | 2 |
| 1.4 | Reactive Intermediates in Organic Chemistry: Electrophiles and Nucleophiles (including charged and neutral species), Carbocations, Carbanions, Carbenes and Carbon radicals: Geometry, stability and properties. Concept of leaving groups, alkyl shift, migratory aptitude. | 3 |
| 1.5 | Acidity and Basicity (Excluding discussion of acidity and basicity of heterocyclic compounds). | 3 |
| 1.6 | Basics of mechanism writing using curved arrows-Homolytic, Heterolytic, Homogenic, Heterogenic. | |
| 2. | Nomenclature of multifunctional organic compounds. | 6 |
| 2.1 | Writing common names of some common compounds. | |
| 2.2 | Writing IUPAC nomenclature of compounds containing multiple functional groups, use of priority charts. | |
| 2.3 | Writing structures of compounds containing multiple functional groups given the Nomenclature. | |
| 2.4 | Nomenclature of stereo isomers including cis/trans, D/L, E/Z and R/S designations. | |
| 3. | Stereochemistry-I | 9 |
| 3.1 | Concept of configuration and chirality, axis of symmetry, plane of symmetry, centre of symmetry, representation of molecules by the use of projection formulae: Fischer, Wedge, Sawhorse and Newman. | 2 |
| 3.2 | Geometric isomerism: Methods of determination of configuration of geometric isomers, Optical isomerism: Enantiomers and diastereoisomers, Resolution of a racemic mixture, Atropisomerism in biphenyls. | 2 |
| 3.3 | Stereospecificity and stereoselectivity in organic reactions: S_N1 , S_N2 , E1, E2 and E1cb reactions, syn and anti additions of H_2 to alkynes, addition of halogens (X_2), Halogens in water (X_2 and H_2O), $KMnO_4$, OsO_4 and alkaline H_2O_2 to alkenes, Hydroboration-Oxidation, Oxymercuration-Demercuration of alkenes. | 5 |
| 4. | Benzene and aromaticity | 6 |
| 4.1 | Concept of aromaticity: Huckel's rule for aromaticity, identification of aromatic, non-aromatic and anti aromatic systems based on planarity, conjugation and Huckel's rule. | 1 |
| 4.2 | Electrophilic Aromatic Substitution: Reactions of benzene (with mechanism and structures of intermediate/s involved) like nitration, sulphonation, protonation, halogenation, Friedel-Crafts alkylation and acylation. Classification and influence of substituent groups on orientation and reactivity, orientation in disubstituted benzenes. | 3 |
| 4.3 | Nucleophilic Aromatic Substitution: Bimolecular displacement mechanism with evidence, reactivity and orientation in nucleophilic aromatic substitution, Elimination-Addition mechanism. | 2 |

| | | |
|-----|---|-----------|
| 5. | Functional group Chemistry | 16 |
| | Discussion of the following classes of compounds in brief, with regard to sources, methods of preparation, general reactions with mechanism. | |
| 5.1 | Alkanes: Physical properties, Preparation of alkanes: Hydrolysis of Grignard reagent, reduction of alkyl halides by metal and acid, Corey House reaction, Wurtz reaction; Reactions: halogenation of alkanes (Mechanism and orientation) | 2 |
| 5.2 | Alkenes: Physical properties, Preparation of Alkenes: Dehydrohalogenation of Alkyl halides (Mechanism and orientation of E1 and E2), dehydration of alcohols, dehalogenation of vicinal dihalides, conversion of aldehydes and ketones to alkenes (Wittig reaction, Peterson reaction, Shapiro reaction). Reactions: Addition of H ₂ , HX (Markovnikov and Anti-Markovnikov), H ₂ SO ₄ , H ₂ O, free radicals, alkenes (dimerization), alkanes (Alkylation), ozonolysis, Michael addition, Simmons-Smith reaction, epoxidation, halogenation by allylic substitution. | 6 |
| 5.3 | Dienes: Resonance in conjugated dienes, electrophilic addition to conjugated dienes: 1, 2 and 1, 4 additions. | 1 |
| 5.4 | Alkynes: Physical properties, Preparation of alkynes: dehydrohalogenation of alkyl dihalides, reaction of metal acetylides with primary alkyl halides; Addition reactions: Addition of X ₂ , addition of HX, addition of H ₂ O (Hydration), formation of metal acetylides. | 2 |
| 5.5 | Alkyl halides: Physical Properties, Preparation: Hunsdieker reaction (other methods are covered under reactions of other functional groups). Reactions: Nucleophilic Aliphatic Substitution reaction (Mechanism, Factors affecting S _N 1 and S _N 2 reactions to be discussed in detail), S _N i reaction. | 5 |
| | Conversions to be discussed | |
| | Total | 48 |

