

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY

LUCKNOW



Evaluation Scheme & Syllabus

for

B.Pharm. First Year

(Effective from the Session: 2017-18)

Course Code	Name of the Course	No. of Hours/ wk	Continuous Mode	Internal Assessment			End Semester Exams		Total Marks	Tutorial	Credit Points
				Sessional Exams		Total	Marks	Duration			
				Marks	Duration						
BP101T	Human Anatomy and Physiology– Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP103T	Pharmaceutics I – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP104T	Pharmaceutical Inorganic Chemistry– Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP105T	Communication Skills – Theory	2	20	30	2 Hr	50	---	---	50	-	2
BP106RBT BP106RMT	Remedial Biology/ Mathematics – Theory	2	20	30	2 Hr	50	---	---	50	-	2
BP107P	Human Anatomy and Physiology – Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
BP109P	Pharmaceutics I – Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
BP110P	Pharmaceutical Inorganic Chemistry– Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
BP111P	Communication Skills – Practical	2	10	15	2 Hrs	25	---	---	25	-	1
BP112RBP	Remedial Biology– Practical	2	10	15	2 Hrs	25	---	---	25	-	1
Total		34^s/ 36[#]	110^s/ 120[#]	175^s/ 190[#]	26^s/28[#]Hrs	285^s/ 310[#]	440[#]	26^s/ 28[#] Hrs	725^s/ 750[#]	4	29^s/ 30[#]

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.

SECOND SEMESTER

Course Code	Name of the Course	No. of Hours/ wk	Internal Assessment				End Semester Exams		Total Marks	Tutorial	Credit Points
			Continuous Mode	Sessional Exams		Total	Marks	Duration			
				Marks	Duration						
BP201T	Human Anatomy and Physiology II – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP203T	Biochemistry – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP204T	Pathophysiology – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP205T	Computer Applications in Pharmacy – Theory	3	25	50	2 Hr	75	---	---	75	-	3
BP206T	Environmental Sciences – Theory	3	25	50	2 Hr	75	---	---	75	-	3
BP207P	Human Anatomy and Physiology II – Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
BP208P	Pharmaceutical Organic Chemistry I – Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
BP209P	Biochemistry – Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
BP210P	Computer Applications in Pharmacy – Practical	2	10	15	2 Hrs	25	---	---	25	-	1
Total		32	115	205	22Hrs	320	405	24 Hrs	725	4	29

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)**45 Hours**

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

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

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the various experiments related to special senses and nervous system.
5. Appreciate coordinated working pattern of different organs of each system.

Unit I**10 hours**

Introduction to human body: Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular level of organization Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent; b) Paracrine; c) Synaptic; d) Endocrine.

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

Unit II**10 hours**

Integumentary system: Structure and functions of skin

Skeletal system: Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction.

Joints: Structural and functional classification, types of joints movements and its articulation

Unit III**10 hours**

Body fluids and blood: Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system.

Unit IV**08 hours**

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

Special senses: Structure and functions of eye, ear, nose and tongue and their disorders.

Unit V**07 hours**

Cardiovascular system: Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.

BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)**4 Hours/week**

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue.
3. Microscopic study of muscular and nervous tissue.
4. Identification of axial bones.
5. Identification of appendicular bones.
6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count.
8. Enumeration of total red blood corpuscles (RBC) count.
9. Determination of bleeding time.
10. Determination of clotting time.
11. Estimation of hemoglobin content.
12. Determination of blood group.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate.
15. Recording of blood pressure.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee Brothers Medical Publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.
3. Physiological Basis of Medical Practice-Best and Taylor. Williams & Wilkins Co, Riverview, MI, USA.
4. Text Book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.
9. Marieb E.N. Human Anatomy and Physiology, Benjamin Cummings (Pearson Education Inc.), San Francisco.
10. Preventive and Social Medicine by Park K., Banarsidas Bhanot Publishers, Jabalpur.
11. Anatomy and Physiology in Health and Illness- by Ross & Wilson Churchill Livingstone, London.
12. Essentials of Anatomy and Physiology- by Seeley R.R., Stephens T.D. and Tate P. McGraw-Hill, New York.
13. Health Education and Community Pharmacy by Parmar N.S., CBS Publishers, Delhi.
14. Health Education and Community Pharmacy by Dandiya, P.C., Zafer, Z.Y.K., and Zafer, A. Vallabh Prakashan, Delhi.
15. Samson Wright's Applied Physiology- by Keele, C.A., Niel, E and Joels N, Oxford University Press, New York.

Reference Books (Latest Editions)

1. Physiological Basis of Medical Practice-Best and Taylor. Williams & Wilkins Co, Riverview, MI, USA.
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje , Academic Publishers Kolkata

BP102T. PHARMACEUTICAL ANALYSIS (Theory) 45 Hours

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

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

- understand the principles of volumetric and electro chemical analysis. □ carryout various volumetric and electrochemical titrations.
- develop analytical skills.

Course Content:**Unit I****10 Hours**

(a) **Pharmaceutical analysis-** Definition and scope i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate

(b) **Errors:** Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures

(c) Pharmacopoeia, Sources of impurities in medicinal agents, limit tests.

Unit II**10 Hours**

Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves

Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

Unit III**10 Hours**

Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride .

Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.

Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.

Basic Principles, methods and application of diazotization titration

Unit IV**08 Hours**

Redox titrations: (a) Concepts of oxidation and reduction

(b) Types of redox titrations (Principles and applications)

Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate.

Unit-V**07 Hours****Electrochemical methods of analysis**

Conductometry- Introduction, Conductivity cell, Conductometric titrations, applications.

Potentiometry - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

Polarography - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications

BP108P. PHARMACEUTICAL ANALYSIS (Practical) 4 Hours / Week

I Limit Test of the following: (1) Chloride (2) Sulphate (3) Iron (4) Arsenic

II Preparation and standardization of: (1) Sodium hydroxide (2) Sulphuric acid

(3) Sodium thiosulfate (4) Potassium permanganate (5) Ceric ammonium sulphate

III Assay of the following compounds along with Standardization of Titrant:

(1) Ammonium chloride by acid base titration. (2) Ferrous sulphate by Cerimetry.

(3) Copper sulphate by Iodometry. (4) Calcium gluconate by complexometry.

(5) Hydrogen peroxide by Permanganometry. (6) Sodium benzoate by non-aqueous titration. (7) Sodium Chloride by precipitation titration.

IV Determination of Normality by electro-analytical methods

(1) Conductometric titration of strong acid against strong base.

(2) Conductometric titration of strong acid and weak acid against strong base.

(3) Potentiometric titration of strong acid against strong base .

Recommended Books: (Latest Editions)

1. Vogel's Textbook of Quantitative Chemical Analysis- by Mendham J., Denney R.C., Barnes J.D., Thomas M, Jeffery G.H., Pearson Education Asia.

2. A Text Book of Pharmaceutical Analysis- by Connors K.A., Wiley Inter-science.

3. Practical Pharmaceutical Chemistry- by Beckett A.H., and Stenlake J.B., Vol. I & II. Athlone Press, University of London.

4. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.

5. Quantitative Analysis- by Alexeyev V. CBS Publishers & Distributors, New Delhi.

6. The Pharmacopoeia of India, The Controller of Publications, Delhi.

7. Inorganic Pharmaceutical Chemistry- by P. Gundu Rao.

8. Textbook of Pharmaceutical Chemistry- by Bentley and Driver's.

9. Analytical Chemistry Principles- by John H. Kennedy

BP103T. PHARMACEUTICS- I (Theory)**45 Hours**

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.

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 & pharmaceutical calculations.
- Understand the professional way of handling the prescription. □ Preparation of various conventional dosage forms.

Unit I**10 Hours**

Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

Dosage forms: Introduction to dosage forms, classification and definitions

Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription.

Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

Unit II**10 Hours**

Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, allegation, 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. Solubility enhancement techniques.

Unit III**08 Hours**

Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.

Biphasic liquids:

Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.

Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

Unit IV**08 Hours**

Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.

Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

Unit V**07 Hours**

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

BP109P. PHARMACEUTICS I (Practical)**3 Hours / week**

1. **Syrups:** a) Syrup IP'66. b) Compound syrup of Ferrous Phosphate BPC'68.
2. **Elixirs** a) Piperazine citrate elixir. b) Paracetamol pediatric elixir.
3. **Linctus** a) Terpin Hydrate Linctus IP'66. b) Iodine Throat Paint (Mandles Paint)
4. **Solutions** a) Strong solution of ammonium acetate. b) Cresol with soap solution. c) Lugol's solution.
5. **Suspensions** a) Calamine lotion. b) Magnesium Hydroxide mixture. c) Aluminium Hydroxide gel.
6. **Emulsions** a) Turpentine Liniment. b) Liquid paraffin emulsion.
7. **Powders and Granules** a) ORS powder (WHO). b) Effervescent granules. c) Dusting powder. d) Divded powders.
8. **Suppositories** a) Glycero gelatin suppository b) Coca butter suppository c) Zinc Oxide suppository
9. **Semisolids** a) Sulphur ointment b) Non staining-iodine ointment with methyl salicylate c) Carbopal gel.
10. **Gargles and Mouthwashes** a) Iodine gargle. b) Chlorhexidine mouthwash.

Recommended 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. Pharmacopoeia of India, The Controller of Publications, Delhi.
5. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.
6. United States Pharmacopoeia (National Formulary).
7. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.
8. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
9. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
10. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
11. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
12. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
13. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.
14. Aulton M.E, Text Book of Pharmaceutics, Vol., I & II. Churchill Livingstone, London.
15. Remington, The Science and Practice of Pharmacy Vol. I & II. Mack Publishing Co., Pennsylvania.
16. Jain N.K., Modern Dispensing Pharmacy, 2nd Ed, PharmaMed Press/BPS Books, Hyderabad.
17. Elementary Pharmaceutical Calculations by Tripathi D.K., PharmaMed Press, Hyderabad.

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)**45 Hours**

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of course student shall be able to

- Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- Understand the medicinal and pharmaceutical importance of inorganic compounds

Course Content:

Unit I**10 Hours**

Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate.

General methods of preparation, assay for the compounds superscripted with **asterisk (*)**, properties and medicinal uses of inorganic compounds belonging to the following classes.

Unit II**10 Hours**

Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.

Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

Unit III**10 Hours**

Gastrointestinal agents Acidifiers: Ammonium chloride* and Dil. HCl. **Antacid:** Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture. **Cathartics:** Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite.

Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations.

Unit IV**08 Hours**

Miscellaneous compounds Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate.

Haematinics: Ferrous sulphate*, Ferrous gluconate.

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite³³³.

Astringents: Zinc Sulphate, Potash Alum.

Unit V**07 Hours**

Radiopharmaceuticals: Radio activity, measurement of radioactivity, properties of α , β , γ radiations, half life, radio isotopes and study of radio isotopes- Sodium iodide I, storage conditions, precautions & pharmaceutical application of radioactive substances.

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)**4 Hours / Week**

I. Limit tests for following ions Limit test for Chlorides and Sulphates, Modified limit test for Chlorides and Sulphates Limit test for Iron Limit test for Heavy metals Limit test for Lead Limit test for Arsenic

II. Identification test Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate

III. Test for purity Swelling power of Bentonite Neutralizing capacity of aluminum hydroxide gel Determination of potassium iodate and iodine in potassium Iodide

IV. Preparation of inorganic pharmaceuticals Boric acid Potash alum Ferrous sulphate

Recommended Books (Latest Editions)

1. Pharmacopoeia of India, 1996 Edition, The Controller of Publications, Delhi.
2. Block J.H., Roche E., Soine, T. and Wilson, C., Inorganic, Medicinal & Pharmaceutical Chemistry, Lea &Febiger, Philadelphia.
3. Atherden L.M., Bentley and Driver's Text Book of Pharmaceutical Chemistry, Oxford University Press, London.
4. Miessler, G.L. and Tarr, D.A. Inorganic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi.
5. Svehla, G. and Sivasankar, B. Vogel's Qualitative Inorganic Analysis, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi.
6. Rao K.S. and Suresh, C.V. Pharmaceutical Inorganic Chemistry, PharmaMed Press, Hyderabad.
7. Chenchu Lakshmi, N.V. Pharmaceutical Inorganic Chemistry: Theory and Practice, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi.
8. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition.
9. M.L Schroff, Inorganic Pharmaceutical Chemistry.
10. A.I. Vogel, Text Book of Quantitative Inorganic analysis.
11. Anand & Chatwal, Inorganic Pharmaceutical Chemistry.

BP105T. COMMUNICATION SKILLS (Theory)**30 Hours**

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.

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

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

Course content:

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

BP111P. COMMUNICATION SKILLS (Practical)**2 Hours / Week**

The following learning modules are to be conducted using words worth® English language lab software.

Basic communication covering the following topics

Meeting People. What did you do? Do's and Dont's.

Asking Questions. Making Friends.

Advanced Learning

Pronunciation (Consonant Sounds).

Pronunciation and Nouns.

Pronunciation (Vowel Sounds).

Pronunciations covering the following topics

Listening Comprehension / Direct and Indirect Speech. Figures of Speech.

Effective Communication. Writing Skills. Effective Writing.

Interview Handling Skills. E-Mail etiquette. Presentation Skills.

Recommended Books: (Latest Edition)

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 Behavior, 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, Gopala Swamy 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, Konar Nira, 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, Mc Graw 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, Mc Graw Hill, 1999.

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

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

Know understand the basic components of anatomy & physiology animal with special reference to human

Course content:

Unit I

07 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,

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 & Dicotyledones.

Unit II

07 Hours

Body fluids and circulation

Composition of blood, blood groups, coagulation of blood

Composition and functions of lymph

Human circulatory system

Structure of human heart and blood vessels

Cardiac cycle, cardiac output and ECG

Digestion and absorption

Human alimentary canal and digestive glands

Role of digestive enzymes

Digestion, absorption and assimilation of digested food

Breathing and respiration

Human respiratory system

Mechanism of breathing and its regulation

Exchange of gases, transport of gases and regulation of respiration

Respiratory volumes

Unit III

07 Hours

Excretory products and their elimination

Modes of excretion

Human excretory system- structure and function

Urine formation

Renin angiotensin system

Neural control and coordination

Definition and classification of nervous system

Structure of a neuron

Generation and conduction of nerve impulse

Structure of brain and spinal cord

Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical coordination and regulation

Endocrine glands and their secretions

Functions of hormones secreted by endocrine glands **Human**

reproduction

Parts of female reproductive system

Parts of male reproductive system

Spermatogenesis and Oogenesis

Menstrual cycle

Unit IV

05 Hours

Plants and mineral nutrition: Essential mineral, macro and micronutrients

Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

Unit V

04 Hours

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

Plant growth and development: Phases & rate of plant growth, Condition of growth, Introduction to plant growth Regulators

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

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

Text Books

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

Reference Books

1. A Text book of Biology by B.V. Sreenivasa Naidu
2. A Text book of Biology by Naidu and Murthy
3. Botany for Degree Students By A.C.Dutta.
4. Outlines of Zoology by M. Ekambaranatha Ayyer and T. N. Ananthkrishnan.
5. A Manual for Pharmaceutical Biology Practical by S.B. Gokhale and C. K. Kokate

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, Root, Leaf, seed, fruit, flower and their modifications.
4. Detailed study of frog by using computer models.
5. Microscopic study and identification of tissues pertinent to Stem, Root, Leaf, seed, fruit and flower
6. Identification of bones.
7. Determination of blood group.
8. Determination of blood pressure.
9. Determination of tidal volume.

Reference Books

1. Practical Human Anatomy and Physiology. by S.R. Kale and R.R. Kale
2. A Manual of Pharmaceutical Biology Practical by S.B. Gokhale, C.K. Kokate and S.P. Shrivastava.
3. Biology Practical Manual According to National Core Curriculum .Biology Forum of Karnataka. Prof. M.J.H. Shafi.

BP 106RMT. REMEDIAL MATHEMATICS (Theory) 30 Hours

Scope: This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.

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

1. Know the theory and their application in Pharmacy.
2. Solve the different types of problems by applying theory.
3. Appreciate the important application of mathematics in Pharmacy.