Books (Latest Editions to be adopted)

1. Organic Chemistry by R.T. Morrison and R.N. Boyd, 6th edition, Prentice Hall Publications
2. Organic Chemistry by Pine, Stanley H.; Hendrickson, James B.; Cram, Donald J.; Hammond, George S., 4th edition. The Macgraw hill publications
3. Organic Chemistry by I.L. Finar, Vol 1& 2, 6th edition, Pearson education
4. Advanced Organic Chemistry: Reactions, Mechanisms, Structures by Jerry March, John Wiley and sons
5. Organic Chemistry, Part A: Structures and Mechanism, Part B: Reactions and Synthesis, Francis and Carry, Richard J Sundberg. Springer publications
6. A Guidebook to Mechanism in Organic Chemistry, 6th edition, Peter Sykes, Pearson Education
7. Peter Sykes, Essentials of Organic chemistry by Paul M Dewick, Wiley, Pine
8. Essentials of Organic chemistry by Paul M Dewick, Wiley
9. Eliel, Kalsi, Organic Chemistry by L.G.Wade, Jr., Maya Shankar Singh, Pearson Education, 6th Ed, Organic Chemistry, 2nd Ed., Thomas Sorrell, University Science Books
10. Stereochemistry: Conformation and Mechanism, b) Organic Reactions And Their Mechanisms. By P. S. Kalsi. New age International
11. Organic Chemistry through Solved Problems, *Goutam Brahmachari*. Edition, Morgan & Claypool
12. Organic Name Reactions: A Unified Approach. *Goutam Brahmachari*. Alpha Science publications

Biochemistry II

4 hrs/week

| Unit | Topics | Hours |
|------------|--|-----------|
| 1 | Carbohydrate metabolism discussed with respect to the structures of intermediates, enzymes and cofactors, energy yield/requirements and regulation. Examples of drugs modulating carbohydrate metabolism. | 12 |
| 1.1 | Glycolysis (Embden Meyerhoff Pathway), TCA cycle (Kreb's Cycle, Citric acid Cycle) and glyoxalate shunt. Entry of sugars other than glucose into glycolytic pathway. Discussion of shuttle systems to transfer NADH to the mitochondria. | 04 |
| 1.2 | Electron Transport Chain discussed with respect to the components of the ETC, explanation of oxidative phosphorylation vs substrate level phosphorylation. Discussion of proton motive force and generation of ATP using proton gradients. Discussion of uncouplers of oxidative phosphorylation. | 04 |
| 1.3 | Discussion of pentose phosphate pathway, glycogenesis, glycogenolysis, gluconeogenesis and other systems involved in carbohydrate metabolism | 04 |
| 2.0 | Lipid metabolism discussed with respect to the structures of intermediates, enzymes and cofactors involved, energy yield/requirements and regulation. | 08 |
| 2.1 | Beta oxidation pathway for catabolism of saturated and unsaturated even number fatty acids, catabolism of odd number carbon containing fatty acids, formation of ketone bodies, | 03 |
| 2.2 | Acetate mevalonate pathway to cholesterol biosynthesis, | 02 |
| 2.3 | Biosynthesis of fatty acids and phospholipids. | 02 |
| 2.4 | Examples of drugs modulating lipid/cholesterol metabolism. | 01 |
| 3 | Nucleic Acid Metabolism discussed with respect to the structures of intermediates, enzymes and cofactors, energy yield/requirements and regulation | 08 |
| 3.1 | Discussion of biosynthesis of purines. | 03 |
| 3.2 | Discussion of biosynthesis of pyrimidines. | 02 |
| 3.3 | Salvage pathways for nucleic acid metabolism. Examples of drugs modulating purine/pyrimidine biosynthesis. | 03 |
| 4 | DNA replication | 08 |
| 4.1 | Details of DNA replication, differences between prokaryotes/eukaryotes. Brief description of telomeres and telomerase activity. DNA polymorphisms and SNPs. Examples of drugs modulating these pathways (polymerase inhibitors, telomerase inhibitors, topoisomerase inhibitors) and polymorphisms involved in disease states. | 04 |
| 4.2 | Discussion of solid phase DNA synthesis, DNA synthesizers and comparison between biosynthesis and chemical synthesis. | 02 |
| 4.3 | Discussion of DNA sequencing (Sanger dideoxy method) | 02 |
| 5 | Protein biosynthesis | 10 |
| 5.1 | Details of DNA transcription and RNA translation. Transcriptional and translational differences in prokaryotes and eukaryotes especially with respect to post-transcriptional and post-translational modifications. Examples of drugs modulating these pathways with emphasis on protein synthesis inhibitors used as drugs. | 06 |
| 5.2 | Discussion of solid phase peptide synthesis, peptide synthesizers and comparison between biosynthesis and chemical synthesis. | 02 |
| 5.3 | Discussion of peptide sequencing (Edman method and its automation). Utility of peptidases and chemical agents to cleave proteins in preparation | 02 |