Course Content:

Unit I

06 Hours

Partial fraction: Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics.

Logarithms: Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.

Function: Real Valued function, Classification of real valued functions, □

Limits and continuity: Introduction, Limit of a function, Definition of limit of a function ($\epsilon - \delta$

$$\text{definition}), \lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}, \quad \lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1,$$

Unit II

06 Hours

Matrices and Determinant:

Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley-Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.

Unit III

06 Hours

Calculus Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of x^n w.r.t. x , where n is any rational number, Derivative of e^x , Derivative of $\log x$, Derivative of a^x Derivative of trigonometric functions from first principles (**without Proof**), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application.

Unit IV

06 Hours

Analytical Geometry Introduction: Signs of the Coordinates, Distance formula,

Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line.

Integration: Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application.

Unit V

06 Hours

Differential Equations: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, Application in solving Pharmacokinetic equations.

Laplace Transform : Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving chemical kinetics and Pharmacokinetics equations.

Recommended Books (Latest Edition)

1. Differential Calculus by Shanthinarayan.
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.
3. Integral Calculus by Shanthinarayan.
4. Higher Engineering Mathematics by Dr. B.S. Grewal

BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)**45 Hours**

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

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

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.
5. Appreciate coordinated working pattern of different organs of each system
6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Course Content:**Unit I****10 hours Nervous system:**

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity).

Unit II**06 hours**

Digestive system Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

Energetics Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III**10 hours**

Respiratory system: Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration. Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

Urinary system Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.

Unit IV**10 hours**

Endocrine system Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.

Unit V**09 hours****Reproductive system**

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

Introduction to genetics Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance.

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)**4 Hours/week**

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

1. To study the integumentary and special senses using specimen, models, etc.
2. To study the nervous system using specimen, models, etc.
3. To study the endocrine system using specimen, models, etc.
4. To demonstrate the general neurological examination.
5. To demonstrate the function of olfactory nerve.
6. To examine the different types of taste.
7. To demonstrate the visual acuity.
8. To demonstrate the reflex activity.
9. Recording of body temperature.
10. To demonstrate positive and negative feedback mechanism.
11. Determination of tidal volume and vital capacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary & reproductive systems with help of models, charts & specimens.
13. Recording of basal mass index.
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyzer.
16. Permanent slides of vital organs and gonads.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam & P. Sembulingam. Jaypee Brothers Medical Publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co., Riverview, MI, USA.
4. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee Brothers Medical Publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee Brothers Medical Publishers, New Delhi.

8. Practical Workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee Brother's Medical Publishers, New Delhi.
9. Dipiro J.L., Pharmacotherapy- A Pathophysiological Approach, Elsevier, Amsterdam.
10. Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
11. Ross and Wilson, Anatomy and Physiology in Health and Illness, Churchill Livingstone, London.
12. Seeley R.R., Stephens T.D. and Tate, P. Essentials of Anatomy and Physiology, McGraw-Hill, New York.

Reference Books:

1. Physiological Basis of Medical Practice-Best and Taylor. Williams & Wilkins Co, Riverview, MI, USA.
2. Text Book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (Vol 1 and 2) by Dr. C.C. Chatterje, Academic Publishers Kolkata.

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory) 45 Hours

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

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

1. Write the structure, name and the type of isomerism of the organic compound.
2. Write the reaction, name the reaction and orientation of reactions.
3. Account for reactivity/stability of compounds.
4. Identify/confirm the identification of organic compound.

Course Content: General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained. To emphasize on definition, types, classification, principles/mechanisms, applications, examples & differences.

Unit-I

07 Hours

Classification, nomenclature and isomerism

Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds

Unit II

10 Hours

Alkanes*, Alkenes* and Conjugated dienes* SP₂ hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP hybridization in alkenes. E₁ and E₂ reactions – Kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E₁ versus E₂ reactions, Factors affecting E₁ and E₂ reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement.

Unit III

10 Hours

Alkyl halides* SN₁ and SN₂ reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN₁ versus SN₂ reactions, Factors affecting SN₁ and SN₂ reactions. Structure and uses of ethylchloride, chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol.

Unit IV

10 Hours

Carbonyl compounds* (Aldehydes and ketones)

Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

Unit V

08 Hours

Carboxylic acids* Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid

Aliphatic amines* - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical) 4 Hours / week

- A. Systematic qualitative analysis of unknown organic compounds like
 1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
 2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
 3. Solubility test
 4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
 5. Melting point/Boiling point of organic compounds
 6. Identification of the unknown compound from the literature using melting point/ boiling point.
 7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
 8. Minimum 5 unknown organic compounds to be analyzed systematically.
- B. Preparation of suitable solid derivatives from organic compounds.
- C. Construction of molecular models.

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison R.T., Boyd R.N. and Bhattacharjee, S.K. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.), New Delhi.
2. Organic Chemistry by I.L. Finar, Volume-I, Pearson Education Ltd, New Delhi.
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Practical Organic Chemistry by Mann and Saunders.
5. Vogel's Text book of Practical Organic Chemistry
6. Advanced Practical Organic Chemistry by N.K. Vishnoi.
7. Introduction to Organic Laboratory Techniques by Pavia, Lampman and Kriz.
8. Reaction and Reaction Mechanism by Ahluwalia/Chatwal.
9. A Guidebook to Mechanism in Organic Chemistry- by Sykes P., Longman Group Ltd, London.
10. Organic Chemistry- by Jain M.K., Sohan Lal Nagin Chand & Co, New Delhi.

BP203 T. BIOCHEMISTRY (Theory)

45 Hours

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.

Objectives: Upon completion of course student shall be able to

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

Course Content:

Unit I

08 Hours

Biomolecules Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

Bioenergetics Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP

Unit II

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 III

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.

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

10 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.

BP 209 P. BIOCHEMISTRY (Practical)**4 Hours / Week**

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. Harper's Illustrated Biochemistry- by Murray R.K. and Granner D.K., Lange Medical Publication.
2. Lehninger Principles of Biochemistry- by Nelson D.L. and Cox M.M., Macmillan Worth Publishers.
3. Fundamentals of Biochemistry- by Voet D., Voet J.G., Pratt C.W., John Wiley and Sons Inc.
4. Lippincott's Illustrative Reviews: Biochemistry- by Champe P.C., Harvey R.A., Ferrier D.R., Lippincott Williams and Wilkins.
5. Principles and Techniques of Biochemistry and Molecular Biology- by Wilson K. and Walker J., Cambridge University Press.
6. Bioorganic Chemistry: A Chemical Approach to Enzyme Action- by Dugas H. 3rd Edition, Springer (India) Private Limited, New Delhi.
7. Molecular Cell Biology- by Lodish H., Berk A., Matsudaira P., Kaiser C.A., Krieger M. and Scott M.P., W.H. Freeman and Company, New York.
8. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition), Mc Graw Hill, New Delhi.
9. Practical Biochemistry by Harold Varley. CBS Publishers and Distributors. New Delhi.
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11. Conn E.E. and Stumph P.K., Outline of Biochemistry, John Wiley & Sons, New York.
12. Stryer L. and Berg J.M., Biochemistry, W.H. Freeman and Company, New York.
13. Harrow B. and Mazur A., Text book of Biochemistry, W.B. Saunders Co., Philadelphia.
14. Jayaraman J., Laboratory Manual in Biochemistry, Wiley Eastern Limited.
15. Singh S.P., Practical Manual to Biochemistry, CBS Publisher, New Delhi.
16. Boyer R.F. Modern Experimental Biochemistry, Dorling Kindersley (India) Pvt. Ltd.
17. Comprehensive Viva and Practical Biochemistry- by Deb A.C., New Central Book Agency (P.) Ltd. London.
18. Vyas S.P. and Kohli D.V., Pharmaceutical Biochemistry, 1st Edition, CBS Publishers & Distributors, New Delhi.

BP 204T. PATHOPHYSIOLOGY (THEORY)**45Hours**

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Objectives: Upon completion of the subject student shall be able to –

1. Describe the etiology and pathogenesis of the selected disease states;
2. Name the signs and symptoms of the diseases; and
3. Mention the complications of the diseases.

Course content:**Unit I****10 Hours****Basic principles of Cell injury and Adaptation:**

Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance.

Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis.

Unit II**10Hours**

Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)

Respiratory system: Asthma, Chronic obstructive airways diseases.

Renal system: Acute and chronic renal failure.

Unit III**10Hours**

Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia

Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones.

Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.

Gastrointestinal system: Peptic Ulcer.

Unit IV **8 Hours**

Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.

Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout.

Principles of cancer: classification, etiology and pathogenesis of cancer.

Unit V **7 Hours**

Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis, Urinary tract infections

Sexually transmitted diseases: AIDS, Syphilis, Gonorrhoea.

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins & Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard);
5. Best and Taylor's Physiological basis of medical practice; 12th ed; united states; William and Wilkins, Baltimore; 1991 [1990 printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston; Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12 th edition; WB Saunders Company; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone Publication; 200

Recommended Journals 1. The Journal of Pathology. ISSN: 1096-9896 (Online).

2. The American Journal of Pathology. ISSN: 0002-9440.

3. Pathology. 1465-3931 (Online).

4. International Journal of Physiology, Pathophysiology and Pharmacology, ISSN: 1944- 8171,

5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory) **30 Hrs (2 Hrs/Week)**

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

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

1. Know the various types of application of computers in pharmacy.
2. Know the various types of databases.
3. Know the various applications of databases in pharmacy.

Course content:

Unit I

06 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 – One's complement ,Two's complement method, binary multiplication, binary division

Concept of Information Systems and Software : Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project

Unit II

06 hours

Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products. Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database.

Unit III

06 hours

Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, 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.

Unit IV

06 hours

Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery.

Unit V

06 hours

Computers as data analysis in Preclinical development:

Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

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
7. Generating report and printing the report from patient database
8. Creating invoice table using – MS Access
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access 11. Exporting Tables, Queries, Forms and Reports to web pages 12. Exporting Tables, Queries, Forms and Reports to XML pages

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA. (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Wiley and Sons, INC., Publication, USA.
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA).
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N. Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002.

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

30 hours

Scope: Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

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

1. Create the awareness about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the environment.
4. Motivate learner to participate in environment protection and environment improvement.
5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.
6. Strive to attain harmony with Nature.

Course content:

Natural Resources Renewable and non-renewable resources: Natural resources and associated problems

Unit I

10hours

The multidisciplinary nature of environmental studies.

- a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

Unit II

10hours

Ecosystems: Concept of an ecosystem.

Structure and function of an ecosystem.

Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III

10hours

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

1. Singh, Y.K. Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment.

(W.E.F. Session 2017-18)

THIRD SEMESTER

Course Code	Name of the Course	No. of Hours/wk	Internal Assessment				End Semester Exams		Total Marks	Tutorial	Credit Points
			Continuous Mode	Sessional Exams		Total	Marks	Duration			
				Marks	Duration						
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP302T	Physical Pharmaceutics I – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP303T	Pharmaceutical Microbiology – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP304T	Pharmaceutical Engineering – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	5	10	4 Hr	15	35	4 Hrs	50	-	2
BP306P	Physical Pharmaceutics I – Practical	4	5	10	4 Hr	15	35	4 Hrs	50	-	2
BP307P	Pharmaceutical Microbiology – Practical	4	5	10	4 Hr	15	35	4 Hrs	50	-	2
BP 308P	Pharmaceutical Engineering – Practical	4	5	10	4 Hr	15	35	4 Hrs	50	-	2
Total		28	60	100	2	160	440	28Hrs	600	4	24

FOURTH SEMESTER

Course Code	Name of the Course	No. of Hours/wk	Internal Assessment				End Semester Exams		Total Marks	Tutorial	Credit Points
			Continuous Mode	Sessional Exams		Total	Marks	Duration			
				Marks	Duration						
BP401T	Pharmaceutical Organic Chemistry III – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP402T	Medicinal Chemistry I – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP403T	Physical Pharmaceutics II – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP404T	Pharmacology I – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP405T	Pharmacognosy I – Theory	3	10	15	1 Hr	25	75	3 Hrs	100	1	4
BP406P	Medicinal Chemistry I – Practical	4	5	10	4 Hr	15	35	4 Hrs	50	-	2
BP407P	Physical Pharmaceutics II – Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
BP408P	Pharmacology I – Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
BP409P	Pharmacognosy I – Practical	4	5	10	4 Hrs	15	35	4 Hrs	50	-	2
Total		31	70	115	21 Hrs	185	515	31 Hrs	700	5	28

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

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

1. Write the structure, name and the type of isomerism of the organic compound
2. Write the reaction, name the reaction and orientation of reactions
3. Account for reactivity/stability of compounds,
4. Prepare organic compounds.

Course Content: General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained. To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

Unit I**10 Hours****Benzene and its derivatives**

A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule

B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedelcrafts alkylation-reactivity, limitations, Friedelcrafts acylation.

C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction.

D. Structure and uses of DDT, Saccharin, BHC and Chloramine.

Unit II**10 Hours**

Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols

Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

Aromatic Acids* - Acidity, effect of substituents on acidity and important reactions of benzoic acid.

Unit III**10 Hours****Fats and oils**

a. Fatty acids – reactions.

b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.

c. Analytical constants– Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value– significance and principle involved in their determination.

Unit IV**08 Hours**

Polynuclear hydrocarbons: a. Synthesis, reactions b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives.

Unit V**07 Hours**

- **Cycloalkanes*** Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only.

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)**4 Hrs/week**

I Experiments involving laboratory techniques: □ Recrystallization □ Steam distillation

II Determination of following oil values (including standardization of reagents) □ Acid value □ Saponification value □ Iodine value

III Preparation of compounds □ Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.

□ 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/

□ Acetanilide by halogenation (Bromination) reaction.

□ 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.

□ Benzoic acid from Benzyl chloride by oxidation reaction.

□ Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.

□ 1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions.

□ Benzil from Benzoin by oxidation reaction.

□ Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction

□ Cinnamic acid from Benzaldehyde by Perkin reaction

□ *P*-Iodo benzoic acid from *P*-amino benzoic acid

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison R.T., Boyd R.N. & Bhattacharjee, S.K. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.), New Delhi
2. Organic Chemistry by I.L. Finar, Volume-I, Pearson Education Ltd, New Delhi.
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Practical Organic Chemistry by Mann and Saunders.
5. Vogel's Text book of Practical Organic Chemistry
6. Advanced Practical Organic Chemistry by N.K.Vishnoi.
7. Introduction to Organic Laboratory Techniques by Pavia, Lampman and Kriz.
8. Reaction and Reaction Mechanism by Ahluwalia/Chatwal.
9. A Guidebook to Mechanism in Organic Chemistry- by Sykes P., Longman Group Ltd, London.
10. Organic Chemistry- by Jain M.K., Sohan Lal Nagin Chand & Co, New Delhi.
11. Organic Chemistry by P.L.Soni.
12. Advanced Practical organic chemistry by N.K.Vishnoi

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)**45Hours**

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

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

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms.
2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations.
3. Demonstrate use of physicochemical properties in the formulation, development and evaluation of dosage forms.

Course Content:**Unit I****10 Hours**

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

Unit II**10 Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapor pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism.

Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.

Unit III**08 Hours**

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

Unit IV**08Hours**

Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

Unit V**07 Hours**

pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)**4 Hrs/week**

1. Determination the solubility of drug at room temperature.
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co-efficient of benzoic acid in benzene and water.
4. Determination of Partition co-efficient of Iodine in CCl₄ and water.
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method.
6. Determination of surface tension of given liquids by drop count and drop weight method.
7. Determination of HLB number of a surfactant by saponification method.
8. Determination of Freundlich and Langmuir constants using activated char coal.
9. Determination of critical micellar concentration of surfactants.
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method.
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method.

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin.
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee.
9. Physical Pharmaceutics by C.V.S. Subramanyam.
10. Test book of Physical Pharmacy, by Gaurav Jain & Roop K. Khar.
11. Physical Pharmaceutics- by Shotten E & Ridgeway K, Oxford University Press, London.
12. Essentials of Physical Pharmacy- by D.V. Derle.
13. Modern Pharmaceutics, Banker and Rhodes.
14. Pharmaceutics- by Aulton, M.E, The Design and manufacture Of Medicines, Churchill Livingstone.
15. Hajare, A. Physical Pharmacy, New Central Book Agency Pvt. Ltd., Kolkata.

Scope: Study of all categories of microorganisms especially for the production of alcohol antibiotics, vaccines, vitamins enzymes etc.

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

1. Understand methods of identification, cultivation and preservation of various microorganisms
2. To understand the importance and implementation of sterilization in pharmaceutical processing and industry
3. Learn sterility testing of pharmaceutical products.
4. Carried out microbiological standardization of Pharmaceuticals.
5. Understand the cell culture technology and its applications in pharmaceutical industries.

Course content:

Unit I**10 Hours**

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

Unit II**10 Hours**

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

Unit III**10 Hours**

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

Unit IV**08 Hours**

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

Unit V**07Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.

BP 307P. PHARMACEUTICAL MICROBIOLOGY (Practical)**4 Hrs/week**

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

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific Publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Pepler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company.
14. Sykes G., Disinfection and Sterilization: Theory and Practice, General and Industrial Chemistry Seris, Spon.
15. Hugo and Russell, Pharmaceutical Microbiology, Black Well Scientific Publication, Oxford.
16. Stanier R.Y., Ingraham, J.L., Wheelis M.L., Painter P.R. General Microbiology, Macmillan Press Limited.

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)**45 Hours**

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

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

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

Course content:

Unit I**10 Hours**

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

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

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

Unit II**10 Hours**

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

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

Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

Unit III**08 Hours**

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

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

Unit IV**08 Hours**

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

Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

Unit V**07 Hours**

Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

BP308P - PHARMACEUTICAL ENGINEERING (Practical)**4 Hours/week**

I. Determination of radiation constant of brass, iron, unpainted and painted glass.

II. Steam distillation – To calculate the efficiency of steam distillation.

III. To determine the overall heat transfer coefficient by heat exchanger.

IV. Construction of drying curves (for calcium carbonate and starch).

V. Determination of moisture content and loss on drying.

VI. Determination of humidity of air – i) From wet and dry bulb temperatures – use of Dew point method.

VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.

VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.

IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.

X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.

XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity)

XII. To study the effect of time on the Rate of Crystallization.

XIII. To calculate the uniformity Index for given sample by using Double Cone Blender.

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchemo, Latest edition.
2. Solid phase extraction, principles, techniques and applications by Nigel J.K. Simpson- Latest edition.
3. Unit operation of chemical engineering – McCabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latest edition.
6. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7. Physical pharmaceuticals- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

SEMESTER IV

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY – III (Theory)

45 Hours

Scope: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Objectives: At the end of the course, the student shall be able to 1. Understand the methods of preparation and properties of organic compounds. 2. Explain the stereo chemical aspects of organic compounds and stereo chemical reactions. 3. Know the medicinal uses and other applications of organic compounds.

Course Content:

Note: To emphasize on definition, types, mechanisms, examples, uses/applications

Unit I

10 Hours

Stereo isomerism Optical isomerism– Optical activity, enantiomerism, diastereoisomerism, meso compounds. Elements of symmetry, chiral and achiral molecules. DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers. Reactions of chiral molecules. Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute.

Unit II

10 Hours

Geometrical isomerism- Nomenclature of geometrical isomers (Cis-Trans, E-Z, Syn-Anti systems). Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions

Unit III

10 Hours

Heterocyclic compounds: Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene.

Unit IV

08 Hours

Synthesis, reactions and medicinal uses of following compounds/derivatives. Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of Pyridine. Synthesis and medicinal uses of Pyrimidine, Purine, Azepines and their derivatives.

Unit V

07 Hours

Reactions of synthetic importance Metal hydride reduction (NaBH_4 and LiAlH_4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation.

Recommended Books (Latest Editions)

1. Organic Chemistry- by Morrison R.T. and Boyd R.N., Bhattacharjee S.K., 7th Edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Organic Chemistry- by Finar I.L., 6th Edition, Vol.-I, Dorling Kindersley (India) Pvt. Ltd (Pearson Education).
3. An Introduction to the Chemistry of Heterocyclic Compounds- by Acheson R.M., 3rd Edition, Wiley (India) Pvt. Ltd.
4. Heterocyclic Chemistry- by Gilchrist T.L., Pearson Education (Singapore) Ltd.
5. Heterocyclic Chemistry- by Bansal R.K., New Age International Publishers.
6. A Textbook of Organic Chemistry- by Jain M.K. and Sharma S.C., Shoban Lal and Co. Educational Publishers.
7. Advanced General Organic Chemistry- A Modern Approach- by Ghosh S. K., Part-I & II, 3rd Edition, New Central Book Agency (P) Ltd.
8. Organic Chemistry- by Bruice P.Y., 3rd Edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. The Chemistry of Organic Medicinal Products- by Jenkins G.L., Hartung W.H., Hamlin K.E. and Data J.B., 4th Edition, Pharma Med Press, Hyderabad.

BP402T. MEDICINAL CHEMISTRY – I (Theory)

45 Hours

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

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

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship (SAR) of different class of drugs
4. Write the chemical synthesis of some drugs

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

Unit I

10 Hours

Introduction to Medicinal Chemistry History and development of medicinal chemistry Physicochemical properties in relation to biological action: Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. **Drug metabolism** Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.

Unit II

10 Hours

Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of sympathomimetic agents Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyl dopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

- Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.
- Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

Unit III**10 Hours****Cholinergic neurotransmitters:**

Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isoflurophate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

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

Unit IV**08 Hours****Drugs acting on Central Nervous System A. Sedatives and Hypnotics:**

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

Barbiturates: SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital.

Miscellaneous: Amides & imides: Glutethimide. Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics Phenothiazines: SAR of Phenothiazines- Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

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

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action.

Barbiturates: Phenobarbitone, Methabarbitol.

Hydantoins: Phenytoin*, Mephentoin, Ethotoin.

Oxazolindione diones: Trimethadione, Paramethadione.

Succinimides: Phensuximide, Methsuximide, Ethosuximide*

Urea and monoacylureas: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam.

Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

Unit V**07 Hours**

Drugs acting on Central Nervous System General anesthetics: Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anileridine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

BP406P. MEDICINAL CHEMISTRY – I (Practical)**4 Hours/Week**

I Preparation of drugs/ intermediates: 1 1,3-pyrazole 2. 1,3-oxazole 3. Benzimidazole 4. Benztriazole

5. 2,3- diphenyl quinoxaline 6. Benzocaine 7. Phenytoin 8. Phenothiazine 9. Barbiturate

II Assay of drugs 1. Chlorpromazine 2. Phenobarbitone 3. Atropine 4. Ibuprofen 5. Aspirin 6. Furosemide

III Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic Medicinal and Pharmaceutical Chemistry by Block J.H. and Beale J.M., Lippincott Williams and Wilkins.
2. Foye's Principles of Medicinal Chemistry by Lemke T.L., Williams D.A., Roche V.F. and Zito S.W., Lippincott Williams and Wilkins.
3. Burger's Medicinal Chemistry and Drug Discovery by Abraham D.J., Vol I to IV. John Wiley and Sons Inc., New York. 4. Synthesis of Essential Drugs by Vardanyan R.S. and Hruby V.J., Elsevier.
5. Medicinal and Pharmaceutical Chemistry by Singh H. and Kapoor V.K., Vallabh Prakashan, Delhi.
6. Medicinal Chemistry: A Biochemical Approach by Nogrady T., Oxford University Press, New York.
7. The Organic Chemistry of Drug Design and Drug Action by Silverman R.B., Elsevier.
8. Essentials of Medicinal Chemistry by Korolkovas A., John Wiley and Sons Inc., New York.
9. Textbook of Drug Design and Discovery by Larsen P.K., Liljefors T. and Madsen U., Taylor and Francis Inc.
10. Practical Organic Chemistry by Mann F.G. and Saunders B.C., Orient Longman
11. Vogel's Textbook of Practical Organic Chemistry by Furniss B.S., Hannaford A.J., Smith P.W.G. and Tatchell A. R., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.).
12. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5. 13. Indian Pharmacopoeia.
14. The Chemistry of Organic Medicinal Products by Jenkins G.L., Hartung W.H., Hamlin K.E. and Data J.B., PharmaMed Press Hyderabad.

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)**45 Hours**

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms. **Objectives:** Upon the completion of the course student shall be able to

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:**Unit I****07 Hours**

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

Unit II**10 Hours**

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

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

Unit III**10 Hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

Unit IV**10Hours**

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

Unit V**10 Hours**

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

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical)**3 Hrs/week**

1. Determination of particle size, particle size distribution using sieving method
2. Determination of particle size, particle size distribution using Microscopic method
3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Recommended Books: (Latest Editions)

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

BP 404 T. PHARMACOLOGY-I (Theory)**45 Hrs**

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

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

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

Course Content:**Unit I****08 hours****1. General Pharmacology**

- a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.
- b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination

Unit II**12 Hours****General Pharmacology**

- a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein– coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.
- b. Adverse drug reactions.
- c. Drug interactions (pharmacokinetic and pharmacodynamic)
- d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

Unit III**10 Hours****2. Pharmacology of drugs acting on peripheral nervous system**

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

Unit IV**08 Hours 3.****Pharmacology of drugs acting on central nervous system**

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

Unit V**07 Hours 3.****Pharmacology of drugs acting on central nervous system**

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

BP 408 P. PHARMACOLOGY-I (Practical)**4Hrs/Week**

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

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

Recommended Books (Latest Editions)

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

BP 405 T. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)**45 Hours**

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

Objectives: Upon completion of the course, the student shall be able

1. To know the techniques in the cultivation and production of crude drugs.
2. To know the crude drugs, their uses and chemical nature.
3. Know the evaluation techniques for the herbal drugs.
4. To carry out the microscopic and morphological evaluation of crude drugs.

Course Content:**Unit I****10 Hours**

Introduction to Pharmacognosy: (a) Definition, history, scope and development of Pharmacognosy (b) Sources of Drugs – Plants, Animals, Marine & Tissue culture (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo-gum-resins).

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

Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

Unit II**10 Hours**

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

Conservation of medicinal plants.

Unit III**07 Hours**

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

Unit IV**10 Hours**

Pharmacognosy in various systems of medicine: Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites: Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins.

Unit V**08 Hours**

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs.

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

Primary metabolites: General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic use and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey.

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

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

Marine Drugs: Novel medicinal agents from marine sources

BP408 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)**4 Hours/Week**

1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil.
2. Determination of stomatal number and index.
3. Determination of vein islet number, vein islet termination and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer.
5. Determination of Fiber length and width.
6. Determination of number of starch grains by Lycopodium spore method.
7. Determination of Ash value.
8. Determination of Extractive values of crude drugs.
9. Determination of moisture content of crude drugs.
10. Determination of swelling index and foaming.

Recommended Books: (Latest Editions)

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

Scheme of Evaluation (Choice Based Credit System)
Bachelor of Pharmacy (B. Pharm.)
FIFTH SEMESTER

S. No.	Subject Code	Subject Name	L--T--P	T/P Marks (ESE)	Sessional	Total	Credit
Theory							
1.	RPH-521	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	3---0---0	70	30	100	3
2.	RPH-522	Pharmaceutics-VI (Pharmaceutical Technology-I)	3---0---0	70	30	100	3
3.	RPH-523/ RPH-530	Pharmaceutics-VII (Pharmaceutical & Food Microbiology)/ Pharmacognosy-III	3---0---0	70	30	100	3
4.	RPH-524	Pharmacology-I (Pharmacology & Toxicology)	3---0---0	70	30	100	3
5.	RPH-525/ RPH-531	Environment & Ecology/ Professional Communication	3---0---0	70	30	100	3
Practical/ Project							
6.	RPH-521P	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I) Practical	0---0---4	50	50	100	2
7.	RPH-522P	Pharmaceutics-VI (Pharmaceutical Technology-I) Practical	0---0---4	50	50	100	2
8.	RPH-523P/ RPH-530P	Pharmaceutics-VII (Pharmaceutical & Food Microbiology) Practical/ Pharmacognosy-III Practical	0---0---4	50	50	100	2
9.	RPH-524P	Pharmacology-I (Pharmacology & Toxicology) Practical	0---0---4	50	50	100	2
10.	RPH-526P	Hospital Training-I		50	50	100	1
TOTAL						1000	24

SIXTH SEMESTER

S. No.	Subject Code	Subject Name	L--T--P	T/P Marks (ESE)	Sessional	Total	Credit
Theory							
1.	<i>RPH-627</i>	Pharmaceutical Chemistry-VII (Medicinal Chemistry-II)	3---0---0	70	30	100	3
2.	<i>RPH-628</i>	Pharmaceutics-VIII (Pharmaceutical Technology-II)	3---0---0	70	30	100	3
3.	<i>RPH-629</i>	Pharmacology-II	3---0---0	70	30	100	3
4.	<i>RPH-630/ RPH-623</i>	Pharmacognosy-III/ Pharmaceutics-VII (Pharmaceutical & Food Microbiology)	3---0---0	70	30	100	3
5.	<i>RPH-631/ RPH-625</i>	Professional Communication/ Environment & Ecology	3---0---0	70	30	100	3
Practical/ Project							
6.	<i>RPH-627P</i>	Pharmaceutical Chemistry-VII (Medicinal Chemistry-II) Practical	0---0---4	50	50	100	2
7.	<i>RPH-628P</i>	Pharmaceutics-VIII (Pharmaceutical Technology-II) Practical	0---0---4	50	50	100	2
8.	<i>RPH-629P</i>	Pharmacology-II Practical	0---0---4	50	50	100	2
9.	<i>RPH-630P/ RPH-623P</i>	Pharmacognosy-III Practical/ Pharmaceutics-VII (Pharmaceutical & Food Microbiology) Practical	0---0---4	50	50	100	2
10.	<i>RPH-632P</i>	Industrial Training		50	50	100	1
TOTAL						1000	24

FIFTH SEMESTER

RPH-521

PHARMACEUTICAL CHEMISTRY-VI (MEDICINAL CHEMISTRY-I)

Unit I

Basic principles of medicinal chemistry: Physicochemical parameters in relation to biological activity, Stereochemical (Geometrical, Optical and Conformational) aspects of drug design, Bioisosterism. Drug-receptor interaction (forces), Concept of pro-drugs (Bio-precursor and Carrier linked).

Classification, mode of action, uses, recent advances and structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only).

Unit II

Drugs acting at autonomic nervous system *Cholinergic drugs:* Methacholine, Pilocarpine.

Anticholinergic drugs: Atropine.

Anticholinesterases: Neostigmine, Physostigmine.

Adrenergic drugs: Ephedrine, Adrenaline, Salbutamol.

Unit III

Drugs acting at central nervous system *General anaesthetics:* Methohexital, Ketamine.

Local anaesthetics: Benzocaine, Lignocaine.

Skeletal muscle relaxants: Succinylcholine, Pancuronium.

Opioid analgesics: Pethidine, Pentazocine.

Antitussives: Cramiphen, Dextromethorphen.

Unit IV

Anxiolytics: Diazepam.

Sedatives and hypnotics: Phenobarbitone, Alprazolam.

Anticonvulsants: Phenytoin, Ethosuximide, Valproic Acid, Vigabatrin.

Drugs for neurodegenerative disorders: Alzheimer's disease (Tacrine), Parkinson's disease (Levodopa).

Unit V

Antidepressants: Imipramine, Amitriptyline, Fluoxetine.

Antipsychotic: Chlorpromazine, Haloperidol.

CNS Stimulants and psychedelics: Amphetamine, Caffeine.

Antispasmodics: Dicyclomine

RPH-521P PHARMACEUTICAL CHEMISTRY-VI

(MEDICINAL CHEMISTRY-I) PRACTICAL

Suggested Practicals Synthesis of selected drugs from the course content involving two or more steps and characterize/evaluate their Pharmacopoeial standards (if available).