| | | |
|--|-----------------|-----------|
| | for sequencing. | |
| | Total | 48 |

Books

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

Dispensing Pharmacy

3 hrs/week

| Unit | Topics | Hours |
|---|---|--------------|
| 1. 1.1 1.2 1.3 1.4 1.5 1.6 | Introduction_ Introduction to compounding and dispensing. Prescription and its parts. Types of prescriptions. Pricing and recording of prescriptions. Types of dispensed preparations. Weights and measures including imperial weights (Apothecary system). | 6 |
| 2. 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 | General dispensing_ Fundamentals of compounding and dispensing including good practices. Formulation of dispensed products. Containers and closures/packaging for dispensed products. Storage and stability of dispensed products. Labeling of dispensed preparations. Latin Terms and abbreviations. Preparation of stock solutions. Dispensing of proprietary medicines. | 6 |
| 3. 3.1 3.2 3.3 3.4 | Calculations. Calculations based on expressions of concentration and dilution (percentage, parts, alligation) ,proof strength. Calculations based on Isotonicity. HLB calculations. Posology. | 4 |
| 4. 4.1 4.2 4.3 | Solutions. Solutions taken orally. Solutions used in body cavities. Solutions for external use. | 2 |
| 5. 5.1 5.2 5.3 5.4 5.5 5.6 | Suspensions. Suspensions containing diffusible solids. Suspensions containing indiffusible solids. Suspensions containing poorly wettable solids. Suspensions containing precipitate forming liquids. Dispersion of oil in inhalation. Suspensions produced by chemical reaction. | 3 |
| 6. 6.1 6.2 6.3 6.4 | Emulsions Types of Emulsions. Emulsifying agents. Compounding and preservation of Emulsions. Emulsions for external use (Creams). | 3 |
| 7. 7.1 7.2 7.3 7.4 | Ointments_ Pastes and Gels_ Types of Ointment bases. Preparation Of Ointments. Pastes and Poultices. Gels. | 3 |
| 8. 8.1 8.2 8.3 8.4 8.5 | Dispensed Oral Solid Dosage forms. Powders. Granules. Tablet Triturates. Pills. Lozenges and Pastilles. | 4 |

| | | |
|------------|-------------------------------------|-----------|
| 8.6 | Capsules. | |
| 9. | Suppositories and Pessaries. | 2 |
| 9.1 | Types of Suppository base. | |
| 9.2 | Compounding of Suppositories. | |
| 10. | Incompatibilities. | 3 |
| 10.1 | Physical Incompatibilities. | |
| 10.2 | Chemical Incompatibilities. | |
| | Total | 36 |

Comment on Prescriptions to be covered for all types of formulations listed in the syllabus.