1. Synthesis of Phenytoin.
2. To evaluate the Pharmacopoeial standards of Phenytoin.
3. Synthesis of Benzocaine.
4. To evaluate Pharmacopoeial standards of Benzocaine.
5. Synthesis of Benzamide.
6. To evaluate the synthesized Benzamide.
7. Synthesis of Caffeine.
8. To evaluate the synthesized Caffeine.
9. Synthesis of Phenobarbitone.
10. To evaluate the Pharmacopoeial standards of Phenobarbitone.
11. Synthesis of Thiobarbituric acid derivatives.
12. To evaluate the synthesized Thiobarbituric acid derivatives.
13. Synthesis of Piperazin-2, 5-dione derivatives.
14. To evaluate the synthesized Piperazin-2,5-dione derivatives.

BOOKS RECOMMENDED

1. Abraham D.J., Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons Inc., New York.
2. Block J.H. and Beale J.M., Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams and Wilkins.
3. Lemke T.L., Williams D.A., Roche V.F. and Zito S.W., Foye's Principles of Medicinal Chemistry, Lippincott Williams and Wilkins.
4. Vardanyan R.S. and Hruby V.J., Synthesis of Essential Drugs, Elsevier.
5. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Nogrady T., Medicinal Chemistry: A Biochemical Approach, Oxford University Press, New York.
7. Silverman R.B., The Organic Chemistry of Drug Design and Drug Action, Elsevier.
8. Korolkovas A., Essentials of Medicinal Chemistry, John Wiley and Sons Inc., New York.
9. Larsen P.K., Liljefors T. and Madsen U. Textbook of Drug Design and Discovery, Taylor and Francis Inc.
10. Mann F.G. and Saunders B.C., Practical Organic Chemistry, Orient Longman Limited.
11. Furniss B.S., Hannaford A.J., Smith P.W.G. and Tatchell A. R., Vogel's Textbook of Practical Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.).

RPH-522 PHARMACEUTICS-VI**(PHARMACEUTICAL TECHNOLOGY-I)****Unit I**

Preformulation studies: Significance of physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and stability on formulation development. Brief introduction to ICH guidelines for stability.

Unit II

Biphasic liquid dosage forms (suspensions and emulsions): Vehicles, additives, stabilizers, preservatives, suspending agents, emulsifying agents, colors and flavors; manufacturing, packaging and evaluation. Brief introduction to multiple emulsion, microemulsion, nanoemulsion and nanosuspension.

Unit III

Semisolid dosage forms: Classification, skin permeation enhancement methods, semisolid bases and their selection, general formulation of semisolids and clear gel manufacturing procedures, packaging and evaluation. Introduction to *in situ* gels and hydrogels. **Suppositories:** Bases, manufacturing procedures, packaging and evaluation. Introduction to liquid suppositories.

Unit IV

Ophthalmic, nasal, otic and parenteral products: Significance and formulation details, equipment for large scale manufacturing, *in-vitro* methods of evaluation, containers and closures, prefilling treatments. Ophthalmic, nasal, otic and parenteral preparations (Sterile water for injection, water for injection, suspension and sterile powder).

Unit V

Pharmaceutical aerosols: Definition, propellants, general formulation, manufacturing, packaging, evaluation and pharmaceutical applications. **Veterinary dosage forms:** Animal dosage forms like solid, liquid oral, parenteral, pastes, pellets and implants; regulatory requirements for approval of animal drugs.

RPH-522P PHARMACEUTICS-VI**(PHARMACEUTICAL TECHNOLOGY-I) PRACTICAL**

1. Formulation and evaluation of the following dosage forms containing drugs mentioned in IP.
 - a. Suspensions.
 - b. Emulsions.
 - c. Ear drops.
 - d. Eye drops.
 - e. Nasal drops.
 - f. Topical gels.
 - g. Ointments.
 - h. Pastes.
 - i. Suppositories.
2. Formulation and evaluation of disodium EDTA injection IP (vials).
3. Formulation and evaluation of water for injection IP (ampoules).
4. To perform tip or bead and pull sealing of ampoules.

BOOKS RECOMMENDED

1. Remington's Pharmaceutical Sciences, Vol. I & Vol. II, Mack Publishing Co., U.S.A.
2. Cooper J.W. and Gunn G., Tutorial Pharmacy, Petman Books Ltd., London.
3. Lachman L., Lieberman H.A., Kanig J.L., Theory and Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.
4. Khar R. K., Vyas S.P., Ahmad F., Jain G. K., The Theory and Practice of Industrial Pharmacy, 4th Edition, CBS Publishers and Distributors.
5. Ansel, H.C., Introduction to Pharmaceutical Dosage Forms, Lea and Febiger, Philadelphia, U.S.A.
6. Juliano, R.L., Drug Delivery Systems, Oxford University Press, Oxford.
7. Brittain, H. G., Polymorphism in Pharmaceuticals Solids.
8. Turco S. J., Sterile Dosage Form-Their Preparation and Clinical Application, LWW. nd
9. Hardee G.E., Baggot J.D., Development and Formulation of Veterinary Dosage Forms, 2Edition, CRC Press.

RPH-523/RPH-623**PHARMACEUTICS-VII (PHARMACEUTICAL & FOOD MICROBIOLOGY)**

Unit I A. Introduction to scope of food and pharmaceutical microbiology.

B. Optical microscopy and electron microscopy.

C. Identification of microbes: Structure of bacterial cell, stains and types of staining techniques.

D. Classification of bacteria based on temperature, pH and oxygen requirements.

Unit II A. Nutrition, cultivation and isolation of bacteria and viruses.

B. Factory and hospital hygiene- control of microbial contamination during manufacture, concept and design of clean and aseptic areas, nosocomial infections and their control.

Unit III Control of microbes

A. Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation.

B. Methods of sterilization, validation of sterilization methods and equipments.

Unit IV Food Microbiology

A. Microbial flora of fresh food: egg, meat, fruits and vegetables.

B. Microbial spoilage of foods.

C. Elementary techniques of industrial food preservation-radiation, low and high temperatures.

D. Probiotics in food: Benefits of probiotic foods, brief introduction to probiotic milk, yogurt and ice-cream.

Unit V

A. Sterility testing as per I.P.

B. Preservative efficacy.

C. Microbial assays of antibiotics: Oxytetracycline and Erythromycin.

D. Microbial assays of Vitamin B12.

RPH-523P/RPH-623P PHARMACEUTICS-VII (PHARMACEUTICAL & FOOD MICROBIOLOGY) PRACTICAL

Suggested Practicals Study of sterilization methods and equipments • Dry heat • Moist heat.

2. Preparation of various types of culture media.
3. Isolation of bacteria.
4. Sub-culturing of common bacteria, fungi and yeast.
5. Identification and staining of bacteria • Simple staining • Gram staining • Acid fast staining • Hanging drop preparation.
6. Microbial examination of foods.
7. Evaluation of disinfectants and antiseptics.
8. Phenol coefficient test, minimum inhibitory concentration.
9. Test for sterility of pharmaceutical products as per IP.
10. Microbial assay of antibiotics as per IP.

BOOKS RECOMMENDED

1. Aneja K.R., Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom Cultivation, Vishwa Prakashan.
2. Gunasekaran P., Lab Manual of Microbiology, New Age Publishers.
3. Davis, Dulbetco, Eisen Microbiology.
4. Stanier R.Y., Ingraham, J.L., Wheelis M.L., Painter P.R. General Microbiology, Macmillan Press Limited.
5. Hugo and Russell, Pharmaceutical Microbiology, Black Well Scientific Publication, Oxford.
6. Prescott L.M., Harley J.P. and Klien D.A., Microbiology, McGraw Hill.
7. Sykes G., Disinfection and Sterilization: Theory and Practice, General and Industrial Chemistry Series, Spon.
8. Pelczar and Reid, Microbiology, Tata McGraw Hill, Delhi.
9. Bean H. S., Beckett A. H. and Carless J. E., Advances in Pharmaceutical Sciences. Vol. 1. Academic Press Inc. Elsevier.
10. Virella G. Microbiology and Infectious Diseases, William & Wilkins.
11. Ananthanarayan R., Paniker C.K.J., Textbook of Microbiology, Orient Longman.
12. Fundamental Food Microbiology, Bibek Ray, Arun Bhunia, CRC Press.

RPH-524 PHARMACOLOGY-I (PHARMACOLOGY & TOXICOLOGY)

Unit I

A. General Pharmacology: Introduction to pharmacology, routes of drug administration, combined effect of drugs, factors modifying drug action. Discovery and development of new drugs. Bioassay of drugs.

B. Basic Concepts of Pharmacokinetics and Pharmacodynamics: Absorption, distribution, metabolism and excretion. Principles of drug action, mechanisms of drug action, receptors.

Unit II Pharmacology of ANS: Drug acting on autonomic nervous system: **A. Cholinergic system:** Parasympathomimetic (cholinergic) drugs, parasympatholytic (anti- cholinergic) drugs, drug acting on autonomic ganglia (stimulants and blocking agents). **B. Adrenergic system:** Sympathomimetic (adrenergic) drugs, sympatholytic (anti-adrenergic) drugs.

Unit III Drugs acting on PNS: Local anesthetics, skeletal muscle relaxants (peripherally and centrally acting muscle relaxants).

Unit IV Pharmacology of CNS: General anaesthetics, alcohols and disulfiram, sedative and hypnotics. antiepileptic drugs, drugs for neurodegenerative diseases, opioid analgesics and their antagonists. Psychopharmacological Agents: Anti anxiety agents, antipsychotics, antidepressants.

Unit V Principles of Toxicology: Definition of poison, general principles for treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning. Heavy metal antagonists.

RPH-524P PHARMACOLOGY-I (PHARMACOLOGY & TOXICOLOGY) PRACTICAL

Suggested Practicals

1. Use of computer simulated (CDs or video cassettes) for pharmacology practical where possible.
2. Preparation of different solutions for experiments. Drug dilutions, use of molar and w/v solutions in experimental pharmacology. Common laboratory animals and anesthetics used in animal studies. Commonly used instruments in experimental pharmacology. Some common and standard techniques.
3. Study of different routes of administration of drugs in mice/rats.
4. To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone sleeping time in mice, using software alternative to use of animals.

BOOKS RECOMMENDED

1. Katzung B.G., Basic and Clinical Pharmacology, Prentice Hall, International
2. Barar F.S.K., Text Book of Pharmacology, Interprint, New Delhi.
3. Rang M.P., Dale, M.M., Ritter J.M., Pharmacology, Churchill Livingstone.
4. Tripathi K.D., Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
5. Satoskar and Bhandarkar, Pharmacology and Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.
6. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
7. Bothra S.B.; Essentials of Experimental Pharmacology, Vol. 1, General Concepts, PharmaMed Press.
8. Ghosh, M.N.; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
9. Grover J.K., Experiments in Pharmacy and Pharmacology, CBS Publishers, New Delhi.
10. Goodman & Gilman's, The Pharmacological Basis of Therapeutics, Ed; Brunton L., Lazo J., Parker K., McGraw Hill Professional.
11. Laurence, D.R. and Bannet P.N., Clinical Pharmacology, Churchill Livingstone.
12. Craig C.R. and Stitzel, R.R., Modern Pharmacology, 4th Edition, Little Brown and Co.
13. Sheffield Bioscience Programs, U.K., ISBN, 1-874758-02-6.

RPH-525/RPH625 ENVIRONMENT & ECOLOGY

Unit I

Environment studies: Definition, scope and importance. Natural resources-renewable and non renewable, utilization, exploitation and associated problems of forests. Water resources, mineral resources, food resources, energy resources, land resources, equitable use of resources for sustainable life style, role of an individual in conservation.

Unit II Components of ecosystem. Green house gases and green house effect. Biodiversity and its conservation with special reference to India.

Unit III Environmental pollution: Introduction, causes and control measures of air, water, soil, marine, noise, thermal, nuclear pollutions.

Unit IV Law related to environmental protection: Air (Prevention and Control of pollution) Act-1987, Water prevention and Control of Pollution Act-1974.

Unit V Environmental Protection Act -1986, Noise Pollution Act, Hazardous Wastes Act, Hazardous Chemicals Act, Hazardous Microorganisms Act, Biomedical Waste Act, Provisions applicable to Drugs and Cosmetic Act.

BOOKS RECOMMENDED

1. Manoharachary C., Reddy P.J., Principles of Environmental Studies, BS Publications, Hyderabad.
2. Trivedy R.K., Handbook of Environmental Laws, Acts, Guidelines, Compliances and Standards, Vol. I & II, Pharma Book Syndicate, Hyderabad.
3. Relevant Acts and Rules Published by Government of India with latest amendments.
4. Reddy M.A., Text book of Environmental Science and Technology, BS Publications, Hyderabad.
5. Sinha S., Shukla M., Siddiqui A., Agrawal N. A., Text book of Environment and Ecology for Pharmacy Students, AITBS Publishers, Delhi, India.

RPH-526P

HOSPITAL TRAINING-I

Training of students at a hospital establishment for a minimum duration of 45 days. The hospital training shall include: First aid (wound dressing, artificial respiration etc.), different routes of injection, study of patient observation charts, prescriptions and dispensing, simple diagnostic reports etc. **May be performed at the end of the 4th semester.**

SIXTH SEMESTER

RPH-627

PHARMACEUTICAL CHEMISTRY-VII (MEDICINAL CHEMISTRY-II)

Classification, mode of action, uses, recent advances and structure activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

Unit I

Drug design: Basic concepts of drug design, introduction to analogue based drug design, structure based drug design, introduction to basic concepts of QSAR, molecular descriptors (2D and 3D parameters), quantitative models, introduction to 2D and 3D QSAR methodologies.

Unit II

Cardiovascular agents *Antiarrhythmic drugs:* Atenolol, Procainamide.

Antianginal drugs: Isosorbide dinitrate.

Antihypertensive drugs: Captopril, Amlodipine.

Antihyperlipidemics: Lovastatin, Clofibrate.

Unit III

Hypoglycaemics: Insulin, Metformin, Tolbutamide, Glibenclamide, Alogliptin.

Diuretics: Acetazolamide, Chlorthiazide, Furosemide, Spironolactone.

Thyroid and antithyroids: Carbimazole, Propylthiouracil, Methimazole.

Unit IV

Non steroidal anti-inflammatory drugs (NSAIDs) and analgesics: Aspirin, Paracetamol, Ibuprofen, Diclofenac, Mefenamic Acid.

Coxibs: Celecoxib.

Anticoagulants: Heparin, Warfarin.

Unit V

Antihistaminics: Diphenhydramine, Chlorpheniramine, Ranitidine.

Proton pump inhibitors: Rabeprazole. ***Cosmeceuticals:*** Isotretinoin, Minoxidil, Tazarotene.

RPH-627

P PHARMACEUTICAL CHEMISTRY-VII (MEDICINAL CHEMISTRY-II) PRACTICAL

Suggested Practicals Synthesis of selected drugs from the course content involving two or more steps and characterize/establish their Pharmacopoeial standards (if available). Spectral analysis of the synthesized drugs.

1. Synthesis of Paracetamol.
2. To evaluate the Pharmacopoeial standards of Paracetamol.
3. Synthesis of Anthranilic Acid.
4. To characterize the synthesized Anthranilic Acid.
5. Synthesis of antipyrine (2,3-Dimethyl-1-phenyl-pyrazol-5-one).
6. To characterize antipyrine (2,3-Dimethyl-1-phenyl-pyrazol-5-one).
7. Few experiments based on Green Chemistry Approach.
8. To study the Cartesian and internal coordinates for small molecules [MOLDEN (freeware program)].
9. To study the architecture of Protein Data Bank (PDB) file.
10. To study the Hansch and Free Wilson analysis (any free statistical program).
11. To study the protein-ligand interaction [AUTODOCK (freeware)].
12. To develop and validate a 3D-QSAR model [Open3D-QSAR (freeware program) or any other licensed program].

BOOKS RECOMMENDED

1. Lemke T.L., Williams D.A., Roche V.F. and Zito S.W., Foyes Principles of Medicinal Chemistry, Lippincott Williams and Wilkins.
2. Block J.H. and Beale J.M., Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams and Wilkins.
3. Patrick G.L., An Introduction to Medicinal Chemistry, Oxford University Press.
4. Vardanyan R.S. and Hruby V.J., Synthesis of Essential Drugs, Elsevier.
5. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Abraham D.J., Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons Inc., New York.
7. Jie-Jack Li, Douglas, S. Johnson, Dhago R. Sliskovic, Bruce, D. Roth. Contemporary Drug Synthesis, John Wiley & Sons Inc.
8. Korolkovas A., Essentials of Medicinal Chemistry, John Wiley and Sons Inc., New York.
9. Pharmacopoeia of India, Ministry of Health, Govt. of India.
10. Lednicher D., The Strategies for Organic Chemistry of Drug Synthesis, John Wiley and Sons Inc., New York.
11. Burger A., A Guide to the Chemical Basis of Drug Design, A Wiley Interscience Publication (John Wiley & Sons), New York.
12. Nogrady T., Medicinal Chemistry: A Biochemical Approach, Oxford University Press, New York.
13. Silverman R.B., The Organic Chemistry of Drug Design and Drug Action, Elsevier.
14. Larsen P.K., Liljefors T. and Madsen U. Textbook of Drug Design and Discovery, Taylor and Francis Inc.
15. Perun T.J. and Propst C.L., Computer-aided Drug Design Methods and Applications, Saurabh Prakashan Pvt.Ltd., New Delhi.
16. Martin Y.C., Quantitative Drug Design: A Critical Introduction, 2nd Edition, CRC Press, London.
17. Purcell W.P., Bass G.E., Clayton J.M., Strategy of Drug Design: A Guide to Biological Activity, PharmaMed Press.
18. Mann F.G. and Saunders B.C., Practical Organic Chemistry, Orient Longman Limited.
19. Furniss B.S., Hannaford A.J., Smith P.W.G. and Tatchell A. R., Vogel's Textbook of Practical Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.).

RPH-628 PHARMACEUTICS-VIII**(PHARMACEUTICAL TECHNOLOGY-II)****Unit I**

Pharmaceutical polymers: Classification of polymers, synonyms, storage and pharmaceutical applications of Carbomers, Microcrystalline cellulose, Chitosan, Cyclodextrin, Hydroxypropyl methyl cellulose, Polyethylene glycol, Polymethyl methacrylate, Polyvinyl pyrrolidone (PVP), Poly(lactic co-glycolic) acid, Poloxamers.

Unit II

Tablets: Classification, granulation technology on large-scale, physics of tablets making, different types of tablet compression machinery and the equipment, evaluation of tablets.

Coating of tablets: Types of coating, film forming materials, formulation of coating solution, equipment for coating process, evaluation of coated tablet.

Unit III

Capsules: Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsule, size of capsules, methods of capsule filling. Soft gelatin capsules- preparation and capsule content, importance of base adsorption and minim/gm factors. Quality control, stability testing and storage of capsule dosage form.

Unit IV

Controlled and sustained release dosage forms: Basic mechanism of sustained and controlled release, definition, advantages and limitations of liposomes, niosomes, resealed erythrocytes, dendrimers, solid lipid nanoparticle (SLN), nano lipid carriers (NLC), implants and transdermal patches.

Micro-particles: Introduction, polymers, methods of preparation (solvent evaporation, spray drying, emulsion cross linking method), evaluations (particle size, surface characterizations, Poly dispersity index, entrapment and loading, in-vitro release and release kinetics).

Unit V

Nanoparticles: Introduction, methods of preparation (emulsion solvent evaporation, double emulsion solvent evaporation, coacervation-phase separation technique), evaluation (particle size, surface characterizations, poly dispersity index, entrapment and loading, *in-vitro* release and release kinetics).

Packaging of Pharmaceutical Products: Packaging component types, specifications and methods of evaluation, stability aspects of packaging equipments, factors affecting choice of containers, legal and other official requirements for containers, package testing.

RPH-628P**PHARMACEUTICS-VIII (PHARMACEUTICAL TECHNOLOGY-II) PRACTICAL****Suggested Practicals**

1. Preparation, evaluation and packaging of the following dosage forms containing drugs mentioned in IP.

a) Capsules. b) Microcapsules and microspheres. c) Tablets. d) Film coated tablets. e) Enteric coated tablets

2. To perform film coating of tablets.

3. To study the gel strength and gelling time of different grades of carbomers and HPMC.

4. To formulate and evaluate sustained release dosage forms.

5. To perform the evaluations of packages (containers and closures) and packaging materials.

BOOKS RECOMMENDED

1. Remington: The Science and Practice of Pharmacy Pharmaceutical Sciences Vol. I and III, Mack Publishing Company, U.S.A.

2. Avis R.E., Pharmaceutical Dosage Forms: Parenteral Medication, Vol-I, Marcel Dekker-Inc, New York & Basel.

3. Ansel H.C., Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.

4. Khar R. K., Vyas S.P., Ahmad F., Jain G. K., The Theory and Practice of Industrial Pharmacy, 4th Edition, CBS Publishers and Distributors.

5. Juliano R.C., Drug Delivery Systems, Oxford University Press, Oxford.

6. Herbert A., Liebermann, Lachman L., Theory and Practice of Industrial Pharmacy, Lea and Febiger, Philadelphia, U.S.A.

7. Potdar M. A., C-GMP for Pharmaceuticals.

8. Dinda S. C., Advances in Pharmaceutical Technology, PharmaMed Press.

9. Ansel H.C., Pharmaceutical Dosage Form and Drug Delivery System.

10. Sankar, V. Ramesh S., Shanmugam V., A Text book of Novel Drug Delivery System, PharmaMed Press.

11. Chaurasia M. K., Chaurasia M., Jain N. K., Novel Carriers for Drug Delivery, 1st Edition, PharmaMed Press.

12. Rao M.Y., Jithan A.V., Advances in Drug Delivery, Vol. I-III, PharmaMed Press.

RPH-629**PHARMACOLOGY-II****Unit I**

Pharmacology of CVS: Cardiac glycosides, antihypertensive drugs, antianginal drugs, antiarrhythmics, antihyperlipidemics.

Unit II

Drugs acting on haemopoietic system: Haematinics, Vit. K and anticoagulants, fibrinolytics and antiplatelet drugs, plasma volume expanders.

Drugs acting on respiratory system: Anti-asthmatic drugs, antitussives and expectorants, respiratory stimulants.

Unit III

Autocoids: Histamine, 5HT and its antagonists, prostaglandins, thromboxane, leukotrienes, angiotensin, bradykinin.

Unit IV

NSAIDS, Anti-gout drugs, diuretics, immunomodulators, anticancer agents.

Unit V

Drugs acting on GIT: Antacids and antiulcer drugs, laxatives and anti-diarrhoeal agents, emetics and anti-emetics.

Suggested Practicals

1. To record the dose response curve (DRC) of Acetylcholine using chicken ileum.
2. To study the parallel shift of DRC in presence of competitive antagonist on DRC of Acetylcholine using chicken ileum.
3. To study effect of Physostigmine on DRC of acetylcholine using chicken ileum.
4. To study the CRC of Histamine on guinea pig ileum.
5. Study of the effect of antihistaminics using software.

BOOKS RECOMMENDED

1. Katzung, B.G. Basic and Clinical Pharmacology, Prentice Hall International.
2. Barar F.S.K., Text Book of Pharmacology, Interprint, New Delhi.
3. Rang M.P. Dale M.M., Riter J.M., Pharmacology Churchill Livingstone.
4. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
5. Satoskar & Bhandarkar; Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.
6. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
7. Bothra S.B., Essentials of Experimental Pharmacology, Vol. 1, General Concepts, PharmaMed Press.
8. Ghosh, M.N., Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
9. Grover J.K., Experiments in Pharmacy and Pharmacology, CBS Publishers, New Delhi.
10. Goodman and Gilman, The Pharmacological basis of Therapeutics, Edited by Hardman J.G.
11. Laurence, D.R. and Bannet P.N., Clinical Pharmacology, Churchill Livingstone.
12. Craig, C.R. and Stitzel, R.R., Modern Pharmacology, Little Brown and Co.
13. Sheffield Bioscience Programs, U.K., ISBN, 1-874758-02-6.
14. Udaykumar Padmaja, Medical Pharmacology, CBS Publishers, New Delhi.
15. Saif S. R., Pharmacology Review, CBS Publishers, New Delhi.
16. Gupta P.K., Essential Concepts in Toxicology, PharmaMed Press.
17. Mukhopadhyay K., Undergraduate Pharmacology, CBS Publishers, New Delhi.
18. Pillai K.K., Experimental Pharmacology, CBS Publishers, New Delhi.

Unit I

Phytochemical screening: A. Introduction, principles and types of extraction methods/techniques.

B. An introduction to active constituents of drugs: Classification, isolation, properties and qualitative chemical tests of alkaloids, saponins, cardenolides and bufadienolides, cynogenetic glycosides, flavanoids and leucoanthocyanidine.

Unit II

Study of the biological sources, commercial varieties, chemical constituents, uses, diagnostic macroscopic and microscopic features, substitutes/adulterants and specific chemical tests of drugs containing the following

glycosides- Saponins: Liquorice, Ginseng, Dioscorea, Coleus species.

Cardioactive sterols: Digitals, Squill, Stropanthus, Thevetia.

Anthraquinone cathartics: Aloe, Senna, Rhubarb, Cascara.

Unit III

Tannins: Study of tannins and tannin containing drugs like gumbir (pale catechu), black catechu, gall and myrobalans (Harde, Baheda, Arjuna and Ashoka).

Unit IV

Plant bitters and sweeteners: Introduction to plant bitters and sweeteners, biological source, chemical nature and therapeutic uses of bitter and sweetener principles of the following drugs-

Plant bitters: Chiratin (*Momordica charantia*), rotenone (*Derris elliptica*), limonin and naringin (*Citrus* fruits).

Plant sweeteners: Thaumatin (*Thaumatococcus danielli*), stevioside and rebaudioside (*Stevia rebaudiana*), neohesperidin (*Citrus aurantium*).

Unit V

Study of traditional drugs: Common vernacular name, biological sources, morphology, chemical nature of chief constituents, common uses and pharmacology of the following indigenous drugs: Psoralea, Gentian, Saffron, Chirata, Quassia, Amla, Kantkari, Shatavari, Tylophora, Bhilwa, Punarnava, Chitrak, Apamarg, Gokhru, Shankpushpi, Brahmi, Methi, Lehsun, Palash, Gymnema, Shilajit, Nagarmotha.

Suggested Practicals

1. Morphology and microscopy (powder) of Liquorice along with its chemical tests.
2. Morphology of Aloe and chemical tests on Aloe-extract.
3. Morphology and microscopy (powder) of Rhubarb.
4. Morphology of Psoralea, Saffron and Chirata.
5. Morphology of Amla, Kantkari, Shatavari and Vach.
6. Morphology of Punarnava, Apamarg, Gokhru, and Shankpushpi.
7. Morphology of Brahmi, Methi, Lehsun and Palash. a) Morphology of Nagarmotha and Neem. b) Identification Tests for Guggul lipids.
8. Test for identification of glycosides (saponin and anthraquinone).
9. Test for identification of tannins.
10. Tests for identification of steroids.
11. Tests for identification of flavonoids.
12. A report on marketed preparations based on traditional drugs mentioned in theory.

BOOKS RECOMMENDED

1. Trease, G.E., and Evans, W.C., Pharmacognosy, Bailliere Tindall East Baorne, U.K.
2. Wallis. T.E. "Text Book of Pharmacognosy" J&A Churchill Ltd. London.
3. Kokate C.K., Gokhale A.S., Gokhale S.B., Cultivation of Medicinal Plants, Nirali Prakashan.
4. Tyler V.E., Lynnr B. and Robbers J.E., Pharmacognosy, 8th Edition, Lea & Febiger, Philadelphia.
5. Harborne J.B., Phytochemical method, Chapman & Hall International Edition, London.
6. Medicinal Plants of India, Vol. I & II, Indian Council of Medical Reasearch, New Delhi.
7. Nadkarni A.K., Indian Materia Medica, Vol- 1&2, Popular Prakashan (P) Ltd. Bombay.
8. Sukh Dev, A Selection of Prime Ayurvedic Plant Drug, Anamaya Publisher New Delhi.
9. Indian Herbal Pharmacopoeia, Vol. I & II, ICMR & RRL, Jammu.
10. Indian Ayurvedic Pharmacopoeia, Govt. of India.
11. The Wealth of India, Raw Materials (All volumes) Council of Scientific & Industrial Research, New Delhi.
12. Rastogi R. P. and Mehrotra B.N., Compendium of Indian Medicinal Plants I-IV, Publications & Information Directorate/Central Drug Research Institute, New Delhi.
13. American Herbal Pharmacopoeia, Botanical Pharmacognosy: Microscopic Characterization of Botanical Medicines, Taylor & Francis Group.
14. Wallis T.E., Analytical Microscopy, J & A Churchill Ltd., London.
15. Kokate C.K., Practical Pharmacognosy, Vallabh Prakashan, New Delhi.
16. Iyengar M.A., Pharmacognosy of Powdered Crude Drugs, PharmaMed Press.
17. Iyengar, M.A. and Nayak S.C.K., Anatomy of Powdered Crude Drugs, PharmaMed Press

***RPH-631/RPH-531* PROFESSIONAL COMMUNICATION**

Unit I

Written skills: a. Proposal writing formats. b. Report writing. c. Business letters. d. Applications. e. Covering letters. f. Curriculum Vitae designing.

Unit II

- a. Barriers to communication, time management simulation exercise.
- b. Leadership skills.
- c. Team work BSC (Boss, subordinates and colleagues).

Unit III

1. **Group discussions (GDs).** a. Tips. b. GD.
2. **Non verbal aspects of communication.**

Unit IV

- a. Corporate communication, corporate expectation, office etiquettes. b. Extempore.

Unit V 1. Interview Tips:

- a. What should be done before the interview, during the interview, after the interview and on the day of interview?
 - b. Various questions that may be asked in an interview.
 - c. Model interview (video-shooting and displaying optional).
2. **Exit interview.**

BOOKS RECOMMENDED 1. Raman M. and Sharma, S., Technical Communications- Principles & Practice, 2nd Edition, Oxford University Press.

2. Sharma, R. C. and Krishna Mohan, Business Correspondence and Report Writing, Tata McGraw Hill Co.
3. Lesikar, R.V., Pettit J.V., Flateley M.E., Lesikar's Basic Business Communication, 8th Edition, McGraw Hill Companies.

***RPH-632* P INDUSTRIAL TRAINING**

The training shall include training at an approved pharmaceutical unit for a minimum of 30 days. The industrial training shall compose of observation of various manufacturing sections, packaging section and testing section. It shall also include the study of GMP requirements, SOPs, batch production records (BPRs), analysis records etc.

May be performed at the end of the 5th semester.

SEMESTER-VII

S. No.	Course Code	Subject	Periods		Evaluation Scheme				Subject Total	Credit	
			L	P	Sessional			ESE			
					CA	TA	EXAM				TOTAL
THEORY											
1	BOP-471	Pharmaceutical Chemistry-VII (Medicinal Chemistry-III)	3	0	5	5	20	30	70	100	4
2	BOP-472	Pharmaceutics-IX (Biopharmaceutics & Pharmacokinetics)	3	0	5	5	20	30	70	100	4
3	BOP-473	Pharmacology-III (Pharmacology & Pharmacovigilance)	3	0	5	5	20	30	70	100	4
4	BOP-474	Pharmacognosy-IV	3	0	5	5	20	30	70	100	4
5	BOP-475	Pharmaceutical Analysis-III (Pharmaceutical Analysis & Quality Assurance)	3	0	5	5	20	30	70	100	4
PRACTICAL/PROJECT											
6	BOP-472P	Pharmaceutics-IX (Biopharmaceutics & Pharmacokinetics) Practical	0	4	5	5	20	30	70	100	4
7	BOP-473P	Pharmacology-III (Pharmacology & Pharmacovigilance) Practical	0	4	5	5	20	30	70	100	4
8	BOP-474P	Pharmacognosy-IV Practical	0	4	5	5	20	30	70	100	4
9	BOP-475P	Pharmaceutical Analysis-III (Pharmaceutical Analysis & Quality Assurance) Practical	0	4	5	5	20	30	70	100	4
10	BOP-476P	Hospital Training-II			5	5	20	30	70	100	2
TOTAL			15	16						1000	38

CA = Class Attendance, TA = Teacher Assessment.