Books

1. Cooper and Gunns Dispensing for Pharmaceutical Students, Edns. 11 and 12; Edited by S.J.Carter, Indian Edition, CBS Publishers, Delhi.
2. Pharmaceutical Practice; Edited by D.M.Collet and M.E.Aulton; Churchill Livingstone, ELBS Edition, 1991.
3. Pharmaceutical Practice Edited by A.J.Winfield and R.M.E. Richards, Second Edition, Churchill Livingstone, 1998.
4. Pharmaceutical Practice; Edited by A.J. Winfield and R.M.E. Richards, Third Edition, Churchill Livingstone, 2004.
5. Husa's Pharmaceutical Dispensing, Edited by Eric Martin, Sixth Edition, Mack Publishing Company, 1996.
6. Pharmaceutical Calculations, A.C. Ansel and M.J.Stoklosa, Lippincott Williams and Wilkins, 2006.
7. Pharmaceutical Calculations – Bradley, Gustafson and Stoklosa, Third Edition, Lea and Febiger, 1957.

Coverage: Only theory, principles, equipments and pharmaceutical applications to be covered. Mathematical derivations and numerical problems are not within the scope.

| Unit | Topics | Hours |
|------|--|-------|
| 1 | Fluid flow | 3 |
| 1.1 | Mention fluid properties such as viscosity, compressibility and surface tension of fluids. Hydrostatics influencing fluid flow. Fluid dynamics- Bernoulli's theorem, flow of fluids in pipes, laminar and turbulent flow. | |
| 2 | Fluid and pressure measurements | 4 |
| 2.1 | <ul style="list-style-type: none"> Measurement of flow- Classification of flow meters, venturimeter, orificemeter, pitot tube, rotameter and current flow meters. | 2 |
| 2.2 | <ul style="list-style-type: none"> Pressure measurement- Classification of manometers, simple manometer, U tube manometer and modifications, Bourdon gauge. | 2 |
| 3 | Pumps: | 2 |
| 3.1 | <ul style="list-style-type: none"> Positive displacement pumps-reciprocating pumps, rotary pumps. | 1 |
| 3.2 | <ul style="list-style-type: none"> Centrifugal pumps | 1 |
| 4 | Heat and Mass transfer | 4 |
| 4.1 | <ul style="list-style-type: none"> Modes of heat transfer- conduction, convection and radiation, Heat exchangers-tubular and plate, Temperature measurement-basic principles and devices Mass transfer in turbulent and laminar flow | 3 |
| 4.2 | <ul style="list-style-type: none"> Concept of interfacial mass transfer | 1 |
| 5 | Conveying of solids | 1 |
| | <ul style="list-style-type: none"> Belt conveyor, Bucket conveyor, Screw conveyor and Pneumatic conveyor. | |
| 6 | Crystallization | 6 |
| 6.1 | <ul style="list-style-type: none"> Crystal forms and crystal habits, Theory of crystallization- Supersaturation- Mier's theory of supersaturation, Nucleation, Crystal growth. | 2 |
| 6.2 | <ul style="list-style-type: none"> Crystallizers- Classification, Tank crystallizers, Agitated tank crystallizers, Swenson Walker crystallizer, Vacuum crystallizer and its modifications, Krystal or Oslo crystallizer. | 3 |
| 6.3 | <ul style="list-style-type: none"> Factors affecting crystallization and Caking of crystals | 1 |
| 7 | Evaporation: | 4 |
| 7.1 | <ul style="list-style-type: none"> Introduction, factors influencing rate of evaporation, including scale formation, Evaporators classification- Pan evaporators, Tubular evaporators (Horizontal tube evaporator, Vertical tube evaporators- short tube vertical evaporator, Multiple effect evaporator, Long tube evaporators -Climbing film evaporator, Falling film evaporator, Forced circulation evaporator,) Wiped film evaporator , Centrifugal rotary evaporator. | 2 |
| 7.2 | <ul style="list-style-type: none"> Evaporator accessories- condensers, vacuum pumps, expansion and bucket traps, entrainment separators | 2 |
| 8 | Distillation: | 6 |
| 8.1 | <ul style="list-style-type: none"> Revision of Vapour-liquid equilibrium, Distillation methods- Equilibrium distillation, Simple distillation | 1 |
| 8.2 | <ul style="list-style-type: none"> Fractional distillation- Theory of batch fractionation, Columns (only construction and working) Bubble cap, sieve plate columns, packed columns. Concept of plate efficiency and HETP (no detailed theories and | 3 |