SEMESTER-VIII

S. No.	Course Code	Subject	Periods		Evaluation Scheme				Subject Total	Credit	
			L	P	Sessional			ESE			
					CA	TA	EXAM				TOTAL
THEORY											
1	BOP-481	Pharmaceutical Chemistry-IX (Chemistry of Natural Products)	3	0	5	5	20	30	70	100	4
2	BOP-482	Pharmaceutics-X (Pharmaceutical Biotechnology)	3	0	5	5	20	30	70	100	4
3	BOP-483	Pharmaceutics-XI (Pharmaceutical Marketing & Management)	3	0	5	5	20	30	70	100	4
4	BOP-484	Pharmaceutics-XII (Food & Neutraceuticals)	3	0	5	5	20	30	70	100	4
5	BOP-485 (A) (B) (C) (D) (E)	Elective (Computational Methods in Drug Design or Good Manufacturing Practices or Clinical Pharmacy or Standardization of Herbal Drugs or Research Methodology)	3	0	5	5	20	30	70	100	4
PRACTICAL/PROJECT											
6	BOP-481P	Pharmaceutical Chemistry-IX (Chemistry of Natural Products) Practical	0	4	5	5	20	30	70	100	4
7	BOP-482P	Pharmaceutics-X (Pharmaceutical Biotechnology) Practical	0	4	5	5	20	30	70	100	4
8	BOP-484P	Pharmaceutics-XII (Food & Neutraceuticals) Practical	0	4	5	5	20	30	70	100	4
9	BOP-485P (A) (B) (C) (D) (E)	Elective Practical (Computational Methods in Drug Design Project or Good Manufacturing Practices Project or Clinical Pharmacy Project or Standardization of Herbal Drugs Project or Research Methodology Project)	0	4	5	5	20	30	70	100	4
10	BOP-486P	Report on Industrial/ Research Laboratory Visit			5	5	20	30	70	100	2
TOTAL			15	16						1000	38

CA = Class Attendance, TA = Teacher Assessment.

SEVENTH SEMESTER

BOP-471 PHARMACEUTICAL CHEMISTRY-VIII (MEDICINAL CHEMISTRY-III)

Classification, mode of action, uses, recent advances and structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only).

Unit I:

Steroidal drugs: Introduction, classification, nomenclature, and stereochemistry of-

Androgens and anabolic steroids: Testosterone, Stanozolol.

Estrogens and progestogens: Progesterone, Estradiol.

Adrenocorticoids: Prednisolone, Dexamethasone.

Unit II:

Chemotherapy of microbial infections: Antibiotics: Penicillin, Semi-synthetic Penicillins (Ampicillin), Cephalosporins (Cefepime), Chloramphenicol, Tetracyclines (Doxycycline), Aminoglycosides, Macrolides.

Antifungals: Ketoconazole and Clotrimazole.

Antiseptics & disinfectants: Chlorhexidine.

Unit III:

Chemotherapy of microbial infections: Synthetic antibacterials: Sulphonamides (Sulphamethoxazole, Sulphadiazine, Sulphacetamide), Quinolones/Fluoroquinolones (Nalidixic acid, Ofloxacin).

Antimycobacterial agents: PAS, Ethambutol, Isoniazid, Dapsone.

Unit IV:

Chemotherapy of parasitic infections: Antimalarials: Chloroquine, Primaquine, Pyrimethamine.

Antiamoebics: Ornidazole, Diloxanide.

Anthelmintics: Albendazole.

Unit V:

Cancer chemotherapy: Alkylating agents (Chlorambucil, Carmustine), Antimetabolites (Methotrexate, 5-Fluorouracil), Anticancer antibiotics (Doxorubicin).

Antiviral/Anti-HIV agents: Amantadine, Acyclovir, Zidovudine, Saquinavir, Raltegravir.

BOOKS RECOMMENDED

1. Abraham D.J., Bur ger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons Inc., New York.
2. Block J.H. and Beale J.M., Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams and Wilkins, Philadelphia.
3. Lemke T.L., Williams D.A., Roche V.F. and Zito S.W., Foyes Principles of Medicinal Chemistry, Lippincott Williams and Wilkins, Philadelphia.
4. Vardanyan R.S. and Hruby V.J., Synthesis of Essential Drugs, Elsevier, Philadelphia.
5. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Nogrady T., Medicinal Chemistry: A Biochemical Approach, Oxford University Press, New York.
7. Patrick G.L., An Introduction to Medicinal Chemistry, Oxford University Press, New York.
8. Hansch C., Comprehensive Medicinal Chemistry, Pergamon Press, U.K.
9. Dharuman J., Chemistry of Synthetic Drugs, AITBS Publishers, New Delhi.
10. Mann F.G. and Saunders B.C., Practical Organic Chemistry, Orient Longman Limited, New York.
11. Furniss B.S., Hannaford A.J., Smith P.W.G. and Tatchell A.R., Vogel's Textbook of Practical Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.), New Delhi.

BOP-472 PHARMACEUTICS-IX (BIOPHARMACEUTICS & PHARMACOKINETICS)

Unit I:

Introduction to biopharmaceutics and pharmacokinetics and their role in formulation development.

Mechanism of absorption, physicochemical and pharmaceutical factors influencing absorption, drug distribution, volume of distribution and distribution coefficient.

Plasma protein binding and its significance.

Unit II:

Significance of plasma drug concentration measurement. Compartment models and non-compartment models: Definition and scope.

Pharmacokinetics of drug absorption: Zero order and first order absorption rate constant. Determination of absorption rate constant using Wagner-Nelson and Loo-Reigelman method.

Unit III:

Compartment kinetics: One compartment and preliminary information of multicompartment models.

Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intra venous (I.V.) bolus and I.V. infusion.

Unit IV:

Dosage adjustment in patients with renal and hepatic disease.

Clinical Pharmacokinetics: Definition and scope.

Unit V:

Brief introduction to bioavailability and bioequivalence: Definition and significance. Measurement of bioavailability.

Introduction to in-vivo in-vitro correlation (IVIVC) and its significance. Review of regulatory requirements for conduction of bioequivalence studies.

BOP-472P PHARMACEUTICS-IX (BIOPHARMACEUTICS & PHARMACOKINETICS) PRACTICAL

1. In-vitro drug release study of the any powder, uncoated tablet, capsule, film-coated tablet, sustained release tablet and fast release (M.D, Dispersible etc.) tablet using various dissolution media.
2. To determine the % protein binding of some drugs.
3. To determine the effect of protein binding on drug bioavailability.
4. To calculate various Pharmacokinetic parameters from zero order drug release data, first order drug release data, blood data of I.V. bolus injection (one compartment model) and urinary excretion data of I.V. bolus. Injection using both methods (Rate of elimination & sigma minus method one compartment model).
5. To study in-vitro drug- drug interactions.
6. To study the passive diffusion of a drug using cellophane membrane.
7. To study the passive diffusion of a drug using egg membrane.
8. To determine the various Pharmacokinetic parameters from the given blood data of oral administration of dosage form.
9. Determination of bioavailability by urinary method. 10. Determination of bioequivalence by dissolution method.

BOOKS RECOMMENDED

1. Notari, R.E, Biopharmaceutics and Pharmacokinetics-An introduction, Marcel Dekker Inc. New York.
2. Rowland M, and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, New York.
3. Wagner J.G. Fundamentals of Clinical Pharmacokinetics, Drugs Intelligence Publishers, Hamilton.
4. Wagner J.G. Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A.G. Basel, Switzerland.
5. Gibaldi, M., Biopharmaceutics & Clinical Pharmacokinetics, Pharma Book Syndicate, Hyderabad.
6. Robert, Rodriguezdiaz, Analytical Techniques for Biopharmaceuticals Development.
7. Curry, S. H., Drug Disposition & Pharmacokinetics, Pharma Book Syndicate, Hyderabad.

BOP- 473 PHARMACOLOGY-III (PHARMACOLOGY & PHARMACOVIGILANCE)

Unit I:

Pharmacology of endocrine system: Hypothalamic and pituitary hormones, thyroid hormones and thyroid drugs. Parathormone, Calcitonin and Vitamin D, Insulin, oral hypoglycemic agents and Glucagon. Corticosteroids, androgens and anabolic steroids, Estrogens, Progesterone and oral contraceptives, drugs acting on the uterus.

Unit II:

Chemotherapy: General principles of chemotherapy. Sulfonamides, Quinolones, Beta-lactam antibiotics, Chloramphenicol, Tetracyclines, Macrolides and Aminoglycosides.

Chemotherapy of parasitic infections: Tuberculosis, leprosy, malaria, fungal infections, viral diseases.

Unit III:

Naturopathy: History, definitions, mechanism and its effect on various systems, hydrotherapy, mud therapy, chromotherapy, acupressure, aromatherapy and therapeutic massage.

Unit IV:

Pharmacovigilance: Scope, definition and aims of pharmacovigilance and pharmacoepidemiology, therapeutic index- LD₅₀ and ED₅₀, drug interactions. Adverse drug reactions: Classification, mechanism, predisposing factors and causality assessment. Role of clinical pharmacist in reporting, evaluation, monitoring, prevention and management of ADR, drug induced diseases affecting different organ systems.

Fixed dose drug combinations (FDDCs): Rational and irrational combinations, FDDCs in Indian scenario.

Unit V:

Epidemiological methods: Case control study: Selection of cases, selection of controls, matching, measurements of exposure, analysis, odds ratio, bias in case control study, advantages, disadvantages.

Cohort study: Concept, framework, combination of prospective and retrospective cohort study, relative risk, attributable risk, advantages, disadvantages.

BOP-473P PHARMACOLOGY-III (PHARMACOLOGY & PHARMACOVIGILANCE)

PRACTICAL

1. To calculate the pA₂ value of Atropine and Chlorpheniramine.
2. Bioassay of Ach, Histamine and Oxytocin on suitable isolated preparations using matching assay, bracketing assay, interpolation, three point assay and four point assay.
3. Bioassay of histamine and acetylcholine using matching and interpolation method on rat and guinea pig.

The experiments should be conducted using software, wherever possible.

BOOKS RECOMMENDED:

1. Rang M.P., Dale MM, Ritter JM, Pharmacology Churchill Livingstone, China.
2. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
3. Satoskar & Bhandarkar: Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.
4. Ghosh M.N. Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
5. Katzung, B.G. Basic & Clinical Pharmacology, Prentice Hall International, New Delhi.
6. Ronald D. Mann & Elizabeth B. Andrews, Pharmacovigilance, John Wiley & Sons, West Sussex, England.
7. Waller and Patrick, An Introduction to Pharmacovigilance, John Wiley & Sons, West Sussex, England.
8. Mohanta G.P., Elementary Pharmacovigilance, PharmaMed Press, Hyderabad.
9. Mohanta G.P., Manna P.K., Textbook of Pharmacovigilance: Concept and Practice, PharmaMed Press, Hyderabad.
10. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
11. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
12. Barar F.S.K : Text Book of Pharmacology, Interprint, New Delhi.
13. Goodman & Gilman, The Pharmacological basis of Therapeutics, Eds: Hardman J.G., Limbird Le, Molinoss P.B., Ruddon R.W. & Gil A.G., Pergamon Press, U.K.
14. Laurene, D.R. & Bennet P.N.; Clinical Pharmacology, Churchill Livingstone, Harlow, England.
15. Paul L., Principles of Pharmacology, Chapman and Hall, New York
16. Sheffield Bioscience Programs, U.K., ISBN. 1-874758-02-6.
17. Ravi Shanker K., Kiranmayi G.V.N., Pharmacology: A Companion Handbook with Illustrations, PharmaMed Press, Hyderabad.
18. Singh S. J., History and Philosophy of Naturopathy, Nature Cure Council of Medical Research, Lucknow.
19. Bakhru H. K., Complete Handbook of Nature Cure, Jaico Publishing House, New Delhi.
20. Pizzorno J. E., Murray M. T., The Encyclopedia of Natural Medicine, Simon & Schuster, New York, USA.

BOP-474 PHAMACOGNOSY-IV

Unit-1:

Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes/adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid containing drugs-

Pyridine-piperidine: Tobacco, Areca and Lobelia.

Tropane: Belladonna, Hyoscyamus, Datura, Coca and Withania.

Quinoline and isoquinoline: Cinchona, Ipecac and Opium.

Indole: Ergot, Rauwolfia, Catharanthus and Nux-vomica.

Unit II:

Imidazole: Pilocarpus.

Steroidal: Veratrum and Kurchi.

Alkaloidal amine: Ephedra and Colchicum.

Glycoalkaloid: Solanum.

Purines: Coffee and Tea

Quinazoline: Vasaka.

Unit III:

Production and utilization of phytoconstituents: Calcium sennosides, Diosgenin, Solasodine, Podophyllotoxins, Tropane alkaloids, Isoquinoline alkaloids and Quinoline alkaloids.

Unit IV:

Plant tissue culture: Historical development of plant tissue culture, type of culture, nutritional requirements, growth and maintenance, factors affecting plant tissue culture. Applications of plant tissue culture in pharmacy.

Unit V:

Introduction to herbal fingerprinting using HPTLC technique. Introduction to herbal drug interactions. Introduction to bioactive compounds enhancing bioavailability such as- Piperine, Vitamin K.

BOP-474P PHAMACOGNOSY-IV PRACTICAL

1. To study the morphology and microscopy of Datura and Withania.
2. To study the morphology and microscopy of Ipecac and Rauwolfia.
3. To study the morphology and microscopy of Catharanthus and Nux-vomica.
4. To study the morphology and microscopy of Ephedra and Kurchi.
5. To study the morphology and microscopy of Solanum and Vasaka.
6. a) Morphology of Areca, Colchicum. b) Transverse section of Catharanthus leaf and Kurchi bark.
7. To study the TLC profile of Catharanthus leaf.
8. To study the TLC profile of Withania root.
9. Chemical test of Tea, Tobacco, Datura and Withania.
10. Chemical test of Nux-vomica, Ephedra and Kurchi.
11. Preparation of different callus cultures using various parts of plants.
12. Study of micropogation using callus culture.
13. Effect of various plant hormones on micropogation.

BOOKS RECOMMENDED

1. Trease, G.E., and Evans, W.C., Pharmacognosy, Bailliere Tindall East Baorne, U.K.
2. Wallis T.E. "Text Book of Pharmacognosy" J & A Churchill Ltd., London.
3. Kokate C.K., Gokhale A.S., Gokhale S.B., Cultivation of Medicinal Plants, Nirali Prakashan.
4. Tyler V.E., Lynn B. and Robbers J.E., Pharmacognosy, 8 Edition, Lea & Febiger, Philadelphia.
5. Harborne J.B., Phytochemical Methods, Chapman & Hall International Edition, London.
6. Medicinal Plants of India, Vol. I & II, Indian Council of Medical Research, New Delhi.
7. Nadkarni A.K., Indian Materia Medica, Vol- 1&2, Popular Prakashan (P) Ltd., Bombay.
8. Sukh Dev, A Selection of Prime Ayurvedic Plant Drugs, Anamaya Publisher New Delhi.
9. Indian Herbal Pharmacopoeia, Vol. I & II, ICMR & RRL, Jammu.
10. Indian Ayurvedic Pharmacopoeia, Govt. of India.
11. The Wealth of India, Raw Materials (All volumes), Council of Scientific & Industrial Research, New Delhi.
12. Rastogi R. P. and Mehrotra B.N., Compendium of Indian Medicinal Plants I-IV, Publications & Information Directorate/Central Drug Research Institute, New Delhi.
13. Wallis T.E., Analytical Microscopy, J&A Churchill Ltd., London.
14. Kokate C.K., Practical Pharmacognosy, Vallabh Prakashan, New Delhi.
15. Iyengar M.A., Pharmacognosy of Powdered Crude Drugs, PharmaMed Press, Hyderabad.
16. Iyengar, M.A. and Nayak S.C.K., Anatomy of Powdered Crude Drugs, PharmaMed Press, Hyderabad.