| | | |
|--------------|---|-----------|
| 8.3 | derivations). <ul style="list-style-type: none"> Distillation under reduced pressure- Theory of molecular distillation and equipments. Falling film and centrifugal molecular distillation still, applications. Azeotropic and Extractive distillation- Theory and applications. Steam distillation- Theory and applications | 2 |
| 9 | Refrigeration: <ul style="list-style-type: none"> Refrigeration –equipment and concept of refrigeration load, concepts of brine systems and absorption systems. | 1 |
| 10 | Materials of construction and Corrosion: <ul style="list-style-type: none"> Classification into metals and non-metals. Ferrous and its alloys-cast iron, mild steel and stainless steel. Copper and its alloys. Nickel and its alloys. Aluminium and its alloys. Plastics- Classification into thermoplastics and thermosetting plastics, properties and applications of polyvinyl chloride, polyethylene, polyporopylene, polystyrene, polyester, ABS, phenolic and epoxy plastics, fluorocarbon plastics, chlorinated plastics and polycarbonated plastics. | 5 |
| 10.1 | | 2 |
| 10.2 | | 3 |
| 11 | Industrial Hazards and safety regulations: <ul style="list-style-type: none"> Mechanical hazards and prevention. Electrical hazards and prevention Chemical hazards and prevention Fire hazards and extinguishers | 2 |
| Total | | 38 |

BOOKS (Latest editions of all books to be referred)

1. K. Sambamurthy, Pharmaceutical Engineering, New age international (P) Limited Publishers, 1998.
2. Dr. A. R. Paradkar, Introduction to Pharmaceutical Engineering, 10th Edition, Nirali Parakashan, 2007.
3. James Swarbrick & James C. Boylon, Encyclopedia of Pharmaceutical Technology, Marcel Dekker, INC, New York, 1994.
4. Walter I. Badger & Julius T. Bancher, Introduction to Chemical Engineering, Mc Graw Hill Inc, 1995.
5. M. E. Aulton, Ed, Pharmaceutics-The Science of Dosage Form Design, Churchill Livingstone Medical Division Of Longman Group UK Ltd, 2002.
6. S. J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6th Edition, CBS Publishers & Distributors, New Delhi, 2005.
7. Robert H. Perry, Don W. Green, Perry's Chemical Engineers Handbook, 7th Edition, Don W. Green, James O. Maloney, McGraw Hill, 1997.
8. G. K. Jani, Pharmaceutical Engineering, Vallabh Prakashan.

Anatomy, Physiology and Pathophysiology- III**3 hrs/week**

| Unit | Topics | Hours |
|-------------|--|--------------|
| 1. | Reproductive system <ul style="list-style-type: none">- Anatomical and Physiological considerations of male and female reproductive system- Reproductive and endocrine functions of testes and ovaries- Menstrual cycle | 4 |
| 2. | Pathophysiology of following diseases <ul style="list-style-type: none">- Infertility- Sexually transmitted diseases (STD)- Dysmenorrhea | 2 |
| 3. | Cardiovascular System <ul style="list-style-type: none">- Functional anatomy of heart- conducting system of heart- cardiac cycle, Electrocardiogram (ECG)-Physiology of blood circulation- Functional anatomy of blood vessels- Blood pressure and factors regulating blood pressure- Baroreceptors, chemoreceptors, vasomotor center- Humoral and neuronal control of blood pressure and circulation | 8 |
| 4. | Pathophysiology of following diseases <ul style="list-style-type: none">- Hypertension- Congestive Cardiac Failure- Cardiac Arrhythmia- Angina Pectoris- Ischemic Heart Disease- Arteriosclerosis/Atherosclerosis | 4 |
| 5. | Urinary system <ul style="list-style-type: none">- Anatomy and Physiology of Urinary System- Formation of urine- water balance, electrolyte balance & acid – base balance | 5 |
| 6. | Formation of body fluids and fluid compartments. | 3 |
| 7. | Pathophysiology of following diseases <ul style="list-style-type: none">- Renal failure- Glomerulonephritis- Renal calculi / kidney stones- Urinary Tract Infections (UTI) | 3 |
| 8. | Digestive System <ul style="list-style-type: none">- Anatomy and physiology of digestive system- Digestion and absorption of carbohydrates, proteins and fats | 6 |
| 9. | Pathophysiology of following diseases <ul style="list-style-type: none">- Peptic ulceration- Zollinger – Ellison’s Syndrome-Inflammatory Bowel Disease (Ulcerative colitis, Crohn’s disease)- Cholecystitis & Cholelithiasis- Jaundice- Hepatitis- Pancreatitis- Achalasia- Reflux esophagitis | 3 |
| | Total | 38 |

Books Latest editions of the following books to be referred

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

Mathematics**3 hrs/week**

| Unit | Topics | Hours |
|-------------|---|--------------|
| 1 | Differential Calculus | 05 |
| 1.1 | Successive Derivatives | |
| 1.2 | Lebnitz's Rule fourth derivative | |
| 1.3 | Lagrange's and Rolle's Mean Value Theorems (Statements only) | |
| 1.4 | Taylor's and Maclaurin's Series (No proof) with application | |
| 2 | Partial Differentiation | 05 |
| 2.1 | Functions of two or three variables | |
| 2.2 | Change of variables | |
| 2.3 | Application to errors, maxima and minima | |
| 3 | Integral Calculus | 07 |
| 3.1 | Integration by parts | |
| 3.2 | Properties of definite integrals and reduction formulae | |
| 3.3 | Determination of the length of the curve, arc and volume | |
| 4 | Differential Equations | 07 |
| 4.1 | Formation of differential equations | |
| 4.2 | Solution of first-order and first-degree equations | |
| 4.3 | Linear differential equations of higher order with constant coefficients | |
| 4.4 | Simple applications to chemical reactions and biopharmaceutics | |
| 5 | Determinants and Matrices | 07 |
| 5.1 | Properties of determinants and applications | |
| 5.2 | Solution of simultaneous equations with three variables by Cramer's method | |
| 5.3 | Types of matrices, inverse of matrix, rank of a matrix, eigen value and eigen vectors | |
| 5.4 | Caley Hamilton Theorem | |
| 6.0 | Numerical Methods | 06 |
| 6.1 | Finite difference operators (δ and E) | |
| 6.2 | Interpolation of equal and unequal intervals – Newton's method and Lagrange method | |
| 6.3 | Numerical integration – Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rules | |
| | TOTAL | 37 |

Books – Latest Editions to be adopted

1. Mathematics for Pharmacy Students (Vol. 1), Gujar, K. N., Bhavale Ashok, Career Publications.
2. Differential Calculus; Nareyan, S., S. Chand Publication
3. Applied Mathematics – I, Baphana R. M., Techmax Publication.
4. Textbook of Applied Mathematics, Vols. I and II, Wartikar, P. N. Pune Vidyarthi Griha Prakashan.
5. Integral Calculus, Shanti Narayan, S. Chand Publication.
6. A Textbook of Matrices, Shantinayakan, S. Chand Publication.