BOP-475 PHARMACEUTICAL ANALYSIS-III (PHARMACEUTICAL ANALYSIS & QUALITY ASSURANCE)

Unit I:

Ultra violet and visible spectroscopy: Principle and origin of spectra, quantitative laws, chromophores and auxochromes, factors affecting absorption, instrumentation- single and double beam spectrophotometer, Woodward-Fieser rule, applications.

Infra-red spectroscopy: Principle, effect of hydrogen bonding and conjugation on absorption band, instrumentation, interpretation of IR spectra of simple compounds (Ethanol, Benzaldehyde). FTIR, applications of IR spectroscopy in pharmaceutical analysis.

Unit II:

NMR spectroscopy: Principle of ^1H -NMR, chemical shift and factors affecting it, shielding and deshielding, spin-spin coupling and coupling constant, spin-spin splitting, instrumentation, NMR active compounds and study of H-NMR spectra of- Ethanol, Benzaldehyde. Introduction to cNMR.

Unit III:

Mass spectrometry: Principle, fragmentation pattern in relation to molecular structure and functional groups including McLafferty rearrangement, ionization techniques (CI, FAB, ESI, MALDI), instrumentation, applications, mass spectra of some simple compounds (Ethanol, Benzaldehyde).

Unit IV:

Miscellaneous techniques: Principle, instrumentation and applications of atomic absorption spectroscopy, fluorimetry and flame photometry. Introduction to gel electrophoresis, scanning electron microscopy (SEM) and transmission electron microscopy (TEM).

Unit V:

Quality Assurance: Basic concept of quality, difference between QC and QA, quality audit, types of quality audits, concept of TQM, ISO 9000 series. Elementary study of WHO guidelines. Different documents prepared by QA department (batch manufacturing record, master formula record, validation master plan). Basic concept of validation, types of validation, different validation parameters, protocols for process validation.

BOP-475 P PHARMACEUTICAL ANALYSIS-III (PHARMACEUTICAL ANALYSIS & QUALITY ASSURANCE) PRACTICAL

1. Determination of λ_{max} of different compounds by UV-visible spectrophotometry.
2. Verification of Beer's law.
3. Determination of unknown concentration of some drugs by UV-visible spectrophotometry.
4. Simultaneous estimation of multi-component drugs by UV-visible spectrophotometry.
5. Determination of factors which affect λ_{max} by UV-visible spectrophotometry.
6. Interpretation of IR, Mass and NMR spectra.
7. Assay of official formulations containing single and more active ingredients using instrumental techniques.
8. Assay of pharmaceutical substances by flame spectrophotometry (NaCl, KCl oral sachet).
9. Separation of a protein mixture using gel electrophoresis.
10. Formation and maintenance of different documents/records formed by QA department.

BOOKS RECOMMENDED

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Becket A. H. and Stenlake J. B., Practical Pharmaceutical Chemistry Vol. I and II, The Athlone Press of the University of London.
3. Chatten L. G., A text book of Pharmaceutical Chemistry, Vol. I & II, Marcel Dekker, New York.
4. Willard H.H., Merrit L.L., Dean J.A., Settle P.A., Instrumental Methods of analysis, Van Nostrand Renhold, New York.
5. Obonson J.W.R., Undergraduate Instrumental Analysis, Marcel Dekker Inc, New York, 1970.
6. Parikh V.H., Absorption Spectroscopy of Organic Molecules, Addison-Wesley Publishing Co., London.
7. Silverstein R.M., and Webster F.X., Spectrometric Identification of Organic Compounds, John Wiley & Sons.
8. Skoog V., Principles of Instrumental Analysis, Holler-Neimen.
9. Kemp W., Organic spectroscopy, 3rd Edition, Palgrave, New York.
10. Kalsi P.S., Spectroscopy of Organic Compounds, New Age International Publishers, New Delhi.
11. Pavia D.L., Lampman G.M., and Kriz G.S., Introduction to spectroscopy, 3rd Edition, Harcourt College Publishers, Philadelphia.
12. Florey K., Analytical Profile of Drug Substance (All volume), Academic Press, Elsevier.
13. WHO-Quality Assurance of Pharmaceuticals, Vol. I & II, AITBS Publisher & Distributors, Delhi.
14. Berry I.R. and Harpaz, D., Validation of API, 2nd Edition, CRC Press.

BOP-476 P HOSPITAL TRAINING-II

Training of students at a hospital establishment for a minimum duration of 45 days. The hospital training shall include: First aid (wound dressing, artificial respiration etc.), different routes of injection, study of patient observation charts, prescriptions and dispensing, simple diagnostic reports etc.

May be performed at the end of the 6 semester

EIGHTH SEMESTER

BOP-481 PHARMACEUTICAL CHEMISTRY-IX (CHEMISTRY OF NATURAL PRODUCTS)

Unit I:

General methods of isolation and separation of plant constituents, qualitative tests for the detection of plant constituents. Application of spectral techniques in the structure determination of natural products. Biogenetic investigations and basic metabolic pathways (Alkaloids, Terpenes, Steroids). Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance (Atropine, Quinine, Papaverine, Morphine and Reserpine).

Unit II :

Extraction, isolation and structure elucidation of **alkaloids**: Tropanes (Atropine); Phenanthrenes (Morphine); Quinolines (Quinine); Isoquinolines (Papaverine); Indoles (Reserpine).

Unit III :

Extraction, isolation and structure elucidation of- **Glycosides**: Digoxin. **Flavonoids**: Quercetin. **Lignans**: Podophyllotoxin. **Purines**: Caffeine.

Unit IV:

Extraction, isolation and structure elucidation of- **Terpenoids**: Camphor, Menthol, Citral.

Carotenoids: β - Carotene. **Vitamins**: α -Tocopherol. **Quassinoids**: Quassin.

Unit V:

Natural allergens, photosensitizing agents and fungal toxins. Role of natural products in drug discovery and development. Recent developments of natural products used as anticancer agents, antidiabetics, antimalarials and immunomodulators.

BOP-481P PHARMACEUTICAL CHEMISTRY-IX (CHEMISTRY OF NATURAL PRODUCTS) PRACTICAL

1. Laboratory experiments on extraction (conventional/microwave assisted), isolation, separation and purification of various groups of chemical constituents of pharmaceutical significance.
2. Exercises on paper and thin layer chromatographic evaluation of herbal drug constituents.
3. Isolation of volatile oils and their chromatographic profiles.

SUGGESTED EXPERIMENTS

1. Isolation of Caffeine from tea leaves.
2. Isolation of Piperine from black pepper.
3. Isolation of Hesperidin from orange peel.
4. Isolation of Clove oil from clove.
5. Isolation of Caraway oil from caraway.
6. Isolation of Cumin oil from cumin.
7. To study the TLC profile of extracted oils.
8. To perform the column chromatography of any available herb.
9. To study the paper chromatographic profile of glycone portion separated from senna.
10. To isolate the active constituent of any available drug with the help of preparative TLC.
11. Quantitative determination of Ascorbic Acid present in amla.

BOOKS RECOMMENDED

1. Brain K.R. and Turner T.D., The Practical Evaluation of Phytopharmaceutical, Wright, Bristol.
2. Kokate C.K., "Practical Pharmacognosy" Vallabh Prakashan, New Delhi.
3. Stahl E., Thin Layer Chromatography: A Laboratory Hand Book, Springer International Edition, New York.
4. Harborne J.B., Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis, Springer (India) Pvt. Ltd., New Delhi.
5. Dewick P.M., Medicinal Natural Products: A Biosynthetic Approach, John Wiley and Sons Ltd., England.
6. Wagner H., Plant Drug Analysis, Springer, Berlin.
7. Cutler S.J. and Cutler H.G., Biologically Active Natural Products: Pharmaceuticals, CRC Press, London.
8. Manitto P., Biosynthesis of Natural Products, BSP Books Pvt. Ltd., Hyderabad.
9. Finar I.L., Organic chemistry, Volume II: Stereochemistry and the Chemistry of Natural Products, Pearson Education, New Jersey.
10. Indian Herbal Pharmacopoeia, Indian Drug Manufacturers Association and Regional Research Laboratory, Jammu.
11. Agarwal O.P., Organic Chemistry, Natural Products, Krishna Prakashan Media (P) Ltd., Meerut.
12. Evans V.C., Trease and Evans Pharmacognosy, Harcourt Publishers Ltd., Sydney.
13. Wallis T. E., Textbook of Pharmacognosy, CBS Publishers and Distributors, New Delhi.
14. Kokate C.K., Practical Pharmacognosy, Vallabh Prakashan, Delhi.
15. Jarald E.E. and Jarald S.E., Textbook of Pharmacognosy and Phytochemistry, CBS Publishers and Distributors Pvt. Ltd., New Delhi.
16. Tyler V.E., "Pharmacognosy" Lea & Febiger, Philadelphia.
17. Deore S.L., Khadabadi S.S., Baviskar B.A., Pharmacognosy and Phytochemistry: A Comprehensive Approach, PharmaMed Press, Hyderabad.
18. Prasad M. R., Rao A.R., Advanced Medicinal Chemistry: A Laboratory Guide, PharmaMed Press, Hyderabad

BOP-482 PHARMACEUTICS-X PHARMACEUTICAL BIOTECHNOLOGY

Unit I:

Immunology and immunological preparations: Principles, antigen and haptens, immune system, cellular and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, standardization and storage of vaccine.

Unit II:

Recombinant DNA technology: A brief introduction to genetic engineering and techniques, production of r-DNA and their application, development of hybridoma for monoclonal antibodies and their application, protoplast fusion and biotechnological production of products such as Insulin and Somatotropin.

Unit III:

Antibiotics: Screening of soil for organisms producing antibiotics. Fermentor: Basic design, control of different parameters and application. Isolation of mutants and factors affecting mutation.

Unit IV:

Microbial transformation: Introduction, types of reactions mediated by microorganisms, selection of organisms, methodology of biotransformation, process improvements with special reference to steroids.

Unit V:

Enzyme immobilization: Sources of enzymes, techniques of immobilization of enzymes and cell, advantages and limitation of immobilization, application of immobilization in pharmacy. Biotechnological production and pharmaceutical application of enzymes such as penicillinase, agalactosidase, amylases and proteases.

BOP-482P PHARMACEUTICS-X PHARMACEUTICAL BIOTECHNOLOGY PRACTICAL

1. Estimation of protein in given sample.
2. Production of protoplast fused cells by chemical method.
3. Production of protoplast fused cells by mechanical method.
4. Estimation of immunological reaction (blood group etc.).
5. Assay of antibiotics.
6. Screening of soil for antibiotic producing microorganisms.
7. Immobilization of drug.
8. Immobilization of enzyme.
9. Immobilization of cell.
10. Protein estimation by gel electrophoresis.
11. Isolation of enzymes from natural sources.

BOOKS RECOMMENDED

1. Prescott and Dunn's Industrial Microbiology, CBS Publishers and Distributors, New Delhi.
2. Vyas S.P. and Dixit V.K., Pharmaceutical Biotechnology, CBS Publication, New Delhi.
3. Kieslich K., Biotechnology, Verlag Chemie, Switzerland.
4. Standury P.F., Whitaker A. & Hall S.J., Principles of Fermentation, Aditya Book Private Limited, New Delhi.
5. Crueger W. & Crueger A, Biotechnology- A Textbook of Industrial Microbiology, Panima Publishing Corporation, Delhi

BOP-483 PHARMACEUTICS-XI PHARMACEUTICAL MANAGEMENT & MARKETING

Unit I:

Concepts of management: Definition, administrative management (planning, organizing, staffing, directing and controlling). Entrepreneurship development, introduction to operative management (personnel, materials, production, financial management).

Unit II:

Principles of management: Coordination, communication, motivation, decision making, leadership, innovation and creativity.

Production management: A brief study of the different aspects of production management, methodology of activities: performance evaluation, review technique, maintenance management.

Unit III;

Pharmaceutical marketing: Introduction to pharmaceutical marketing. Functions, buying, selling, transportation, storage and finance. Feedback information, channels of distribution, wholesale, retail, department store. Introduction to e-commerce (online shopping, online banking, pretail, marketing to prospective and established customers) and start up business.

Unit IV:

Salesmanship: Principle of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, recruitment, training, performance appraisal of sales force.

Unit V:

Market research: Definition, steps and limitations of market research. Market segmentation and market targeting. Major concepts in demand measurement, estimating current demand. Geo-demographic analysis. Estimating industry sales.

BOOKS RECOMMENDED

1. Beri, Marketing Research. Tata Mc Graw Hill Publishing Company Limited, New Delhi.
2. Chary S.N, Production and Operations Management. Tata Mc Graw Hill Publishing Company Limited, New Delhi.
3. Datta A.K., Materials Management. Prentice Hall of India Private Limited, New Delhi.
4. Massie L. Joseph, Essentials of Management. Prentice Hall of India Private Limited, New Delhi.
5. Shreenivasan K.R., An Introduction to Industrial Management. Vikas Publishing House Private Limited, New Delhi.
6. Daver Rustam S., Salesmanship and Publicity. Vikas Publishing House Private Limited, New Delhi.
7. Mukopadhyay S., Pharmaceutical Selling, Sterling Publishers.
8. Koontz H, Wehrich H, Essentials of Management. Tata Mc Graw Hill Publishing Company Limited, New Delhi.
9. G Vidya Sagar, Pharmaceutical Industrial Management, Pharma Med Press, Hyderabad.
10. Micky C Smith, Principles of Pharmaceutical Marketing. CBS Publishers and Distributors, New Delhi.
11. Chaganti S.R., Pharmaceutical Marketing in India: Concept, strategy and cases. Pharma Med Press, Hyderabad

BOP-484 PHARMACEUTICS-XII (FOOD & NEUTRACEUTICALS)

Unit I

Introduction to food technology.

Food Processing: Freezing, changes in food during refrigerated storage, progressive freezing, Ice crystal damage, effect of dehydration, microwave heating and drying methods on food products.

Unit II:

Food packaging and preservation: Properties of packaging material used for food packaging, influence of packaging material on changes of food stuffs, brief description of packaging of frozen, dried products and thermally processed foods. Brief description of food preservation and its methods.

Unit III:

Neutraceuticals: Introduction, classification, categories and rational of use of neutraceuticals. Brief description to dietary supplements, fortified foods, functional foods and phytoneutraceuticals.

Unit IV:

Development and marketing of neutraceutical products: Supercritical fluid extraction technology-basics and application for extraction of neutraceuticals from various sources, Packaging, label claims. Regulatory aspects of neutraceutical products in India.

Unit V:

Testing of neutraceuticals and food products: Testing of microbial load, nutritional value, heavy metals, calorific value and neutraceutical label claim test. Brief introduction to Agmark, Bureau of Indian Standards (BIS) and Food Safety and Standards Authority of India (FSSAI).

BOP 484P PHARMACEUTICS-XII (FOOD & NEUTRACEUTICALS) PRACTICAL

1. Preparation of traditional health products e.g. Gulkand, Amla syrup
2. Formulation of health drinks.
3. Preparation and testing of some food products.
4. Testing of food packaging materials.
5. Preparation and testing of some nutraceuticals.

BOOKS RECOMMENDED

1. Potter, N. M., Food Science, CBS Publishers and Distributors, New Delhi.
2. Manay, S. and Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers, New Delhi.
3. Frazier W.C. and Westhoff, D.C., Food Microbiology, TMH, New Delhi.
4. Krammer, A. and Twigg B.A., Quality control for food industry, Third edition, AVI, West port.
5. Ranganna S., Handbook of Analysis and Quality control for Fruit and Vegetables Products, Tata McGraw Hill, New Delhi.
6. Girdharilal, Preservation of Food and Vegetables, ICAR, New Delhi.
7. Fellows P., Food Processing Technology: Principles and Practice, Ellis Horwood Ltd, Horwood.
8. Earle R. L., Unit Operations in Food Processing, Pergamon Press, New York.
9. Deore, S. L. Khadbadi S. S., and Baviskar B. A., Pharmacognosy and Phytochemistry: A Comprehensive Approach, PharmaMed Press, Hyderabad.
10. Robert E.C., Wildman, R., Taylor C. Wallace., Handbook of Nutraceuticals and Functional Foods, Second Edition. CRC Press, Boca Raton.