Practicals

Organic Chemistry Lab. – I

4 hrs/week

- 1) Laboratory safety measures to be taken for:
 - a. Fire and burns
 - b. Spillage
 - c. Inhalation of toxic fumes
 - d. Dress code in a laboratory
 - e. First aid measures to be taken in cases of accidents
 - f. Use of fume hood, eye shower, body shower.
- 2) Organic spotting: Minimum eight samples of mono-functional groups and two samples of bifunctional groups to be taken.
- 3) Theoretical aspects of physical constant determination, and detection of functional groups.

Books

1. A laboratory hand book of Organic qualitative analysis and separations, V.S. Kulkarni, S.P.Pathak, D. Ramchandra & Co., Pune
2. Text book of organic practical chemistry, V.S. Kulkarni, S.P.Pathak, D. Ramchandra & Co., Pune.
3. R. L. Shriner, R. C. Fuson and D. Y. Curtin, The systematic Identification of Organic compounds, 6th Ed., Wiley, New York, 1980
4. A. I. Vogel, A textbook of practical organic chemistry, 4th edition, Wiley New York, 1978
5. Comprehensive Practical Organic Chemistry: Qualitative Analysis, V.K. Ahluwalia, S. Dhingra, Universities Press (India) Limited, 2000
6. Comprehensive Practical Organic Chemistry: Preparation and Quantitative analysis, V.K. Ahluwalia, Renu Aggarwal, Universitites Press (India) Limited, 2000

Biochemistry Lab.**4 hrs/week**

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

Books

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

Dispensing Lab**4 hrs/week**

| Dosage form | Representative preparations |
|----------------------------|--|
| 1. Solutions | 1. Potassium Permanganate Solution 2. Zinc Chloride and Zinc sulphate Mouthwash BPC 1973 3. Sodium Bicarbonate Ear Drops BP 4. Paediatric Ferrous Sulphate Oral Solution BP 1988 |
| 2. Suspensions | 1. Menthol and Eucalyptus oil inhalation 2. Paediatric Chalk Mixture BP 1988 3. Kaolin Mixture BP 1988 |
| 3. Emulsions And Creams | 1. Arachis Oil Emulsion 2. Calciferol Emulsion 3. Aqueous Calamine cream IP 2010 4. Medicated cream 5. Buffered Cream BP 1988 |
| 4. Ointment | 1. Zinc and Castor Oil Ointment BP 1988 / Calamine Ointment IP 2010 |
| 5. Gel | 1. Lubricating Jelly |
| 6. Paste | 1. Compound Zinc Paste BP 1988/ Zinc and Salicylic Acid paste BP 1988 2. Kaolin Poultice BP 1988 |
| 7. Powder | 1. Bulk Powder : Compound Magnesium trisilicate Oral Powder BP 1988 / Zinc, Starch and Talc Dusting Powder BPC 1973 2. Divided Powder : Hyoscine Hydrobromide Powder 3. Siedlitz Powder |
| 8. Granules | 1. Isapgahl Granules 2. Effervescent Granules |
| 9. Tablet triturate | 1. Boric acid / Riboflavin tablet triturate |
| 10. Capsule | 1. Chlordiazepoxide capsules BP |
| 11. Pills | 1. Compound Rhubarb Pills BPC 1960 / Potassium Permanganate Pills |
| 12. Pastilles | 1. Medicated Pastille |
| 13. Lozenge | 1. Brompton Cough Lozenge BPC 1973 / Compound Bismuth Carbonate Lozenge BPC 1973 |
| 14. Suppository | 1. Compound Bismuth Subgallate Suppositories BP 1980 |
| 15. Incompatibility | 1. Eutectic Mixture |

Books

1. Relevant editions of IP, BP, BPC
2. Cooper and Gunns Dispensing for Pharmaceutical Students, Edns. 11 and 12; Edited by S.J.Carter, Indian Edition, CBS Publishers, Delhi.
3. Pharmaceutical Practice; Edited by D.M.Collet and M.E.Aulton; Churchill Livingstone, ELBS Edition, 1991.
4. Pharmaceutical Practice Edited by A.J.Winfield and R.M.E. Richards, Second Edition (1998), Third Edition (2004) Churchill Livingstone.