ELECTIVE BOP-485

(A) COMPUTATIONAL METHODS IN DRUG DESIGN

Unit I

Introduction to drug design concept, rational approaches of drug design, role of computational chemistry in drug design. The concept of drug likeness and druggability.

Chemometrics: Introduction to multivariate analysis, linear (PCA, MLR, PLS) and non-linear methods, validation tools. Introduction to some statistical softwares (such as; SPSS, Graph Pad Prism etc.).

Unit II

Molecular Modeling: Introduction to the principles of molecular mechanics, quantum mechanics, molecular dynamics and their applications in drug design.

Unit III

Quantitative structure activity relationship (QSAR): Basic concepts of QSAR, molecular descriptors (2D and 3D parameters), biological parameters, tools and techniques, quantitative models, validation of models, introduction to 2D and 3D QSAR methodologies.

Unit IV

Virtual screening: Introduction to some molecule databases. Ligand based and structure based virtual screening. Similarity searching, various methods of similarity searching and their applications in virtual screening: QSAR modeling, pharmacophore modeling, shape based screening, fingerprint based screening etc.

Unit V

Structure based drug design: Protein Data Bank, molecular graphics, design of enzyme inhibitors, receptor based drug design, molecular docking and protein homology modeling. Introduction to bioinformatics and some drug design softwares (free and commercially available).

BOP-485P (A) COMPUTATIONAL METHODS IN DRUG DESIGN PROJECT

1. To perform the Hansch and Free-Wilson analysis for the given dataset.
2. To develop and validate a 3D-QSAR model on a given dataset.
3. To develop and validate a 3D-Pharmacophore model on a given dataset.
4. To create a 3D-QSAR based hypothesis for virtual screening on a small molecule dataset.
5. To create a shape-based pharmacophore query on a set of aligned molecules and perform a virtual screening on a small molecule dataset.
6. To perform the virtual screening on a small molecule dataset using different fingerprint methods.
7. To perform molecular docking simulation and study various non-covalent interaction in protein-ligand complex.
8. To perform a homology modeling for a given target using modeler.
9. To perform the structure based virtual screening on a small molecule dataset.
10. To perform the different machine learning methods on a given dataset.
11. To perform the drug-likeness (ADMET) for small molecules.

BOOKS RECOMMENDED

1. Patrick G.L., An Introduction to Medicinal Chemistry, Oxford University Press.
2. Perun T.J. and Propst C.L., Computer-aided Drug Design Methods and Applications, Saurabh Prakashan Pvt.Ltd., New Delhi.
3. Veerapandian P., Structure-based Drug Design, Sirohi Brothers Pvt. Ltd., Noida.
4. Burger A., A Guide to the Chemical Basis of Drug Design, A Wiley Interscience Publication (John Wiley & Sons), New York.
5. Wermuth C.G., The Practice of Medicinal Chemistry, Elsevier.
6. Purcell W.P., Bass G.E., Clayton J.M., Strategy of Drug Design: A Guide to Biological Activity, Pharmamed Press, Hyderabad.
7. Nogrady T., Medicinal Chemistry: A Biochemical Approach, Oxford University Press, New York.
8. Abraham D.J., Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons Inc., New York.
9. Ananda Kumar T.D., Elementary Pharmacoinformatics, PharmaMed Press, Hyderabad

BOP-485 (B) GOOD MANUFACTURING PRACTICES

Unit I

Introduction to good manufacturing practices (GMP), good clinical practices (GCP) and good laboratory practices (GLP). Schedule M. Standard operating procedure (SOP): Introduction, preparation, validation and revision.

Unit II

Documentation: Protocols, forms and maintenance of records in pharmaceutical industry, preparation of document for investigational new drug (IND), new drug application (NDA), abbreviated new drug application (ANDA) and export registration.

Unit III

Introduction to 21-Code of federal regulations. Current good manufacturing practices (c-GMP) guidelines according to United States Food and Drug Administration (USFDA), difference between GMP and c-GMP.

Unit IV

Pharmaceutical product recall: Recall classification, strategy for effective recall, FDA requested recall, firm initiated recall, recall status reports, termination of recall. Introduction to finished product reprocessing and salvaging.

Unit V

Sampling: Introduction, WHO guidelines, sampling plans and techniques, operating characteristics curves, maintenance of sampling records of finished product and packaging material.

BOP-485P (B) GOOD MANUFACTURING PRACTICES PROJECT

1. Study the steps to generate SOP.
2. Generation and validation of SOP for Autoclave.
3. Generation and validation of SOP for Dissolution apparatus.
4. Generation and validation of SOP for Centrifuge.
5. Generation and validation of SOP for Balance (electronic and dispensing).
6. Generation and validation of SOP for Cleaning.
7. Generation and validation of SOP for Hot air oven.
8. Generation and validation of SOP for Disintegration apparatus.
9. Generation and validation of SOP for Friability apparatus.
10. Generation and validation of SOP for Incubator.
11. Generation of Master formula record.
12. Generation of Batch formula record.

BOOKS RECOMMENDED

1. Willing, Tuckerman and Hitchings, Good Manufacturing Practices for Pharmaceuticals, Marcel Dekker, New York.
2. Garfield, Quality Assurance Principles for Analytical Laboratories, Published by Oxford University Press, USA.
3. Potdar M. A., Current Good Manufacturing Practices for Pharmaceuticals. PharmaMed Press, Hyderabad.
4. Loftus and Nash, Pharmaceutical Process Validation, Taylor & Francis, New York.
5. Florey, Analytical Profile of Drugs (All volumes), Academic Press, United States.
6. Indian Pharmacopoeia.
7. United States Pharmacopoeia.
8. British Pharmacopoeia.

BOP-485 (C) CLINICAL PHARMACY

Unit I

Introduction to clinical pharmacy: Definition, development and scope of clinical pharmacy. Variability in human response to drugs and influence of disease processes: Drug handling and prescribing in the elderly, infants and children. Drug usage in pregnancy and in breast-feeding women. Prescribing for patients with renal or hepatic disease. Pharmacogenetics: implications for altered or unusual drug handling. Pharmacoepidemiology.

Unit II

Data analysis and compiling: The patient's case history, communication skills including patient medication history interview, patient counseling. Pharmacoeconomics. Medical writing: Regulatory and educational medical writing. Literature review and meta-analysis: Process, methods and application, research, report and paper / thesis writing. Pharmacovigilance programme of India (PvPI) and Geneva (UPSALA).

Unit III

Daily activities of clinical pharmacists: Drug therapy monitoring (medication chart view, clinical review), therapeutic drug monitoring, ward round participation, drug utilization evaluation/ review (DUE)/ (DUR). Quality assurance of clinical pharmacy services.

Unit IV

Research design and conduct of clinical trials: Research support including planning and execution of clinical trials. Schedule Y, GLP, GCP and ICH Guidelines, trial master file and ethical requirements. Various phases of clinical trials. Categories of Phase IV studies. Bioavailability (BA) and bioequivalence (BE) studies and the estimation with the help of plasmaconcentration profile curve. Statistical analysis plan (SAP) and its importance in clinical research.

Unit V

Data collection and biostatistical analysis: Statistical principles underlying clinical trials, data handling and role of biostatistician. Sample size calculation, types of variables, Type I error and type II errors, application of parametric and non-parametric tests, confidence intervals, outliers. Data analysis with the help of bio-statistical software.

BOP-485P (C) CLINICAL PHARMACY PROJECT

Epidemiological survey and comparison of prescribed therapeutic agents/diagnostic reports on different diseases such as- Cardiovascular disorders, central nervous system disorders, gastro intestinal tract disorders, hormonal disorders, pathogenic diseases.

BOOKS RECOMMENDED

1. Scott L.T., Basic skills in interpreting laboratory data, American Society of Health System Pharmacists Inc., USA.
2. Rowland and Tozer, Clinical Pharmacokinetics, Williams and Wilkins Publication, Philadelphia, USA.
3. Shargel L., Biopharmaceutics and Applied Pharmacokinetics, Prentice Hall publication, New Delhi.
4. Parthasarathi G., Nyfort-Hansen K. and Nahata M.C., A Text book of Clinical Pharmacy Practice-Essential Concepts and Skills, Orient Longman, Chennai.
5. Colledge N.R., Walker B. R. and Stuart H., R alst on Daviss on's P rinciples and P ract ice of Medicine, ELBS/Churchill Livingstone, Edinburgh, U.K.
6. Herfindal E.T. and Hirashman J.L., Clinical Pharmacy and Therapeutics Williams and Wilkins, Philadelphia, USA.
7. Wagner J.G., Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A G Basel, Switzerland.
8. Katzung B., Masters S. and Trevor A., Basic and Clinical Pharmacology, McGraw Hill Professional, U.K.
9. Spilker B. and Schoenfelder J., Data Collection Forms in Clinical Trials, Raven Press, New York.
10. Roger and Walker: Clinical Pharmacy and Therapeutics, Churchill, Livingston, London.
11. Stockley I.H., Drug interactions, Pharmaceutical Press, London.
12. Ravishankar K., Kiranmayi G.V.N., Clinical Pharmacy and Pharmacotherapeutics, PharmaMed Press, Hyderabad.

BOP-485 (D) STANDARDIZATION OF HERBAL DRUGS

Unit I

Commerce and quality control of natural medicinal plants products, organoleptic, microscopical, physical and chemical evaluation of crude drugs.

Unit II

Standardization of plant material as per WHO guidelines.

Unit III

Methods of extraction and modern techniques for the isolation, purification, separation estimation and characterization of active plant constituents.

Unit IV

Analysis of official formulations derived from crude drugs, including some ayurvedic preparations.

Unit V

General methods of screening of natural products for following biological activity:

- a) Anti-inflammatory b) Hypoglycaemic c) Antibacterial d) Antifertility e) Psychopharmacological

BOP-485P (D) STANDARDIZATION OF HERBAL DRUGS PROJECT

Projects based on-

1. Standardization of Ayurvedic liquid formulations on the basis of the following parameters- viscosity, pH, loss on drying, foaming index, chromatography.
2. Standardization of Ayurvedic powdered formulations on the basis of following parameters- extractable matter by using various solvents, ash value, stomatal and stomatal index, trichomes and their types, loss on drying, foaming index, fiber content, chromatography.
3. Stability studies of herbal products as per WHO guidelines.

BOOK RECOMMENDED

1. Trease, G.E., and Evans, W.C., Pharmacognosy, Bailliere Tindall East Baorne, U.K.
2. Tyler V.E., Lynn B. and Robbers J.E., Pharmacognosy, 8 Edition, Lea & Febiger, Philadelphia.
3. Harborne J.B., Phytochemical Methods, Chapman & Hall International Edition, London.
4. Pharmacoepl Standards for Ayurvedic Formulations, CCRAS, Delhi.
5. Dhavan B.N. and Srimal R.C., The Use of Pharmacological Techniques for Evaluation of Natural Products. CDRI, Lucknow.
6. Brain K.R. and Turner T.D, The Practical Evaluation of Phytopharmaceuticals, Wright, Bristol.
7. Peach K. and Tracey MV, Modern Methods of Plant Analysis, Springer, Berlin. 17. Indian Herbal Pharmacopoeia, Vol. I & II, ICMR & RRL, Jammu.
8. Chaudhary. R.D., Herbal Drug Industry, Eastern Publisher, New Delhi.
9. Deore S.L., Khadabadi S.S., Baviskar B.A., Pharmacognosy and Phytochemistry: A Comprehensive Approach, PharmaMed Press, Hyderabad.
10. Nadkarni A.K., Indian Materia Medica, Vol- 1&2, Popular Prakashan (P) Ltd., Bombay.
11. Sukh Dev, A Selection of Prime Ayurvedic Plant Drugs, Anamaya Publisher New Delhi.
12. Indian Ayurvedic Pharmacopoeia, Govt. of India.
13. The Wealth of India, Raw Materials (All volumes), Council of Scientific & Industrial Research, New Delhi.
14. Mukherjee P.K., Quality Control of Herbal Drugs, Business Horizons Pharmaceutical Publisher, New Delhi

BOP-485 (E) RESEARCH METHODOLOGY

Unit I

Fundamentals of research: Meaning and objective of research, types of research (basic, applied and patent oriented), defining research problem, research design including various methods, research process and steps involved.

Literature survey and documentation: Methods of literature survey, use of library, books, journals, e-journals, thesis, chemical abstracts and patent database, importance of documentation, documentation techniques, use of computer programs/packages (online resources such as-scientific search engines and online servers) in literature survey and documentation.

Unit II

Data collection and data analysis: Execution of the research, observation and collection of data, types of data (primary and secondary), methods of data collection, sample size, sampling procedure and methods. Data processing and analysis strategies. Research hypothesis (experimental and non-experimental), hypothesis testing (parametric and non-parametric tests), types of errors and their control, generalization and interpretation of results. Use of statistical softwares/ packages in data analysis (SPSS, Graph Pad Prism).

Unit III

Technical writing and reporting of research: Types of research report: Dissertation and thesis, research paper, review article, short communication, conference presentation, meeting report etc. Structure and organization of research reports: Title, abstract, key words, introduction, methodology, results, discussion, conclusion, acknowledgement, references, footnotes, tables and illustrations. Use of reference managing softwares (such as- MENDELEY, ENDNOTE). Impact factor, rating, indexing and citation of journals. Detailed study of 'Instr ucti on to Authors' of any ACS or ScienceDirect journal, a

thorough understanding of steps involved in submitting articles electronically to any ACS or ScienceDirect journal (registration, new article submission, tracking process, submitting revised articles).

Unit IV

Research ethics, ethical consideration during animal experimentation including CPCSEA guidelines, impact of research on environment and society, commercialization of research, intellectual ownership, plagiarism and use of plagiarism detection softwares such as TURNITIN, VIPER etc., responsibility and accountability of the researchers. Academia-Industry interface and research.

Project cost management: Cost analysis of the project, cost incurred on raw materials, procedure, instrumentation and biological testing.

Unit V

Funding agencies and research grants: Introduction to various research funding agencies such as-DST, DBT, AICTE, UGC, CSIR, ICMR, AAYUSH, and DRDO along with their functions in India. Writing a research project and procurement of research grant.

BOP-485P (E) RESEARCH METHODOLOGY PROJECT

Projects based on –

1. Literature survey, data collection, formulation and testing of hypothesis, interpretation of results on a particular research project.
2. Use of statistical packages/ programs (such as SPSS, Graph Pad Prism) in data analysis.
3. Collection, compilation and execution of computational programs for research benefits.
4. Manuscript preparation, communication and follow-up of a research paper/review article.
5. Writing a research project for the procurement of research grant/travel grant from any funding agency.
6. Preparation and presentation of a research report (Oral and Poster presentations using Microsoft PowerPoint Package, Microsoft Publisher etc.).

BOOKS RECOMMENDED

1. Kothari C.R., Research Methodology Methods and Techniques, 2nd Edition, Wishwa Prakashan, New Delhi.
2. Lokesh K., Methodology of Educational research, 3rd revised Edition, Vikash Publishing House Pvt. Ltd., New Delhi.
3. Kumar R., Research Methodology, 2nd Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
4. Rao G.N., Research Methodology and Qualitative Methods, B.S. Publications, Hyderabad.
5. Saunders M., Lewis P. and Thornhill A., Research Methods for Business Students, 3rd Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
6. Bolton S. and Bon C., Pharmaceutical Statistics: Practical and Clinical Applications, 4th edition, Marcel Dekker, New York.
7. Matad V., Anusuya D., Medicomarketing Writing, PharmaMed Press, Hyderabad.
8. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.

BOP-486P Report on Industrial/ Research Laboratory Visit

Visit of students to an industrial establishment or an approved research laboratory.

The industrial/ research laboratory visit shall include: in case of industry- visit to different sections and subsections of the industry, an idea about the functioning of the industry, product range of the industry and various approvals of the industry; in case of research laboratory- visit to different departments of the laboratory, an idea about the interdisciplinary coordination, contribution of the laboratory to the society and various approvals of the laboratory. A proper report of the same shall be submitted by the students, which shall be subsequently evaluated to assess the impact of the visit.

May be performed at the end of the 7 semester.